INTERNATIONAL CODE COUNCIL
2009/2010 CODE DEVELOPMENT CYCLE

2009/2010 FINAL ACTION AGENDA FOR THE PROPOSED CHANGES TO THE 2009 EDITIONS OF THE

ADMINISTRATIVE PROVISIONS

INTERNATIONAL ENERGY CONSERVATION CODE®

INTERNATIONAL PROPERTY MAINTENANCE CODE®

INTERNATIONAL RESIDENTIAL CODE®

-ENERGY

INTERNATIONAL ZONING CODE®

October 25, 27-31, 2010

CHARLOTTE CONVENTION CENTER

CHARLOTTE, NC

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INTRODUCTION

This publication contains the Final Action Agenda for consideration at the Final Action Hearings of the International Code Council on October 25, 27-31, 2010 at the Charlotte Convention Center in Charlotte, NC (see page xxiii). See page xix for hearing schedule.

This publication contains information necessary for final action consideration of the proposed code changes which have been considered in the ICC Code Development Hearings held on October 24 – November 11, 2009 at the Hilton Baltimore in Baltimore, MD. More specifically, this agenda addresses final action consideration for proposed code changes to the *ICC Administrative Provisions, International Energy Conservation Code, International Property Maintenance Code, International Residential Code-Energy, and the International Zoning Code,* considered by the respective Code Committee at the Code Development Hearings.

ICC GOVERNMENTAL MEMBER REPRESENTATIVES

Council Policy #28-Code Development (page viii) requires that ICC's membership records regarding ICC Governmental Member Representatives reflect the eligible voters **10 days prior** to the start of the Final Action Hearing. This includes new as well as changes to voting status. Section 7.4 of CP #28 (page xviii) reads as follows:

> **7.4** **Eligible voters:** ICC Governmental Member Representatives and Honorary Members in attendance at the Final Action Hearing shall have one vote per eligible attendee on all International Codes. Applications, whether new or updated, for governmental member voting representative status must be received by the Code Council ten days prior to the commencement of the first day of the Final Action Hearing in order for any designated representative to be eligible to vote.

As such, new and updated eligible voter status must be received by ICC's Member Services Department by October 15, 2010. As noted in Section 2.1.1.1 of the Bylaws, this must be done in writing – via either a letter or a form which can be downloaded from the Members-Only area of the ICC website. This can be mailed, faxed to 205-591-0775 or emailed as an attachment to members@iccsafe.org. These records will be used to verify eligible voter status for the Final Action Hearing. Voting members are strongly encouraged to review their membership record for accuracy well in advance of the Final Action Hearing so that any necessary changes are made prior to the October 15, 2010 deadline.

ICC Policy on Financial Assistance for Governmental Member Voting Representatives

ICC Council Policy #CP-36 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.

Prior to receiving a voting device, each Governmental Member Voting Representative will have to sign a written certification that he/she has complied with ICC policy regarding the receipt of financial assistance in connection with attendance at the hearing. All Governmental Member Voting Representatives will be expected to be familiar with and understand such policy, and to have inquired of ICC well in advance of the hearing regarding any questions or uncertainty about the application of such policy. A Governmental Member Voting Representative who does not sign the compliance certification, or who is determined to have accepted financial assistance from a prohibited source, *will NOT be permitted to vote at the hearing.* 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:

3.0. 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 activities provided that:

3.1. Contributions of financial assistance to governmental member representatives for the purposes of participating in ICC activities are prohibited except for reimbursements by the ICC or its subsidiaries, a regional, state, or local chapter of the ICC, or a local, state or federal unit of government. For the purposes of this policy financial assistance includes the payment of expenses on behalf of the governmental member.

3.2. 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.

3.3. Donations of technical services in support of a governmental member's jurisdictional business activities are acceptable.

3.4. Any contributions to a governmental member of the ICC shall comply with applicable law.

For further information about CP-36, please visit:
http://www.iccsafe.org/MEMBERSHIP/Pages/2010FinancialAssistance.aspx
To view ICC Policy CP-36 please go to the following link:
http://www.iccsafe.org/AboutICC/Documents/CP36-09.pdf

ADVANCE REGISTRATION

The Final Action Hearings are only one component of the 2010 Annual Conference and Hearings. The information required for the Education Program is listed on page xxiv. **All attendees to the Final Action Hearings are required to register. Registration (see page xxiii) for the Final Action Hearings is FREE, and is necessary to verify voting status (see above). You are encouraged to register prior to the Final Action Hearings.**

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

ELECTRONIC VOTING

Electronic voting by the ICC Governmental Member Representative in attendance at the Final Action Hearings, will continue to be used in Charlotte, NC. Eligible voters will be issued a handheld device to be used to cast their vote. Please see "ICC Policy on Financial Assistance for Governmental Member Voting Representatives" on page i.

AGENDA FORMAT

This Final Action Agenda includes the Consent Agenda and the Individual Consideration Agenda for the code provisions that comprise the modified Group B for the 2009-2010 Code Development Cycle. This will complete the Final Action Hearings for the 2009-2010 Code Development Cycle. The hearings for the code provisions that comprise the modified Group A were heard in Dallas TX, May 15 – 23. The modified Group B includes the codes listed in the Table of Contents on page xxv.

The Consent Agenda is comprised of proposed changes to the 2009 editions of the International Codes 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 to the 2009 editions of the International Codes which received a successful assembly action or received a public comment in response to the Code Committee's action at the Code Development Hearings.

Items on the Individual Consideration Agenda are published with information as originally published for the Code Development 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 *CP#28-05 Code Development* as published on page viii. Refer to the tentative hearing order on xx.

MODIFICATIONS

In addition to modifications made by a committee at the Code Development hearings, *CP#28-05 Code Development* allows modifications to be made by the assembly at the Code Development Hearings. In addition modifications can be proposed in a public comment for consideration. Therefore, proposed changes on the Individual Consideration Agenda at the Final Action Hearings may have up to six 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.

CONSENT AGENDA

The Final Action Consent Agenda consists of proposals which have neither an assembly action nor public comments. The Final Action Consent Agenda for each code or segment of code changes will be placed before the assembly with a single motion for final action in accordance with the results of the Code Development Hearing at the beginning of the respective portion of the hearings. For codes which have no code change proposals on the Individual Consideration Agenda, a motion for the final action in accordance with the results of the Code Development Hearing will be placed before the assembly at the beginning of the hearings.

INDIVIDUAL CONSIDERATION AGENDA

The Final Action Individual Consideration Agenda is comprised of proposals which have an assembly action or public comment. This includes code changes which affect only one code (i.e. EC24-09/10) and code changes which affect multiple codes and were considered individually at the Code Development Hearings by the respective Code Committee (i.e. EC25-09/10: Part I-Energy Conservation Code Committee; Part II-IRC Building/Energy Committee). Where a public comment was submitted to more than one part of the code change proposals (i.e. EC27-09/10), each part of the code change is heard with the code in which the proposal was originally published, but each part is published separately (EC27-09/10 Part I and EC24-09/10 Part II) and considered separately. All 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 xx and the agenda starts on page 1. There are some exceptions in the hearing order for the placement of code change proposals. Please review the hearing order on page xx to see these exceptions. In particular, note that code change proposals designated for the IECC with prefix "EC", and code change proposals designated for IRC–Energy with prefix "RE" are heard together.

WITHDRAWALS OF CODE CHANGE PROPOSALS

The following code change proposals have been withdrawn after the publication of the 2009/2010 Report of Public Hearing on the 2009 Edition of the International Codes:

EC14	EC19	EC29
EC15	EC28 Part II	EC123

ICC WEBSITE - WWW.ICCSAFE.ORG

While great care has been exercised in the publication of this document, there may be errata posted for the Final Action Agenda. Errata, if any, identified prior to the Final Action Hearings will be posted on the ICC website at www.iccsafe.org. Users are encouraged to periodically review the ICC Website for updates to errata to the 2009/2010 Final Action Agenda.

VIEW THE FINAL ACTION HEARINGS ON YOUR PC

The Final Action 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 free 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.

2012/2013 ICC CODE DEVELOPMENT SCHEDULE

STEP IN CODE DEVELOPMENT CYCLE	DATE	
	2012 – Group A Codes **IBC, IFGC, IMC, IPC, IPSDC**	**2013 – Group B Codes** **Admin, IEBC, IECC, IFC, IGCC, IPerfC, IPoolC, IPMC, IRC, IWUIC, IZC**
2012 EDITION OF I-CODES PUBLISHED	April 30, 2011	
DEADLINE FOR RECEIPT OF APPLICATIONS FOR ALL CODE COMMITTEES	June 1, 2011	
DEADLINE FOR RECEIPT OF CODE CHANGE PROPOSALS	January 3, 2012	January 3, 2013
WEB POSTING OF "PROPOSED CHANGES TO THE I-CODES"	March 12, 2012	March 11, 2013
DISTRIBUTION DATE OF "PROPOSED CHANGES TO THE I-CODES" (CD only)	April 2, 2012	April 1, 2013
CODE DEVELOPMENT HEARING (CDH)	April 29 – May 6, 2012 Sheraton Dallas Hotel Dallas, TX	April 21 – 28, 2013 Sheraton Dallas Hotel Dallas, TX
WEB POSTING OF "REPORT OF THE PUBLIC HEARING"	June 8, 2012	June 7, 2013
DISTRIBUTION DATE OF "REPORT OF THE PUBLIC HEARING" (CD only)	June 29, 2012	June 28, 2013
DEADLINE FOR RECEIPT OF PUBLIC COMMENTS	August 1, 2012	August 1, 2013 (tentative)
WEB POSTING OF PUBLIC COMMENTS "FINAL ACTION AGENDA"	September 10, 2012	September 9, 2013 (tentative)
DISTRIBUTION DATE OF PUBLIC COMMENTS "FINAL ACTION AGENDA" (CD only)	October 1, 2012	September 30, 2013 (tentative)
FINAL ACTION HEARING (FAH)	October 24 – 28, 2012 Oregon Convention Center Portland, OR	Late Oct/Early Nov, 2013 Hotel TBD Location TBD
ANNUAL CONFERENCES	October 21 – 24, 2012 Oregon Convention Center Portland, OR	Late Oct/Early Nov, 2013 Hotel TBD Location TBD

Notes:

- The International Green Construction Code (IGCC) and International Swimming Pool Code (IPoolC) to undergo a full cycle of code development in 2011 resulting in 2012 editions published March/2012
- Group B "Admin" includes code change proposals submitted Chapter 1 of all the I-Codes except the IRC and the administrative update of currently referenced standards
- Publish 2015 I-Codes in April/2014
- Start 2015/2016 Code Development Cycle with Group A Codes and code change proposals due January 5, 2015

GET INVOLVED—ICC COMMITTEES

The ICC relies upon the work and expertise of volunteers to develop and maintain the I-Codes and the ICC Standards. The ICC does this through committees that review and approve code change proposals, interpret the codes, draft standards, and review code correlation issues.

Code Committees

The ICC Code Committees are an instrumental part of the ICC Code Development Process. There are currently 16 Code Committees, responsible for the review and evaluation of code change proposals submitted to 14 *International Codes*. The Code Committees for the 2012/2013 Code Development Cycle will hear the code change proposals at the 2012 or 2013 Code Development Hearings, depending upon the Group into which the code committee is placed. Deadline for application to all code committees is June 1, 2011. Current Code Committee members interested in serving are required to re-apply.

Interpretation Committees

The purpose of the ICC Interpretation Committees is to provide technical support for adopting jurisdictions by processing official interpretations for the *International Codes*. Committee Interpretations represent the official position of the ICC but in all cases, the final authority on matters of interpretation is the code official. There are currently 5 ICC Interpretation Committees. Committee travel is not anticipated - the committee conducts its business via correspondence. Current Interpretation Committee members interested in serving are required to re-apply.

Code Correlation Committee

The Code Correlation Committee is responsible for evaluating matters of consistency, coordination and format in the *International Codes*. This includes determining matters of maintenance responsibility of Code Committees and identification of technical and editorial revisions necessary in the *International Codes*. Committee travel is anticipated. Current Code Correlation Committee members interested in serving are required to re-apply.

STAFF SECRETARIES

To contact a staff secretary, please call: 888-ICC-SAFE followed by the extension listed below.

IBC-General Chapters 1-6, 12, 13, 27-34	**IBC-Fire Safety Chapters 7, 8, 9, 14, 26**	**IBC-Means of Egress Chapters 10, 11**	**IBC-Structural Chapters 15-25**
Kermit Robinson ICC Whittier District Office X3317 FAX: 562/699-4522 krobinson@iccsafe.org	Ed Wirtschoreck ICC Chicago District Office X4317 FAX: 913/888-4526 ewirtschoreck@iccsafe.org	Kim Paarlberg ICC Chicago District Office x4306 FAX: 708/799-0320 kpaarlberg@iccsafe.org	Alan Carr ICC Washington Field Office x7601 FAX: 425-637-8939 acarr@iccsafe.org
IECC	**IEBC**	**IFC**	**IFGC**
Elaine Deak and Kermit Robinson ICC Chicago District Office X4422 FAX:708/ 799-0320 edeak@iccsafe.org krobinson@iccsafe.org	Beth Tubbs ICC Massachusetts Field Office X7708 FAX: 419/730-6531 btubbs@iccsafe.org	Bill Rehr ICC Chicago District Office x4342 FAX: 708/799-0320 brehr@iccsafe.org	Gregg Gress ICC Chicago District Office x4343 FAX: 708/799-0320 ggress@iccsafe.org
IMC	**ICC PC**	**IPC/IPSDC**	**IPMC**
Gregg Gress ICC Chicago District Office x4343 FAX: 708/799-0320 ggress@iccsafe.org	Beth Tubbs ICC Massachusetts Field Office X7708 FAX: 419/730-6531 btubbs@iccsafe.org	Fred Grable ICC Chicago District Office X4349 FAX: 708/799-0320 fgrable@iccsafe.org	Ed Wirtschoreck ICC Chicago District Office X4317 FAX: 708/799-0320 ewirtschoreck@iccsafe.org
IRC-Building/Energy	**IRC-Mechanical**	**IRC-Plumbing**	**IWUIC**
Larry Franks and Elaine Deak ICC Birmingham District Office FAX:205/592-7001 lfranks@iccsafe.org edeak@iccsafe.org	Gregg Gress ICC Chicago District Office x4343 FAX: 708/799-0320 ggress@iccsafe.org	Fred Grable ICC Chicago District Office x4349 FAX: 708/799-0320 fgrable@iccsafe.org	Bill Rehr ICC Chicago District Office x4342 FAX: 708/799-0320 brehr@iccsafe.org
IZC	**IADMIN Chapter 1 (All codes except IRC)**		
Ed Wirtschoreck ICC Chicago District Office X4317 FAX: 708/799-0320 ewirtschoreck@iccsafe.org	Dave Bowman ICC Chicago District Office X4323 FAX: 708/299-0320 dbowman@iccsafe.org		

CP# 28-05 CODE DEVELOPMENT

Approved: 9/24/05
Revised: 2/27/09

CP # 28-05 is an update to *ICC's Code Development Process for the International Codes* dated May 15, 2004.

1.0 Introduction

1.1 Purpose: 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 proposals by all parties desiring to participate.

1.2.3 The final determination of Code text by officials representing code enforcement and regulatory agencies and by honorary members.

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. Where a given subject matter or code text could appear in more than one Code, the ICC Board shall determine which Code shall be the primary document, and therefore which code development committee shall be responsible for review and maintenance of the code text. 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 4.4.

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 ICC codes are developed embodies core principles of the organization. One of those principles is that the final content of ICC codes is determined by a majority vote of the governmental and honorary members. It is the policy of the 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.

1.6 Video Taping: Individuals requesting permission to video tape any meeting, or portion thereof, shall be required to provide the ICC with a release of responsibility disclaimer and shall acknowledge that they have insurance coverage for liability and misuse of video tape materials. Equipment and the process used to video tape 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 videotaping. An unedited copy of the video tape shall be forwarded to ICC within 30 days of the meeting.

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 final action on the code change proposals (see Section 7.6).

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 last edition.

2.3 Supplements: The results of code development activity between editions may be published.

2.4 Emergency Procedures: In the event that the ICC Board determines that an emergency amendment to any Code 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 ICC Governmental Member 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.

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 Final Action Consideration of that proposal. A withdrawn code change proposal shall not be subject to a public hearing, motions, or Final Action Consideration.

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.

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 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 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 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 proposal shall be in proper code format and terminology.

3.3.4.4 Each 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 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 proposed code change (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 proposal is superior to the current provisions of the Code. 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 proposals will improve the Code.

3.3.5.3 **Substantiation:** The proponent shall substantiate the proposed code change 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 proposed code change shall be identified as such. The proponent shall be notified that the 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.

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 and the proponent shall make the substantiating materials available for review at the appropriate ICC office and during the public hearing.

3.3.5.5 **Copyright Release:** The proponent of code change proposals, floor modifications and public comments shall sign a copyright release reading: "I hereby grant and assign to ICC all rights in copyright I may have in any authorship contributions I make to ICC in connection with any proposal and public comment, in its original form submitted or revised form, including written and verbal modifications submitted in accordance Section 5.5.2. I understand that I will have no rights in any ICC publications that use such contributions in the form submitted by me or another similar form and certify that such contributions are not protected by the copyright of any other person or entity."

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; or 2) the code change proposal will not increase the cost of construction. This information will be included in the published code change proposal.

3.4 **Number:** One copy of each code change proposal, two copies of each proposed new referenced standard and one copy of all substantiating information 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. A copy of the code change proposal in electronic form is preferred.

3.5 **Submittal Deadline:** Each code change proposal shall be received at the office of the Secretariat by the posted deadline. Such posting shall occur no later than 120 days prior to the code change deadline. The submitter of a proposed code change 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 shall comply with this section. The standard shall be completed and readily available prior to Final Action Consideration based on the cycle of code development which includes the proposed code change proposal. 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. Updating of standards without corresponding code text changes shall be accomplished administratively in accordance with Section 4.5.
3.6.3.2 The standard shall be developed and maintained through a consensus process such as ASTM or ANSI.

4.0 Processing of 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 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.
4.3 **Incomplete 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 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 proposal that incorporates a new referenced standard shall be processed with an analysis of referenced standard's compliance with the criteria set forth in Section 3.6.
4.4 **Editorial:** The Chief Executive Officer shall have the authority at all times to make editorial and format changes to the Code text, or any approved changes, consistent with the intent, provisions and style of the Code. An editorial or format change is a text change that does not affect the scope or application of the code requirements.
4.5 **Updating Standards:**

4.5.1 **Standards referenced in the 2012 Edition of the I-Codes:** The updating of standards referenced by the Codes shall be accomplished 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, 2011. The published version of the 2012 Code which references the standard will refer to the updated edition of the standard. If the standard is not available by the 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.

4.5.2 Standards referenced in the 2015 Edition and following Editions of the I-Codes: The updating of standards referenced by the Codes shall be accomplished administratively by the Administrative code development committee in accordance with these full procedures except that multiple standards to be updated may be included in a single proposal. The standard shall be completed and readily available prior to Final Action Consideration of the Administrative code change proposal which includes the proposed update.

4.6 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.

4.7 Publication: All code change proposals shall be posted on the ICC website at least 30 days prior to the public hearing on those proposals and shall constitute the agenda for the public hearing. Code change proposals which have not been published shall not be considered.

5.0 Public Hearing

5.1 Intent: The intent of the public 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 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 Code Development Committees shall be appointed by the applicable ICC Council.

5.2.1 Chairman/Moderator: The Chairman and Vice-Chairman shall be appointed by the Steering Committee on Councils from the appointed members of the committee. The ICC President shall appoint one or more Moderators who shall act as presiding officer for the public 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 on the matter or any committee vote. Violation thereof shall result in the immediate removal of the committee member from the committee. A committee member who is a proponent of a 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 each public hearing shall be announced not less than 60 days prior to the date of the public hearing.

5.4 General Procedures: *The Robert's Rules of Order* shall be the formal procedure for the conduct of the public 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 Meetings: Public hearings of the Code Development Committees are open meetings.

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Any interested person may attend and participate in the Floor Discussion and Assembly Consideration portions of the hearing. Only eligible voters (see Section 5.7.4) are permitted to vote on Assembly Considerations. Only Code Development Committee members may participate in the Committee Action portion of the hearings (see Section 5.6).

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. Audio-visual presentations are not permitted. Substantiating material submitted in accordance with Section 3.3.4.4 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 an agenda for each public 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 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. A motion to revise the agenda order is subject to a 2/3 vote of those present and voting.

5.4.5 Reconsideration: There shall be no reconsideration of a proposed code change after it has been voted on by the committee in accordance with Section 5.6; or, in the case of assembly consideration, there shall be no reconsideration of a proposed code change after it has been voted on by the assembly in accordance with Section 5.7.

5.4.6 Time Limits: Time limits shall be established as part of the agenda for testimony on all proposed changes at the beginning of each hearing session. Each person requesting to testify on a change 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.

5.4.6.1 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.

5.4.6.2 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.

5.4.7 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 the eligible voters as determined in Section 5.7.4 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 proposal for their comments.
2. *Opponents.* After discussion by those in support of a 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. *Rerebuttal in opposition.* Opponents shall then have the opportunity to respond to the proponent's rebuttal.

5.5.2 Modifications: Modifications to proposals may be suggested from the floor by any person participating in the public hearing. The person proposing the modification is deemed to be the proponent of the modification.

5.5.2.1 Submission and Written Copies. All modifications must be written, unless determined by the Chairman to be either editorial or minor in nature. The modification proponent shall provide 20 copies to the Secretariat for distribution to the committee.

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. is not legible, unless not required to be written in accordance with Section 5.5.2.1; or
2. changes the scope of the original proposal; or
3. is not readily understood to allow a proper assessment of its impact on the original 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 5.4.7.

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 public hearing shall be established by the committee's action. If a motion in accordance with Section 5.7.1 is brought forward and is sustained in accordance with Section 5.7.3, both the committee's action and the assemblies' action shall be reported as the results of the public hearing. Where a motion is sustained in accordance with Section 5.7.3, such action shall be the initial motion considered at Final Action Consideration in accordance with Section 7.3.8.2.

5.7.1 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 **Discussion:** On receipt of a second to the floor motion, the Moderator shall place the otion before the assembly for a vote. No additional testimony shall be permitted.

5.7.3 **Assembly Action:** The assembly action shall be in accordance with the following majorities based on the number of votes cast by eligible voters (See 5.7.4).

Committee Action	**Desired Assembly Action**		
	ASF	**AMF**	**DF**
AS	**--**	**2/3 Majority**	**2/3 Majority**
AM	**2/3 Majority**	**2/3 Majority**	**2/3 Majority**
D	**2/3 Majority**	**2/3 Majority**	--

5.7.4 **Eligible Voters:** All members of ICC in attendance at the public hearing shall be eligible to vote on floor motions. Only one vote authorized for each eligible attendee. Code Development Committee members shall be eligible to vote on floor motions. Application, whether new or updated, for ICC membership must be received by the Code Council ten days prior to the commencement of the first day of the public hearing.

5.8 **Report of the Public Hearing:** The results of the public hearing, including committee action and successful assembly action, shall be posted on the ICC website not less than 60 days prior to Final Action Consideration except as approved by the ICC Board.

6.0 Public Comments

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

6.1.1 Consideration of items for which a public comment has been submitted; and
6.1.2 Consideration of items which received a successful assembly action at the public hearing.

6.2 **Deadline:** The deadline for receipt of a public comment to the results of the public hearing shall be announced at the public hearing but shall not be less than 30 days from the availability of the report of the results of the public 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 Final Action Consideration of that comment. A withdrawn public comment shall not be subject to Final Action 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 7.3.4, 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 7.3.4, the proposal shall continue as part of the individual consent agenda in accordance with Section 7.3.5, however the public comment shall not be subject to Final Action 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 public 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. If 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 3.3.4.5 shall be provided with the public comment.

6.4.2 **Code Reference:** Each public comment shall include the code change proposal number and the results of the public hearing, including successful assembly actions, on the code change proposal to which the public comment is directed.

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:** 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 (AM) by one or more specific modifications published in the Results of the Public Hearing or published in a public comment, or
3. Disapprove the code change proposal (D)

6.4.5 **Supporting Information:** The public comment shall include in 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 6.4 and determined as not germane to the technical issues addressed in the code change proposal or committee 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. 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 Final Action Hearing.

6.4.6 **Number:** One copy of each public comment and one copy of all substantiating information shall be submitted. Additional copies may be requested when determined necessary by the Secretariat. A copy of the public comment in electronic form is preferred.

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 Final Action 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 Final Action Consideration.

6.6 **Publication:** The public hearing results on code change proposals that have not been public commented and the code change proposals with public commented public hearing results and successful assembly actions shall constitute the Final Action Agenda. The Final Action Agenda shall be posted on the ICC website at least 30 days prior to Final Action consideration.

7.0 Final Action Consideration

7.1 **Intent:** The purpose of Final Action Consideration is to make a final determination of all code change proposals which have been considered in a code development cycle by a vote cast by eligible voters (see Section 7.4).

7.2 **Agenda:** The final action consent agenda shall be comprised of proposals which have neither an 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 Sections 5.7 and 6.0).

7.3 **Procedure:** *The Robert's Rules of Order* shall be the formal procedure for the conduct of the Final Action Consideration except as these Rules of Procedure may otherwise dictate.

7.3.1 **Open Meetings:** Public hearings for Final Action Consideration are open meetings. Any interested person may attend and participate in the Floor Discussion.

7.3.2 **Agenda Order:** The Secretariat shall publish an agenda for Final Action Consideration, placing individual code change proposals and public comments in a logical order to facilitate the hearing. The proponents or opponents of any 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. A motion to revise the agenda order is subject to a 2/3 vote of those present and voting.

7.3.3 **Presentation of Material at the Public Hearing:** Information to be provided at the hearing shall be limited to verbal presentations. Audio-visual presentations are not permitted. Substantiating material submitted in accordance with Section 6.4.4 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.

7.3.4 **Final Action Consent Agenda:** The final action consent agenda (see Section 7.2) shall be placed before the assembly with a single motion for final action in accordance with the results of the public 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.

7.3.5 **Individual Consideration Agenda:** Upon completion of the final action consent vote, all proposed changes not on the final action consent agenda shall be placed before the assembly for individual consideration of each item (see Section 7.2).

7.3.6 **Reconsideration:** There shall be no reconsideration of a proposed code change after it has been voted on in accordance with Section 7.3.8.

7.3.7 **Time Limits:** Time limits shall be established as part of the agenda for testimony on all proposed changes at the beginning of each hearing session. Each person requesting to testify on a change 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.

7.3.7.1 **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.

7.3.8 **Discussion and Voting:** Discussion and voting on proposals being individually considered shall be in accordance with the following procedures:

7.3.8.1 **Allowable Final Action Motions:** The only allowable motions for final action are Approval as Submitted, Approval as Modified by one or more modifications published in the Final Action Agenda, and Disapproval.

7.3.8.2 **Initial Motion:** The Code Development Committee action shall be the initial motion considered, unless there was a successful assembly action in accordance with Section 5.7.3. If there was a successful assembly action, it shall be the initial motion considered. If the assembly action motion fails, the code development committee action shall become the next motion considered.

7.3.8.3 **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 Final Action Agenda may be made (see Section 6.4.3). 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.

7.3.8.4 **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. If the motion fails to receive the majority required in Section 7.5, the Moderator shall ask for a new motion.

7.3.8.5 **Subsequent Motion:** If the initial motion is unsuccessful, a motion for one of the other allowable final actions shall be made (see Section 7.3.8.1) and dispensed with until a successful final action is achieved. If a successful final action is not achieved, Section 7.5.1 shall apply.

7.3.9 **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.

7.3.10 **Points of Order:** Any person participating in the public hearing may challenge a procedural ruling of the Moderator. A majority vote of the eligible voters as determined in Section 5.7.4 shall determine the decision.

7.4 **Eligible voters:** ICC Governmental Member Representatives and Honorary Members in attendance at the Final Action Hearing shall have one vote per eligible attendee on all International Codes. Applications, whether new or updated, for governmental member voting representative status must be received by the Code Council ten days prior to the commencement of the first day of the Final Action Hearing in order for any designated representative to be eligible to vote.

7.5 **Majorities for Final Action:** The required voting majority based on the number of votes cast of eligible voters shall be in accordance with the following table:

Public Hearing Action (see note)	**Desired Final Action**		
	AS	**AM**	**D**
AS	Simple Majority	2/3 Majority	Simple Majority
AM	2/3 Majority	Simple Majority to sustain the Public Hearing Action or; 2/3 Majority on additional modifications and 2/3 on overall AM	Simple Majority
D	2/3 Majority	2/3 Majority	Simple Majority

Note: The Public Hearing Action includes the committee action and successful assembly action.

7.5.1 **Failure to Achieve Majority Vote:** In the event that a code change proposal does not receive any of the required majorities for final action in Section 7.5, final action on the code change proposal in question shall be disapproval.

7.6 **Publication:** The Final action on all proposed code changes shall be published as soon as practicable after the determination of final action. The exact wording of any resulting text modifications shall be made available to any interested party.

8.0 Appeals

8.1 **Right to Appeal:** Any person may appeal an action or inaction in accordance with CP-1.

2010 FINAL ACTION HEARING SCHEDULE
October 25 – October 31, 2010
Charlotte Convention Center, Charlotte, NC

The hearings will start on Monday, October 25 at 1:00 pm, following the Foundation Luncheon. Administration, IPMC and IZC are scheduled to finish on Monday. The IECC and IRC–Energy hearings will not start until 1:00 pm on Wednesday, following the Awards Luncheon. The energy hearing schedule is split between residential energy and commercial energy as follows:

- IECC Chapters 1- 4: Code changes EC 1 through EC 145 (including Part II's to Chapter 11 of the IRC)
- IRC Chapter 11: Code changes RE 2, RE 4, RE 5 and RE 7
- IECC Chapter 5: Code changes EC 147 through EC 231

Actual start times for each code/chapter cannot be stipulated due to uncertainties in hearing progress. The hearing on each code/chapter will begin immediately upon the completion of the hearings for the prior code/chapter. This includes moving the hearing up or back from the day indicated based on hearing progress. The schedule anticipates that the hearings will be completed no later than 12 pm on Sunday, October 31. This may require adjustments to the daily start/end times based on hearing progress.

In accordance with the revised ICC Code Development Procedures, this hearing is the second of two Final Action Hearings to be conducted in 2010 and concludes the 2009/2010 Code Development Cycle.

Monday October 25	Tuesday October 26	Wednesday October 27	Thursday October 28	Friday October 29	Saturday October 30	Sunday October 31
Start 1 pm		**Start 1 pm**	**Start 8 am**	**Start 8 am**	**Start 8 am**	**Start 8 am**
ADMIN **IPMC** **IZC**	**NO HEARINGS**	**IECC Chs. 1- 4 & IRC Ch. 11**	**IECC Chs. 1- 4 & IRC Ch. 11**	**IECC Chs. 1- 4 & IRC Ch. 11** **IECC Ch. 5**	**IECC Ch. 5**	**IECC Ch. 5**
End 4 pm		**End 5 pm**	**End 6 pm**	**End 6 pm**	**End 6 pm**	**End 12 pm**

Notes:

1. Daily start and end hearing times are subject to change based on progress.

2. Lunch breaks to be announced. The hearings are scheduled without a dinner break.

TENTATIVE HEARING ORDER
FOR EACH INDIVIDUAL CONSIDERATION AGENDA
FINAL ACTION AGENDA – CHARLOTTE, NC

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 xxi for code change which affect codes other than those under their respective code change number prefix.

IPMC
(See page 1)
PM4
    PM19, Part I
    PM20, Part I
    PM20, Part II
PM7
    PM21
PM9
PM12
PM14
    PM23, Part I
    PM23, Part II
PM18

ADMIN
(See page 39)
ADMIN3, Part I
ADMIN3, Part II
ADMIN6
ADMIN12
ADMIN35
ADMIN38
ADMIN39

IZC
(See page 100)
Z2

IECC Ch. 1 – 4
(See page 104) &
IRC Chapter 11
(See page 877)
EC1, Part I
EC1, Part II
EC3
EC9
EC13, Part I
EC13, Part II
    EC25, Part I
    EC25, Part II
EC16, Part I
EC16, Part II
EC17, Part I
EC17, Part II
EC24
EC27, Part I
EC27, Part II
EC30, Part I
EC30, Part II
EC31, Part I
EC31, Part II
EC34, Part I
EC34, Part II
EC35, Part I
EC35, Part II
EC36, Part I
EC36, Part II
EC38, Part I
EC38, Part II
EC39, Part II
EC41, Part I
EC41, Part II
EC42, Part I
EC42, Part II
EC45, Part I
EC45, Part II
EC46, Part I
EC46, Part II
EC47, Part I
EC47, Part II
EC48, Part I
EC48, Part II
EC50, Part I
EC50, Part II
EC54, Part I
EC54, Part II
EC55, Part I
EC55, Part II
EC57, Part I
EC57, Part II
EC60, Part I
EC60, Part II
EC63, Part I
EC66, Part I
EC66, Part II
EC68. Part I
EC68, Part II
EC70
EC71, Part I
EC71, Part II
EC74, Part I
EC74, Part II
EC79, Part I
EC79, Part II
EC81, Part I
EC81, Part II
EC84, Part I
EC84, Part II
EC86, Part I
EC86, Part II
EC88
EC89, Part I
EC89, Part II
EC91, Part I
EC91, Part II
    RE5
EC96, Part I
EC96, Part II
EC97
EC99, Part I
EC99, Part II
EC100, Part I
EC100, Part II
EC101, Part I
EC101, Part II
EC102, Part I
EC102, Part II
EC103, Part I
EC103, Part II
EC105
EC106, Part I
EC106, Part II
EC107, Part I
EC107, Part II
EC108
EC109, Part I
EC109, Part II
EC110
EC112, Part I
EC112, Part II
EC114, Part I
EC114, Part II
EC115, Part I
EC115, Part II
    RE7
EC119, Part I
EC121, Part I
EC121, Part II
EC124, Part I
EC124, Part II
EC125, Part I
EC125, Part II
EC126, Part I
EC126, Part II
EC129, Part I
EC129, Part II
EC131, Part I
EC131, Part II
EC132
EC133
EC134
EC135
EC137
EC140
EC141
EC142
EC145
    RE2
    RE4

IECC Ch. 5
(See page 638)
EC147
EC148
EC150
EC157
EC158
EC159
EC164
EC165
EC166
EC168
EC169
EC170
EC172
EC173
EC174
EC176
EC179
EC180
EC182
EC183
EC184
EC188
EC191
EC192
EC193
EC194
EC195
EC198
EC203
EC204
EC207
EC212
EC216
EC217
EC219
EC225
EC230
EC231

2009/2010 ICC CODE DEVELOPMENT CYCLE
CROSS INDEX OF PROPOSED CODE CHANGES WITH PUBLIC COMMENTS

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 Staff Secretaries on page vii. 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 index are proposed code changes that include sections or codes other than those listed on xxii. For example, International Building Code Section 107.2.6 is proposed for revision in code change ADM12-09/10. The International Building Code Chapter 1 is listed on page xxii as part of the IBC-General group. It is therefore identified in this index. Another example is Section N1101.7 of the International Residential Code. Chapter 11 of the IRC is listed on page xxii part of the IRC B/E group, and the proposed revision to Section N1101.7 was considered for revision in code change EC28-09/10, Part II.

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 the IPC, review the proposed code changes for the IPC Code Committee (listed with a P prefix) then review this cross reference for the IMC for proposed code changes published in other code change groups. 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 Table of Contents on page xxv for location)
E	**International Building Code - Means of Egress**
EC	**International Energy Conservation Code**
EB	**International Existing Building Code**
F	**International Fire Code**
FG	**International Fuel Gas Code**
FS	**International Building Code - Fire Safety**
G	**International Building Code - General**
M	**International Mechanical Code**
P	**International Plumbing Code**
PM	**International Property Maintenance Code**
RB	**International Residential Code - Building**
RE	**International Residential Code - Energy**
RM	**International Residential Code - Mechanical**
RP	**International Residential Code - Plumbing**
S	**International Building Code - Structural**
WUIC	**International Wildland-Urban Interface Code**

IBC	
101.3	ADM3
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CODE **PAGE**

PM4-09/10
304.15

Proposed Change as Submitted

Proponent: Joseph R. Hetzel, Thomas Associates, Inc., representing the Door & Access Systems Manufacturers Association (DASMA)

Revise as follows:

304.15 Doors. All exterior doors, door assemblies, operator systems if provided, and hardware shall be maintained in good condition. Locks at all entrances to dwelling units and sleeping units shall tightly secure the door. Locks on means of egress doors shall be in accordance with Section 702.3.

Reason: The purpose of the proposed code change is to address maintenance of automated aspects of doors not made clear in the first sentence under Section 304.15. The phrase "operator systems if provided" draws attention to automated doors, for checking on the performance to their intended functions while checking on the presence of any automated door safety functions and whether they are working.

The current provisions are inadequate because they do not consider the increased positive effect on public safety by effectively maintaining automated door systems. The proposed language fills this need, with code and legislative precedence for automated doors helping define an effective evaluation for maintenance purposes. As an example, automated garage doors are required to comply with UL 325 per the IBC, the IRC, and (for residential) Federal law.

Death and injury statistics are well established for individuals that have been entrapped by automated garage doors not in compliance with the UL 325 safety standard. The new language will be a preventive measure toward a reduction of death and injuries by requiring regular inspecting of automated door systems including automated garage doors.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: HETZEL-PM1-302.7.DOC

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: The committee felt that requiring door operator systems to be maintained was appropriate and enhanced public safety. Further, this language affords greater authority to the code official to cite these conditions where maintenance is required. Lastly, this change was preferred over PM3-09/10 based on its location.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Rick Davidson, City of Maple Grove, representing self, requests Disapproval.

Commenter's Reason: The membership should disapprove this proposal because it contains conflicting and confusing language and there was no safety reasons given for approval.

According to the proponent, *"the purpose of the proposed code change is to address maintenance of automated aspects of doors not made clear in the first sentence under Section 304.15. The phrase "operator systems if provided" draws attention to automated doors, for checking on the performance to their intended functions while checking on the presence of any automated door safety functions and whether they are working."* But the proponent does not provide a definition for "operator systems". One might assume these are the accessibility operators with the push pad found at the entry of some commercial occupancies or the automatic sliding doors found at many big box retailers. But if you read further down in the reason statement the proponent makes the following statement: *"As an example, automated garage doors are required to comply with UL 325 per the IBC, the IRC, and (for residential) Federal law."* So now one might presume that the reference to "operator systems" means residential "automatic garage door openers". The term "automatic garage door openers" is the term used in the IRC, not "operator systems" (**From the IRC - R309.4 Automatic garage door openers.** Automatic garage door openers, if provided, shall be listed in accordance with UL 325.). So, what exactly is the proponent's intent? It is very uncertain as to which doors this language is intended to apply.

The proponent directs his code change to Section 304.15. Reading the language of 304.15 leads one to believe that the section applies to egress doors and other doors allowing passage through the building, not an overhead garage door. That language reads: "**Doors.** All exterior doors, door assemblies, and hardware shall be maintained in good condition. Locks at all entrances to dwelling units and sleeping units shall tightly secure the door. Locks on means of egress doors shall be in accordance with Section 702.3." This doesn't sound like it is referencing overhead garage doors.

The term "operator systems" is not found in either the IBC or the IRC. Since the installation of "operator systems" is not regulated in the IBC or IRC, how can one regulate their maintenance or operation?

Furthermore, the proposed language states that “operator systems” “be maintained in good condition”. What hazard exists if the owner chooses to remove the motor from an “operator system” and leave it inoperable? The opening is not required for exiting or any life safety purpose.

And last, UL325 applies to newly installed or repaired automatic garage door openers. The code permits older units to comply with the rules in effect at the time of installation. To what standard would the code official require these doors be tested to? Will code officials mistakenly believe they should order these older, but legal, installations removed erroneously?

Because of the vagaries of this language, it should be disapproved and more understandable language submitted for the next cycle.

Final Action: AS AM AMPC____ D

PM7-09/10
308

Proposed Change as Submitted

Proponent: Robert F. Hale, Jr., Town of Warrenton, VA, representing Virginia Building Code Officials Association

1. Revise section title as follows:

SECTION 308
RUBBISH AND GARBAGE AND OTHER MATERIALS

2. Add new text as follows:

308.4 Accumulation of other materials. Materials of any type shall not be accumulated within a structure so as to impede upon the safe occupancy or egress from the space or significantly alter its intended use.

When materials of any type are gathered together within a room or space so as to limit the space within the room anywhere between 2' and 6' above the finished floor to less than the required square footage specified in Section 404 of this code, then the room or space in question shall then be considered a storage area as defined in Section 311.2 or 311.3 of the *International Building Code* and subsequently a change of occupancy as specified in Section 3408 of the *International Building Code*.

If the materials stored within a room or space exceed the permitted floor loading, then the room or space in question shall then be considered a storage area as defined in Section 311.2 or 311.3 of the *International Building Code* and subsequently a change of occupancy as specified in Section 3408 of the *International Building Code*.

Reason: The accumulation of materials within dwelling units and other spaces is an unsafe practice that leads to blocked egress, super-imposed loads, non-functional spaces as well as being a potentially deadly fire hazard. This proposed code section permits the code official enforcement option where none existed before to deal with conversions of use to storage.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: HALE-PM1-308

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee felt that much of the proposal was unenforceable. The committee also felt the concerns that the proponent was trying to address are currently addressed by Section 702 and 108 of the code related to egress and structural concerns. Lastly, it appears that the IRC should have been addressed in the proposal to bring in structures under the scope of that code.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Sean P. Farrell, Chief Property Code Enforcement Inspector, representing VBCOA, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

SECTION 308
RUBBISH AND GARBAGE AND OTHER MATERIALS

308.4 Accumulation of other materials. Materials of any type shall not be accumulated within a structure so as to impede upon the safe occupancy or egress from the space or significantly alter its ~~intended~~ approved use.

~~When materials of any type are gathered together within a room or space so as to limit the space within the room anywhere between 2' and 6' above the finished floor to less than the required square footage specified in Section 404 of this code, then the room or space in question shall then~~

~~be considered a storage area as defined in Section 311.2 or 311.3 of the *International Building Code* and subsequently a change of occupancy as specified in Section 3408 of the *International Building Code*.~~

~~If the materials stored within a room or space exceed the permitted floor loading, then the room or space in question shall then be considered a storage area as defined in Section 311.2 or 311.3 of the *International Building Code* and subsequently a change of occupancy as specified in Section 3408 of the *International Building Code*.~~

Commenter's Reason: This proposal was intended to address the accumulation of items and materials other than rubbish and garbage which results in blocked egress paths, super-imposed loads, non-functional required spaces as well as being a potentially deadly fire hazard. This proposed language permits the Code Official enforcement tools where none existed before to deal with situations regarding conversions of approved uses to that of storage, and the safety and fire hazards associated with the recently documented phenomena of hording. Additionally, by deleting the modifying text, it removes complicated and unnecessary pre-determined conclusions which may limit the code official from implementing the appropriate corrective solution.

Final Action: AS AM AMPC____ D

PM9-09/10

404.4.1, 404.5, Table 404.5 (New), 404.5.1 (New), 404.5.2 (New)

Proposed Change as Submitted

Proponent: Sean P. Farrell, Prince William County Virginia, representing Virginia Building and Code Officials Association

1. Revise as follows:

404.4.1 Room area. Every living room shall contain at least 120 square feet (11.2 m^2) and every bedroom shall contain at least 70 square feet (6.5 m^2) and every bedroom occupied by more than one person shall contain at least 50 square feet (4.6 m^2) of floor area for each occupant thereof.

404.5 Overcrowding. ~~The number of persons occupying a dwelling unit shall not create conditions that, in the opinion of the code official, endanger the life, health, safety or welfare of the occupants.~~ Dwelling units shall not be occupied by more occupants than permitted by the minimum area requirements of Table 404.5.

2. Add new table and text as follows:

TABLE 404.5
MINIMUM AREA REQUIREMENTS

SPACE	MINIMUM AREA IN SQUARE FEET		
	1-2 occupants	**3-5 occupants**	**6 or more occupants**
Living room[a, b]	120	120	150
Dining room[a, b]	No requirement	80	100
Bedrooms	Shall comply with Section 404.4.1		

For SI: 1 square foot = 0.093 m^2

a. See Section 404.5.2 for combined living room/dining room spaces.
b. See Section 404.5.1 for limitations on determining the minimum occupancy area for sleeping purposes.

404.5.1 Sleeping area. The minimum occupancy area required by Table 404.5 shall not be included as a sleeping area in determining the minimum occupancy area for sleeping purposes. All sleeping areas shall comply with Section 404.4.

404.5.2 Combined spaces. Combined living room and dining room spaces shall comply with the requirements of Table 404.5 if the total area is equal to that required for separate rooms and if the space is located so as to function as a combination living room/dining room.

Reason: Code officials need objective criteria in which to draw conclusions and make educated and calculated decisions. The current code language "in the opinion of" is as subjective as language and text can be. By adding the square footage table back into the code, the official has objective criteria based upon reasonable and normal household conditions that account for live and dead loading. In most cases, the numbers in the table are very liberal but are effective at dealing with true overcrowded rooms and structures. The reason the language was stricken from the code several years ago was to allow for a couple and their small child(ren) to occupy a single room less than 150 square feet. This option is still afforded to the code official by way of code modification. Additionally, a strict interpretation of the current language does not allow for individual overcrowded room situations, the code official must take the entire unit into consideration even when the occupants may not have rights to the entire unit. We feel that is an unnecessary limitation imposed on the code official trying to ensure the safety of the occupants.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: Code change proposals PM8, PM9 and PM10 deal with minimum room area requirements. PM10 proposes placing minimum area requirements in an appendix. The committee needs to make its intent clear with respect to the location of these requirements, if approved.

ICCFILENAME: FARRELL-PM1-404.4.1.DOC

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: The committee agreed that this change was appropriate because it replaces the current ambiguous language with clear enforceable language. Further, this change was preferred to PM8-090/10 as it maintains the requirements for minimum living room area.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Rick Davidson, City of Maple Grove, representing self, requests Disapproval.

Commenter's Reason:

It is amazing in this day of Internet access that someone didn't do a Google search on the matter of or the problems with enforcing "overcrowding" regulations based strictly on area requirements.

What has been proposed by the proponent is the return to antiquated rules that had been put in place during the tenement regulations of the early 20th century. These rules were arbitrary, not based on any analysis. Neither was there analysis provided by the proponent that the proposed limitations had any validity in this day and age and none was requested by the committee. They can still be presumed to be arbitrary. This is unconscionable.

There are thousands of articles, studies, and matters of case law on this issue of which people need to be aware before they vote on this issue.

The article "**The Changing Problem Of Overcrowded Housing.**" by Myers, Dowell.; Baer, William C.,; Choi, Seong-You in the Journal of the American Planning Association makes the following statements:

"Implicit in all discussions of crowding is the assumption that it is a policy problem--that the effects from crowding, and especially overcrowding, are deleterious to people's physical and mental health. Although much analysis has been marshaled to support this conclusion, it has never been definitively established.

Overcrowding is a highly complex problem, involving household structure, racial and ethnic diversity, housing availability, and consumer preferences. The dynamics of what causes overcrowding are largely unknown. Instead, past social science research has focused largely on the effects of overcrowding, although even those findings are uncertain. Moreover, the issue of overcrowding exemplifies the current perplexities about imposing a particular, middle-class, majority standard in an evolving multiethnic society. In short, how much crowding is excessive?"

After a century of debate it is still in question whether so-called overcrowding is harmful to the people affected, or merely socially distasteful to outsiders who observe its presence among others.

The article goes on to say: *"As yet, there is no basis in the scientific literature for choosing one standard of unacceptable crowding over another. The basic research issues are so problematic that researchers never get to the standard-setting stage in applying their findings. Indeed, in a curious twist, they use the unproven standard (e.g., 1.00) to measure the basic phenomena whose extent they are trying to determine. Thus researchers tend to implicitly leave standard setting to professional organizations such as the American Public Health Association, or to building code officials (both of which groups, by the way, have more relaxed standards than do policy commentators or even HUD); meanwhile, these organizations pretend the standards have some basis in science."*

Please note that these professionals make the statement that "these organizations (building code officials) pretend the standards have some basis in science". That is exactly the point.

This and numerous other articles on the matter point out the complexities of dealing with overcrowded housing. The proponent and the committee seem to believe that this complex problem can be solved using a one size fits all approach. That fails to acknowledge all of the issues.

Reading the reason statement, it appears that the primary reason for making the change is to make life easier for code enforcement. Rather than evaluating the actual living conditions in a dwelling, the proponent would have you determining whether the dwelling is safe based on a mathematical exercise!

Let's look at a couple of examples using the proposed rules.

Example #1: Juan and his wife live in an immaculate 1000 square foot house. Their master bedroom is 120 square feet. They welcome a child into their family and they prefer to have the child sleep in their room due to health issues. Their master bedroom is not large enough based on these proposed rules and the local housing inspector must issue an order for him to remove one individual from the room. Where is the health or safety issue that was created by having the child sleep in the room? Can you imagine trying to explain that you are there to protect them; the current arrangement is unsafe; and if the bedroom had only been 30 square feet larger that the building would again be safe!

Example #2: Jim Willy and his wife love children. They live in a 3000 square foot house with four bedrooms. They have eighteen children. Their eighteen children sleep in bunk beds in three bedrooms, six to a room. The children are perfectly healthy. The house is immaculate. Each bedroom must be 300 square feet by these proposed rules but is only 200 square feet. As the local housing inspector, do you order Jim Willy to (a) vacate his house, (b) construct an addition with additional sleeping space, or (c) get rid of some children? How does your order reflect the intent of the IPMC? As a side note, the home only has one toilet, one lavatory, and one tub/shower. The dining room need only be 100 square feet. The living room need only be 150 square feet. This meets minimum proposed IPMC requirements. Is this more of a health/safety/welfare issue than the size of the bedrooms?

Example #3: Ahmad, his wife, and their three teenage sons and one daughter live in an immaculate modest three bedroom home. The three sons share a 120 square foot bedroom. The daughter has her own bedroom that is 100 square feet. Since the bedroom occupied by the three sons is not large enough based on the proposed rules, do you (a) tell Ahmad to get rid of one son, (b) tell him to move one of his teenage sons in with his teenage daughter, or (c) move out of the house? Where is the health, safety, and welfare issue that exists with the current living arrangements? Is the welfare of the children improved if the teenage son is forced to share the same bedroom with his teenaged sister?

Now the proponent does give Juan, Jim Willy, and Ahmad an out. He says they can apply to the local property maintenance office for a modification (which the reason statement gives as relief). The code official can grant the modification if the request is in compliance with the intent and purpose of the code and does not lessen health, life, and safety requirements. So how many people do you think will feel it necessary to get permission from the government to have more children? And on what would the code official base approval? How many code officials will want to make this decision? How many of these decisions will ultimately be influenced by elected officials or by other factors such as bias?

Limiting the number of occupants in a dwelling strictly on a mathematical formula with no correlating health or safety stipulations being present is outside the scope of the IPMC.

When the current language was debated and approved by the membership, the discussion largely focused on the fact that the previous code language was discriminatory.

The following excerpt is from an article written by Ellen Pader entitled *"Restricting Occupancy, Hurting Families"* in Progressive Planning Magazine: *"Occupancy standards have had a large influence on the ethnic, racial, social and economic structure of cities. Occupancy standards govern the acceptable number of people-per-unit or acceptable household composition. They directly impact the availability and affordability of housing and, by extension, homelessness, coercive racial, ethnic and class segregation and access to quality education, jobs, recreation, transportation and other services.*

While appearing to be neutral, and purported by their supporters to be in the interest of protecting the physical and mental health and safety of all, property owners and municipalities have long used overly restrictive occupancy codes explicitly to keep out unwanted populations and maintain a particular ethnic status quo in a community. Two popular ways that occupancy standards are used for discriminatory purposes are by writing zoning policies that restrict the number of non-nuclear or unrelated people who may share a rented or self-owned home, and setting restrictive person-to-room ratios. The standards are purposefully designed to be biased against certain groups by legislating away the right to have extended or large nuclear families live together. Once the regulations are in effect, there is often uneven enforcement, targeting those unwanted groups, generally based on their ethnicity or the presence of children in the household.

What we're really talking about here is a culturally constructed definition of appropriate family composition and the apportioning of domestic space masquerading as a neutral, and even healthy and necessary, social policy - a social policy which can only have a disparate cultural and economic impact on low-income households. What makes this more insidious is that the history of current occupancy standards derives from racist and ethnocentric beliefs and attempts to control, contain and assimilate non-white and "not-yet-white" populations (as historian David Roediger refers to the non-WASP ethnic groups which were once considered distinct races)."

On September 24th , 2009, housing experts from the worlds of design, development, law, policy and government gathered at the Japan Society for ***One Size Fits Some**,* an international symposium convened by the Citizen's Housing and Planning Council (CHPC). The symposium is part of wider research project by CHPC that takes a fresh look at housing and space standards in New York City.

Jerilyn Perine**,** Executive Director of CHPC, began the day's proceedings by asking: why should we care about the issue in New York City? She framed the symposium in the historical, social, political and architectural context of New York City. Demographics, technologies (such as electrical light, heating and air conditioning), and the uses of the city's building stock have changed dramatically since much of our current housing codes, laws and resolutions were developed. The Tenement House Act of 1901 and the Multiple Dwelling Law of 1929 set a standard for light, air, room size, health and safety that still largely influences our housing stock and the regulations codified and enforced by municipal, state and federal agencies today. Yet, fewer and fewer people can afford to live within this outdated housing standard, and more and more live outside of it. Perine issued a powerful call to action for policy-makers and designers to provide housing solutions that are more flexible and responsive to changes in population, livelihoods, family structure and costs. The challenge – for housing officials, designers and developers – is to "look at how people are really living." If we fail to do this, and our population continues to grow, the mismatch between households and housing stock will become even deeper, causing incredible dysfunction in an already complicated market.

The articles and references cited are but a very few that exist on the issue of the perception of overcrowding. If one comes to no other conclusion it should be that further study is necessary. We should not return to rules based on 100 plus year old ideologies.

It is extremely important to remember that these rules apply to owner occupied homes as well as rentals. How many of you at one time or another in your life may have lived in a home that would have violated the proposed rules?

It was argued that overcrowding leads to other issues such as perking problems, increased trash, etc. Don't cities have regulations on parking? If cars are parked on the street, on the grass, or causing a problem in another way is this always a sign of overcrowding? No it isn't. Parking regulations should be in place and enforced whether it is one person with twenty cars or twenty people with twenty cars. Regulations on garbage storage and accumulation can be put in place and enforced. Interior issues related to sanitation, disease, or fire hazards such as amount of combustible storage or blocked exits can be enforced. It is much better to attack the real issues.

If the proposed language is approved by the membership and adopted by jurisdictions, those jurisdictions could find themselves accused of discriminatory housing practices and all that entails.

If there are to be new rules regulating overcrowding, they should be based on studies that have occurred in this century, not from the 1800's.

Final Action: AS AM AMPC____ D

PM12-09/10
504.3, 504.4 (New)

Proposed Change as Submitted

Proponent: Ronald L. George, Ron George Design & Consulting Services, representing self

Revise as follows:

504.3 Plumbing system hazards. Where it is found that a plumbing system in a structure constitutes a hazard to the occupants or the structure by reason of inadequate service, inadequate venting, cross connection, backsiphonage, improper installation, scald hazard. deterioration or damage or for similar reasons, the *code official* shall require the defects to be corrected to eliminate the hazard.

504.4 Scalding hazards. Every shower, bathtub or combination tub/shower shall be equipped with a temperature or pressure compensation shower valve conforming to ASSE 1016 or CSA B-125.1 with a maximum temperature limit stop adjustable to limit hot water temperatures to a maximum of 120 degrees F.

Exceptions:

1. A compensating type shower valve is not required if a properly sized master thermostatic mixing valve is installed at the hot water source conforming to ASSE 1017 or ASME A112.18.1/CSA B-125.1 and set to limit the hot water distribution temperature to a maximum of 120 degrees F.
2. A compensating type shower valve is not required if a properly sized thermostatic mixing valve conforming to ASSE 1070 or CSA B-125.3 is installed near the fixtures and set to limit the hot water distribution temperature to a maximum of 120 degrees F.
3. A compensating type shower valve is not required if a temperature actuated flow reduction device conforming to ASSE 1062 is installed on the shower arm and the tub fill spout.

Reason: Currently there is not any specific language guiding inspectors for safety hazards associated with plumbing and scalding hazards in older buildings. Scalding hazards are one of the most painful and most common injuries in older apartments, and rental properties with two-handled non-compensating type shower valves.

The proposed language is intended to address these life altering and very painful injuries which commonly occur in older buildings and apartments. The property maintenance code allows inspectors to correct hazardous conditions but does not specifically address one of the biggest hazards in a home, scalding.

Cost Impact: The code change proposal will cause a minimal cost increase.

Analysis: All standards referenced in this proposal are currently referenced in other I-Codes.

ICCFILENAME: GEORGE-PM1-504.4.DOC

Public Hearing Results

This code change was heard by the IPC Code Development Committee.

Committee Action: **Approved As Submitted**

Committee Reason: Scalding is a real concern and the proposal provides reasonable options for safety.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Sally Remedios, Delta Faucet Company requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

504.3 Plumbing system hazards. Where it is found that a plumbing system in a structure constitutes a hazard to the occupants or the structure by reason of inadequate service, inadequate venting, cross connection, backsiphonage, improper installation, scald and thermal shock hazard, deterioration or damage or for similar reasons, the *code official* shall require the defects to be corrected to eliminate the hazard.

504.4 Scalding hazards. Every shower, ~~bathtub~~ or combination tub/shower shall be equipped with an ~~temperature or pressure compensation shower~~ automatic compensating valve conforming to ASSE 1016 or ASME A112.18.1/CSA B-125.1 with a maximum temperature limit stop adjustable to limit hot water temperatures to a maximum of 120 degrees F. Every bathtub shall be equipped with a temperature limiting device conforming to ASSE 1070 or CSA B-125.3 with a maximum temperature limit stop adjustable to limit hot water temperatures to a maximum of 120 degrees F.

~~**Exceptions:**~~

1. ~~A compensating type shower valve is not required if a properly sized master thermostatic mixing valve is installed at the hot water source conforming to ASSE 1017 or ASME A112.18.1/CSA B-125.1 and set to limit the hot water distribution temperature to a maximum of 120 degrees F.~~
2. ~~A compensating type shower valve is not required if a properly sized thermostatic mixing valve conforming to ASSE 1070 or CSA B-125.3 is installed near the fixtures and set to limit the hot water distribution temperature to a maximum of 120 degrees F.~~
3. ~~A compensating type shower valve is not required if a temperature actuated flow reduction device conforming to ASSE 1062 is installed on the shower arm and the tub fill spout.~~

Commenters' Reason: The proposal addresses a scalding hazard, but it should also address thermal shock for showers which is as just as much a significant hazard, for showers, such as slips and falls. However, the proponents' rationale is not completely accurate. In addition the exceptions are not acceptable alternatives, as only devices compliant to ASSE 1016 or ASME A112.18.1/CSA B-125.1 are recommended to protect against the shower discharge against scalding and thermal shocks. An additional clause is needed to address bathtubs since the device to protect against scalding is different to that for a shower.

Public Comment 2:

Rick Davidson, City of Maple Grove, representing self, requests Disapproval.

Commenter's Reason: The membership should disapprove this proposal for the following reason: it imposes a mandatory retroactive rule on all existing dwellings by requiring all dwellings to immediately install anti-scald devices creating a significant liability and expense for all homeowners.

The proposal requires that anti-scald devices be installed in all existing bathtubs and showers. The proponent's reason statement states: *"The proposed language is intended to address these life altering and very painful injuries which commonly occur in older buildings and apartments."* What the proponent, and apparently the committee, forgot was that the IPMC applies not only to "older buildings and apartments" but to all buildings including owner occupied single-family dwellings. So this rule will apply to every dwelling unit where the IPMC is adopted. It would make any bath tub or shower valve in any dwelling illegal if it didn't have an anti-scald device. The proponent gave absolutely no evidence that there is a problem or, if there is a problem, how wide spread or frequent it may be.

The proposal would seem to conflict with both the International Existing Building Code and the scope and maintenance provisions of the IPMC which read:

International Existing Building Code

101.4 Applicability. This code shall apply to the repair, alteration, change of occupancy, addition and relocation of all existing buildings, regardless of occupancy, subject to the criteria of Sections 101.4.1 and 101.4.2.

101.4.2 Buildings previously occupied. The legal occupancy of any building existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, the *International Fire Code*, or the *International Property Maintenance Code*, or as is deemed necessary by the code official for the general safety and welfare of the occupants and the public.

101.5 Compliance methods. The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with one of the methods listed in Sections 101.5.1 through 101.5.3 as selected by the applicant. Application of a method shall be the sole basis for assessing the compliance of work performed under a single permit unless otherwise approved by the code official. Sections 101.5.1 through 101.5.3 shall not be applied in combination with each other.

Exception: Alterations complying with the laws in existence at the time the building or the affected portion of the building was built shall be considered in compliance with the provisions of this code unless the building has sustained substantial structural damage as defined in Section 506.2, or the building is undergoing more than a limited structural alteration as defined in Section 807.5.3. New structural members added as part of the repair or alteration shall comply with the *International Building Code*. Repairs and alterations of existing buildings in flood hazard areas shall comply with Sections 501.4 and 601.3, respectively.

And,

International Property Maintenance Code

101.2 Scope. The provisions of this code shall apply to all existing residential and nonresidential structures and all existing premises and constitute minimum requirements and standards for premises, structures, equipment and facilities for light, ventilation, space, heating, sanitation, protection from the elements, life safety, safety from fire and other hazards, and for safe and sanitary maintenance; the responsibility of owners, operators and occupants; the occupancy of existing structures and premises, and for administration, enforcement and penalties.

102.2 Maintenance. Equipment, systems, devices and safeguards required by this code or a previous regulation or code under which the structure or premises was constructed, altered or repaired shall be maintained in good working order. No owner, operator or occupant shall cause any service, facility, equipment or utility which is required under this section to be removed from or shut off from or discontinued for any occupied dwelling, except for such temporary interruption as necessary while repairs or alterations are in progress. The requirements of this code are not intended to provide the basis for removal or abrogation of fire protection and safety systems and devices in existing structures. Except as otherwise specified herein, the owner or the owner's designated agent shall be responsible for the maintenance of buildings, structures and premises.

These sections are generally interpreted to permit the existing faucets/showers to remain if they complied with the rules in effect at the time of their installation. Furthermore, the installation of the devices specified in the code change is beyond the skill levels of most homeowners and will require that they hire a plumber. Homes with two or three showers/tubs could have hundreds, if not thousands, of dollars in expense. This is far from the "minimal cost increase" indicated by the proponent.

Some would argue this is no different than the requirement to install smoke alarms. But it is different. Smoke alarms can be installed even by a novice. They don't require any special skills or knowledge to install. And installing a smoke alarm isn't an alteration of an existing code compliant system. Requiring anti-scald protection in an existing installation is an alteration of an approved system that requires special knowledge, effort and tools.

This proposal will elevate the liability level for unsuspecting homeowners, sellers of homes, and building owners. There were no statistics or other evidence provided to support the change, only anecdotal statements. This is an insufficient basis on which to approve a code change.

This is an expensive correction that is retroactively placed on every building in the jurisdiction that contains a bath tub or shower. The language applies to buildings beyond those indicated by the proponent. It will place significant pressure on jurisdictions to notify all of their residents of this retroactive change. It should be disapproved.

Public Comment 3:

Sean P. Farrell, Chief Property Code Enforcement Inspector, representing VBCOA, requests Disapproval.

Commenter's Reason: The Property Maintenance Code was designed to ensure that structures are maintained in accordance with the code under which constructed and approved. This proposal suggests that structures are not compliant with the code under which they were constructed and approved. If code enforcement personnel undertake that kind of philosophy, they must require retrofit of every structure each and every time a code is changed or modified. Additionally, this will have a significant cost factor for building and home owners, especially for those devices that cannot be installed in readily accessible locations.

Public Comment 4:

Dustin McLehaney, Chesterfield Country, representing VA Plumbing and Mechanical Inspectors Association, VA Building and Code Officials Association and ICC Region VII, requests Disapproval.

Commenter's Reason: The provisions contained within the proposed section insinuate that not including scald protection was not acceptable when the original structure was constructed, and now, by virtue of applying the property maintenance code all structures need to be brought in compliance to meet current codes on scald protection. This concept totally goes against the philosophy of the property "maintenance" code. This is not a "maintenance" issue, but rather a "new" installation issue. Otherwise this same situation would impact all structures built under previous editions of the codes. This would affect many other building components such as stair tread and riser measurements, water conservation fixtures, energy conservation or arc fault and other electrical provisions.

The proponent states this change will cause a minimal cost increase, that is incorrect. In fact, quite the opposite, the reality is this will cause a substantial cost increase to the end user depending on the type of device currently installed to serve existing bath tubs and showers. This could be as complex as having to remove wall board and/or ceramic tile prior to replace the faucet. Not to mention this could also require major repairs or even possible replacement of fiberglass tub/shower enclosures.

A master thermostatic mixing valve may appear to be a simple fix, by including this option as an exception, but residential occupants may not want this type of device to control the entire hot water system.

The language used in the charging text is not even consistent with the current IPC and IRC provisions. The terms "temperature or pressure compensating shower valve" is not the appropriate code terminology.

This proposal changes the entire scope and intent of "property maintenance" code provisions and now would require code officials to enforce the concept of retro fitting and up–dating older systems unnecessarily because they were once "approved" when originally constructed.

Lastly, to address the issue with the "minimal" cost increase we discovered, after some local market research, that the average cost to install the master thermostatic mixing valve is more than $250.00 per unit, and replacing faucets was even more. This excessive cost is just unreasonable simply because a structure happens to undergo a "property maintenance" code inspection. In this current economic environment, a mandatory costly upgrade of tub and shower faucets is going to have a negative impact on existing home market.

Public Comment 5:

Don Surrena, CBO, National Association of Home Builders (NAHB), requests Disapproval.

Commenter's Reason: Section 504.3. As approved by the committee with the addition of "scald hazard" into the section, now will require all fixtures beyond the tub/shower to abate a scald hazard. That would include the lavatory, wash sink, kitchen sink, garage or any other hot water dispensing fixture within the purview of the "Housing Inspector." The whole code change acts as a retroactive requirement to all existing housing and buildings covered by the Property Maintenance Code. This is a property maintenance code and as stated in the "Scope and Application" Section 101.2 Scope. The provisions of this code shall apply to all existing residential and nonresidential structures and all existing *premises* and constitute minimum requirements and standards for *premises*, structures, equipment and facilities for light, *ventilation*, space, heating, sanitation, protection from the elements, life safety, safety from fire and other hazards, and for safe and sanitary maintenance. The key to this section is that it is for the minimum requirements. In Section 102.2 Maintenance. Equipment, systems, devices and safeguards required by this code or a previous regulation or code under which the structure or *premises* was constructed, altered or repaired shall be maintained in good working order. If equipment or devices ar e i n w orking or der a nd ar e bei ng m aintained and th ey were c ompliant when i nstalled, the y have met the c riteria of the P roperty Maintenance Code. To require a system to be upgraded that was lawful and is still operational because a new system is developed fly's in the face of a minimum requirement. What is to stop the requirement of any new product that performs better or differently than the presently legal equipment to then be required to be installed?

Final Action: AS AM AMPC____ D

PM14-09/10
603.7 (New)

Proposed Change as Submitted

Proponent: Mona Casey, United Parents to Restrict Open Access to Refrigerant

Add new text as follows:

603.7 Existing HVAC systems. Refrigerant circuit access ports located outdoors shall be provided with locking-type tamper-resistant caps whenever the system is modified, serviced, or repaired.

Reason: The purpose of this code modification is to add new requirements to the Code. The existing code does not address the issue of accessibility to refrigerant by unauthorized individuals. Refrigerant is extremely dangerous and potentially lethal.

Facts:

- Refrigerant "can cause death without warning".
- Refrigerant is considered a gateway drug because users often progress from refrigerant use to drug and alcohol abuse.
- Refrigerant is not a cumulative substance where chances of dying from it increase as the dosage and number of use increases. It can kill on the 1st, 10th, 100th, or any other time. 33 percent of deaths resulting from refrigerant huffing occurred on the 1st use.
- Refrigerant, like other poisons, must be kept out of reach of children.
- Refrigerant theft is increasing.
- According to Mike Opitz, Certification Manager, LEED for Existing Buildings, U.S. Green Building Council, chlorine in CFCs and HCFCs destroy the ozone and depletes the Earth's natural shield for incoming ultraviolet radiation and absorb outgoing infrared radiation from the earth, functioning as potent greenhouse gases.

National Statistics:

- The National Institute on Drug Abuse reports that one in five American teens have used Inhalants to get high.
- According to Stephen J. Pasierb, President and CEO of The Partnership for Drug-Free America, 22% of 6th and 8th graders admitted abusing inhalants and only 3% of parents think their child has ever abused inhalants.
- An analysis of 144 Texas death certificates by the Texas Commission on Alcohol and Drug Abuse involving misuse of inhalants found that the most frequently mentioned inhalant (35%) was Freon (51 deaths). Of the Freon deaths, 42 percent were students or youth with a mean age of 16.4 years.
- Suffocation, inhaling fluid or vomit into the lungs, and accidents each cause about 15% of deaths linked to inhalant abuse.
- National Institute on Drug Abuse's 'Monitoring the Future' study reveals that inhalant abuse among 8th graders is up 7.7% since 2002.
- 55% of deaths linked to inhalant abuse are caused by "Sudden Sniffing Death Syndrome." SSDS can occur on the first use or any use. The

Inhalant causes the heart to beat rapidly and erratically, resulting in cardiac arrest.

- 22% of inhalant abusers who died of SSDS had no history of previous inhalant abuse. In other words, they were first-time users.

Collier County, FL Statistics:

- The use of inhalants in middle schools has doubled in two years
- The average age a child starts using drugs or alcohol is just 12½
- Every third day a child is taken to the hospital because of a drug overdose
- 85 percent of all juvenile criminal cases are substance related
- Deaths due solely to drug toxicity increased 76% between 1998 and 2005
- The modification of this code will have an immense positive impact on the safety and health of our citizens, especially our youth. It will reduce the number of deaths associated with Inhalant abuse and the number of injuries associated with Freon accidents and leaks.

Cost Impact: The code change proposal will increase the cost of construction by $25-$30.

ICCFILENAME: CASEY-PM1-603.7.DOC

Public Hearing Results

Committee Action: **Approved as Modified**

Modify the proposal as follows:

603.7 Existing HVAC systems. Air conditioning units with a refrigerant circuit access ports located outdoors shall be provided with locking-type tamper-resistant caps or shall be otherwise secured to prevent unauthorized access whenever the system is recharged ~~modified~~, serviced, or repaired.

Committee Reason: The committee argeed that providing safety caps for these outdoor access ports was justified and relatively inexpensive. Further, it was felt that owners and contractors would install these items as a liability measure. The modification clarifies that the concern is only air conditioning units with refrigerant ports and allows methods other than the safety cap to be utilized.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Curt Campbell, Chesterfield County, representing VA Plumbing and Mechanical Inspectors Association, VA Building and Code Officials Association, requests Disapproval.

Commenter's Reason: The provisions contained within the proposed section insinuate that not including the locking-type tamper-resistant caps or otherwise securing to prevent unauthorized access to refrigerant circuit access ports located outside was not acceptable when the original structure was constructed, and now, by virtue of applying the property maintenance code all structures need to be brought in compliance to meet current codes on refrigerant access ports located outside. This concept totally goes against the philosophy of the property "maintenance" code. This is not a "maintenance" issue, but rather a "new" installation issue. Otherwise this same situation would impact all structures built under previous editions of the code. This would affect many other building components such as stair tread and riser measurements, water conservation fixtures, energy conservation or arc fault and other electrical provisions.

This proposal changes the entire scope and intent of "property maintenance" code provisions and now would require code officials to enforce the concept of retro-fitting and up-dating older systems unnecessarily because they were once "approved" when originally constructed.

Public Comment 2:

Rick Davidson, City of Maple Grove, representing self, requests Disapproval.

Commenter's Reason: The membership should disapprove this proposal because it imposes a retroactive rule on all existing homes and creates a significant liability for homeowners.

This proposal would require the installation of locking-type tamper-resistant caps on refrigerant circuit access ports that are a part of existing HVAC systems. The proposed language is overly restrictive as written.

It states that "owners and contractors would install these items as a liability measure". How will a homeowner be made aware that this retroactive rule (liability) exists if they do their own service work? Doesn't the IPMC and the IEBC permit legal existing installations to remain?

Furthermore the language references "HVAC systems" and triggers the requirement whenever the "system" is "serviced". "Serviced" is not defined in the code. Does this mean if a homeowner changes the filters on the furnace or HRV of his "HVAC system" that they must install these devices? What about a homeowner installing an energy saving thermostat? Since even a bathroom fan is part of the HVAC system of a dwelling, servicing or replacing one of these fans would seem to trigger the requirement. How will a homeowner know about this rule? Do the devices require any special knowledge or effort to install? Are the devices readily available to homeowners?

The proponent and the committee made assumptions that were too far reaching. The language in the proposal is way too broad. This proposal will elevate the level of liability placed on an owner for compliance to a rule they would have no opportunity to be aware.

This proposal will place significant pressure on the Property Maintenance Departments to notify all existing homeowners of this retroactive requirement.

Two groups will benefit from the proposal, sellers of the devices and attorneys.

Public Comment 3:

Sean P. Farrell, Chief Property Code Enforcement Inspector, representing VBCOA, requests Disapproval.

Commenter's Reason: The Property Maintenance Code was designed to ensure that structures are maintained in accordance with the code under which constructed and approved. This proposal suggests that structures are not compliant with the code under which they were constructed and approved. If code enforcement personnel undertake that kind of philosophy, they must require retrofit of every structure each and every time a code is changed or modified. There is a cost factor to building and home owners.

Final Action: AS AM AMPC____ D

PM18-09/10
Chapter 8 (New)

Proposed Change as Submitted

Proponent: Howard Asch, City of East Lansing, representing Michigan Association of Housing Officials

Add new chapter as follows:

CHAPTER 8
HEALTH

801
GENERAL

801.1 Scope. The provisions of this chapter shall govern the minimum conditions and standards for the health of persons at a premises.

801.2 Responsibility. The owner of the premises shall maintain the premises in compliance with these requirements, except as provided for in this code. A person shall not occupy as owner-occupant or permit another person to occupy or allow the public to use any premises which does not comply with the requirements of this chapter. Occupants of a dwelling unit, rooming unit or housekeeping unit or persons in control of any space are responsible for keeping the areas they occupy or control free from hazards to health.

801.3 Approved agency. An approved agency is an established and recognized agency regularly engaged in conducting tests or furnishing inspections services, when such agency has been approved by the code official. The code official shall accept a report from an approved agency as basis upon which to determine compliance in accordance with this chapter.

801.4 Testing. The code official is authorized to require the owner or occupant responsible for maintenance to provide findings from an approved agency when, in the opinion of the code official, it is likely that there exists a hazard to health in violation of the requirements of this chapter. The report of an approved agency shall be deemed sufficient to establish whether a premise is in compliance with the requirements of this chapter. The building owner or occupant responsible as set forth in section 801.2 shall pay the cost of inspection and testing by an approved agency.

801. Vacating. When an area is required to be vacated by this chapter, occupancy shall be prohibited except by persons actively engaged in removing a hazard to health. The code official shall order the area to be vacated in accordance with section 108 of this code.

802
EXCREMENT

802.1 Exterior accumulations. Excrement shall not accumulate in any yard area and shall be contained and disposed of in a safe and sanitary manner so as to control insects, vermin, odor and the spread of disease.

> **Exception:** Waste from animals raised for commercial purposes that is contained and safely disposed of in a manner consistent with general agricultural practices shall not be regulated.

802.2 Interior accumulation. Excrement shall not be allowed to accumulate in any dwelling unit except in an approved device which is properly maintained to contain excrement and control odor.

803
FRIABLE HAZARDOUS MATERIALS

803.1 Maintenance. Materials containing friable hazardous particles including but not limited to asbestos, lead, arsenic or crystalline silica shall be maintained in such a manner as to prevent friable particles from becoming airborne or ingestible.

803.2 Abatement. When exposed friable particles are determined by an approved agency to be present in hazardous quantities, the condition causing the material to become friable shall be abated and the exposed area shall be cleared of hazardous particles. The code official is authorized to order occupancy of the affected space to be prohibited until the contaminated area has been certified by an approved agency as safe for normal occupancy, and the cause of the material becoming friable has been abated or the friable material has been removed.

804
HAZARDOUS GASEOUS MATERIALS

804.1 Allowable levels. The following gaseous hazardous substances shall not exceed allowable specified levels within a dwelling unit:

Carbon monoxide--35 PPM 8 hour time weighted average; 200 PPM maximum concentration
Formaldehyde-- 0.5 PPM based on a 30 minute sampling period
Radon-- 4 picocuries/liter

When another adopted standard conflicts with these allowable levels, the more restrictive shall apply.

804.2 Abatement. Gaseous hazardous substances determined by an approved testing agency to exceed the levels provided in section 804.1 shall be abated. The code official is authorized to order the affected area to be vacated until testing by an approved agency finds the area to be in compliance with section 804.1.

805
PESTICIDES

805.1 Storage. Pesticides shall be stored in the manner prescribed by the manufacturer and shall be used in areas and at concentrations in compliance with the labeling of the manufacturer.

805.2 Abatement. When a pesticide is determined by an approved agency to be in a location or at a concentration dangerous to human health and/or contrary to manufacturer labeling the code official is authorized to order the area containing such pesticide to be vacated until the hazard has been abated.

806
CHEMICAL CONTAMINATION

806.1 Vacating. When determined by an approved agency that a dwelling unit is contaminated by a chemical at a concentration and in such a condition as to be hazardous to human health after short term exposure the code official is authorized to order the dwelling unit to be vacated and remain vacated until the hazard has been abated.

806.2 Illegal Methamphetamine manufacturing sites. A dwelling unit declared by a law enforcement agency or health official to be a site of illegal Methamphetamine manufacture shall be vacated and shall not be occupied until certified by an approved agency as safe from hazardous materials related to the Methamphetamine manufacturing process.

807
BIOLOGICAL HAZARDS

807.1 Waterborne organisms. When determined by testing of an approved agency that the domestic water supply of a dwelling unit is contaminated with toxin producing bacteria, human parasite, or other organism deemed by an approved agency as dangerous to human health, the water supply shall be made safe. The code official is authorized to order the dwelling unit to be vacated until such time as the water supply is safe as determined by an approved agency. The code official is authorized to permit use of a water purification system capable of removing organisms or use of an alternative water supply on a temporary basis provided the water so supplied is safe for drinking and bathing.

807.2 Airborne organisms. Heating, air conditioning and ventilation systems shall be kept clean and maintained so as to prevent the growth of harmful organisms within the system.

808
AIR-BORNE CONTAMINATES

808.1 Air-borne contaminates. Spaces in which air borne contaminates are generated shall comply with the International Mechanical Code requirements for hazardous exhaust systems. Contaminated air shall not be circulated between tenant spaces or dwelling units. Tobacco smoke shall be considered a hazardous contaminate for purposes of this section. Air may be circulated between tenant spaces or dwelling units when properly installed and maintained equipment first removes any contaminate.

809
SANITARY CLEANUP

809.1 Sanitary cleanup. When an event occurs that makes occupancy of a space unsafe or unhealthful, the space shall not be occupied unless the unsafe conditions are removed in accordance with this section. Sewage spills and flooding shall be considered to make a space unsafe.

809.2 Approved agency. The code official may accept a report from an approved agency that certifies an unsafe or unhealthful condition has been eliminated as a basis for approving occupancy of a space.

809.3 Prescriptive methods. When the prescriptive methods contained in section 809.3.1 through 809.3.2 are used the hazard shall be deemed to have been abated.

809.3.1 Sewage spills. All water containing sewage and all sewage solids shall be removed and disposed of in a safe and sanitary manner. Every absorbent material in contact with sewage or water which contains sewage shall be removed. Every non-absorbent material in contact with sewage or water which contains sewage shall be cleaned with detergent and disinfected with a 10% solution of household bleach in water.

809.3.2 Flood damage. Any material that has been damaged or weakened by water shall be removed. Material saturated by water, such as insulation or gypsum board, shall be removed. All surfaces that support mold growth which have come in contact with water shall be removed or thoroughly dried and treated with a fungicide. All materials and systems required by this code and the International Building Code or the International Residential Code shall be replaced or restored to a dry condition and capable of performing the intended purpose. When flood water is known to be contaminated with harmful chemical compounds, the contamination shall be removed and the area shall be tested and found safe by an approved agency in addition to the other requirements of this section.

810
FOOD PREPARATION AREAS

810.1 Responsibility. The occupant of each space with a food preparation or storage area shall be responsible to maintain that area in accordance with this section.

810.2 Food preparation areas. Food preparation areas shall be maintained free of spoiled or rotting foodstuffs. Grease shall not be allowed to accumulate on surfaces in food preparation areas, including counters, walls, floors, ceilings, appliances and storage areas.

Reason: The code does not presently address health related concerns very well. The proposal clearly enumerates various health issues and describes minimum standards to enable the code official to have a more solid legal standing to address those issues.

There are no universally accepted standards for carbon monoxide, formaldehyde or radon in a dwelling unit. Standards have been proposed for work places and the proposed standards for exposure to these gasses are taken from NIOSH HSM 73-11000 for carbon monoxide, NIOSH DHEW 77-126 for formaldehyde, and the U. S. Environmental Protection Agency for radon. The code official is authorized to accept documentation from an approved agency to establish compliance with other hazards where technical knowledge is required, much in the fashion an engineer's report would be accepted for a structural concern in a building. A clear basis for a decision strengthens the code official's position when challenged on appeal or in court.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: ASCH-PM1-CH 8 NEW

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee felt that this proposal goes far beyond the scope and intent of this code with respect to health provisions. Health departments and social services departments currently deal with many of these issues and they should not be part of a property maintenance code. Lastly, many of the issues can be dealt with thorough the current provisions of Chapter 3.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Jane Malone, National Center for Healthy Housing, requesting Approval as Modified by this Public Comment.

Modify the proposal as follows:

CHAPTER 8
HEALTH

801
GENERAL

801.1 Scope. The provisions of this chapter shall govern the minimum conditions and standards for the health of persons at a premises.

801.2 Responsibility. The owner of the premises shall maintain the premises in compliance with these requirements, except as provided for in this code. A person shall not occupy as owner-occupant or permit another person to occupy or allow the public to use any premises which does not comply with the requirements of this chapter. Occupants of a dwelling unit, rooming unit or housekeeping unit ~~or persons in control of any space~~ are responsible for keeping the areas they ~~occupy or~~ control free from hazards to health.

801.3 ~~**Approved agency.** An approved agency is an established and recognized agency regularly engaged in conducting tests or furnishing inspections services, when such agency has been approved by the code official. The code official shall accept a report from an approved agency as basis upon which to determine compliance in accordance with this chapter.~~

~~**801.4**~~ **Approved Testing Methods** The code official is authorized to require the owner ~~or occupant responsible for maintenance~~ to provide testing or inspection results as evidence of compliance ~~findings from an approved agency~~ when, in the opinion of the code official, it is likely that there exists a hazard to health in violation of the requirements of this chapter. The report of an approved agency that conducted a test or an inspection in accordance with federal or state laws consistent with approved methods shall be deemed sufficient to establish whether a premise is in compliance with the requirements of this chapter for the condition or standard for which the test or inspection was conducted. The building owner ~~or occupant responsible as set forth in section 801.2~~ shall pay the cost of inspection and testing by an approved agency unless, in the opinion of the code official, the tenant is responsible.

801. Vacating. When an area is required to be vacated by this chapter, occupancy shall be restricted to ~~prohibited except by~~ persons actively engaged in removing a hazard to health. The code official shall order the area to be vacated in accordance with Section 108 of this code.

802
~~**EXCREMENT**~~

~~**802.1 Exterior accumulations.** Excrement shall not accumulate in any yard area and shall be contained and disposed of in a safe and sanitary manner so as to control insects, vermin, odor and the spread of disease.~~
~~**Exception:** Waste from animals raised for commercial purposes that is contained and safely disposed of in a manner consistent with general agricultural practices shall not be regulated.~~

~~**802.2 Interior accumulation.** Excrement shall not be allowed to accumulate in any dwelling unit except in an approved device which is properly maintained to contain excrement and control odor.~~

~~803~~
~~FRIABLE~~ HAZARDOUS MATERIALS

~~**803.1**~~ **802.1 Maintenance.** Building ~~M~~ materials containing ~~friable~~ hazardous substances ~~particles~~ including but not limited to asbestos, lead, arsenic or crystalline silica shall be maintained intact in such a manner as to prevent ~~friable~~ particles of the hazardous substance from becoming airborne or ingestible.

~~**803.2**~~ **802.2 Abatement.** When building materials containing hazardous substances have released or exposed ~~friable~~ particles that are determined by an approved agency to be present in hazardous quantities, the condition causing the building material to ~~become friable~~ release or expose particles of hazardous substances shall be abated and the exposed area shall be cleared of hazardous substances ~~particles~~. The code official is authorized to order occupancy of the affected space to be prohibited until the contaminated area has been certified by an approved testing method ~~agency~~ as safe for normal occupancy~~, and the~~ because ~~of~~ the non-intact building material ~~becoming friable~~ has been abated and ~~or~~ the hazardous substance ~~friable~~ ~~material~~ has been removed.

~~804~~ 803
HAZARDOUS GASEOUS MATERIALS

~~**804.1**~~ **803.1 Allowable levels.** The following gaseous hazardous substances shall not exceed ~~allowable~~ specified levels within a dwelling unit:

Carbon monoxide--~~35~~ 9 PPM averaged over 8 hours ~~time weighted average~~; 35 PPM averaged over 1 hour; and 200 PPM maximum concentration as measured in general indoor air not directly over a combustion source.
Formaldehyde-- 0.05 PPM based on a ~~30~~ 60 minute sampling period.
Radon-- 4 picocuries of radon per ~~/~~liter of air in the lowest occupied level.
When another adopted standard conflicts with these allowable levels, the more restrictive shall apply.

~~**804.2**~~ **803.2 Abatement.** Gaseous hazardous substances determined by an approved testing method ~~agency~~ to exceed the levels provided in section 8034.1 shall be abated. The code official is authorized to order the affected area to be vacated until testing by an approved method ~~agency~~ finds the area to be in compliance with section 8034.1.

~~805~~ 804
PESTICIDES

~~**805.1**~~ **804.1 Storage.** Pesticides shall be stored in the manner prescribed by the manufacturer and shall be used in areas and at concentrations in compliance with the labeling of the manufacturer.

~~**805.2**~~ **804.2 Abatement.** When a pesticide is determined by an approved agency to be in a location or at a concentration dangerous to human health and/or contrary to manufacturer labeling the code official is authorized to order the area affected by or containing such pesticide to be vacated until the hazard has been abated.

~~806~~ 805
CHEMICAL CONTAMINANTS ~~TION~~

~~**806.1**~~ **805.1 Vacating.** When determined by an approved testing method ~~agency~~ that a dwelling unit is contaminated by a chemical at a concentration and in such a condition as to be hazardous to human health after short term exposure the code official is authorized to order the dwelling unit to be vacated and remain vacated until the hazard has been abated.

~~**806.2**~~ **805.2 Illegal Methamphetamine manufacturing sites**. A dwelling unit declared by a law enforcement agency or health official to be a site of illegal Methamphetamine manufacture shall be vacated and shall not be occupied until certified by an approved testing method ~~agency~~ as safe from hazardous materials related to the Methamphetamine manufacturing process.

~~807~~ 806
BIOLOGICAL HAZARDS

~~807.1~~ 806.1 Waterborne organisms. When determined by ~~testing of~~ an approved testing method ~~agency~~ that the domestic water supply of a dwelling unit is contaminated with toxin producing bacteria, human parasite, or other organism deemed by an approved testing method ~~agency~~ as dangerous to human health, the water supply shall be made safe. The code official is authorized to order the dwelling unit to be vacated until such time as the water supply is safe as determined by an approved testing method ~~agency~~. The code official is authorized to permit use of a water purification system capable of removing organisms or use of an alternative water supply on a temporary basis provided the water so supplied is safe for drinking and bathing.

~~807.2~~ 806.2 Airborne organisms. Heating, air conditioning and ventilation systems shall be kept clean and maintained so as to prevent the growth of harmful organisms within the system.

~~808~~ 807
AIR-BORNE CONTAMINANTS ~~TES~~

~~808.1~~ 807.1 Air-borne contaminants ~~tes~~. Spaces in which air borne contamina**nts** ~~**tes**~~ are generated shall comply with the International Mechanical Code requirements for hazardous exhaust systems. Contaminated air shall not be circulated between tenant spaces or dwelling units. Tobacco smoke shall be considered a hazardous contaminate for purposes of this section. Air may be circulated between tenant spaces or dwelling units when properly installed and maintained equipment first removes any contamina**nt** ~~**te**~~.

~~809~~ 808
SANITARY CLEANUP

~~809.1~~ 808.1 Sanitary cleanup. When an event occurs that makes occupancy of a space unsafe or unhealthful, the space shall not be occupied unless the unsafe conditions are removed in accordance with this section. Sewage spills and flooding shall be considered to make a space unsafe.

~~809.2~~ 808.2 ~~**Approved agency.** The code official may accept a report from an approved agency that certifies an unsafe or unhealthful condition has been eliminated as a basis for approving occupancy of a space.~~

~~809.3~~ Prescriptive methods. When the prescriptive methods contained in section ~~809.3.1~~ 808.3.1 through ~~809.3.2~~ 808.3.2 are used the hazard shall be deemed to have been abated.

~~809.3.1~~ 808.3.1 Sewage spills. All water containing sewage and all sewage solids shall be removed and disposed of in a safe and sanitary manner. Every absorbent material in contact with sewage or water which contains sewage shall be removed. Every non-absorbent material in contact with sewage or water which contains sewage shall be cleaned with detergent and disinfected with ~~a 10% solution of~~ household bleach in water.

~~809.3.2~~ 808.3.2 Flood damage. Any material that has been damaged or weakened by water shall be removed. Material saturated by water, such as insulation or gypsum board, shall be removed. All surfaces that support mold growth which have come in contact with water shall be removed or thoroughly dried and treated with a fungicide. All materials and systems required by this code and the International Building Code or the International Residential Code shall be replaced or restored to a dry condition and capable of performing the intended purpose. When flood water is known to be contaminated with harmful chemical compounds, the contamination shall be removed and the area shall be tested and found safe by an approved testing method ~~agency~~ in addition to the other requirements of this section.

809 ~~810~~
FOOD PREPARATION AREAS

~~810.1~~ 809.1 Responsibility. The occupant of each space with a food preparation or storage area shall be responsible to maintain that area in accordance with this section.

~~810.2~~ 809.2 Food preparation areas. Food preparation areas shall be maintained free of spoiled or rotting foodstuffs. Grease shall not be allowed to accumulate on surfaces in food preparation areas, including counters, walls, floors, ceilings, appliances and storage areas.

Commenter's Reason: We understand that the committee felt that this proposal goes beyond the scope and intent of this code. We feel the original proposal addresses basic hazards that injure health and threaten life that can be present anywhere in the dwelling. The purpose of the proposed chapter is to address the problems that surpass Chapter 3 and other chapters, all of which are specific to particular building components, systems, etc. The proposal clearly enumerates various health issues and describes minimum standards to enable the code official to have a more solid legal standing to address those issues.

We do not understand a comment that health departments and social services departments currently deal with many of these issues and they should not be part of a property maintenance code: these are all matters that are attached to the property and not the occupant.

Since some of the committee debate and comments concerned testing activities and concern about on what agency testing responsibility may fall, we have amended the proposal to clarify that approved methods must be used when testing or inspections are required, and that the code official can order the property owner or occupant to pay for testing as needed. The code official is authorized to accept this documentation to establish compliance with other hazards where technical knowledge is required, much in the fashion an engineer's report would be accepted for a structural concern in a building. A clear basis for a decision strengthens the code official's position when challenged on appeal or in court.

Final Action: AS AM AMPC____ D

PM19-09/10, Part I
305.3

NOTE: PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS ON THE CONSENT AGENDA, PART II IS REPRODUCED ONLY FOR INFORMATION PURPOSES FOLLOWING ALL OF PART I.

Proposed Change as Submitted

Proponent: Tom Neltner, National Center for Healthy Housing, representing National Center for Healthy Housing and Alliance for Healthy Homes.

PART I - IPMC

Revise as follows:

305.3 Interior surfaces. All interior surfaces, including windows and doors, shall be maintained in good, clean and sanitary condition. Peeling, chipping, flaking or abraded paint shall be repaired, removed or covered. Cracked or loose plaster, decayed wood and other defective surface conditions shall be corrected. Surfaces of porous or water permeable materials made of or containing organic materials, such as but not limited to wood, textiles, paint, cellulose insulation, and paper, including paper-faced gypsum board, that have visible signs of mold or mildew shall be removed and replaced or remediated in an approved manner.

Exception: Porous materials that do not contain organic materials,such as clean unpainted bricks and concrete.

Reason: Mold typically grows in buildings affected by water damage. According to the Institute of Medicine of the National Academies' *Damp Indoor Spaces and Health* (2004), mold and damp indoor environments are associated with asthma symptoms in sensitized persons, coughing, wheezing, and upper respiratory tract symptoms. *See www.nap.edu/books/0309091934/html/*

In December 2007, the National Center for Healthy Housing (NCHH) and the U.S. Centers for Disease Control and Prevention (CDC) convened an Expert Panel consistent with National Institute of Health guidelines to assess the effectiveness of various interventions to make homes healthier and safer. NCHH and CDC published the report of the experts in January 2009. See www.nchh.org/LinkClick.aspx?fileticket=2lvaEDNBIdU%3d&tabid=229 for the full report.

The Expert Panel reviewed five peer-reviewed research studies on the issue of mold and allergens and concluded that "when implemented together, eliminating moisture intrusion and leaks and removal of moldy items were found to be effective in reducing asthma triggers and reducing exposures." Other provisions of the IPMC address eliminating moisture intrusion. But no provisions require the removal, replacement or remediation of the mold.

This proposal implements the Expert Panel's recommendation while allowing the option of remediation in an approved manner. To ensure the health of the building's occupants, mold mitigation measures must be a part of the code.

Water damage, if left unattended for any period of time, may lead to mold growth. Molds typically grow in buildings affected by water damage and are a potential cause of many health problems including asthma, sinusitis, and infections. Water infiltration of the building envelope due to damage or deterioration is the primary contributor to mold. To ensure the health of the buildings occupants mold mitigation measures must be a part of the code.

Cost Impact: This code change proposal will increase the cost of construction.

ICCFILENAME: NELTNER-PM2-305.3 AND NELTNER-EB2-602.1.1

Public Hearing Results

PART I- IPMC
Committee Action: **Disapproved**

Committee Reason: The committee felt that typically a code official would not have the knowledge and experience necessary to enforce the proposed requirements. Further, if testing were required to verify whether or not mold was present, the cost of these tests may fall to the jurisdiction.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Jane Malone, National Center for Healthy Housing, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

305.3 Interior surfaces. All interior surfaces, including windows and doors, shall be maintained in good, clean and sanitary condition. Peeling, chipping, flaking or abraded paint shall be repaired, removed or covered. Cracked or loose plaster, decayed wood and other defective surface conditions shall be corrected. Surfaces of porous or water permeable materials made of or containing organic materials, such as but not limited to wood, textiles, paint, cellulose insulation, and paper, including paper-faced gypsum board, that have visible signs of mold or mildew shall be removed and replaced or remediated~~ in an approved manner~~.

Exception: Porous materials that do not contain organic materials, such as clean unpainted bricks and concrete.

Commenter's Reason: Mold typically grows in buildings affected by water damage. According to the Institute of Medicine of the National Academies' *Damp Indoor Spaces and Health* (2004), mold and damp indoor environments are associated with asthma symptoms in sensitized persons, coughing, wheezing, and upper respiratory tract symptoms. In December 2007, the National Center for Healthy Housing (NCHH) and the U.S. Centers for Disease Control and Prevention (CDC) convened an Expert Panel consistent with National Institute of Health guidelines to assess the effectiveness of various interventions to make homes healthier and safer. NCHH and CDC published the report of the experts in January 2009. See www.nchh.org/LinkClick.aspx?fileticket=2lvaEDNBIdU%3d&tabid=229 for the full report. The Expert Panel reviewed five peer-reviewed research studies on the issue of mold and allergens and concluded that "when implemented together, eliminating moisture intrusion and leaks and removal of moldy items were found to be effective in reducing asthma triggers and reducing exposures."

Other provisions of the IPMC address eliminating moisture intrusion. But no provisions require the removal and replacement of mold-contaminated materials. This proposal requires it and allows the option of remediation in an approved manner. To ensure the health of the building's occupants, mold mitigation measures must be a part of the code.

The committee felt that "typically a code official would not have the knowledge and experience necessary to enforce the proposed requirements." No special expertise is required to determine if visible mold observed during a prior inspection has disappeared from the surface of the building material. But we have deleted "in an approved manner" from qualifying "remediated" since most states do not have programs regulating mold remediation.

The committee also stated "Further, if testing were required to verify whether or not mold was present, the cost of these tests may fall to the jurisdiction." This proposal does not rely on testing: a visual observation alone would prompt the citation of the mold problem. Many code officials enforcing a property maintenance code know what mold looks like.

Final Action: AS AM AMPC____ D

NOTE: PART II REPRODUCED FOR INFORMATION PURPOSES ONLY – SEE ABOVE

PART II - IEBC

Add new text as follows:

602.1 Interior finishes. All newly installed interior wall and ceiling finishes shall comply with Chapter 8 of the *International Building Code*.

602.1.1 Interior surfaces. All interior surfaces, including windows and doors, shall be maintained in good, clean and sanitary condition. Peeling, chipping, flaking or abraded paint shall be repaired, removed or covered. Cracked or loose plaster, decayed wood and other defective surface conditions shall be corrected. Surfaces of porous or water permeable materials made of or containing organic materials, such as but not limited to wood, textiles, paint, cellulose insulation, and paper, including paper-faced gypsum board, that have visible signs of mold or mildew shall be removed and replaced or remediated in an approved manner.

Exception: Porous materials that do not contain organic materials, such as clean unpainted bricks and concrete.

Reason: Mold typically grows in buildings affected by water damage. According to the Institute of Medicine of the National Academies' *Damp Indoor Spaces and Health* (2004), mold and damp indoor environments are associated with asthma symptoms in sensitized persons, coughing, wheezing, and upper respiratory tract symptoms. *See www.nap.edu/books/0309091934/html/*

In December 2007, the National Center for Healthy Housing (NCHH) and the U.S. Centers for Disease Control and Prevention (CDC) convened an Expert Panel consistent with National Institute of Health guidelines to assess the effectiveness of various interventions to make homes healthier and safer. NCHH and CDC published the report of the experts in January 2009. See www.nchh.org/LinkClick.aspx?fileticket=2lvaEDNBIdU%3d&tabid=229 for the full report.

The Expert Panel reviewed five peer-reviewed research studies on the issue of mold and allergens and concluded that "when implemented together, eliminating moisture intrusion and leaks and removal of moldy items were found to be effective in reducing asthma triggers and reducing exposures." Other provisions of the IPMC address eliminating moisture intrusion. But no provisions require the removal, replacement or remediation of the mold.

This proposal implements the Expert Panel's recommendation while allowing the option of remediation in an approved manner. To ensure the health of the building's occupants, mold mitigation measures must be a part of the code.

Water damage, if left unattended for any period of time, may lead to mold growth. Molds typically grow in buildings affected by water damage and are a potential cause of many health problems including asthma, sinusitis, and infections. Water infiltration of the building envelope due to damage or deterioration is the primary contributor to mold. To ensure the health of the buildings occupants mold mitigation measures must be a part of the code.

Cost Impact: This code change proposal will increase the cost of construction.

PART II- IEBC

Committee Action: **Disapproved**

Committee Reason: The committee felt that maintenance provisions did not belong in the alterations portions of this code and perhaps be located in the repairs section. Further, there should be a standard provided to describe the remediation methods that should be followed.

Assembly Action: **None**

PM20-09/10, Part I
305.4 (New)

Proposed Change as Submitted

Proponent: Jane Malone, National Center for Healthy Housing, representing National Center for Healthy Housing and Alliance for Healthy Homes.

PART I - IPMC

1. Add new text as follows:

305.4 Pre-1978 Structures. Deteriorated paint in structures built before 1978 shall be repaired in accordance with the work practice standards for renovations in 40 CFR 745.85(a).

Exceptions:

1. Structures built after 1977 (or earlier date, if applicable to the jurisdiction of the structure), when lead-based paint was banned.
2. Structures with documentation from an approved test in accordance with 40 CFR 745 that proves that the deteriorated paint contains no lead-based paint.

(Renumber subsequent sections)

2. Revise Chapter 8 as follows:

EPA U.S. Environmental Protection Agency

40 CFR 745 Lead-Based Paint Poisoning Prevention in Certain Residential Structures……………………..305.4

Reason:
PART I - The purpose of this proposed code language for the surfaces of the interior structure is to incorporate measures that reflect current knowledge about working with paint that may contain lead-based paint and thereby prevent lead poisoning. These changes would only affect structures likely to contain lead-based paint to promote the safe repair of deteriorated paint that is likely to contain lead. Multiple studies have demonstrated that lead dust, which is caused by deteriorated lead-based paint and some methods of paint repair, is the major source of lead exposure for young children. The dangers associated with exposure to lead based paint hazards are well-known: lead is associated with a range of serious health effects on children, including detrimental effects on cognitive and behavioral development with serious personal and social consequences that may persist throughout their lifetime. More than 36 million pre-1978 US housing units contain lead-based paint.

Section 305.3 Interior surfaces of the current property maintenance code fails to specifically require, in older structures that are likely to contain lead-based paint, the use of precautionary practices in order to prevent the dispersal of lead before, during, and after the repair work, in the course of complying with the code requirement to repair peeling, chipping, flaking or abraded paint. The proposal improves the current Code by adding a health-protective requirement to perform the repair safely around lead-based paint, a subject currently acknowledged in the Commentary but not in the Code. The addition of the proposed new language will protect children from lead poisoning by specifying the use of federally – or state - approved lead safe work practices in making the required repairs. As noted under exceptions, the requirement is not in effect if the paint has been tested using an approved test and proven to not be lead-based paint. The lead-safe work practices are required by EPA effective April 22, 2010, for most renovation, repair and painting work in pre-1978 homes.

The proposed new sub-sub-section contains two exceptions to the requirement: structures built after lead was banned from paint used in residential structures (1977 US; earlier in some US cities; 1909 France, Belgium, Austria), and where the deteriorated paint has been documented to not contain lead (such as by a lead-based paint inspection or risk assessment, by the use of a test kit by a certified renovator, or through completion of another government-approved test method or ANSI standard).

Cost Impact: This code change proposal will not increase the cost of construction.

Analysis: A review of the standard(s) proposed for inclusion in the code, 40 CFR 745, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: MALONE-PM1-305.4 AND MALONE-EB1-502.1.1

Public Hearing Results

PART I- IPMC
Committee Action: **Approved as Submitted**

Committee Reason: The committee agreed that the requirements and methods within the EPS 40 CFR 745 were appropriate and did not place undue burden on code officials or inspectors. Further, no certifications or testing are required to enforce these provisions. Lastly, repainting projects are not affected by these provisions.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Sean P. Farrell, Chief Property Code Enforcement Inspector, representing VBCOA, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

305.4 ~~Pre-1978 Structures~~ Lead-Based Paint. Deteriorated lead-based paint ~~in structures built before 1978~~ shall be repaired in ~~accordance with the work practice standards for renovations in 40 CFR 745.85(a).~~ an approved manner.

~~**Exceptions:**~~

1. ~~Structures built after 1977 (or earlier date, if applicable to the jurisdiction of the structure), when leadbased paint was banned.~~
2. ~~Structures with documentation from an approved test in accordance with 40 CFR 745 that proves that the deteriorated paint contains no lead-based paint.~~

~~*(Renumber subsequent sections)*~~

~~**2. Revise Chapter 8 as follows**:~~

~~**EPA** U.S. Environmental Protection Agency~~
~~40 CFR 745 Lead-Based Paint Poisoning Prevention in Certain Residential Structures……………………..305.4~~

Commenter's Reason: It is appropriate for the Property Maintenance Code to address lead-based paint hazards. However, the original proposal grossly broadens the scope of EPA regulation 40CFR745. The EPA regulation is only applied to renovations for compensation by certified entities in certain targeted housing and uses where lead based paint actually exists. This proposal now implicates all Pre 1978 structures to be held compliant to these regulations regardless of whether lead based paint exists or not. Additionally, the specified enforcement agency for these regulations is the EPA, not the local Code Official. Lastly, these regulations are not compliant with ICC standards and the IEBC Committee disapproved a similar change referencing this EPA standard for similar reasons.

By modifying the proposal, we capture and deal with the lead hazard where it exists without imposing regulations where lead does not exist or where the regulation was not intended to be applied.

Public Comment 2:

Rick Davidson, City of Maple Grove, representing self, requests Disapproval.

Commenter's Reason: The membership should disapprove this proposal because it places the responsibility for enforcement of federal regulations on the local property maintenance department.

This new language requires that lead based paint be removed in accordance with "U.S. Environmental Protection Agency 40 CFR 745 Lead-Based Paint Poisoning Prevention in Certain Residential Structures" and adopts the standard by reference.

This makes the code official responsible for enforcing federal regulations. It is inappropriate for the local property maintenance office to enforce federal rules. The authority for enforcing these rules must be given by the federal government. Local jurisdictions cannot just decide to play the role of the federal government. Furthermore, this will require an expense to the jurisdiction for acquiring copies of the rules and training its staff members about proper application.

Enforcement by the local jurisdiction of "Title 40: Protection of Environment PART 745—LEAD-BASED PAINT POISONING PREVENTION IN CERTAIN RESIDENTIAL STRUCTURES" would require that the local jurisdiction monitor licensing, work practices, training, certification, notification and a whole host of responsibilities that go way beyond that of the property maintenance department.

Furthermore, the federal rules already have regulations for enforcement, authority, and inspections that do not include local jurisdictions. The federal rules give the local jurisdiction no authority.

This proposal needs to be disapproved before it causes the local jurisdiction embarrassment and liability.

Final Action: AS AM AMPC____ D

PM20-09/10, Part II
IEBC 502.1.1 (New)

Proposed Change as Submitted

Proponent: Jane Malone, National Center for Healthy Housing, representing National Center for Healthy Housing and Alliance for Healthy Homes.

PART II - IEBC

1. Add new text as follows:

502.1 Existing buildings materials. Materials already in use in a building in conformance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the code official to render the building or structure unsafe or dangerous as defined in Chapter 2.

502.1.1 Lead safe work practices during additions, alterations and repairs. Unless it is determined by an approved test that lead-based paint is not present on the surfaces where paint is disturbed, addition, alteration, and repair activities that disturb painted surfaces in structures built before 1978 shall be performed using lead safe work practices by a certified renovation firm in accordance with U.S. Environmental Protection Agency requirements for renovation activities in 40 CFR 745.

Exceptions:

1. Structures built after 1977 (or earlier date, if applicable to the jurisdiction of the structure), when lead-based paint was banned.
2. Structures with documentation from an approved test in accordance with 40 CFR 745 that proves that the painted surfaces to be disturbed contain no lead-based paint.

2. Revise Chapter 15 as follows:

EPA U.S. Environmental Protection Agency

40 CFR 745 Lead-Based Paint Poisoning Prevention in Certain Residential Structures……………………..502.1.1

Reason:
PART II - The purpose of this proposed code language is to incorporate lead-safe work practices in work that disturbs paint known or presumed to be lead-based paint in order to reflect current knowledge and to promote consistency with imminent federal regulations. These changes would only affect structures likely to contain lead-based paint. Multiple studies have demonstrated that lead dust caused by deteriorated lead-based paint and repair activity is the major source of lead exposure for young children. The dangers associated with exposure to lead based paint hazards are well-known: lead is associated with a range of serious health effects on children, including detrimental effects on cognitive and behavioral development with serious personal and social consequences that may persist throughout their lifetime. More than 36 million pre-1978 US housing units contain lead-based paint.

Section 302 requires that all alteration and addition jobs comply with the IBC new construction and that alteration, addition, and repair jobs in flood hazard areas comply with flood design requirements, but fails to require, in structures that are likely to contain lead-based paint, the use of precautionary practices to prevent the dispersal of lead before, during, and after the addition, alteration, and repair work in structures likely to contain lead-based paint. The addition of the proposed new language will protect children from lead poisoning by specifying compliance with federal requirements for lead safe work practices and the use of certified renovators working for certified renovation firms when conducting addition, alteration, or repair work in such structures. The related EPA certification requirements take effect April 22, 2010. In the jurisdiction of a State or Federally-recognized Tribe that obtains EPA authorization to administer the renovation program, the requirements of that State or Tribe will take effect on or after April 22, 2010.

The proposed new sub-sub-section contains two exceptions to the requirement: structures built after lead was banned from paint used in residential structures (1977 US; earlier in some US cities; 1909 France, Belgium, Austria), and where the deteriorated paint has been documented to not contain lead (such as by a lead-based paint inspection or risk assessment, use of an approved test kit by a certified renovation firm, or through completion of another government-approved test method or ANSI standard).

Cost Impact: This code change proposal will not increase the cost of construction.

Analysis: A review of the standard(s) proposed for inclusion in the code, 40 CFR 745, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: MALONE-PM1-305.4 AND MALONE-EB1-502.1.1

Public Hearing Results

PART II- IEBC
Committee Action: **Disapproved**

Committee Reason: The committee felt that this proposal was too broad in scope and appeared to regulate labor issues, which is not in the scope of this code. Further, there were concerns that this could create a conflict with Chapter 34 of the *International Building Code*. Lastly, if these provisions are considered, they should also be in other chapters of this code to be applicable to other than repairs.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment:

Jane Malone, National Center for Healthy Housing, requests Approval as Submitted.

Commenter's Reason: The purpose of this proposed code language is to incorporate lead-safe work practices in work that disturbs paint known or presumed to be lead-based paint in order to reflect current knowledge and to promote consistency with federal regulations that are in effect as of April 22, 2010. These changes would only affect structures likely to contain lead-based paint. Multiple studies have demonstrated that lead dust caused by deteriorated lead-based paint and repair activity is the major source of lead exposure for young children. The dangers associated with exposure to lead based paint hazards are well-known: lead is associated with a range of serious health effects on children, including detrimental effects on cognitive and behavioral development with serious personal and social consequences that may persist throughout their lifetime. More than 36 million pre-1978 US housing units contain lead-based paint. The addition of the proposed new language will protect children from lead poisoning by specifying compliance with federal requirements for lead safe work practices and the use of certified renovators working for certified renovation firms when conducting addition, alteration, or repair work in such structures. The related EPA requirements took effect April 22, 2010 although enforcement of certification requirements was recently delayed until October 1, 2010.

The proposed new sub-sub-section contains two exceptions to the requirement: structures built after lead was banned from paint used in residential structures (1977 US; earlier in some US cities; 1909 France, Belgium, Austria), and where the deteriorated paint has been documented to not contain lead (such as by a lead-based paint inspection or risk assessment, use of an approved test kit by a certified renovation firm, or through completion of another government-approved test method or ANSI standard).

The committee felt that this proposal appeared to regulate labor issues, which is not in the scope of this code. This is incorrect: the proposal requires contractor and property owner compliance with federal rules for training and work practices but not labor issues.

Further, the committee wondered if this could create a conflict with Chapter 34 of the *International Building Code*. That is incorrect.

Lastly, the committee felt that these provisions could be applied to other chapters of this code to be applicable to other than repairs. The proponents will be pleased to consider such other applications in the next round and thank the committee for the suggestion, but do not feel such an argument invalidates the need to add this to this chapter of the IEBC now. The federal regulation requiring the added provisions is in effect.

Final Action: AS AM AMPC____ D

PM21-09/10
102.5, 308.4

Proposed Change as Submitted

Proponent: Tom Neltner, National Center for Healthy Housing, Representing the National Center for Healthy Housing and the Alliance for Healthy Homes.

Revise as follows:

102.5 Workmanship. Repairs, maintenance work, alterations or installations which are caused directly or indirectly by the enforcement of this code shall be executed and installed in a workmanlike manner and installed in accordance with the manufacturer's installation instructions. Where pest elimination is ordered, application of pesticides to control cited pests must be performed by a company authorized to perform pest management by the state or territory lead agency in accordance with applicable state and federal laws.

309.4 Multiple occupancy. The owner of a structure containing two or more dwelling units, a multiple occupancy, a rooming house or a nonresidential structure shall be responsible for pest elimination in the public or shared areas of the structure and exterior property. If infestation is caused by failure of an occupant to prevent such infestation in the area occupied, the occupant shall be responsible for pest elimination. Where pest elimination is ordered, application of pesticides to control cited pests must be performed by a company authorized to perform pest management by the state or territory lead agency in accordance with applicable state and federal laws.

Reason: As amended in the 2007/2008 cycle, Section 202 of the IPMC defines "pest elimination" as the "control and elimination of insects, rodents or other pests by eliminating their harborage places; by removing or making inaccessible materials that serve as their food or water; by other approved pest elimination methods."

In situations where the code official has to order pest elimination, the owner's and occupant's current pest control practices have clearly failed. The owner and occupant are unlikely to improve their practices without expert assistance. They are likely to simply apply pesticides while not eliminating the pest's harborage places and eliminating the pests' access to food and water.

They need a professional who has the training and oversight to do the work properly consistent with the law working for a company that is authorized by the state to manage pests. All states license or otherwise authorize companies to perform pest management. If a state drops its program, EPA is required to administer the program until the state resumes it. Under these authorized programs, pest management professionals must be employed by state-authorized companies. These employees of these companies must meet specific training, continuing education, and work practice standards established in state regulations and law. The state conducts inspections and takes enforcement actions to ensure compliance by these companies. The code official can rely on the state agency to be more confident that the order will be fully complied with the first time.

The National Pest Management Association supports this proposal. It represents more than 5000 companies providing structural pest control services.

Cost Impact: The code change proposal will not increase the cost of construction. While the professional may initially cost more than "do-it-yourself" pest control, it will avoid the need for repeated orders and inspections if they fail to achieve pest elimination the first time.

ICCFILENAME: NELTNER-PM1-102.5

Public Hearing Results

This code change was contained in the errata posted on the ICC website. Please go to http://www.iccsafe.org/cs/codes/Pages/09-10ProposedChanges.aspx.

Committee Action: **Disapproved**

Committee Reason: The committee felt that the language was not needed and that the determination of the qualifications to perform pest management should remain at the state level rather than in a model code. Also, the affects related to costs and inspections, due to multiple treatments by an authorized company being required, should be part of the requirements.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Jane Malone, representing National Center for Healthy Housing, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

102.5 Workmanship. Repairs, maintenance work, alterations or installations which are caused directly or indirectly by the enforcement of this code shall be executed and installed in a workmanlike manner and installed in accordance with the manufacturer's installation instructions. Where pest elimination is ordered, application of pesticides to control cited pests must be performed by a company qualified ~~authorized~~ to perform pest management as determined by the State ~~or territory~~ lead agency ~~in accordance with applicable state and federal laws~~.

309.4 Multiple occupancy. The owner of a structure containing two or more dwelling units, a multiple occupancy, a rooming house or a nonresidential structure shall be responsible for pest elimination in the public or shared areas of the structure and exterior property. If infestation is caused by failure of an occupant to prevent such infestation in the area occupied, the occupant and owner shall be responsible for pest elimination. Where pest elimination is ordered, application of pesticides to control cited pests must be performed by a company qualified ~~authorized~~ to perform pest management as determined by the State ~~or territory~~ lead agency ~~in accordance with applicable state and federal laws~~.

Commenter's Reason: As amended in the 2007/2008 cycle, Section 202 of the IPMC defines "pest elimination" as the "control and elimination of insects, rodents or other pests by eliminating their harborage places; by removing or making inaccessible materials that serve as their food or water; by other approved pest elimination methods."

In situations where the code official must order pest elimination, the owner's pest control strategies have clearly failed. The property owner is unlikely to improve its pest management without expert assistance. Instead they keep applying pesticides while not eliminating the pest's harborage places and access to food and water. They need a professional who has the training and oversight to do the work properly consistent with the law working for a company that is authorized by the state to manage pests.

The committee's reason for disapproval was "that the determination of the qualifications to perform pest management should remain at the state level." We agree completely, and have modified the text to make crystal clear that the states' programs to license or otherwise authorize companies to perform pest management would still drive this process and should be recognized in the code. All states have these programs. Few state programs have the authority to ensure that such professionals are used; with this change the code agency will be able to point the property owner in the direction of the state licensed personnel employed by state-authorized companies. These personnel must meet specific training, continuing education, and work practice standards established in state regulations and law. The state conducts inspections and takes enforcement actions to ensure compliance by these companies. The code official can rely on property owner use of state licensed personnel to be confident that there will be effective compliance with the pest management order the first time. The National Pest Management Association, which represents 5,000 companies providing structural pest control services, supports this proposal.

Final Action: AS AM AMPC____ D

PM23-09/10, Part I
705.1 (New), 705.2 (New)

Proposed Change as Submitted

Proponent: Tom Neltner, National Center for Healthy Housing, representing National Center for Healthy Housing and Alliance for Healthy Homes.

PART I - IPMC

1. Add new text as follows:

SECTION 705 CARBON MONOXIDE ALARMS

705.1 Carbon monoxide alarms. An approved carbon monoxide alarm shall be installed outside of every separate sleeping area in the immediate vicinity of the bedrooms in dwelling units within which a fuel-fired appliance, including a portable fuel burning space heater, exists and in dwelling units that have an attached garage.

705.2 Alarm requirements. Single station carbon monoxide alarms shall be listed as complying with UL 2034 and shall be installed in accordance with this code and the manufacturer's installation instructions.

2. Revise Chapter 8 as follows:

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, IL 60062

UL 2034-2008 Standard for Single- and Multiple-station Carbon Monoxide Alarms………………..…….705.2

Reason:
PART I - Carbon monoxide (CO) is an odorless, tasteless, invisible gas that kills more than 300 people in homes each year. Thousands more are admitted to the hospital with carbon monoxide poisoning. This is a serious issue that effects people nationwide is all regions of the country.

The International Residential Code was amended in the 2007/2008 cycle with similar language to require CO alarms whenever a building permit is issued in an existing residence within which fuel-fired appliances exist or have or attached garages. This proposal expands on the requirement to specifically include portable fuel burning space heaters. Portable fuel burning space heaters may not normally be considered an appliance.

The following states have required CO alarms in existing residences: Alaska, Colorado, Illinois, Massachusetts, Michigan, Minnesota, Montana, New Jersey, New York, Oklahoma, Rhode Island, Vermont and Wisconsin. While these are cold weather states, the deaths from CO are spread throughout the country as residents unwittingly use dangerous methods to stay warm in unusually cold weather.

Cost Impact: Yes, this code change proposal will increase the cost of construction. Carbon monoxide alarms typically cost approximately $25.00 each.

Analysis: A review of the standard(s) proposed for inclusion in the code, UL 2034-2008, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: NELTNER-PM4-705.1 PART I AND NELTNER-EB3-704.4.4 PART II

Public Hearing Results

Note: The following analysis was not in the Code Change monograph but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf :

Analysis: This standard is currently referenced in the *International Residential Code*.

This code change was contained in the errata posted on the ICC website. Please go to http://www.iccsafe.org/cs/codes/Pages/09-10ProposedChanges.aspx.

PART I- IPMC
Committee Action: **Approved as Modified**

Modify the proposal as follows:

SECTION 705 CARBON MONOXIDE ALARMS

705.1 Carbon monoxide alarms. An approved carbon monoxide alarm shall be installed outside of every separate sleeping area in the immediate vicinity of the bedrooms in dwelling units within which a fuel-fired appliance, including a portable fuel burning space heater, exists and in dwelling units that have an attached garage.

Exceptions:

1. Dwelling units in which the fuel fired appliance is located outside of the dwelling unit.
2. Dwelling units in which the attached garage is an open parking garage complying with Section 406.3.3.1 of the *International Building Code*
3. Dwelling units in which the attached garage is ventilated in accordance with Section 406.4.2 of the *International Building Code* and Section 404 of the *International Mechanical Code*.

705.2 Alarm requirements. Single station carbon monoxide alarms shall be listed as complying with UL 2034 and shall be installed in accordance with this code and the manufacturer's installation instructions.

Committee Reason: The committee agreed that requiring carbon monoxide alarms for existing residential structures was appropriate at this time and was consistent with recent provisions in the *International Residential Code*. The modification provides consistency with actions taken on a similar change to the *International Fire Code*.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ron Nickson representing National Multi Housing Council, requests Approval as Modified by this Public Comment.

Delete and replace as follows:

PART I – IPMC

SECTION 705 CARBON MONOXIDE ALARMS

~~**705.1 Carbon monoxide alarms.** An approved carbon monoxide alarm shall be installed outside of every separate sleeping area in the immediate vicinity of the bedrooms in dwelling units within which a fuel-fired appliance, including a portable fuel burning space heater, exists and in dwelling units that have an attached garage.~~

~~**Exceptions:**~~

1. ~~Dwelling units in which the fuel fired appliance is located outside of the dwelling unit.~~
2. ~~Dwelling units in which the attached garage is an open parking garage complying with Section 406.3.3 of the *International Building Code.*~~
3. ~~Dwelling units in which the attached garage is ventilated in accordance with Section 406.4.2 of the *International Building Code* and Section 404 of the *International Mechanical Code.*~~

~~**705.2 Alarm requirements.** Single station carbon monoxide alarms shall be listed as complying with UL 2034 and shall be installed in accordance with this code and the manufacturer's installation instructions.~~

705.1 Carbon monoxide alarms. Group I or R occupancies located in a building containing a fuel-burning appliance or a building which has an attached garage with a communicating opening shall be provided with single station carbon monoxide alarms outside of each separate dwelling unit sleeping area in the immediate vicinity of the bedrooms and on every occupiable level of a dwelling unit. The carbon monoxide alarms shall be listed as complying with UL 2034 and be installed and maintained in accordance with NFPA 720 and the manufacturer's instructions. An open parking garage, as defined in the *International Building Code*, or enclosed parking garage ventilated in accordance with Section 404 of the *International Mechanical Code* shall not be deemed to be an attached garage.

Exception: Sleeping units or dwelling units which do not themselves contain a fuel-burning appliance or have an attached garage, but which are located in a building with a fuel-burning appliance or an attached garage, need not be provided with single station carbon monoxide alarms provided that:
1. The sleeping unit or dwelling unit is located more than one story above or below any story which contains a fuel-burning appliance or an attached garage;

2. The sleeping unit or dwelling unit is not connected by duct work or ventilation shafts to any room containing a fuel-burning appliance or to an attached garage; and
3. A carbon monoxide detector is installed in the room containing the fuel burning appliance.

705.2 Carbon monoxide detection systems. Carbon monoxide detection systems, that include carbon monoxide detectors and audible notification appliances, installed and maintained in accordance with this section for carbon monoxide alarms and NFPA 720 shall be permitted. The carbon monoxide detectors shall be listed as complying with UL 2075.

Commenter's Reason: The code development committees approved requirements for installation of carbon monoxide detectors in the IBC, IFC, IPMC, and IEBC. However, they were not the same and thus new buildings which become existing buildings or buildings falling under the requirements of the IPMC would have different requirements than required for new construction. This modification to the proposal for PM23 Part I (IMPC) and Part II (IEBC) aligns the requirements in the two codes to match the requirements in the IBC and IFC. The modification does include modifications that were submitted as a public comment to F133.

Public Comment 2:

Rick Davidson, City of Maple Grove, representing self, requests Disapproval.

Commenter's Reason: The membership should disapprove this code change for the following reasons.

The proponent's reason starts with the statement: "Carbon monoxide (CO) is an odorless, tasteless, invisible gas that kills more than 300 people in homes each year. Thousands more are admitted to the hospital with carbon monoxide poisoning." The proponent did not give the source of this statistic.

Since the proponent did not give the source of the statistic, it is unknown if there was an intention to mislead the committee or if the source of the information was incorrect.

Unlike some issues, there is a wealth of information available regarding carbon monoxide deaths. The Consumer Product Safety Commission regularly produces a document, the most recent of which is entitled "Non-Fire Carbon Monoxide Deaths Associated with the Use of Consumer Products 2006 Annual Estimates."

The report states that 180 accidental carbon monoxide deaths occurred in 2006 in the US. And this includes deaths that occurred in cabins, travel trailers, and tents. So, the statement that 300 people die in homes each year is not accurate. To put the number of CO deaths in perspective, how does the number of CO deaths compare with other accidental deaths? Compared to the 180 CO deaths in 2006:

- 784 people died in bicycle accidents in 2005 (nearly 4 ½ times more than died of CO poisoning).
- 3,579 people died from accidental drowning in 2006.
- 20,823 people died from accidental falls in 2006.
- 43,313 people died in auto crashes in 2008.
- 3,320 people died in fires in 2008.
- 18,573 people were murdered in 2006.
- 27,531 people died from accidental poisoning in 2006.
- 31 people died from dog attacks in 2006

The number of accidental CO deaths pales compared too many other common types of accidental deaths. In fact, if you had a natural gas range, furnace and water heater as your only sources of CO, you would more likely die from a dog bite than from CO from those applicances.

The following table is from the above referenced CPSC report. If you look at the number of CO deaths that occurred in 2006, you will quickly see that placing CO alarms in homes will have a negligible effect on CO deaths. Of the 180 deaths, 104 occurred because of engine driven tools such as snow blowers that you don't usually find in your living room. Nearly 60 percent of the deaths occurred because of tools that are not used in a home. Fourteen deaths occurred from the use of charcoal grills, gas grills, camp stoves, and lanterns. Again, these are devices not used in homes. These three categories account for 66% of CO deaths attributable to consumer products.

If one presumes that the remaining 62 deaths occurred because of CO poisoning in the home, that is a long ways from the 300 claimed by the proponent. And for those appliances thought of as common culprits for CO poisoning, namely gas ranges, gas water heaters, and natural gas or propane furnaces, they accounted for only 46 deaths. Again, compare these 46 deaths to the number of deaths from other causes listed above.

Table 1
Estimated Non-Fire Carbon Monoxide Poisoning Deaths by Associated Fuel-Burning Consumer Product, 1999-2006.

Consumer Product	2004 - 2006+ Average Estimate	2004 - 2006+ Average Percent	Annual Estimate 1999	2000	2001	2002	2003	2004	2005+	2006+
Total Deaths	*181*	*100%*	109	137	122	181	154	167	*197*	*180*
Heating Systems	*63*	*35%*	50	81	72	97	66	87	*53*	*50*
Unspecified Gas Heating	*8*	*4%*	5	1	5	2	4	14	*6*	*3*
LP Gas Heating	*22*	*12%*	22	28	24	41	22	28	*20*	*19*
Natural Gas Heating	*20*	*11%*	20	42	28	32	27	30	*8*	*23*
Coal/Wood Heating	*2*	*1%*	*	2	6	4	2	4	*3*	*
Kerosene/Oil Heating	*4*	*2%*	2	8	6	8	6	4	*4*	*3*
Diesel Fuel Heating	*	*	*	*	*	1	*	*	*	*
Heating Systems, Not Specified	*6*	*3%*	1	*	3	9	5	6	*12*	*1*
Charcoal Grills or Charcoal	*6*	*3%*	17	8	10	11	8	3	*6*	*10*
Gas Water Heaters	*4*	*2%*	1	3	1	1	7	2	*6*	*4*
Gas Grills, Camp Stoves, Lanterns	*6*	*3%*	14	4	1	5	2	8	*6*	*4*
Gas Ranges/Ovens	*3*	*2%*	6	12	9	3	3	4	*6*	*
Other Appliances	*1*	*1%*	1	*	*	*	2	1	*2*	*1*
Multiple Appliances	*7*	*4%*	6	2	7	12	8	4	*9*	*7*
Engine-Driven Tools	*90*	*50%*	13	27	22	51	57	57	*111*	*104*
Generators	*75*	*41%*	7	19	21	41	50	42	*97*	*85*
Other Engine-Driven Tools	*16*	*9%*	6	8	1	10	7	15	*13*	*18*

\+ Data collection for 2005 and 2006 is nearly complete. Italicized estimates may change in the future if more reports of fatalities are received.
* No reports received by CPSC staff.
Source: U.S. Consumer Product Safety Commission / EPHA.
CPSC Death Certificate File, CPSC Injury or Potential Injury Incident File, CPSC In-Depth Investigation File, National Center for Health Statistics Mortality File, 1999 - 2006.
Note: Reported annual estimates and estimated averages and percentages may not add to subtotals or totals due to rounding.

The CPSC 2006 report listed a number of key findings. Among them:

- *"There were an estimated 180 unintentional non-fire CO poisoning deaths associated with consumer products under CPSC's jurisdiction. The estimated annual average from 2004-2006 was 181 deaths."*
- *"Engine-Driven Tools were associated with the largest percentage of non-fire CO poisoning fatalities at 58 percent (104 deaths). Heating Systems-related CO fatalities were associated with 28 percent (50 deaths) and five of the remaining six product categories [Charcoal Grills or Charcoal (10 deaths), Gas Water Heaters (4 deaths), Gas Grills, Camp Stoves, Lanterns (4 deaths), Other Appliances (1 deaths), and Multiple Appliances (7 deaths)] combined were associated with a total of 14 percent. There were no reported deaths in the Gas Ranges/Ovens category."*

  Comment: 180 accidental CO deaths occurred. 58% of the CO deaths were a result of engine-driven tools. How many could have been prevented if CO alarms were in new homes? Some of these deaths occurred in garages, tents, campers and locations other than the home. If one subtracts the 104 deaths from engine-driven tools, 10 deaths from charcoal grills, and 4 deaths from gas grills, camp stoves, and the like, that leaves only 62 deaths occurring from heating systems, water heaters, and other appliances likely to be found in a home. Clearly, CO alarms would have prevented few if any of the 114 CO deaths attributed to engine-driven tools, camps stoves, charcoal grills and similar devices not found in homes. That leaves 62 deaths that may have been impacted by CO alarms.

- *"Of the estimated 104 CO fatalities in 2006 that were associated with Engine-Driven Tools, 82 percent (85 deaths) involved generators. Additionally, generator usage was associated with three of the estimated seven multiple appliance CO poisoning fatalities."*
- *"There is a statistically significant increasing trend in consumer product-related non-fire CO fatalities from 1999 to 2006 that is attributable to generators."*

  Comment: Generators are not a home appliance and should not be operated in a home. Should homes be provided with CO alarms because someone may run engine driven tools in their home? Where does this stop? Is the solution to this problem putting alarms in homes or are there better solutions such as public education or better labeling and instructions for engine-driven tools. The entire US population should not have to pay hundreds of millions of dollars to install CO alarms in their homes because 50 people operated gas powered tools or charcoal grills inside their homes.

- *"Of the estimated 50 Heating Systems-related fatalities in 2006, 90 percent involved gas heating. Natural gas heating accounted for 46 percent of heating system-related fatalities, liquefied petroleum (LP or propane) gas heating accounted for 38 percent, and an additional* *six percent were only identified as unspecified gas heating. Kerosene/oil heating and unspecified heating systems accounted for the remaining eight percent."*

Comment: Since the adoption and enforcement of model codes in rural areas of the country is sporadic to non-existent, those areas are seen as less likely to benefit from a CO alarm mandate because there is no agency to educate the public or enforce rules. Because of the cost of installing gas lines, natural gas is usually only available in communities or more highly developed areas. Rural areas are more dependent on propane, fuel oil, and kerosene. Of the 50 estimated CO deaths attributable to heating systems, 23 occurred with a natural gas appliance. The remainder of the deaths was attributed to propane, fuel oil, and kerosene. These deaths are more likely to have occurred in areas that wouldn't be reached by code adoption. How many of these 50 estimated deaths could be saved with a CO alarm mandate?

• *"Seventy-one percent of the estimated 180 CO deaths in 2006 occurred in a home; while an estimated 17 percent of deaths occurred in tents, campers, and other temporary shelters."*

Comment: 31 of the 180 CO deaths occurred outside the home. Requirements for CO alarms would have no impact on these deaths.

•*"CO poisoning fatalities in isolated locations account for a larger proportion of all CO fatalities (13% in 2004 through 2006) than the proportion of the U.S. population living in isolated areas (4%). The disparity is even higher at isolated non-home locations which account for 25 percent of all CO fatalities occurring at non-home locations."*

Comment: The model codes are not adopted uniformly across all areas of the country. Often, rural areas are not governed by codes. This statistic indicates that more isolated areas have a greater incidence of CO deaths. Could it be that rural areas have less code enforcement that leads to more CO deaths? What other explanations are there? What impact would a CO alarm mandate have on these areas?

• *"… for non-engine driven tool products, the mortality rate has decreased by 16 percent since 1999/2000, from 3.67 in 1999/2000 down to a 3.08 average mortality rate in 2004 through 2006."*

Comment: So with no requirements for CO alarms in the I-Codes, the mortality rate has decreased by 16% since 2000. With the number of deaths decreasing at a steady pace, how necessary is it to require CO alarms?

The report goes on to say:

"Of the estimated 19 deaths in 2006 that were associated with LP gas heating systems, 11 (58%) involved unvented portable propane heaters. These unvented portable propane heaters were fueled by a propane tank and were not a component of an installed heating system. Unvented portable propane heaters were either camping heaters that used disposable propane tanks, one pound propane bottles, or tank top heaters that used bulk tanks larger than one pound."

And,

"…an estimated 10 CO deaths (6% of the 180 total consumer product estimate) were associated with charcoal or charcoal grills"

"…an estimated four deaths (2% of the total consumer product estimate) were associated with a subcategory of products which include gas grills, camp stoves, and lanterns; and one death was either associated with a consumer product that did not fit into the categories given above or there was insufficient detail to categorize the appliance involved. This latter incident involved the use of a grill inside a house, but it is unclear whether the grill was a gas grill or a charcoal or wood burning grill. This incident was categorized as Other Appliances."

"Additionally, in 2006, an estimated seven deaths were associated with multiple appliances (4% of the total consumer product estimate). The Multiple Appliances category includes all incidents where multiple fuel-burning products were used simultaneously such that a single source of the CO could not be determined. Of the estimated seven multiple appliance fatalities, three were associated with the simultaneous use of a gasoline-fueled generator and an LP heater. Of the estimated seven multiple appliance fatalities, six were associated with some type of LP heater."

"An estimated 104 CO poisoning deaths (58% of the estimated total from 2006) were associated with the category of Engine-Driven Tools, which includes generators, riding mowers or garden tractors, pressure washers, a snowmobile, a snow thrower, an air compressor, a water pump, and a non-vehicular internal compression engine."

The current rules require CO alarms if the home contains an attached garage. Although the proponent makes no argument for requiring CO alarms in dwellings with attached garages, the obvious presumption is that automobiles create some type of CO hazard and that garages are constructed such that they will allow CO to accumulate and flow into the dwelling. There is no data to indicate this is so.

None of the I-Codes require that garages have doors or be airtight. A carport is a roofed structure with not more than two sides enclosed. A garage is a roofed structure with more than two sides enclosed. Since a garage could have one wall completely open, why is it more hazardous than a car port?

Furthermore, following are excerpts from an article entitled:
The Role of Catalytic Converters in Automobile Carbon Monoxide Poisoning[*] A Case Report by Bradley Vossberg, MD and Judah Skolnick, MD, FCCP
[*] From the Frazier Rehab Center, Jewish Hospital Health Network, Louisville, KY.

Inhaling motor vehicle exhaust fumes is a common method used by people attempting to commit suicide; however, the decreased carbon monoxide concentrations found in the exhaust of late-model automobiles equipped with catalytic converters are changing the clinical presentation of exhaust inhalation.

Closed-environment exposure to MVEGE from automobiles not equipped with catalytic converters can result in death within 30 min. The introduction of catalytic converters beginning with 1975 new-car models dropped CO emission rates to 6.00 g/min. By 1989, the average new-car CO emission at idling was 0.22 g/min. The catalytic conversion process removes CO, hydrocarbons, and nitrogen oxide; the resultant emission is a more desirable mixture of nitrogen, CO_2, and water. ***Contemporary three-way catalytic converters eliminate > 99% of CO emissions.***

Given the increased efficiency of modern catalytic converters, patients presenting with closed-environment MVEGE exposure may have much lower HbCO levels than would have been previously expected; in some cases, the HbCO level may be normal. Other important factors to be considered are the role of supplemental O_2 given at the scene and the time taken to obtain the HbCO level.

More findings related to automobile carbon monoxide poisoning can be found in a technical paper entitled "***Reducing the Risk of Accidental Death Due to Vehicle-Related Carbon Monoxide Poisoning***" by **Linsey C. Marr, Glenn C. Morrison, William W. Nazaroff, and Robert A. Harley,** *Department of Civil and Environmental Engineering, University of California, Berkeley, California.* This technical paper reports on studies and analysis of computer modeling undertaken to determine the risk of death from CO poisoning in homes and garages. Among the findings: "The risk of death ranged from 16-21% for a 3-hr exposure ***in*** a garage to 0% for a 1-hr exposure in a house."

With any study with so many variables, one can question the validity of the study. This one is no different. Among the difficulties in modeling the conditions were numerous variables including:

- Age and condition of the motor vehicle
- Air exchange rates for the garage and dwelling
- Size of the garage and dwelling
- Length of time the vehicle is running
- Amount of fuel in the fuel tank
- Age and health of the individual
- Temperature and weather conditions
- Newer vehicles have more effective catalytic converters
- Socioeconomic factors may result in older, less efficient vehicles stored outside or garages with higher air exchange rates

But the study was based on very conservative conditions and it was pointed out that the risks may be overestimated.

The study points out that unintentional CO deaths from automobiles do occur. But most all of these deaths occurred ***in*** the garage. The most frequent cause of CO deaths were a driving into a garage (often under the influence of alcohol or drugs) and leaving the engine running (42% of deaths) and starting the car to perform vehicle maintenance (25%) or to provide heat (23%).

Importantly, the study points out that even these deaths are dropping at a rate of about 7% a year as older vehicles are replaced by newer, more efficient ones. In fact, in the technical paper by **M. Shelef** titled "***Unanticipated benefits of automotive emission control: Reduction in fatalities by motor vehicle exhaust gas***" SAE Technical Paper No. 922335, Society of Automotive Engineers: Warrendale, PA, 1992, Shelef argued that reducing CO poisoning deaths may be the biggest benefit from current motor vehicle emission control programs, even though the programs are motivated by concentration standards for outside air.

After reading the various reports and studies on automobile carbon monoxide emissions, it is difficult to come to any conclusion that automobile generated carbon monoxide creates any sort of hazard in the home and the proponent has provided no statistical evidence that it does.

According to the US Environmental Protection Agency and in recognition of the fact that cold engines give off more CO, the 1990 Clean Air Act calls for 1994 and later cars and light trucks to meet federal carbon monoxide standards at 20 degrees Fahrenheit whereas the old rules required those standards be met at 75 degrees Fahrenheit. So the risk of increased CO levels emitting from cold engines is significantly reduced.

And the anecdotal statements that people start their cars in cold garages to warm up, walk into their house and leave the door to the garage open allowing carbon monoxide, cold air, and noise to enter the home is simply not accurate. Even if the door to the home fit poorly, carbon monoxide in the quanities needed to result in death may not occur or only occur after many hours. The person starting the car did so with the intent to go somewhere. It is unlikely they will forget where they were going for six or seven or eight hours.

The current rules require CO alarms in homes that have any fuel burning appliances. But some appliances have an extremely high safety record when it comes to CO incidents. No deaths were attributed to CO poisoning from gas ranges or ovens in 2006. Only four deaths occurred from water heaters. 2,426,264 people died from all causes in the US during 2006. The number of deaths attributable to CO poisoning from water heaters is .0001648% of the total number of deaths. Given the low number of deaths compared to overall US mortality rates, deaths attributable to CO poisoning is statistically irrelevant.

Is there a problem with CO poisoning in the home that occurs to a degree that warrants expensive regulation? I would say that the evidence indicates there is not.

It has been argued that several states have adopted CO regulations. That is true and Minnesota is one of them. But deaths attributable to CO poisoning in Minnesota are extremely rate. However, some years ago, the tragic death of a young girl occurred in a home where an older heating system had not been properly maintained. As is often the case, grieving parents fail to take responsibility for what occurred and stated that if carbon monoxide alarms had been required in all homes that perhaps their daughter wouldn't have died. It isn't known why the parents felt a law was necessary and why they couldn't have voluntarily installed an alarm if they felt it was important. The grandparents of the young girl approached the Minnesota IRC Advisory Committee about placing a mandate in the state building code to require CO detectors. However, amendments to the state code must pass a need and reasonable test and there were insufficient reasons to require them to be installed. The grandparents then went to several legislators who crafted a poorly worded law that makes CO alarms mandatory in all dwellings in the state except those owned by the state. The state legislature has no burden to prove that their rules are necessary or reasonable. The rule is not in the Minnesota State Building Code and there is no enforcement mechanism. The law sold a few alarms and creates necessary work for some attorneys.

The issue has also been studied by ICC. In 2005 The ICC Code Technology Committee conducted a study on the need for Carbon Monoxide alarms.

The Committee came to the following conclusion: "There has not been sufficient justification presented to the CTC to mandate carbon monoxide alarms in new or existing residential type occupancies".

The report was based on a number of findings including:

- Requiring functional and reliable CO detection in all new and existing dwelling units would potentially reduce fatalities. However, the technical analysis on expected effectiveness and cost impact, as submitted to the CTC, is not adequate to justify a mandate at this time.
- A number of elements impact effectiveness of a mandate, including breadth of building stock covered, performance of alarms and compliance with use, installation and maintenance instructions.
- The data presented to the CTC indicates that the number of CO related deaths in dwelling units has reduced by about 5% per year, and that only non-fire, unintentional deaths could be avoided by a CO alarm mandate. Insufficient data was presented to assess the potential impact of CO alarms with respect to preventable injuries.
- Laboratory and field data presented to the CTC indicate conflicting performance data of CO alarms across a range of currently listed products.
- Insufficient benefit/cost data has been presented to mandate CO alarms.

Studies from the federal government, ICC, and numerous medical and university studies all indicate that mandating the use of CO alarms will have little or no impact on CO deaths. Why then require the public to spend millions of dollars?

At some point the membership has to come the conclusion that minimum codes cannot and are not intended to protect everyone from everything. This is clearly one of those situations where additional regulation will cost but not provide any benefit.

Public Comment 3:

Don Surrena, CBO, National Association of Home Builders (NAHB), requests Disapproval.

Commenter's Reason: NAHB requests the final assembly to reject this proposal given that information from a report prepared for "Kathleen Almonr" of the "Fire Protection Research Foundation show, national level studies and analysis have been developed by the Center for Disease Control (CDC), the Consumer Product Safety Commission (CPSC), the Bureau of Labor Statistics (BLS) the UK Health and Safety Executive, and the National Fire Protection Association (NFPA). Among these studies the scope of coverage of the CO poisoning differed depending upon the scope of responsibility of the sponsoring organization. For instance the CPSC studies did not include motor vehicle exhaust, boats, or any work related exposures. ***The overall finding from the collective body of work is that in the US there are approximately 500 CO poisoning deaths per year*** and about 15,000 individuals who receive treatment for CO poisoning.

The CO poisoning deaths and injuries have been steadily decreasing over recent decades. The steady decline has been attributed to improved motor vehicle emissions controls and general improvements in combustion devices. All the studies indicate that CO poisonings result from CO produced by combustion sources. Identified sources include furnaces, motor vehicles, ranges/ovens, stoves, water heaters, generators, engine-driven tools, space heaters, and charcoal grills. Automobile incidents comprise about half the non-fire CO incidents and overwhelmingly involve idling vehicles. ***About ⅔ of all CO exposures occur in the home***, with the remainder most often found in public areas and facilities, temporary shelters, and the workplace.

The 2/3 number that occur in the home has no indication as to how many of those were self inflicted.

The science of the units are of concern also with placement of detectors not being a clear or precise placement. There are so many variables that the author as well as NFPA have deferred to the individual manufacturer for placement instructions.

The main objection is that this requirement does not belong in the Property Maintenance Code. The whole code change acts as a retroactive requirement to all existing housing and buildings covered by the Property Maintenance Code. This is a property maintenance code and as stated in the "Scope and Application" Section 101.2 Scope. The provisions of this code shall apply to all existing residential and nonresidential structures and all existing *premises* and constitute minimum requirements and standards for *premises*, structures, equipment and facilities for light, *ventilation*, space, heating, sanitation, protection from the elements, life safety, safety from fire and other hazards, and for safe and sanitary maintenance. The key to this section is that it is for the minimum requirements. In Section 102.2 Maintenance. Equipment, systems, devices and safeguards required by this code or a previous regulation or code under which the structure or *premises* was constructed, altered or repaired shall be maintained in good working order. If equipment or devices are in working order and are being maintained and they were compliant when installed, they have met the criteria of the Property Maintenance Code. To require a system to be upgraded that was lawful and is still operational because a new system is developed fly's in the face of a minimum requirement. What is to stop the requirement of any new product that performs better or differently than the presently legal equipment to then be required to be installed?

Bringing new requirements into the public sector should be done through the building code and not a minimum maintenance code.

Final Action: AS AM AMPC____ D

PM23-09/10, Part II
IEBC 704.4.4 (New), 704.4.4.1 (New)

Proposed Change as Submitted

Proponent: Tom Neltner, National Center for Healthy Housing, representing National Center for Healthy Housing and Alliance for Healthy Homes.

PART II - IEBC

1. Add new text as follows:

704.4.4 Carbon monoxide alarms. Where work requiring a permit occurs, carbon monoxide alarms shall be provided outside of each separate sleeping area in the immediate vicinity of the bedroom(s) in dwelling units within which a fuel burning appliance, including a portable fuel burning space heater, exist or in dwelling units that have an attached garage.

704.4.4.1 Alarm requirements. Single station carbon monoxide alarms shall be listed as complying with UL 2034 and shall be installed in accordance with this code and the manufacturer's installation instructions.

2. Revise Chapter 8 as follows:

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, IL 60062

UL 2034-2008 Standard for Single- and Multiple-station Carbon Monoxide Alarms………………704.4.4.1

Reason:
PART II - Carbon monoxide (CO) is an odorless, tasteless, invisible gas that kills more than 300 people in homes each year. Thousands more are admitted to the hospital with carbon monoxide poisoning. This is a serious issue that effects people nationwide is all regions of the country.

This proposal provides consistency between the IEBC and the International Residential Code. The IRC was amended in the 2007/2008 cycle with similar language to require CO alarms whenever a building permit is issued in an existing residence within which fuel-fired appliances exist or have or attached garages. This proposal expands on the IRC requirement to specifically include portable fuel burning space heaters. Portable fuel burning space heaters may not normally be considered an appliance.

The following states require CO alarms in existing residences: Alaska, Colorado, Illinois, Massachusetts, Michigan. Minnesota, Montana, New Jersey, New York, Oklahoma, Rhode Island, Vermont and Wisconsin. While these are cold weather states, the deaths from CO are spread throughout the country as residents unwittingly use dangerous methods to stay warm in unusually cold weather.

Cost Impact: Yes, this code change proposal will increase the cost of construction. Carbon monoxide alarms typically cost approximately $25.00 each.

Analysis: A review of the standard(s) proposed for inclusion in the code, UL 2034-2008, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: NELTNER-PM4-705.1 PART I AND NELTNER-EB3-704.4.4 PART II

Public Hearing Results

Note: The following analysis was not in the Code Change monograph but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf :

Analysis: This standard is currently referenced in the *International Residential Code*.

This code change was contained in the errata posted on the ICC website. Please go to http://www.iccsafe.org/cs/codes/Pages/09-10ProposedChanges.aspx.

PART II- IEBC
Committee Action: **Approved as Submitted**

Committee Reason: The committee agreed that requiring carbon monoxide alarms for existing structures undergoing alterations in the *International Existing Building Code* was appropriate at this time and was consistent with recent provisions in the *International Residential Code*. Further it was felt to be a cost effective remedy in the interest of life safety.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ron Nickson representing National Multi Housing Council, requests Approval as Modified by this Public Comment.

Delete and replace as follows:

PART II - IEBC

~~**704.4.4 Carbon monoxide alarms.** Where work requiring a permit occurs, carbon monoxide alarms shall be provided outside of each separate sleeping area in the immediate vicinity of the bedroom(s) in dwelling units within which a fuel burning appliance, including a portable fuel burning space heater, exist or in dwelling units that have an attached garage.~~

~~**704.4.4.1 Alarm requirements.** Single station carbon monoxide alarms shall be listed as complying with UL 2034 andshall be installed in accordance with this code and the manufacturer's installation instructions.~~

704.4.4 Carbon monoxide alarms. Group I or R occupancies located in a building containing a fuel-burning appliance or a building which has an attached garage with a communicating opening shall be provided with single station carbon monoxide alarms outside of each separate dwelling unit sleeping area in the immediate vicinity of the bedrooms and on every occupiable level of a dwelling unit. The carbon monoxide alarms shall be listed as complying with UL 2034 and be installed and maintained in accordance with NFPA 720 and the manufacturer's instructions. An open parking garage, as defined in the *International Building Code*, or enclosed parking garage ventilated in accordance with Section 404 of the *International Mechanical Code* shall not be deemed to be an attached garage.

> **Exception:** Sleeping units or dwelling units which do not themselves contain a fuel-burning appliance or have an attached garage, but which are located in a building with a fuel-burning appliance or an attached garage, need not be provided with single station carbon monoxide alarms provided that:
>
> 1. The sleeping unit or dwelling unit is located more than one story above or below any story which contains a fuel-burning appliance or an attached garage;
> 2. The sleeping unit or dwelling unit is not connected by duct work or ventilation shafts to any room containing a fuel-burning appliance or to an attached garage; and
> 3. A carbon monoxide detector is installed in the room containing the fuel burning appliance.

704.4.1 Carbon monoxide detection systems. Carbon monoxide detection systems, that include carbon monoxide detectors and audible notification appliances, installed and maintained in accordance with this section for carbon monoxide alarms and NFPA 720 shall be permitted. The carbon monoxide detectors shall be listed as complying with UL 2075.

Commenter's Reason: The code development committees approved requirements for installation of carbon monoxide detectors in the IBC, IFC, IPMC, and IEBC. However, they were not the same and thus new buildings which become existing buildings or buildings falling under the requirements of the IPMC would have different requirements than required for new construction. This modification to the proposal for PM23 Part I (IMPC) and Part II (IEBC) aligns the requirements in the two codes to match the requirements in the IBC and IFC. The modification does include modifications that were submitted as a public comment to F133.

Public Comment 2:

Don Surrena, CBO, National Association of Home Builders (NAHB), requests Disapproval.

Commenter's Reason: See PM23, Part I.

Final Action: AS AM AMPC____ D

ADM3-09/10, Part I

PART I: IBC 101.3, K101.3; IMC 101.3; IFGC 101.4; IPC 101.3; IPSDC 101.3, IECC 101.3; IFC 101.3; IEBC 101.3; IPMC 101.3; IWUIC 101.3; IZC 101.2

Proposed Change as Submitted

PART I – IBC, IMC, IFGC, IPC, IPSDC, IECC, IFC, IEBC, IPMC, IWUIC, IZC

Proponent: Zaida Basora, AIA, Building Official, City of Dallas; in consultation with the Codes Committee of the U.S. Green Building Council

1. IBC – Revise as follows:

101.3 Intent. The purpose of this code is to establish the minimum requirements for the built environment to safeguard the public health, safety and general welfare through provisions that address*:*

1. Structural strength, means of egress facilities, stability, durability, sanitation, adequate light and ventilation, energy conservation and accessibility;
2. Safety to life and property from fire and other hazards attributed to the built environment; ~~and to provide~~
3. Safety ~~to~~ of fire fighters and emergency responders during emergency operations; and
4. Sustainable practices in building design, construction and use.

K101.3 Intent. The purpose of this code is to establish the minimum requirements for electrical equipment and systems in the built environment to safeguard the public safety, health and general welfare through provisions that address:

1. Design, quality of materials, construction and installation, durability, operation and maintenance;
2. Safety to life and property from fire and other hazards attributed to the built environment; and
3. Sustainable practices in building design, construction and use.

2. IMC – Delete and substitute in its entirety as follows:

~~**101.3 Intent.** The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation and maintenance or use of mechanical systems.~~

101.3 Intent. The purpose of this code is to establish the minimum requirements for mechanical equipment and systems in the built environment to safeguard the public safety, health and general welfare through provisions that address:

1. Design, quality of materials, construction and installation, durability, operation and maintenance;
2. Safety to life and property from fire and other hazards attributed to the built environment; and
3. Sustainable practices in building design, construction and use.

3. IFGC – Delete and substitute in its entirety as follows:

~~**101.4 Intent.** The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation and maintenance or use of fuel gas systems.~~

101.4 Intent. The purpose of this code is to establish the minimum requirements for fuel gas equipment and systems in the built environment to safeguard the public safety, health and general welfare through provisions that address:

1. Design, quality of materials, construction and installation, durability, operation and maintenance;
2. Safety to life and property from fire and other hazards attributed to the built environment; and
3. Sustainable practices in building design, construction and use.

4. IPC – Delete and substitute in its entirety as follows:

~~**101.3 Intent.** The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation and maintenance or use of plumbing equipment and systems.~~

101.3 Intent. The purpose of this code is to establish the minimum requirements for plumbing equipment and systems in the built environment to safeguard the public safety, health and general welfare through provisions that address:

1. Design, quality of materials, construction and installation, durability, operation and maintenance;
2. Safety to life and property from fire and other hazards attributed to the built environment; and
3. Sustainable practices in building design, construction and use.

5. IPSDC – Delete and substitute in its entirety as follows:

~~**101.3 Intent.** The purpose of this code is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation and maintenance or use of private sewage disposal systems.~~

101.3 Intent. The purpose of this code is to establish the minimum requirements for private sewage disposal equipment and systems in the built environment to safeguard the public safety, health and general welfare through provisions that address:

1. Design, quality of materials, construction and installation, durability, operation and maintenance;
2. Safety to life and property from fire and other hazards attributed to the built environment; and
3. Sustainable practices in building design, construction and use.

6. IECC – Revise as follows:

101.3 Intent. This code shall regulate the design and construction of buildings through provisions that address sustainable practices for the effective use of energy. This code is intended to provide flexibility to permit the use of innovative approaches and techniques ~~to achieve the effective use of energy~~. This code is not intended to abridge, but to augment, safety, health or environmental requirements contained in other applicable codes and ordinances.

7. IFC – Revise as follows:

101.3 Intent. The purpose of this code is to establish the minimum requirements consistent with nationally recognized good practice for providing a reasonable level of life safety and property protection from the hazards of fire, explosion or dangerous conditions in new and existing buildings, structures and premises and to provide safety to fire fighters and emergency responders during emergency operations. This code is not intended to abridge, but to augment, safety, health or environmental requirements contained in other applicable codes and ordinances.

8. IEBC – Revise as follows:

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 public health, safety and general welfare insofar as they are affected by the repair, alteration, change of occupancy, addition and relocation of existing buildings. This code supports responsible alteration and reuse of buildings to enhance and protect the long term investment of materials and resources in existing structures.

9. IPMC – Revise as follows:

101.3 Intent. This code shall be construed to secure its expressed intent, which is to ensure public health, safety and general welfare in so far as they are affected by the continued occupancy and maintenance of structures and premises. This code supports the responsible performance and maintenance of buildings to protect the long term investment of materials and resources inherent in existing structures. 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 required herein.

10. IWUIC – Revise as follows:

101.3 Objective. The objective of this code is to establish minimum regulations consistent with nationally recognized good practice for the safeguarding of life and property. Regulations in this code are intended to mitigate the risk of life and structures from intrusion of fire from wildland fire exposures and fire exposures from adjacent structures and to mitigate structure fires from spreading to wildland fuels. This code encourages the maintenance of the investment of materials and resources in buildings and structures and the preservation of surrounding wildland resources. The extent of this regulation is intended to be tiered commensurate with the relative level of hazard present.

The unrestricted use of property in wildland-urban interface areas is a potential threat to life and property from fire and resulting erosion. Safeguards to prevent the occurrence of fires and to provide adequate fire-protection facilities to control the spread of fire in wildland-urban interface areas shall be in accordance with this code.

This code shall supplement the jurisdiction's building and fire codes, if such codes have been adopted, to provide for special regulations to mitigate the fire- and life-safety hazards of the wildland-urban interface areas.

11. IZC – Revise as follows:

101.2 Intent. The purpose of this code is to safeguard the public health, property and ~~public~~ general welfare by controlling the design, location, use or occupancy of all buildings and structures through ~~regulated and~~, regulations supporting long term solutions, that result in orderly development of land and land uses within this jurisdiction that are sensitive to the environment and the community.

PART II – IRC BUILDING/ENERGY

Revise as follows:

R101.3 Intent. The purpose of this code is to establish the minimum requirements for the built environment to safeguard the public health, safety~~, health~~ and general welfare through provisions which address:

1. Affordability, structural strength, means of egress facilities, stability, durability, sanitation, light and ventilation, and energy conservation ~~and~~;
2. Safety to life and property from fire and other hazards attributed to the built environment; ~~and to provide~~
3. Safety ~~to~~ of fire fighters and emergency responders during emergency operations; and
4. Sustainable practices in building design, construction and use.

Reason: General:
Purpose: Align the intent statements of the I-Codes for consistency, reformat the statements for improved clarity, and add a provision for sustainability to the intent statements: "Sustainable practices in building design, construction and use."
Note: This code proposal updates the Intent section of each of the I-Codes to incorporate sustainability as a core principle. The intent statements vary widely from one code to the next so the language varies accordingly but the principle is the same and this proposal strives to update some outdated language, maintain specific relevance, and improve consistency and clarity.

1. INTEGRATING PUBLIC HEALTH, SAFETY AND WELFARE AND THE ENVIRONMENT

This proposal recognizes a fundamental link between "safeguarding the public health, safety and general welfare" and preserving a safe and healthy natural environment. There is widely recognized and growing evidence that many of the immediate and cumulative negative impacts of the built environment threaten the health and viability of the natural systems underlying human health and welfare. The importance of this connection has been acknowledged in policy positions of the International Code Council and organizations including the American Institute of Architects (AIA), the American Society of Civil Engineers (ASCE), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), the American Planning Association (APA), the World Business Council for Sustainable Development (http://www.wbcsd.org/web/about/members.html), which includes many of the largest companies in the US and the world, and many others.

The health and welfare of humans and society depend directly on the health and viability of ecological and natural systems and on many critical non-renewable resources. Safeguarding the public from hazards attributed to the built environment necessarily includes addressing these larger hazards created by building practices. The benefits of enabling more sustainable practices extend beyond improving environmental and human health, to creating a more sustainable economy, greater social equity and more resilient communities. Improving the efficiency of resource use, reducing waste and pollution, improving indoor environmental quality, and enabling water and energy saving strategies relieve pressures on public infrastructure, reduce public expenditures, and increase health and productivity of everyone, at home, in schools and at work.

2. NOT REPLACING EXISTING PROVISIONS OR COMPROMISING SAFETY

Adding sustainability to the intent of the code does not negate any other provisions. Sustainability identifies a consideration that, in addition to existing safety goals, addresses systemic risks, providing increased safety with respect to the cumulative impacts of construction-related activities that create risks to building occupants, the general public, and future generations. Though these are hazards attributable to the built environment, and thus part of the responsibility for safeguarding the public, they have not previously been recognized or explicitly acknowledged in the codes. Adding this provision will aid code officials in interpreting the codes as supporting practices that seek to address both the current concerns and the large-scale and long-term risks that are emerging. Code enforcement during plan review and site inspections determines the fundamental safety conditions of a building that will impact the health and safety of occupants for the life of the building after the Certificate of Occupancy is issued. Consideration of more sustainable practices is important for maintaining safety both in the immediate and long term.

3. STATEMENTS ON SUSTAINABILITY

Incorporating sustainability into the intent and purpose statements of the I-Codes is parallel to commitments and statements made by several leading organizations representing regulatory bodies and the design, building and development sectors.

AIA (American Institute of Architects):

A. Excerpted from "AIA Position Statement #41 on Sustainable Built Environment," December 2008
"The AIA supports governmental and private sector policy programs, and incentives to encourage a built environment that embodies the advantages of sustainable architecture."
http://www.aia.org/aiaucmp/groups/aia/documents/pdf/aias078764.pdf

B. Excerpted from "Sustainable Architectural Practice Position Statement," 2005:
"The AIA recognizes a growing body of evidence that demonstrates current planning, design, construction, and real estate practices contribute to patterns of resource consumption that seriously jeopardize the future of the Earth's population. Architects need to accept responsibility for their role in creating the built environment and, consequently, believe we must alter our profession's actions and encourage our clients and the entire design and construction industry to join with us to change the course of the planet's future."
http://www.aia.org/aiaucmp/groups/aia/documents/pdf/aias077734.pdf

APA (American Planning Association):

Excerpted from the "Policy Guide on Planning for Sustainability" – Section I: Findings, April 2000:
"…Over the last 40 years, the increase in per capita energy and material consumption has increased even faster than the world's human population. Scientists estimate that our present consumption level is exceeding the Earth's carrying capacity by 30%. We are making up that difference by depleting "natural capital". The United States leads the world in material consumption and waste generation…"
"…Modern economies rely on a host of substances that are not part of nature's cycle of growth and decay. Because these substances are not renewable, their supplies are constantly diminishing. This causes competition for limited resources, with societal repercussions and resulting damage to the environment…"
"…The use of substances that accumulate in the ecosphere and are not part of nature's cycle causes environmental pollution in various forms. Carbon dioxide has increased 30% over its natural occurrence in our atmosphere. Poisonous elements mined from below the Earth's crust, such as cadmium and lead, are found at five and eight times, respectively, their natural rates in the ecosphere. Over 70,000 chemical compounds are now present and accumulating in the ecosphere. Many of these may be toxic to humans or other species."
http://www.planning.org/policy/guides/adopted/sustainability.htm

ASCE (American Society of Civil Engineers):

A. Excerpted from "ASCE Code of Ethics" –Fundamental Canons, July 2006, the first of which states:
"1. Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties."
http://www.asce.org/inside/codeofethics.cfm

B. Excerpted from "The Role of the Civil Engineer in Sustainable Development" – Policy Statement #418, April 2007:
"ASCE Code of Ethics requires civil engineers to strive to comply with the principles of sustainable development in the performance of their professional duties."
http://www.asce.org/pressroom/news/policy_details.cfm?hdlid=60

ASHRAE (American Society of Heating, Refrigeration and Air-conditioning Engineers):

Excerpted from "Sustainability Roadmap," January 2006
"*To achieve and maintain a position of leadership, ASHRAE will:*
- *Expand our efforts to foster sustainable buildings.*
- *Conduct our own affairs of the Society in a sustainable manner…*
- *Integrate building sustainability principles, effective practices and emerging concepts into all appropriate ASHRAE standards, guidelines, research, Handbook chapters, and other publications."*

http://www.ashrae.org/docLib/200621485921_886.pdf

ICC (International Code Council):

A. Excerpted from "Council Policy #35 - 08 – Sustainable Building Technology Committee," September 2008
"…2.1 To work for the continual improvement of ICC Codes, Standards and Guidelines in the areas of sustainability and high performance. This includes the development of proposed code changes, and analysis/response to sustainability-related changes submitted by others..."
http://www.iccsafe.org/news/about/pdf/CP35-08.pdf

B. Excerpted from "Council Policy Position on Green Buildings/Sustainable Communities" – ICC PS 1-2006
"…The Code Council must lead the building safety field: …
- *In monitoring and advocating in the legislative, regulatory and codes arena to give Code Council members the opportunity to speak for sustainable building safety;*
- *Promote the environmental features of the I-Codes and reinforce the understanding that safety and sustainability are both achievable;*
- *Promote the understanding that the I-Codes and the Code Council safety system facilitate the application of sustainable building policy…"*

http://www.iccsafe.org/news/green/Green_Building_policy.pdf

4. SOCIAL VALUE / PUBLIC GOOD

The history of building codes and standards reveals a continuous evolution in understanding and addressing risks as society recognizes them and deems them important enough to require regulation. Public health, safety, and general welfare represent evolving social values. Addressing accessibility of building facilities for users with disabilities is an example of a social issue that was at one time unaddressed by codes and now is fully addressed throughout the building code, in other codes, and as a separate ANSI standard. Affordability, a social issue, is now addressed in the intent statement of the IRC. The NAHB wrote in its supporting statement for adding affordability to the code, "inclusion of "affordability" in the IRC is needed to clarify that safeguarding the public welfare includes concerns about the affordability of housing". The same is true for sustainability. Whether it is through protecting the health of community or regional ecosystems, saving costs of operations and maintenance, reducing negative community impacts, reducing demand for electricity and water, improving occupant and employee health and productivity, or maintaining clean air, the public is demanding better buildings that address these important concerns.

5. BUILDING IMPACTS - LOCAL

Buildings never exist in isolation. They provide a visible, tangible component of the physical infrastructure of a place, town or region. And no matter where it is located, a building has impacts related to its initial construction and the resources necessary to sustain it over time. Whether it is the utility system, the traffic system, the waste stream, flows of equipment and supplies for operations, or the micro-climate impacts of shade, heat, wind or storm runoff, the permitted designs and methods of construction will affect the building occupants and the surrounding environment of the jurisdiction for its lifetime and beyond.

6. BUILDING IMPACTS - GLOBAL

There are negative impacts at every point of the lifecycle of a material or product – whether at extraction or harvest, transport or distribution, alteration or manufacture, construction, installation, use, and later deconstruction, demolition, or destruction. Given that the citizens of a jurisdiction, of a region and even citizens of the world pay the price when such impacts are unregulated and unchecked—effectively externalized to the Commons—and that those impacts are now widely recognized, the public and leading industries and businesses should address these broader impacts. Local activities have both local and global consequences, with both short- and long-term effects. This reality needs to be an inherent part of the process of designing, regulating, building and operating buildings. Incorporating sustainability into the intent provisions of the I-Codes begins the process of acknowledging this reality and its importance.

7. INDUSTRY ADVANCING

In recent years industry professionals and the public have developed a new understanding that short-term focus on first costs along with wasteful building practices can lead to long term costs and system failures. In the arena of energy efficiency, the cheapest, easiest building to construct often becomes the costliest, most maintenance-intensive building to operate. Buildings full of chemicals that retard moisture, rot, mildew, insects, or flame-spread are, in some cases, negatively impacting the health of building occupants. Industry is learning from and adapting to market demand for better buildings and emerging information from the fields of building science, biology, ecology and human health, and it is essential that knowledge be integrated into standard practice. Building regulations should support, not impede this transition to healthier, more sustainable practice.

8. NOT GREEN BUILDING CODE

This is not a green building provision. Green buildings are typically considered above-code or high performance buildings and rating systems exist to define them. New green building codes will set standards for green building designs in enforceable language. As some green building practices become commonplace they will find their way into the ICC family of codes. Having sustainability as a scoping provision will provide the vehicle for transitioning to more sustainable building construction over time. While green buildings may be more likely to be sustainable buildings, they are not necessarily sustainable just because they meet the criteria of a rating system.

9. NOT DEFINING SUSTAINABILITY

Just as the terms "health," "safety," and "welfare" are not defined in the code, we will not attempt to define Sustainability here. This will be for code officials to determine during the consideration of future code proposals one at a time – each on its own merit. The level of safety within the codes is decided by each final action proposal that is passed by ICC membership. Consideration is given to balancing the risks to public health, safety, and welfare against the costs for compliance and consequences of enforcement on building owners, occupants and safety professionals. This will not change.

10. NOT TOO EARLY

Sustainability addresses a set of issues that are increasingly recognized as urgent today, are already included in many European and other national codes, and should already be in U.S. codes. Regulations always lag behind both innovation and the emergence of new risks or new understanding about existing risks. The design, construction and development industry is already well ahead of the codes and this will only increase in coming years. As it stands, the codes affected by this proposal will not be published until 2012, and will likely not be widely adopted for several more years after publication, meaning that official recognition of the need to incorporate sustainable practices into the building regulatory system will not appear for several years. The changes proposed set the stage for more rapid acceptance and advancement of changes that are already taking place. As techniques, methods and strategies make their way into the market, they will become the norm. As they become the norm, they become candidates for code requirements. Without explicit support for such changes, the codes will be an impediment to responsible change, rather than increasing public safety and welfare. Response to water and energy shortages, climate change and other factors are already driving many jurisdictions to develop their own ordinances, codes and standards in efforts to address realities that exist on the ground today. There should be no question about the need to incorporate these changes in the 2012 family of International Codes.

Explanation of Proposed Changes to Each Code:

Section 101.3, Intent of the 2009 IBC reads as follows:

> **101.3 Intent**. The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, sanitation, adequate light and ventilation, energy conservation, and safety to life and property from fire and other hazards attributed to the built environment and to provide safety to fire fighters and emergency responders during emergency operations.

In developing the 13 proposed revisions to 12 International Codes, the existing intent statement of the IBC formed the base platform from which the proposals for all the other codes were then constructed. The existing intent of the IBC already covers many topics but it doesn't fully address the total scope of the current code. The primary intent of this proposal is to add one provision which clarifies the code's role in supporting the shift to sustainable building practices. This is principally accomplished by adding item 4 to the existing three items in the IBC intent statement but also by adding 'durability' to the first item. It became clear to us in developing this proposal that the existing intent statements would be clearer to all if reformatted. Therefore, the final piece of the proposal is a revised format. This proposal provides a clearer format for the intent statement by creating a list. The existing intent statement results in Items 1 through 3. A final change for the IBC is to add 'accessibility' into Item 1's list of broad elements of the code. The IBC is the main location of accessibility standards in the International family of codes and that should be acknowledged in the intent statement.

Intent sections of the IMC, IFGC, IPC, IPSDC and Appendix K of the IBC

These four codes and Appendix K of the IBC are similar codes to each other in that they address specific systems within and serving the building. They are also similar to the IBC and IRC in that they are primarily 'new construction codes'. As similar codes, their existing intent statements are very similar to each other, with unique text for each discipline. However these intent statements are significantly different than the IBC or IRC statements. As an example of these intent statements, the IMC Section 101.3 is shown below:

> **101.3 Intent.** The purpose of this code is provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation and maintenance or use of mechanical systems.

The proposals for these 4 codes and the electrical administrative provisions of IBC Appendix K provide similar language and format to the proposals for the IBC and IRC, yet maintain the unique focus of each code's intent. Language was modernized and made consistent with the IBC and IRC in stating that the intent is to 'safeguard the public health, safety and general welfare. Because the revisions were presented in a new format, it was clearer to show these proposals as 'delete and replace' text. Existing intent provisions from these 5 documents is provided in the charging text and Items 1 and 2. Item 3 reflects the goal of sustainable practices for each system.

Section 101.3, Intent of the IECC

The IECC is already a sustainable practices code. Therefore the existing intent fairly well addresses the need for minimizing the use of energy by buildings constructed under its provisions. The proposed changes are mostly to establish similar language as provided in the other proposals. Further, we propose adding the text to clarify that the IECC doesn't supersede the safety standards of the other construction codes, but is a partner with them. The intent of the IECC does not lend itself to the same formatting as proposed for the 7 previous codes.

Intent sections of the IFC, IEBC and IPMC

These three codes do not have a primary focus of new construction as covered by codes in Parts 1 through 8, but have a primary focus on the maintenance of existing buildings in a safe and occupiable condition. (Although the IFC does contain many new construction standards.) One can say that these codes are already fully engaged in sustainability. The whole concept of taking action to maintain buildings so that they will survive and that people in them won't be harmed by what is in them is embodied in each of these codes. As such their existing intent statements already differ significantly from the 'construction' codes. However the phrasing and text in the existing intent statements was not consistent with each other, or with similar language in the construction codes.

IFC: The IFC has many of the provisions found in the IBC Intent Section 101.3 spread in two sections - 101.2 Scope and 101.3 Intent. For your convenience Section 101.2 is reproduced below: It is already in the list format we've proposed for the construction codes.

101.2 Scope. This code establishes regulations affecting or relating to structures, processes, premises and safeguards regarding:

1. The hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices;
2. Conditions hazardous to life, property or public welfare in the occupancy of structures or premises.
3. Fire hazards in the structure or on the premises from occupancy or operation;
4. Matters related to the construction, extension, repair, alteration or removal of fire suppression or alarm systems.

Therefore the only proposed amendment is to Section 101.3. This proposal adds a sentence parallel to the sentence which is present in the IECC. That proposed sentence is: <u>This code is not intended to abridge, but to augment, safety, health or environmental requirements contained in other applicable codes and ordinances.</u>

IEBC: While the title is the Existing Building Code, its primary purpose is addressing the reuse of existing buildings as well as guiding additions and alterations. Reuse and upgrading the existing building stock is perhaps one of the most 'sustainable' practices in development. The IEBC provides alternatives for compliance that encourages use of existing materials, yet upgrading to current standards and technologies where appropriate. The proposed new sentence is intended to make plain the goal of this code and how it relates to the sustainability of development as it relates to existing buildings. The term "general' was added for consistency with other codes.

IPMC: The Property Maintenance Code only addresses maintenance of existing structures and their continued safe use. It does not address remodeling or other upgrades as addressed in the IEBC. The basic intent of the IMPC is keeping what is there in good condition so that use can be continued and is safe and healthy. In a broad sense the IPMC is a code about sustainability. The proposed new sentence is intended to make plain the goal of this code and how it relates to the sustainability of existing buildings.

Section 101.3 The "Objective" of IWUIC

The IWUIC is unique in many ways. First it doesn't have an "Intent" section, but rather it has an "Objective". It is also unique in that it provides for construction standard for buildings in fire risk areas, but also contains maintenance provisions. Perhaps the IWUIC can be viewed as ICC's first "green" code in that it addresses the need for the built environment and the natural environment to co-exist. Its goal could be summarized by saying it intends to keep the forest wildlands from burning down the built environment and to keep the built environment from burning down the neighboring wildlands**.** Similar to the proposals to the IEBC and IPMC, the proposed additional language is only to make plain this existing intent of the IWUIC

Section 101.2. Intent of the IZC.

The IZC is another unique code in the ICC galaxy of codes. While the balance of the International Codes are focused on building construction and maintenance, the IZC is focused on the rational use of land. Yet while the IZC should be more closely linked to the use of the key resource, land; its intent statement doesn't clearly address sustainability. Because of its unique role, the proposal is also unique through enhancing the codes focus on long term solutions to zoning decisions as well as the clearly needed statement of relating zoning development to the existing environment - be that the natural environment or the community environment.

The Performance Code

The Performance Code was reviewed to determine if similar revisions needed to be proposed. There are already numerous, and sufficient goals statements spread throughout the Performance Code. No additional revisions are proposed.

Cost Impact: The code change proposal will not increase the cost of construction. Subsequent proposals by others addressing sustainable practices may increase initial construction costs, however, a growing body of evidence indicates that more sustainable design and building practices often have no cost implications and sometimes reduce construction costs, while typically reducing operating costs and other negative impacts, improving the long-term affordability of ownership and operation.

PART I – IBC, IMC, IFGC, IPC, IPSDC, IECC, IFC, IEBC, IPMC, IWUIC, IZC

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: BASORA-ADMIN1-101.3 sub only

<u>Public Hearing Results</u>

PART I-IBC, IMC; IFGC; IPC; IPSDC; IECC; IEBC; IPMC; IWUIC; IZC

Committee Action: Disapproved

Committee Reason: The committee's disapproval is based upon the portion that would add sustainability to the intent statement of all I-Codes. The committee disapproved this code change proposal because at the present time, sustainability is not within the purview of the I-Codes. Further, sustainability is not yet clearly understood or established, so it would be a vague provision that could cause confusion in understanding the I-Codes.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Zaida Basora, AIA, Assistant Director, City of Dallas Building Inspection, representing the Codes Committee of the U.S. Green Building Council, requests Approval as Submitted.

Commenter's Reason: Votes for disapproval were cast by both the I-ADMIN and the IRC hearing committees during the first code development hearings for the 2012 codes. These votes cited two reasons for disapproval:

1. That ICC's work to develop the International Green Construction Code (IGCC) removes the importance and relevance of this proposal, and that the goal of the green code is to safeguard public health, safety and general welfare from a more comprehensive set of hazards attributed to the built environment – and the other I-Codes are not intended to embrace such protections. This code change proposal does not modify any technical language of any of the I-Codes, but instead aligns the intent of these codes with a contemporary view of public health and safety that has been clearly endorsed by the ICC Board and staff leadership. This proposal complements the tremendous work undertaken by the Council in the development of the IGCC, and provides the opportunity in future code cycles to more directly consider the healthy, safe, tried-and-tested code measures that will have been road-tested in the IGCC. This proposal neither adopts any such provision, nor does it provide for the automatic adoption of any such provisions. The recognition that the long-term hazards from the cumulative effects of our built world on human and environmental health is driving the shift in how public health and safety are viewed, was what drove the need to create the IGCC, and continues to demand a more holistic approach to code and standard development.

2. That sustainability and environmental health has no place in the codes.

Nothing in the creation of the IGCC negates the need to address these issues in the rest of the I-Codes. In truth, the IGCC is the beginning of the process whereby the larger and longer-term hazards now recognized in the IGCC can be fully developed and responsibly integrated into the full set of base codes. Further, jurisdictions large and small across the country are struggling to upgrade their building codes to incorporate and enable green building practices. These communities have recognized the need and appropriateness of addressing these issues in building codes. Thus, the argument that was made, that most jurisdictions would not adopt the I-Codes if they included sustainability in the intent statement, is being proven false by the many communities already working independently to achieve these goals.

The history of building codes in the United States and internationally has been a constant evolution of thinking about how people can live free from harm or hazard in our built world. When cities were first born, structural codes soon followed to ensure buildings didn't collapse and harm building occupants or the community. When fires swept cities, fire codes were born. When the dense concentrations of people in cities introduced hazards of sanitary safety, plumbing codes were born to deliver potable water and remove human waste. The same can be said for the dangers of hurricanes, floods and earthquakes.

The less acute but regionally significant challenges of pollution caused by the use of fossil fuels and wasted money on utilities that could otherwise put dinner on the table was an impetus for energy efficiency to become a mainstay in the codes. The set of plumbing-related, mechanical-related, building- elated, zoning-related, and other code provisions now addressed in the IGCC PV-1.0 address hazards that had not yet seen debate at code hearings for their possible inclusion in their respective base codes. This code change proposal speeds up the conveyor belt of safer, healthier, more durable and resource-efficient code language from green code to base code, and is commensurate with the large-scale challenges at hand. These human and environmental health concerns are large and looming because they are the cumulative, aggregate impacts that arise from not addressing such human and environmental health concerns building-by-building.

Just as much as building occupants need these safeguards, so too does society at large. Society depends on the codes to protect us from the inherent dangers of a man-made world. Realigning the purpose of the I-Codes to incorporate these concerns merely creates framework for the technical debates about how best to achieve these societal goals. This is the natural next step for code development and a modern-day recognition of the code official as possibly the last line of defense against some of the world's greatest threats to public health and safety.

Final Action: AS AM AMPC____ D

ADM3-09/10-Part II
R101.3

Proposed Change as Submitted

PART II – IRC BUILDING/ENERGY

Proponent: Zaida Basora, AIA, Building Official, City of Dallas; in consultation with the Codes Committee of the U.S. Green Building Council

Revise as follows:

R101.3 Intent. The purpose of this code is to establish the minimum requirements for the built environment to safeguard the public health, safety~~, health~~ and general welfare through provisions which address:

1. Affordability, structural strength, means of egress facilities, stability, durability, sanitation, light and ventilation, and energy conservation ~~and~~;
2. Safety to life and property from fire and other hazards attributed to the built environment; ~~and to provide~~
3. Safety ~~to~~ of fire fighters and emergency responders during emergency operations; and
4. Sustainable practices in building design, construction and use.

PART II – IRC BUILDING/ENERGY

Reason: General:
Purpose: Align the intent statements of the I-Codes for consistency, reformat the statements for improved clarity, and add a provision for sustainability to the intent statements: "Sustainable practices in building design, construction and use."

Note: This code proposal updates the Intent section of each of the I-Codes to incorporate sustainability as a core principle. The intent statements vary widely from one code to the next so the language varies accordingly but the principle is the same and this proposal strives to update some outdated language, maintain specific relevance, and improve consistency and clarity.

1. INTEGRATING PUBLIC HEALTH, SAFETY AND WELFARE AND THE ENVIRONMENT

This proposal recognizes a fundamental link between "safeguarding the public health, safety and general welfare" and preserving a safe and healthy natural environment. There is widely recognized and growing evidence that many of the immediate and cumulative negative impacts of the built environment threaten the health and viability of the natural systems underlying human health and welfare. The importance of this connection has been acknowledged in policy positions of the International Code Council and organizations including the American Institute of Architects (AIA), the American Society of Civil Engineers (ASCE), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), the American Planning Association (APA), the World Business Council for Sustainable Development (http://www.wbcsd.org/web/about/members.html), which includes many of the largest companies in the US and the world, and many others.

The health and welfare of humans and society depend directly on the health and viability of ecological and natural systems and on many critical non-renewable resources. Safeguarding the public from hazards attributed to the built environment necessarily includes addressing these larger hazards created by building practices. The benefits of enabling more sustainable practices extend beyond improving environmental and human health, to creating a more sustainable economy, greater social equity and more resilient communities. Improving the efficiency of resource use, reducing waste and pollution, improving indoor environmental quality, and enabling water and energy saving strategies relieve pressures on public infrastructure, reduce public expenditures, and increase health and productivity of everyone, at home, in schools and at work.

2. NOT REPLACING EXISTING PROVISIONS OR COMPROMISING SAFETY

Adding sustainability to the intent of the code does not negate any other provisions. Sustainability identifies a consideration that, in addition to existing safety goals, addresses systemic risks, providing increased safety with respect to the cumulative impacts of construction-related activities that create risks to building occupants, the general public, and future generations. Though these are hazards attributable to the built environment, and thus part of the responsibility for safeguarding the public, they have not previously been recognized or explicitly acknowledged in the codes. Adding this provision will aid code officials in interpreting the codes as supporting practices that seek to address both the current concerns and the large-scale and long-term risks that are emerging. Code enforcement during plan review and site inspections determines the fundamental safety conditions of a building that will impact the health and safety of occupants for the life of the building after the Certificate of Occupancy is issued. Consideration of more sustainable practices is important for maintaining safety both in the immediate and long term.

3. STATEMENTS ON SUSTAINABILITY

Incorporating sustainability into the intent and purpose statements of the I-Codes is parallel to commitments and statements made by several leading organizations representing regulatory bodies and the design, building and development sectors.

AIA (American Institute of Architects):

A. Excerpted from "AIA Position Statement #41 on Sustainable Built Environment," December 2008
"The AIA supports governmental and private sector policy programs, and incentives to encourage a built environment that embodies the advantages of sustainable architecture."
http://www.aia.org/aiaucmp/groups/aia/documents/pdf/aias078764.pdf

B. Excerpted from "Sustainable Architectural Practice Position Statement," 2005:
"The AIA recognizes a growing body of evidence that demonstrates current planning, design, construction, and real estate practices contribute to patterns of resource consumption that seriously jeopardize the future of the Earth's population. Architects need to accept responsibility for their role in creating the built environment and, consequently, believe we must alter our profession's actions and encourage our clients and the entire design and construction industry to join with us to change the course of the planet's future."
http://www.aia.org/aiaucmp/groups/aia/documents/pdf/aias077734.pdf

APA (American Planning Association):

Excerpted from the "Policy Guide on Planning for Sustainability" – Section I: Findings, April 2000:

"…Over the last 40 years, the increase in per capita energy and material consumption has increased even faster than the world's human population. Scientists estimate that our present consumption level is exceeding the Earth's carrying capacity by 30%. We are making up that difference by depleting "natural capital". The United States leads the world in material consumption and waste generation…"

"…Modern economies rely on a host of substances that are not part of nature's cycle of growth and decay. Because these substances are not renewable, their supplies are constantly diminishing. This causes competition for limited resources, with societal repercussions and resulting damage to the environment…"

"…The use of substances that accumulate in the ecosphere and are not part of nature's cycle causes environmental pollution in various forms. Carbon dioxide has increased 30% over its natural occurrence in our atmosphere. Poisonous elements mined from below the Earth's crust, such as cadmium and lead, are found at five and eight times, respectively, their natural rates in the ecosphere. Over 70,000 chemical compounds are now present and accumulating in the ecosphere. Many of these may be toxic to humans or other species."

http://www.planning.org/policy/guides/adopted/sustainability.htm

ASCE (American Society of Civil Engineers):

A. Excerpted from "ASCE Code of Ethics" –Fundamental Canons, July 2006, the first of which states:

"1. Engineers shall hold paramount the safety, health and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of their professional duties."

http://www.asce.org/inside/codeofethics.cfm

B. Excerpted from "The Role of the Civil Engineer in Sustainable Development" – Policy Statement #418, April 2007:

"ASCE Code of Ethics requires civil engineers to strive to comply with the principles of sustainable development in the performance of their professional duties."

http://www.asce.org/pressroom/news/policy_details.cfm?hdlid=60

ASHRAE (American Society of Heating, Refrigeration and Air-conditioning Engineers):

Excerpted from "Sustainability Roadmap," January 2006

"*To achieve and maintain a position of leadership, ASHRAE will:*

- *Expand our efforts to foster sustainable buildings.*
- *Conduct our own affairs of the Society in a sustainable manner…*
- *Integrate building sustainability principles, effective practices and emerging concepts into all appropriate ASHRAE standards, guidelines, research, Handbook chapters, and other publications."*

http://www.ashrae.org/docLib/200621485921_886.pdf

ICC (International Code Council):

A. Excerpted from "Council Policy #35 - 08 – Sustainable Building Technology Committee," September 2008

"…2.1 To work for the continual improvement of ICC Codes, Standards and Guidelines in the areas of sustainability and high performance. This includes the development of proposed code changes, and analysis/response to sustainability-related changes submitted by others..."

http://www.iccsafe.org/news/about/pdf/CP35-08.pdf

B. Excerpted from "Council Policy Position on Green Buildings/Sustainable Communities" – ICC PS 1-2006

"…The Code Council must lead the building safety field: …

- *In monitoring and advocating in the legislative, regulatory and codes arena to give Code Council members the opportunity to speak for sustainable building safety;*
- *Promote the environmental features of the I-Codes and reinforce the understanding that safety and sustainability are both achievable;*
- *Promote the understanding that the I-Codes and the Code Council safety system facilitate the application of sustainable building policy…"*

http://www.iccsafe.org/news/green/Green_Building_policy.pdf

4. SOCIAL VALUE / PUBLIC GOOD

The history of building codes and standards reveals a continuous evolution in understanding and addressing risks as society recognizes them and deems them important enough to require regulation. Public health, safety, and general welfare represent evolving social values. Addressing accessibility of building facilities for users with disabilities is an example of a social issue that was at one time unaddressed by codes and now is fully addressed throughout the building code, in other codes, and as a separate ANSI standard. Affordability, a social issue, is now addressed in the intent statement of the IRC. The NAHB wrote in its supporting statement for adding affordability to the code, "inclusion of "affordability" in the IRC is needed to clarify that safeguarding the public welfare includes concerns about the affordability of housing". The same is true for sustainability. Whether it is through protecting the health of community or regional ecosystems, saving costs of operations and maintenance, reducing negative community impacts, reducing demand for electricity and water, improving occupant and employee health and productivity, or maintaining clean air, the public is demanding better buildings that address these important concerns.

5. BUILDING IMPACTS - LOCAL

Buildings never exist in isolation. They provide a visible, tangible component of the physical infrastructure of a place, town or region. And no matter where it is located, a building has impacts related to its initial construction and the resources necessary to sustain it over time. Whether it is the utility system, the traffic system, the waste stream, flows of equipment and supplies for operations, or the micro-climate impacts of shade, heat, wind or storm runoff, the permitted designs and methods of construction will affect the building occupants and the surrounding environment of the jurisdiction for its lifetime and beyond.

6. BUILDING IMPACTS - GLOBAL

There are negative impacts at every point of the lifecycle of a material or product – whether at extraction or harvest, transport or distribution, alteration or manufacture, construction, installation, use, and later deconstruction, demolition, or destruction. Given that the citizens of a jurisdiction, of a region and even citizens of the world pay the price when such impacts are unregulated and unchecked—effectively externalized to the Commons—and that those impacts are now widely recognized, the public and leading industries and businesses should address these broader impacts. Local activities have both local and global consequences, with both short- and long-term effects. This reality needs to be an inherent part of the process of designing, regulating, building and operating buildings. Incorporating sustainability into the intent provisions of the I-Codes begins the process of acknowledging this reality and its importance.

7. INDUSTRY ADVANCING

In recent years industry professionals and the public have developed a new understanding that short-term focus on first costs along with wasteful building practices can lead to long term costs and system failures. In the arena of energy efficiency, the cheapest, easiest building to construct often becomes the costliest, most maintenance-intensive building to operate. Buildings full of chemicals that retard moisture, rot, mildew, insects, or flame-spread are, in some cases, negatively impacting the health of building occupants. Industry is learning from and adapting to market demand for better buildings and emerging information from the fields of building science, biology, ecology and human health, and it is essential that knowledge be integrated into standard practice. Building regulations should support, not impede this transition to healthier, more sustainable practice.

8. NOT GREEN BUILDING CODE

This is not a green building provision. Green buildings are typically considered above-code or high performance buildings and rating systems exist to define them. New green building codes will set standards for green building designs in enforceable language. As some green building practices become commonplace they will find their way into the ICC family of codes. Having sustainability as a scoping provision will provide the vehicle for transitioning to more sustainable building construction over time. While green buildings may be more likely to be sustainable buildings, they are not necessarily sustainable just because they meet the criteria of a rating system.

9. NOT DEFINING SUSTAINABILITY

Just as the terms "health," "safety," and "welfare" are not defined in the code, we will not attempt to define Sustainability here. This will be for code officials to determine during the consideration of future code proposals one at a time – each on its own merit. The level of safety within the codes is decided by each final action proposal that is passed by ICC membership. Consideration is given to balancing the risks to public health, safety, and welfare against the costs for compliance and consequences of enforcement on building owners, occupants and safety professionals. This will not change.

10. NOT TOO EARLY

Sustainability addresses a set of issues that are increasingly recognized as urgent today, are already included in many European and other national codes, and should already be in U.S. codes. Regulations always lag behind both innovation and the emergence of new risks or new understanding about existing risks. The design, construction and development industry is already well ahead of the codes and this will only increase in coming years. As it stands, the codes affected by this proposal will not be published until 2012, and will likely not be widely adopted for several more years after publication, meaning that official recognition of the need to incorporate sustainable practices into the building regulatory system will not appear for several years. The changes proposed set the stage for more rapid acceptance and advancement of changes that are already taking place. As techniques, methods and strategies make their way into the market, they will become the norm. As they become the norm, they become candidates for code requirements. Without explicit support for such changes, the codes will be an impediment to responsible change, rather than increasing public safety and welfare. Response to water and energy shortages, climate change and other factors are already driving many jurisdictions to develop their own ordinances, codes and standards in efforts to address realities that exist on the ground today. There should be no question about the need to incorporate these changes in the 2012 family of International Codes.

Part II: Section R101.3, Intent of the 2009 IRC

The existing intent provisions of the IRC mirror the provisions of the IBC but with a slightly different listing of public health, safety and general welfare. This proposal for the IRC would make this intent statement consistent with the IBC intent statement with one key difference. The existing IRC intent section includes the word 'affordability' in its provisions. This is unique to the IRC and this proposal does nothing to change that nor to extend it to other codes. This proposal continues the parallel construction already existing between the IBC and IRC and would add the same text as proposed for the IBC as well as establishing the same format.

Cost Impact: The code change proposal will not increase the cost of construction. Subsequent proposals by others addressing sustainable practices may increase initial construction costs, however, a growing body of evidence indicates that more sustainable design and building practices often have no cost implications and sometimes reduce construction costs, while typically reducing operating costs and other negative impacts, improving the long-term affordability of ownership and operation.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: BASORA-ADMIN1-101.3 sub only

Public Hearing Results

PART II-IRC B/E
Committee Action: Disapproved

Committee Reason: There are several terms undefined such as "durability" and "sustainable practices". The committee feels the issue of sustainability would be more appropriately addressed in other standards or codes. The ICC Sustainable Building Technology Committee (SBTC) is working on this and the development of the *International Green Building Code* is in process.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Zaida Basora, AIA, Assistant Director, City of Dallas Building Inspection, representing the Codes Committee of the U.S. Green Building Council, requests Approval as Submitted.

Commenter's Reason: Votes for disapproval were cast by both the I-ADMIN and the IRC hearing committees during the first code development hearings for the 2012 codes. These votes cited two reasons for disapproval:

1. That ICC's work to develop the International Green Construction Code (IGCC) removes the importance and relevance of this proposal, and that the goal of the green code is to safeguard public health, safety and general welfare from a more comprehensive set of hazards attributed to the built environment – and the other I-Codes are not intended to embrace such protections.

This code change proposal does not modify any technical language of any of the I-Codes, but instead aligns the intent of these codes with a contemporary view of public health and safety that has been clearly endorsed by the ICC Board and staff leadership. This proposal complements the tremendous work undertaken by the Council in the development of the IGCC, and provides the opportunity in future code cycles to more directly consider the healthy, safe, tried-and-tested code measures that will have been road-tested in the IGCC. This proposal neither adopts any such provision, nor does it provide for the automatic adoption of any such provisions. The recognition that the long-term hazards from the cumulative effects of our built world on human and environmental health is driving the shift in how public health and safety are viewed, was what drove the need to create the IGCC, and continues to demand a more holistic approach to code and standard development.

2. That sustainability and environmental health has no place in the codes.

Nothing in the creation of the IGCC negates the need to address these issues in the rest of the I-Codes. In truth, the IGCC is the beginning of the process whereby the larger and longer-term hazards now recognized in the IGCC can be fully developed and responsibly integrated into the full set of base codes. Further, jurisdictions large and small across the country are struggling to upgrade their building codes to incorporate and enable green building practices. These communities have recognized the need and appropriateness of addressing these issues in building codes. Thus, the argument that was made, that most jurisdictions would not adopt the I-Codes if they included sustainability in the intent statement, is being proven false by the many communities already working independently to achieve these goals.

The history of building codes in the United States and internationally has been a constant evolution of thinking about how people can live free from harm or hazard in our built world. When cities were first born, structural codes soon followed to ensure buildings didn't collapse and harm building occupants or the community. When fires swept cities, fire codes were born. When the dense concentrations of people in cities introduced hazards of sanitary safety, plumbing codes were born to deliver potable water and remove human waste. The same can be said for the dangers of hurricanes, floods and earthquakes.

The less acute but regionally significant challenges of pollution caused by the use of fossil fuels and wasted money on utilities that could otherwise put dinner on the table was an impetus for energy efficiency to become a mainstay in the codes. The set of plumbing-related, mechanical-related, building- elated, zoning-related, and other code provisions now addressed in the IGCC PV-1.0 address hazards that had not yet seen debate at code hearings for their possible inclusion in their respective base codes. This code change proposal speeds up the conveyor belt of safer, healthier, more durable and resource-efficient code language from green code to base code, and is commensurate with the large-scale challenges at hand. These human and environmental health concerns are large and looming because they are the cumulative, aggregate impacts that arise from not addressing such human and environmental health concerns building-by-building.

Just as much as building occupants need these safeguards, so too does society at large. Society depends on the codes to protect us from the inherent dangers of a man-made world. Realigning the purpose of the I-Codes to incorporate these concerns merely creates framework for the technical debates about how best to achieve these societal goals. This is the natural next step for code development and a modern-day recognition of the code official as possibly the last line of defense against some of the world's greatest threats to public health and safety.

Final Action: AS AM AMPC____ D

ADM6-09/10-Part I
IBC 105.2; IRC R105.2

<u>Proposed Change as Submitted</u>

Proponent: Rick Davidson, City of Maple Grove, MN

PART I – IBC

Revise IBC as follows:

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 detached accessory structures used as tool and storage sheds, playhouses and similar uses, provided the floor area does not exceed 120 square feet (11 m^2).
2. Fences not over ~~6 feet (1829 mm)~~ <u>7 feet (2134 mm)</u> 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 does not exceed 5,000 gallons (18 925 L) and the ratio of height to diameter or width does not exceed 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, do not exceed 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* 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 of Groups R-3 and U occupancies.
13. Nonfixed and movable fixtures, cases, racks, counters and partitions not over 5 feet 9 inches (1753 mm) in height.

(Remainder of text unchanged)

Reason: While this code change may seem petty, it does point out the reality faced by building departments on a daily basis and the conflict that occurs when the point at which fences are regulated hits smack dab in the middle of the height range of commonly constructed fences. The current language establishes the maximum height for a fence not needing a permit at 6 feet. However, fence boards are commonly sold in lengths of 6 feet to 6 feet ½ inch. Coupled with the fact that fences are almost always constructed with fence boards slightly above grade and your standard six foot fence is most often 6 feet 1 inch to 6 feet 2 inches high. Fences are often constructed because of a dispute between neighbors. Then one of those neighbors will often complain to the building department that their neighbor should have a permit to construct a fence that is only an inch or two more than six feet. This attempt to place the building department in the middle of the dispute is often successful. Raising the height when a permit is needed to seven feet will not have any significant impact on the design of fences and changes the point when a permit is required to a height that is not as likely to conflict with standard construction practices. This would be much better public policy.

Cost Impact: The code change proposal will not increase the cost of construction.

PART I – IBC

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

Public Hearing Results

PART I-IBC
Committee Action: **Approved as Modified**

Modify proposal as follows:

2. ~~Fences not over 7 feet (2134 mm) high.~~ <u>6 foot (1829 mm) fences with no parts more than 7 feet (2134 mm) above grade.</u>

Committee Reason: T he c ommittee agr eed with the pr oponent's poi nt about the pr actical m atter of bui lding a 6 foot fenc e with di mensions commonly higher than 6 feet. The modification addresses the issue in terms of height of the fence above grade, which is the true intent of the code, to limit the height of the fence above grade.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Maureen Traxler, Washington Assn of Building Officials, Technical Code Development Committee, requests Approval as Submitted.

Commenter's Reason: The two parts of this proposal were heard by two different code development committees who reached different conclusions. The IRC committee approved as submitted while the Administration committee modified the proposal. We recommend that Part 1 which modified the IBC be approved as submitted so the two codes will be consistent.

Another reason to approve Part 1 as submitted is that the modification approved for the IBC is difficult to understand, and would be very difficult to interpret. It says that permits are not required for "6 foot (1829 mm) fences with no parts more than 7 feet (2134 mm) above grade". The modified language doesn't limit how much of the fence can be at 7 feet; it only says that none of the fence can be more than 7 feet. If part of a fence is 7 feet above grade, doesn't that mean it's a 7-foot fence?

Final Action: AS AM AMPC____ D

ADM12-09/10
IBC 107.2.6 (New)

Proposed Change as Submitted

Proponent: William E. Koffel, Koffel Associates, Inc., representing Firestop Contractors International Association

Add new text as follows:

IBC 107.2.6 Protection of penetrations and joints. Where fire resistance designs from approved sources for through or membrane penetration firestop, fire resistant joint systems are used, documentation acceptable to the code official shall be submitted prior to construction to indicate conformance with this code and the construction documents, and shall be approved prior to the start of system installation.

Reason: Fire resistance rated systems and their features should be given the same level of attention in the code as fire sprinklers, detection and alarm systems, as already exists currently in the building code. Recognizing that Firestop Systems are different than sprinkler systems and shop drawings are not required for this work, we changed the name of the requested information from 'shop drawings' to 'fire resistance designs from approved sources'. This language better describes information that must is vital for all parties – architects, AHJ's, contractors, maintenance personnel, during the life cycle of the building. These Through Penetration Firestop Systems and Fire Resistant Joint Systems aren't systems without this documentation. With this documentation, workers can identify systems used and repair / maintain as necessary.

If means of egress, horizontal assemblies, and other compartments are to be protected with fire resistance rated and smoke resistant construction features, then it is considered vital in importance for fire and life safety. When fire, smoke, or fire/smoke resistance rated compartmentation and with firestopping is used for safety, these submissions should be examined with the same scrutiny as other fire protection items during permit process…which then sets up a documentation stream that is used for the life cycle of the building.

Where required by code, compartmentation needs to be properly designed, installed, inspected and maintained for effectiveness when called upon to protect people in buildings. This code change addresses only firestopping, an item that is very detailed, with documentation tracking that is imperative to identifying what is in the penetration or joint firestop system for annual inspection and maintenance, as required by the International Fire Code.

Just like fire protection system shop drawings, this documentation may be submitted by the contractor after the building permit has been initially issued.

Cost Impact: The code change proposal will not increase the cost of construction, as this documentation is required…but not necessarily at this time.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: KOFFELL-ADM1-107.2.6 NEW

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There is no reason to single out opening protectives as items to review prior to installation. All details of construction should be provided in the construction documents for approval by the building official.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Eirene Oliphant, MCP, City of Leawood, representing Metropolitan Kansas City Chapter of the ICC requests Approval as Submitted .

Commenter's Reason: The importance of firestop in life safety has been well documented, but unfortunately not well understood. One of the main misconceptions is that if we get *most* of the areas treated that will suffice. Unfortunately the opposite is true. One small penetration in a fire resistance rated system could allow smoke and toxic gases to migrate to the unexposed side of the assembly, thus increasing the degree of hazard for someone who should be protected.

In terms of maintaining compartmentation, the protection of penetrations and joints is just one of the components with the other items being detection and suppression. The proponent is attempting to integrate into a submittal package what would address the third aspect of compartmentation whereas the other two items already have provisions in the IBC for submittals.

As a code official, I have the perogative to request that this information be provided on the submittal documents. However, because submittal requirements vary from jurisdiction to jurisdiction, the proponent is trying to establish a standard which can be applied uniformally to provide a minimum standard in an attempt to establish a degree of maintaining compartmentation.

Final Action: AS AM AMPC____ D

ADM35-09/10
IFC 107.2.1 (New)

Proposed Change as Submitted

Proponent: William Winslow, CIH, CFI, CMI, Winslow Partnership, representing self

Add new text as follows:

IFC 107.2 Testing and operation. Equipment requiring periodic testing or operation to ensure maintenance shall be tested or operated as specified in this code.

IFC 107.2.1 Safety devices and systems. Safety interlocks, automatic emergency shutoff valves, and emergency shutoff switches shall be tested as specified in this code or as required by the fire code official, where testing requirements are not specified by this code.

Reason: Many chapters in the IFC require safety devices for equipment. A quick scan of the code revealed approximately 15 interlocks and a similar number of automatic emergency shutoff valves and switches, all of which are safety devices. Some of these devices have testing requirements but many don't. For example, Chapter 21 requires an interlock for a Class A furnace, so that conveyors of flammable materials shut down if the exhaust system stops. However, there is no testing requirement specified in Chapter 21 for this safety interlock. So, based on 107.2, it appears testing of the interlock would not be required, because it is not specified. This modification of Section 107.2 gives the FCO the authority to establish a testing requirement where such a requirement is not currently specified in the IFC. The section is limited to interlocks, automatic emergency shutoff valves and emergency shutoff switches.

Cost Impact: The code change should not increase cost of construction because testing of safety devices is already required or inferred by the code

Public Hearing Results

This code change proposal was heard by the IFC Code Development Committee.

Committee Action: **Disapproved**

Committee Reason: The committee felt that the proposal was unclear as to whether it would apply to all devices or only required devices. The proposal also does not take into account the requirements of other agencies that might require testing which could lead to inter-agency conflict. The committee also felt that this lack of clarity could lead to varying application throughout the jurisdiction resulting in inconsistent enforcement.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

William Winslow requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

107.2 Testing and operation. Equipment requiring periodic testing or operation to ensure maintenance shall be tested or operated as specified in this code.

107.2.1 Safety devices and systems. Where not provided for in this code, required ~~safety~~ interlocks, automatic emergency shutoff valves, ~~and~~ emergency shutoff switches, and gas or liquid leak detection systems shall be tested as specified ~~in this code or as required by the fire code official, where testing requirements are not specified by this code~~ by the device or system manufacturer, or at startup and annually thereafter, if the manufacturer does not specify a testing frequency. ~~in this code or as required by the fire code official.~~ Written records of the tests conducted shall be maintained in accordance with the provisions of Section 107.2.1.

Exception: Devices and systems where the manufacturer specifically states in writing that testing is not required.

Commenter's Reason: It defies logic not to periodically test interlocks, automatic emergency shutoff valves, emergency shutoff switches, and gas and liquid leak detection systems required by the IFC. Experience has shown, if they aren't tested, they may not work when needed. Many of these devices have testing requirements in the IFC, such as the emergency shutoff valves found in Sections 2205.2.2 and 2206.7.4. Annual testing is required, which seems reasonable, and is the testing frequency included in this public comment. Other such devices found in the IFC do not have testing requirements. You can eliminate this hazard and improve testing consistency by voting to overturn the committee action for disapproval and by voting to approve this public comment.

In its reason for disapproval, the committee was concerned there would be confusion as to whether the proposal would apply to all devices or only required devices. As a result, the proposal now references "required" devices in the first sentence. The other concern was that the requirement would conflict with other recommended or required testing frequencies. The proposal has been modified to provide for using the device manufacturer's testing frequency, if it is provided. In other cases, annual testing of safety devices is common, and it is found throughout the IFC. I don't see how there will be a conflict. Finally, so there is no confusion as to applicability, I have copied the pages from the 2009 IFC where this proposal will apply.

These are all of the "required" devices without testing requirements. The following are excerpts from the 2009 IFC:

1504.6.1.2.1 Interlocks. The spraying apparatus, drying apparatus and ventilating system for the spray booth or spray room shall be equipped with interlocks arranged to:

1504.7.1 Operation. Mechanical ventilation shall be kept in operation at all times while spraying operations are being conducted and for a sufficient time thereafter to allow vapors from drying coated articles and finishing material residue to be exhausted. Spraying equipment shall be interlocked with the ventilation of the flammable vapor areas such that spraying operations cannot be conducted unless the ventilation system is in operation.

1505.8 Conveyor interlock. Dip tanks utilizing a conveyor system shall be arranged such that in the event of a fire, the conveyor system shall automatically cease motion and the required tank bottom drains shall open.

1509.6.1 Local ventilation. Local ventilation shall be provided inside of workpieces where personnel will be under or inside of the workpiece.

2006.5 Kettle controls. The kettle and thin-down tank shall be instrumented, controlled and interlocked so that any failure of the controls will result in a safe condition. The kettle shall be provided with a pressure-rupture disc in addition to the primary vent. The vent piping from the rupture disc shall be of minimum length and shall discharge to an *approved* location. The thin-down tank shall be adequately vented. Thinning operations shall be provided with an adequate vapor removal system.

2105.1 Shut down. Interlocks shall be provided for Class A ovens so that conveyors or sources of flammable or combustible materials shall shut down if either the exhaust or recirculation air supply fails.

2205.2.2 Repairs and service. The *fire code official* is authorized to require damaged or unsafe containment and dispensing equipment to be repaired or serviced in an *approved* manner including, but not limited to, equipment that shows signs of physical damage, internal and external corrosion, leakage, brittleness, aging or undue wear and tear.

2206.7.7.1 Leak detection. Where remote pumps are used to supply fuel dispensers, each pump shall have installed on the discharge side a *listed* leak detection device that will detect a leak in the piping and dispensers and provide an indication. A leak detection device is not required if the piping from the pump discharge to under the dispenser is above ground and visible.

2207.4 Location of dispensing operations and equipment. In addition to the requirements of Section 2206.7, the point of transfer for LP-gas dispensing operations shall be 25 feet (7620mm) or more from buildings having combustible exterior wall surfaces, buildings having noncombustible exterior wall surfaces that are not part of a 1-hour fire-resistance-rated assembly, or buildings having combustible overhangs, *lot lines* of property which could be built on, public streets, or sidewalks and railroads; and at least 10 feet (3048 mm) from driveways and buildings having noncombustible exterior wall surfaces that are part of a fire-resistance-rated assembly having a rating of 1 hour or more.

Exception: The point of transfer for LP-gas dispensing operations need not be separated from canopies that are constructed in accordance with the *International Building Code* and which provide weather protection for the dispensing equipment.

LP-gas containers shall be located in accordance with Chapter 38. LP-gas storage and dispensing equipment shall be located outdoors and in accordancewith Section 2206.7.

2211.7.2 Gas detection system. Repair garages used for repair of vehicles fueled by nonodorized gases, such as hydrogen and nonodorized LNG, shall be provided with a flammable gas detection system.

2211.7.2.3 Failure of the gas detection system. Failure of the gas detection system shall result in the deactivation of the heating system, activation of the mechanical ventilation system and where the system is interlocked with gas detection and causes a trouble signal to sound in an *approved* location.

3305.5.1.1 Wet collector. When collecting *explosives* dust, a wet collector system shall be used. Wetting agents shall be compatible with the *explosives*. Collector systems shall be interlocked with process power supplies so that the process cannot continue without the collector systems also operating.

Final Action: AS AM AMPC____ D

ADM38-09/10
IPMC 108.1.3, 110.1, 202

Proposed Change as Submitted

Proponent: Tom Neltner / National Center for Healthy Housing / Representing the National Center for Healthy Housing and the Alliance for Healthy Homes

Revise as follows:

IPMC 108.1.3 Structure unfit for human occupancy. A structure is unfit for human occupancy whenever the code official finds that such structure is unsafe, unlawful or, because of the degree to which the structure is in disrepair or lacks maintenance, is not ~~in~~sanitary, vermin or ~~rat~~ rodent infested, contains filth and contamination, or lacks ventilation, illumination, sanitary or heating facilities or other essential equipment required by this code, or because the location of the structure constitutes a hazard to the occupants of the structure or to the public.

IPMC 110.1 General. The code official shall order the owner of any premises upon which is located any structure, which in the code official's judgment is so old, dilapidated or has become so out of repair as to be dangerous, unsafe, not ~~in~~sanitary or otherwise unfit for human habitation or occupancy, and such that it is unreasonable to repair the structure, to demolish and remove such structure; or if such structure is capable of being made safe by repairs, to repair and make safe and sanitary or to demolish and remove at the owner's option; or where there has been a cessation of normal construction of any structure for a period of more than two years, to demolish and remove such structure.

SECTION 202
GENERAL DEFINITIONS

1. IPMC Add new definition as follows:

SANITARY. A condition that is clean and free of: infestation of rodents or insects, rodent residues such as urine, droppings, gnaw marks, grease marks, or nest debris; insect residues such as droppings, debris, or body parts; human and animal waste; mold; wastewater; sewage; and rotting material; and accumulation of rubbish or garbage. Swimming pools or food preparation areas shall meet the sanitary requirements as prescribed by local or state authorities having jurisdiction.

Exception: It does not include systems designed and properly managed to handle contained rubbish, garbage, sewage or wastewater.

2. IPMC Revise as follows:

INFESTATION. The presence, within or contiguous to, a structure or premises of insects including: cockroaches, fleas, and bedbugs; spiders; pest rodents rats; vermin; or other pests. Visible pest residues or debris constitutes an infestation unless there is clear evidence that the pest has been eliminated. The term does not include pets kept in a cage or other container.

Reason: The current definition of infestation would appear to exclude rodents other than rats. However, rodents carry disease and, in the case of mice, may trigger an asthma attack. The proposal applies the term to all rodents while creating an exception for rodents kept as pets in a cage or other container.

The proposal also would make it clear that visible evidence of pest residues is a sufficient basis for action by a code official. The code official does not have to see a live pest. Many of the pests of most concern are nocturnal.

The term "sanitary" is used in 24 times in 16 sections of the code: 108.1.3, 110.1, 301.2, 301.3, 302.1, 303.1, 304.1, 305.1, 305.3, 307.2, 307.3, 402.3, 404.7, 502.1, 503.4, and 504.1 as well as the title of Section 506. The sections are repeated below for convenience.

> **108.1.3 Structure unfit for human occupancy.** A structure is unfit for human occupancy whenever the code official finds that such structure is unsafe, unlawful or, because of the degree to which the structure is in disrepair or lacks maintenance, is not insanitary, vermin or rat rodent infested, contains filth and contamination, or lacks ventilation, illumination, sanitary or heating facilities or other essential equipment required by this code, or because the location of the structure constitutes a hazard to the occupants of the structure or to the public.

> **110.1 General.** The code official shall order the owner of any premises upon which is located any structure, which in the code official's judgment is so old, dilapidated or has become so out of repair as to be dangerous, unsafe, not insanitary or otherwise unfit for human habitation or occupancy, and such that it is unreasonable to repair the structure, to demolish and remove such structure; or if such structure is capable of being made safe by repairs, to repair and make safe and sanitary or to demolish and remove at the owner's option; or where there has been a cessation of normal construction of any structure for a period of more than two years, to demolish and remove such structure.

301.2 Responsibility. The owner of the premises shall maintain the structures and exterior property in compliance with these requirements, except as otherwise provided for in this code. A person shall not occupy as owner-occupant or permit another person to occupy premises which are not in a **sanitary a**nd safe condition and which do not comply with the requirements of this chapter. Occupants of a dwelling unit, rooming unit or housekeeping unit are responsible for keeping in a clean, **sanitary** and safe condition that part of the dwelling unit, rooming unit, housekeeping unit or premises which they occupy and control.

301.3 Vacant structures and land. All vacant structures and premises thereof or vacant land shall be maintained in a clean, safe, secure and **sanitary** condition as provided herein so as not to cause a blighting problem or adversely affect the public health or safety.

302.1 Sanitation. All exterior property and premises shall be maintained in a clean, safe and **sanitary** condition. The occupant shall keep that part of the exterior property which such occupant occupies or controls in a clean and **sanitary** condition.

303.1 Swimming pools. Swimming pools shall be maintained in a clean and **sanitary** condition, and in good repair.

304.1 General. The exterior of a structure shall be maintained in good repair, structurally sound and **sanitary** so as not to pose a threat to the public health, safety or welfare.

305.1 General. The interior of a structure and equipment therein shall be maintained in good repair, structurally sound and in a **sanitary** condition. Occupants shall keep that part of the structure which they occupy or control in a clean and sanitary condition. Every owner of a structure containing a rooming house, housekeeping units, a hotel, a dormitory, two or more dwelling units or two or more nonresidential occupancies, shall maintain, in a clean and **sanitary** condition, the shared or public areas of the structure and exterior property.

305.3 Interior surfaces. All interior surfaces, including windows and doors, shall be maintained in good, clean and **sanitary** condition. Peeling, chipping, flaking or abraded paint shall be repaired, removed or covered. Cracked or loose plaster, decayed wood and other defective surface conditions shall be corrected.

307.2 Disposal of rubbish. Every occupant of a structure shall dispose of all rubbish in a clean and sanitary manner by placing such rubbish in approved containers.

307.3 Disposal of garbage. Every occupant of a structure shall dispose of garbage in a clean and **sanitary** manner by placing such garbage in an approved garbage disposal facility or approved garbage containers.

402.3 Other spaces. All other spaces shall be provided with natural or artificial light sufficient to permit the maintenance of **sanitary** conditions, and the safe occupancy of the space and utilization of the appliances, equipment and fixtures.

404.7 Food preparation. All spaces to be occupied for food preparation purposes shall contain suitable space and equipment to store, prepare and serve foods in a **sanitary** manner. There shall be adequate facilities and services for the **sanitary** disposal of food wastes and refuse, including facilities for temporary storage.

502.1 Dwelling units. Every dwelling unit shall contain its own bathtub or shower, lavatory, water closet and kitchen sink which shall be maintained in a **sanitary**, safe working condition. The lavatory shall be placed in the same room as the water closet or located in close proximity to the door leading directly into the room in which such water closet is located. A kitchen sink shall not be used as a substitute for the required lavatory.

503.4 Floor surface. In other than dwelling units, every toilet room floor shall be maintained to be a smooth, hard, nonabsorbent surface to permit such floor to be easily kept in a clean and **sanitary** condition.

504.1 General. All plumbing fixtures shall be properly installed and maintained in working order, and shall be kept free from obstructions, leaks and defects and be capable of performing the function for which such plumbing fixtures are designed. All plumbing fixtures shall be maintained in a safe, **sanitary** and functional condition.

Although used extensively in the code, because “sanitary” currently lacks a definition, the varying contexts in which it appears give the word different connotations. As a result the term is ambiguous allowing for differing interpretations. The ambiguity means that the code official’s interpretation is open to challenge. As a result, code officials are often reluctant to cite for unsanitary conditions absent other violations such as active infestation.

In addition, control of an infestation does not require the removal of the residues of the infestation. These residues may carry infectious diseases and allergens that cause allergies, cause asthma or trigger an asthma attack. Accumulations of rubbish or garbage can provide harborage and a food source for rodents or insects and become the source of disease.

The definition of sanitation addresses those situations commonly understood to spread or support disease. In addition, it includes the term infestation is included in the definition of sanitary to make clear that an infestation is never sanitary. The definition accommodates situations where a state or local health department provides set more stringent standards for food preparation areas and swimming pools.

Finally, the definition makes it clear that systems designed and manage wastes are inherently not sanitary by design. These include sanitary sewage disposal systems and trash handling systems. Therefore, they are excluded from the definition.

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: NELTNER-ADM1-108.1.3 PM.DOC

Public Hearing Results

This code change proposal was heard by the IPMC Code Development Committee.

Committee Action: **Disapproved**

Committee Reason: Although mold is a sanitary issue, referencing it in the definition is not appropriate because the code does not give any direction for the mitigation of mold. Further, the last sentence in the proposed definition of sanitary contains requirements, which is not appropriate as part of a definition.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Jane Malone, National Center for Healthy Housing, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

SECTION 202
GENERAL DEFINITIONS

SANITARY. A condition that is clean and free of: infestation of rodents or insects, rodent residues such as urine, droppings, gnaw marks, grease marks, or nest debris; insect residues such as droppings, debris, or body parts; human and animal waste; mold; wastewater; sewage; and rotting material; and accumulation of rubbish or garbage. ~~Swimming pools or food preparation areas shall meet the sanitary requirements as prescribed by local or state authorities having jurisdiction.~~

> **Exception:** ~~It~~ This definition does not ~~include~~ apply to systems designed and properly managed to handle contained rubbish, garbage, sewage or wastewater.

INFESTATION. The presence, within or contiguous to, a structure or premises of insects including: cockroaches, fleas, and bedbugs; pest rodents ~~rats~~; vermin; or other pests. Visible pest residues or debris constitutes an infestation unless there is clear evidence that the pest has been eliminated. The term does not include pets kept in a cage or other container.

Commenter's Reason: The current definition of infestation would appear to exclude rodents other than rats. However, rodents such as mice carry disease and may trigger an asthma attack. The proposal applies the term to all rodents while creating an exception for rodents kept as pets in a cage or other container. The infestation definition would make it clear that visible evidence of pest residues is a sufficient basis for action by a code official. The code official does not have to see a live pest. Many of the pests of most concern are nocturnal.

The term "sanitary" is used in 24 times in 16 sections of the code: 108.1.3, 110.1, 301.2, 301.3, 302.1, 303.1, 304.1, 305.1, 305.3, 307.2, 307.3, 402.3, 404.7, 502.1, 503.4, and 504.1 as well as the title of Section 506. Because "sanitary" lacks definition, the varying contexts in which it appears give the word different connotations. As a result the term is ambiguous allowing for differing interpretations. The ambiguity means that the code official's interpretation is open to challenge. The specifics cited in this definition of sanitary are known and common problems: the residues of an infestation may carry infectious diseases and allergens that cause allergies and can trigger an asthma attack; accumulations of rubbish or garbage can provide harborage and a food source for rodents and insects, and become the source of disease; the other conditions listed are commonly understood to spread or support disease. The term infestation is included in the definition of sanitary to make clear that an infestation is never sanitary. Finally, the sanitary definition makes it clear that systems designed and manage wastes are inherently not sanitary by design. These include sanitary sewage disposal systems and trash handling systems. Therefore, they are excluded from the definition.

Response to committee's reason for disapproval at the committee hearing:

1. **"**Although mold is a sanitary issue, referencing it in the definition is not appropriate because the code does not give any direction for the mitigation of mold." Response: PM19 provides a requirement for addressing mold.
2. "Further, the last sentence in the proposed definition of sanitary contains requirements, which is not appropriate as part of a definition." The last sentence, which contained such requirements, is not included in this proposal.

Final Action: AS AM AMPC____ D

ADM39-09/10
202

Proposed Change as Submitted

ADM39-09/10

IBC-Chapter 35, IECC-Chapter 6, IEBC-Chapter 15, IFC-Chapter 47, IFGC-Chapter 8, IMC-Chapter 15, IPC-Chapter 13, IPMC-Chapter 8, IRC-Chapter 44

The following table provides a comprehensive list of all standards that the respective standards promulgators have indicated have been, or will be, updated from the listing in the 2009 Editions of the International Codes. According to Section 4.5 of ICC Council Policy #CP 28, Code Development Policy, the updating of standards referenced by the Codes shall be accomplished administratively by the Administrative code development committee. Therefore, referenced standards that are to be updated for the 2012 edition of any of the I-Codes are listed in this single code change proposal. This is unlike the way these standards were updated in the past code change cycles, where updates for standards were dealt with by each committee for their respective codes. Note that the table below indicates the change to the standard, and the code or codes in which each standard appears. The list includes standards that the promulgators have already updated or will have updated by December 1, 2011.

4.5 Updating Standards: The updating of standards referenced by the Codes shall be accomplished 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, 2011. The published version of the 2012 Code which references the standard will refer to the updated edition of the standard. If the standard is not available by the 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.

AA	**Aluminum Association**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
ADM 1-20~~05~~ 2010	Aluminum Design Manual: Part ~~I-A~~ Specification for Aluminum Structures ~~- Allowable Stress Design; and Part I-B - Specification for Aluminum Structures - Load and Resistance Factor Design~~	IBC							
AAMA	**American Architectural Manufacturers Association**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
AAMA/WDMA/CSA 101/I.S.2/A440-~~08~~ 11	North American Fenestration Standard/Specification for Windows, Doors, and Skylights	IBC	IRC	IECC					
450-~~06~~ 09	Voluntary Performance Rating Method for Mulled Fenestration Assemblies	IRC							
506-~~06~~ 08	Voluntary Specifications for Hurricane Impact and Cycle Testing of Fenestration Products	IRC							
ACCA	**Air Conditioning Contractors of America**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
Manual D-~~95~~ 09	Residential Duct Systems	IMC	IRC						
Manual J-~~02~~ 11	Residential Load Calculation - Eighth Edition	IRC							
Manual S-~~04~~ 10	Residential Equipment Selection	IRC							

ACI	American Concrete Institute								
Standard Reference Number	Title	Referenced in Code(s):							
318-~~08~~ 11	Building Code Requirements for Structural Concrete (Revised 2011)	IBC	IRC						
332-~~08~~ 10	Code Requirements for Residential Concrete Construction	IRC							
530-~~08~~ 11	Building Code Requirements for Masonry Structures	IBC	IRC						
530.1-~~08~~ 11	Specifications for Masonry Structures	IBC	IRC						

AF&PA	American Forest & Paper Association								
Standard Reference Number	Title	Referenced in Code(s):							
AF&PA-~~93~~ 2012	Span Tables for Joists and Rafters	IBC	IRC						
ANSI/AF&PA PWF-2007	Permanent Wood Foundation Design Specification	IBC	IRC						
ANSI/AF&PA SDPWS-2008	Special Design Provisions for Wind and Seismic	IBC							
NDS-~~05~~ 2012	National Design Specification (NDS) for Wood Construction - with 20~~05~~ 12 Supplement	IBC	IRC						
AF&PA WCD No. 4-~~89~~ 2003	Wood Construction Data-Plank and Beam Framing for Residential Buildings	IBC							
ANSI/AF&PA WFCM-~~01~~ 2012	Wood Frame Construction Manual for One- and Two-Family Dwellings	IBC	IRC						

AHRI	Air Conditioning, Heating and Refrigeration Institute								
Standard Reference Number	Title	Referenced in Code(s):							
210/240-~~03~~ 08	Unitary Air-Conditioning and Air-Source Heat Pump Equipment	IECC							
310/380-~~93~~ 04	Standard for Packaged Terminal Air-Conditioners and Heat Pumps	IECC							
340/360-20~~00~~ 07	Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment	IECC							
365-~~02~~ 09	Commercial and Industrial Unitary Air-Conditioning Condensing Units	IECC							
440-~~05~~ 08	Room Fan-Coil	IECC							
550/590-~~98~~ 03	Water-Chilling Packages Using the Vapor Compression Cycle with Addenda	IECC							
700-~~99~~ 2006	Purity Specifications for Fluorocarbon and Other Refrigerants	IMC							
1160-~~04~~ 08	Performance Rating of Heat Pump Pool Heaters	IECC							

AISC — American Institute of Steel Construction

Standard Reference Number	Title	Referenced in Code(s):							
341-~~05~~ 10	Seismic Provisions for Structural Steel Buildings~~, including Supplement No.1 dated 2005~~	IBC							
360-~~05~~ 10	Specification for Structural Steel Buildings	IBC							

AISI — American Iron and Steel Institute

Standard Reference Number	Title	Referenced in Code(s):							
AISI S100-07/S1-10	North American Specification for the Design of Cold Formed Steel Structural Members, with Supplement 1, dated 2010	IBC	IRC						
AISI S213-07/S1-10	North American Standard for Cold-Formed Steel Framing-Lateral Design, with Supplement 1, dated 2010	IBC							

AITC — American Institute of Timber Construction

Standard Reference Number	Title	Referenced in Code(s):							
113-~~01~~ 10	Standard for Dimensions of Structural Glued Laminated Timber	IBC							
117-~~04~~ 10	Standard Specifications for Structural Glued Laminated Timber of Softwood Species	IBC							
200-~~04~~ 09	Manufacturing Quality Control System Manual for Structural Glued Laminated Timber	IBC							

ALI — Automotive Lift Institute

Standard Reference Number	Title	Referenced in Code(s):							
ALI ALCTV- 2011	Standard for Automo~~bile~~ tive Lifts - Safety Requirements for Construction, Testing, and Validation (ANSI)	IBC							

AMCA — Air Movement and Control Association International

Standard Reference Number	Title	Referenced in Code(s):							
500D-~~07~~ 10	Laboratory Methods for Testing Dampers for Rating	IECC							
511-~~99 (Reaffirmed 2002~~) 09	Certified Ratings Program for Air Control Devices	IBC							

ANSI	American National Standards Institute								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
Z 97.1~~—04~~ 09	Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test	IBC	IRC						
A208.1-~~99~~ 2009	Particleboard	IRC	**IBC**						

APA	APA -The Engineered Wood Association								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
APA PDS Supplement 5-~~95~~ 08	Design and Fabrication of All-plywood Beams (revised ~~1995~~) 08	IBC							

APSP	The Association of Pool & Spa Professionals								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
ANSI/~~NSPI~~ APSP-4 ~~99~~ 2007	American National Standard for Aboveground/Onground Residential Swimming Pools	IRC							

ASABE	American Society of Agricultural & Biological Engineers								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
EP 484.2 JUN 1998 (R200~~3~~ 8)	Diaphragm Design of Metal-Clad, Wood-Frame Rectangular Buildings	IBC							
EP 486.1 DEC1999 (R200~~0~~5)	Shallow Post Foundation Design	IBC							
EP 559 ~~(~~1997~~)~~ DEC1996 (R2008)	Design Requirements and Bending Properties for Mechanically Laminated Columns	IBC							

ASCE/SEI	American Society of Civil Engineers/Structural Engineers Institute								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
~~3-91~~	~~Structural Design of Composite Slabs~~	~~IBC~~							
~~5—08~~ 402-11	Building Code Requirements for Masonry Structures	IBC	IRC						
~~6—08~~ 602-11	Specifications for Masonry Structures	IBC	IRC						
7~~—05~~ 10	Minimum Design Loads for Buildings and Other Structures ~~including Supplement No.1 and 2 excluding Chapter 14 and Appendix 11A~~	IBC	IRC	IEBC					
19-~~96~~ 09	Structural Applications of Steel Cables for Buildings	IBC							

ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers								
Standard Reference Number	Title	Referenced in Code(s):							
15-~~2004~~ 2010	Safety Standard for Refrigeration Systems	IMC							
34-~~2004~~ 2010	Designation and Safety Classification of Refrigerants	IMC	IRC						
62.1-~~2004~~ 2010	Ventilation for Acceptable Indoor Air Quality	IMC	IECC	IEBC					
90.1-~~2007~~ 2010	Energy Standard for Buildings Except Low-Rise Residential Buildings including Addendum G (ANSI/ASHRAE/IESNA 90.1-2007)	IECC							
140-~~2007~~ 2010	Standard Method of Test for the Evaluation of Building Energy Analysis Computer Programs	IECC							
146-~~1998~~ 2006	Testing for Rating Pool Heaters	IECC							
ASHRAE-~~2005~~ 2009	ASHRAE Handbook Fundamentals	IMC	IECC	IRC					

ASME	American Society of Mechanical Engineers								
Standard Reference Number	Title	Referenced in Code(s):							
A13.1- ~~[96 (Reaffirmed 2002)]~~ 2007	Scheme for the Identification of Piping Systems	IBC	IFC	IFGC					
~~A17.1/CSA B44-2007~~ASME/A17.1-2007/CSA B44-2007	Safety Code for Elevators and Escalators - with A17.1a/CSA B44a-08 Addenda	IBC	IFC	IEBC	IRC	IPMC			
A17.3-200~~2~~ 8	Safety Code for Existing Elevators and Escalators	IFC	IEBC						
A18.1-0~~5~~ 8	Safety Standard for Platform Lifts and Stairway Chairlifts	IBC	IFC	IEBC	IRC				
A90.1-0~~3~~ 9	Safety Standard for Belt Manlifts	IBC							
A112.14.1-2003 (Reaffirmed 2008)	Backwater Valves	IPC	IRC						
A112.14.3-2000 (Reaffirmed 2004)	Grease Interceptors	IPC	IRC						
A112.18.1-2005/CSA B125.1-20~~05~~ 10	Plumbing Supply Fittings	IPC	IRC						
A112.18.2-2005/CSA B125.2-05	Plumbing Waste Fittings with 2007 and 2008 Supplements	IPC	IRC						
A112.18.3M-2002 (Reaffirmed 2008)	Performance Requirements for Backflow Protection Devices and Systems in Plumbing Fixture Fittings	IPC	IRC						
A112.18.6- ~~2003~~ /CSA B125.6-2010	Flexible Water Connectors	IPC	IRC						
A112.19.1M~~-1994 (Reaffirmed 2004)~~/CSA B45.2-2008	Enameled Cast Iron and Enameled Steel Plumbing Fixtures	IPC	IRC						
A112.19.2-~~2003~~ 2008/CSA B45.1-08	~~Vitreous China Plumbing Fixtures - and Hydraulic Requirements for Water Closets and Urinals~~ Ceramic Plumbing Fixtures	IPC	IRC						

A112.19.3~~M-2000 (Reaffirmed 2007)~~ 2008/CSA B45.4-08	Stainless Steel Plumbing Fixtures ~~(Designed for Residential Use) - with 2002 Supplement~~	IPC	IRC							
ASME A112.19.5/CSA B45.X-200~~5~~ 9	Trim for Water-Closet Bowls, Tanks, and Urinals	IPC	IRC							
ASME A112.19.7/CSA B45.10~~M-2006~~ 2009	Hydromassage Bathtub Appliances	IPC	IRC							
A112.19.8~~M—~~2007	Suction Fittings for Use in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Whirlpool Bathtub Appliances - with A112.19.8a-2008 Addenda	IPC	IRC							
A112.36.2.M-1991(R200~~2~~ 8)	Cleanouts	IPC								
B16.9-200~~3~~ 7	Factory-Made Wrought Steel Steel Buttwelding Fittings	IPC	IRC	IMC						
B16.20-98 (Reaffirmed 2007)	Metallic Gaskets for Pipe Flanges Ring-Joint, Spiral-Wound and Jacketed	IFGC								
B16.24-200~~1~~ 6	Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500	IMC								
B16.29-200~~1~~ 7	Wrought Copper and Wrought Copper Allow Solder Joint Drainage Fittings - DWV	IPC	IRC	IMC						
B16.33-2002 (Reaffirmed 2007)	Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 125 psig (Sizes ½ through 2)	IFGC	IRC							
B16.44-2002 (Reaffirmed 2007)	Manually Operated Metallic Gas Valves for Use in Above Ground Piping Systems up to 5 psi	IFGC	IRC							
B20.1-200~~6~~ 9	Safety Standard for Conveyors and Related Equipment	IBC								
B31.1-20~~04~~ 07	Power Piping with B31.1a-2008 Addenda	IFC								
B31.9~~-04~~ 08	Building Services Piping	IMC	IFC							
BPVC-20~~04~~ 07	ASME Boiler & Pressure Vessel Code (20~~04)~~ 07 Edition	IMC	IFC	IFGC	IRC					
CSD-1-20~~04~~ 09	Controls and Safety Devices for Automatically Fired Boilers	IMC	IRC	IFGC						
PTC 4.1-1964 ~~(Reaffirmed 1991~~) 2008	Fired Steam Generat~~ing~~ ors ~~Units~~	IECC								
ASSE	**American Society of Sanitary Engineering**									
Standard Reference Number	**Title**	**Referenced in Code(s):**								
1001~~-02~~ 08	Performance Requirements for Atmospheric Type Vacuum Breakers	IPC	IRC							
1002~~-1999~~ 2008	Performance Requirements for Antisiphon Fill Valves ~~Ballcocks~~ for ~~Gravity~~ Water Closet Flush Tanks	IPC	IRC							
1003~~-01~~ 2009	Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems	IPC	IRC							
1004~~-1990~~ 2008	Performance Requirements for Commercial Dishwashing Machines	IPC								
1008~~-1989~~ 2006	Performance Requirements for ~~Household~~ Plumbing Aspects of Residential Food Waste Disposer Units	IPC	IRC							

1012-~~02~~ 09	Performance Requirements for Backflow Preventers with Intermediate Atmospheric Vent	IPC	IRC						
1013-~~2005~~ 2009	Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection ~~Principle~~ Backflow Preventers	IPC	IRC						
1015-~~2005~~ 2009	Performance Requirements for Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies	IPC	IRC						
1016-~~1996~~ 2010	Performance Requirements for Automatic Compensating, Valves for Individual Showers and Tub/Shower Combinations	IPC	IRC						
1017-~~2003~~ 2010	Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems	IPC	IRC	IMC					
1018-~~2001~~ 2010	Performance Requirements for Trap Seal Primer Valves - Potable Water Supplied	IPC							
1019-~~2004~~ 2010	Performance Requirements for Freeze Resistant~~,~~ Wall Hydrant~~s~~, Vacuum Breaker, ~~Automatic~~ Draining Type	IPC	IRC						
1022-2003	Performance Requirements for Backflow Preventer for ~~Carbonated~~ Beverage Dispensing ~~Machines~~ Equipment	IPC							
1023-~~1979~~ 2010	Performance Requirements for Hot Water Dispensers - Household Storage Type - Electrical	IPC	IRC						
1035-~~02~~ 2008	Performance Requirements for Laboratory Faucet Backflow Preventers	IPC	IRC						
1037-~~1990~~ 2010	Performance Requirements for Pressurized Flushing Devices for Plumbing Fixtures	IPC	IRC						
1044-~~2001~~ 2010	Performance Requirements for Trap Seal Primer Devices - Drainage Types and Electronic Design Types	IPC							
1047-~~2005~~ 2009	Performance Requirements for Reduced Pressure Detector Fire Protection Backflow Prevention Assemblies	IPC	IRC						
1048-~~2005~~ 2009	Performance Requirements for Double Check Detector Fire Protection Backflow Prevention Assemblies	IRC	IPC						
1050-~~02~~ 2009	Performance Requirements for Stack Air Admittance Valves for Sanitary Drainage Systems	IPC	IRC						
1051-~~02~~ 2009	Performance Requirements for Individual and Branch Type Air Admittance Valves for Sanitary Drainage Systems	IRC	IPC						

1055-~~1997~~ 2009	Performance Requirements for Backflow Devices for Chemical Dispensing Systems	IPC							
1056-~~01~~ 2010	Performance Requirements for Spill Resistant Vacuum Breaker	IPC	IRC						
1060-~~1996~~ 2006	Performance Requirements for Outdoor Enclosures for ~~Backflow Prevention Assemblies~~ Fluid Conveying Components	IPC	IRC						
1061-~~06~~ 2010	Performance Requirements for Removable and Non-Removable Push Fit Fittings	IPC	IRC						
1062-~~1997~~ 2006	Performance Requirements for Temperature Actuated, Flow Reduction Valves to Individual ~~Fixture~~ Supply Fittings	IRC	IPC						
1066-~~1997~~ 2009	Performance Requirements for Individual Pressure Balancing In-Line Valves for Individual Fixture Fittings	IPC	IRC						
1079-2005	Performance Requirements for Dielectric Pipe Unions	IPC							
5013-~~1998~~ 2009	Performance Requirements for Testing Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Principle Fire Protection ~~Principle~~ Backflow Preventers (RFP)	IPC							
5015-~~1998~~ 2009	Performance Requirements for Testing Double Check Valve Backflow Prevention Assembl~~y~~ ies (DC~~VA~~) and Double Check Fire Protection Backflow Prevention Assemblies (DCF)	IPC							
5020-~~1998~~ 2009	Performance Requirements for Testing Pressure Vacuum Breaker Asse~~nbly~~ mblies (PVB~~A~~)	IPC							
5048-~~1998~~ 2009	Performance Requirements for Testing Double Check Valve Detector Assembly (DCDA)	IPC							
5052-1998 ~~2009~~	Performance Requirements for Testing Hose Connection Backflow Preventers	IPC							
5056-1998 ~~2009~~	Performance Requirements for Testing Spill Resistant Vacuum Breaker (SRVB)	IPC							
ASTM	**ASTM International**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
A 36/A 36M-~~05~~ 08	Specification for Carbon Structural Steel	IBC	IRC						
A 53/A 53M-~~06a~~ 07	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless	IPC	IMC	IRC	IFGC				
A 74-~~06~~ 09	Specification for Cast Iron Soil Pipe and Fittings	IPC	IRC	IPSDC					
A 106/A 106M-~~06a~~ 08	Specification for Seamless Carbon Steel Pipe for High-Temperature Service	IMC	IRC	IFGC					

A 167-99(2004~~)~~ 9	Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip	IRC							
A 240/A 240M-~~07~~ 09a	Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications	IBC	IRC						
A 252-98(20~~02~~ 07)	Specification for Welded and Seamless Steel Pipe Piles	IBC							
A 254-97(20~~02~~ 07)	Specification for Copper Brazed Steel Tubing	IMC	IRC	IFGC					
A 283/A 283M-03(2007)	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates	IBC							
A 307-~~04E01~~ 07b	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength	IBC	IRC						
A 312/A 312M-~~06~~ 08a	Specification for Seamless, ~~and~~ Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes	IPC	IRC						
A 463M/A 463M-~~05~~ 06	Specification for Steel Sheet, Aluminum-Coated, by the Hot Dip Process	IBC	IRC						
A 510-~~06~~ 08	Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel	IRC							
A 588/A 588M-05	Specification for High-Strength Low-Alloy Structural Steel with 50 ksi (345 Mpa) Minimum Yield Point, ~~to 4 Inches (100mm) Thick~~ with Atmospheric Corrosion Resistance	IBC							
A 615/A 615M-~~04a~~ 09	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement	IBC	IRC						
A 641/A 641M-~~03~~ 09a	Specification for Zinc-Coated (Galvanized) Carbon Steel Wire	IRC							
A 653/A 653M-~~07~~ 08	Specification for Steel Sheet, Zinc-Coated Galvanized or Zinc-Iron Alloy-Coated Galvannealed by the Hot-Dip Process	IBC	IRC						
A 706/A 706M-~~05a~~ 09	Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement	IBC	IRC						
A 755/A 755M-~~07~~ 03(2008)	Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process and Prepainted by the Coil-Coating Process for Exterior Exposed Building Products	IBC	IRC						
A 792/A 792M-~~06a~~ 08	Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process	IBC	IRC						
A 888-~~07a~~ 09	Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Application	IPC	IPSDC	IRC					
A 913/A 913M-~~04~~ 07	Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST)	IBC							

A 924/A 924M-~~07~~ 08a	Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot Dip Process	IBC	IRC							
A 996/A 996M-~~06a~~ 09	Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement	IRC								
A 1003/A 1003M-~~05~~ 08	Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-formed Framing Members	IRC								
B 32-~~04~~ 08	Specification for Solder Metal	IPC	IMC	IRC	IPSDC					
B 101-~~02~~ 07	Specification for Lead-Coated Copper Sheet and Strip for Building Construction	IBC	IRC							
B 135-~~02~~ 08a	Specification for Seamless Brass Tube	IMC	IRC							
B 152/B 152M-06ae1	Specification for Copper Sheet, Strip Plate and Rolled Bar	IPC								
B 209-~~06~~ 07	Specification for Aluminum and Aluminum-Alloy Steel and Plate	IBC	IRC							
B 210-~~02~~ 04	Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes	IFGC								
B 280-~~03~~ 08	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	IMC	IFC	IBC						
B 302-~~02~~ 07	Specification for Threadless Copper Pipe, Standard Sizes	IPC	IRC	IMC						
B 306-~~02~~ 09	Specification for Copper Drainage Tube (DWV)	IPC	IRC							
B 370-~~03~~ 09	Specification for Cold Rolled Copper Sheet and Strip for Building Construction	IBC	IRC							
B 813-00~~e01~~ (2009)	Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube	IPC	IPSDC	IRC	IMC					
C 14-07	Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe	IPC	IPSDC	IRC						
C 27-98(~~2002)~~ 2008	Specification for Standard Classification of Fireclay and High-Alumina Refractory Brick	IBC	IRC							
C 31/C 31M-~~06~~ 08b	Practice for Making and Curing Concrete Test Specimens in the Field	IBC								
C 33/C33M-~~03~~ 08	Specification for Concrete Aggregates	IBC	IRC							
C 62-~~05~~ 08	Specification for Building Brick (Solid Masonry Units Made From Clay or Shale)	IBC	IRC							
C 67-~~07~~ 08	Test Methods of Sampling and Testing Brick and Structural Clay Tile	IBC								
C 76-~~07~~ 08a	Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe	IPC	IPSDC	IRC						
C 90-~~06b~~ 08	Specification for Loadbearing Concrete Masonry Units	IBC	IRC	IECC						
C 94/C 94M-~~07~~ 09	Specification for Ready-Mixed Concrete	IBC	IRC							

C 140-~~07~~ 08a	Test Method Sampling and Testing Concrete Masonry Units and Related Units	IBC								
C 143/C 143M-~~05a~~ 08	Test Method for Slump of Hydraulic Cement Concrete	IRC								
C 172-~~04~~ 08	Practice for Sampling Freshly Mixed Concrete	IBC								
C 207-06	Specification for Hydrated Lime for Masonry Purposes	IRC								
C 208-~~95 (2001)~~ 08a	Specification for Cellulosic Fiber Insulating Board	IBC	IRC							
C 216-07a	Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale)	IBC	IRC							
C 270-~~07~~ 08a	Specification for Mortar for Unit Masonry	IBC	IRC							
C 272-01(2007)	Standard Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions	IRC								
C 273/ C273M-~~00e1~~ 07a	Standard Test Method for Shear Properties of Sandwich Core Materials	IRC								
C 296-00(2004)e~~0~~1	Specification for Asbestos-Cement Pressure Pipe	IPC	IRC							
C 428-~~97~~ 05(2006)	Specification for Asbestos-Cement Nonpressure Sewer Pipe	IPC	IPSDC	IRC						
C 473-~~06a~~ 07	Test Methods for Physical Testing of Gypsum Panel Products	IBC								
C 474-~~02(2007)~~ 05	Test Methods for Joint Treatment Materials for Gypsum Board Construction	IBC								
C 475/C 475M-~~05~~ 02(2007)	Specification for Joint Compound and Joint Tape for Finishing Gypsum Wallboard	IBC	IRC							
C 476-~~02~~ 08	Specification for Grout for Masonry	IRC								
C 503-~~05~~ 08a	Specification for Marble Dimension Stone (Exterior)	IBC								
C 516-~~02~~ 08a	Specification for Vermiculite Loose Fill Thermal Insulation	IBC								
C 547-~~06~~ 07e1	Specification for Mineral Fiber Pipe Insulation	IBC								
C 552-~~03~~ 07	Standard Specification for Cellular Glass Thermal Insulation	IBC	IRC							
C 564-~~03a~~ 08	Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings	IPC	IPSDC	IRC						
C 568-~~03~~ 08a	Specification for Limestone Dimension Stone	IBC								
C 578-~~07~~ 08b	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation	IBC	IRC							
C 595-~~07~~ 08a	Specification for Blended Hydraulic Cements	IBC	IRC							
C 616-~~03~~ 08a	Specification for Quartz Dimension Stone	IBC								
C 629-~~03~~ 08	Specification for Slate Dimension Stone	IBC								
C 631-~~95a(2004)~~ 09	Specification for Bonding Compounds for Interior Gypsum Plastering	IBC	IRC							

C 635/C635M-~~04~~ 07	Specification for the Manufacturer, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings	IBC							
C 636/C636M-~~06~~ 08	Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels	IBC							
C 645-~~07~~ 08a	Specification for Nonstructural Steel Framing Members	IBC	IRC						
C 652-~~05a~~ 09	Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)	IBC	IRC						
C 685/C 685M-~~01~~ 07	Specification for Concrete Made by Volumetric Batching and Continuous Mixing	IRC							
C 700-07a	Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated	IPC	IPSDC	IRC					
C 744-~~05~~ 08	Specification for Prefaced Concrete and Calcium Silicate Masonry Units	IBC							
C 754-~~04~~ 08	Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products	IBC							
C 840-~~07~~ 08	Specification for Application and Finishing of Gypsum Board	IBC							
C 841-03(2008)e1	Specification for Installation of Interior Lathing and Furring	IBC							
C 847-~~06~~ 09	Specification for Metal Lath	IBC	IRC						
C 913-~~02~~ 08	Specification for Precast Concrete Water and Waste Water Structures	IPSDC	IBC						
C 920-~~05~~ 08	Standard Specification for Elastomeric Joint Sealants	IBC	IRC						
C 926-~~98a(2005)~~ 06	Specification for Application of Portland Cement-Based Plaster	IBC	IRC						
C 933-~~05~~ 07b	Specification for Welded Wire Lath	IBC	IRC						
C 954-~~04~~ 07	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	IRC						
C 955-~~06~~ 09	Standard Specification for Load-bearing Transverse and Axial Steel Studs, Runners Tracks, and Bracing or Bridging, for Screw Application of Gypsum Panel Products and Metal Plaster Bases	IBC	IRC						
C 1002-~~04~~ 07	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	IRC						
C 1007-~~04~~ 08a	Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories	IBC							
C 1019-~~05~~ 09	Test Method for Sampling and Testing Grout	IBC							

C 1029-~~05a~~ 08	Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation	IBC	IRC						
C 1047-~~05~~ 09	Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base	IBC	IRC						
C 1053-00(2005)	Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) Applications	IPC							
C 1063-~~06~~ 08	Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster	IBC	IRC						
C 1088-~~07a~~ 09	Specification for Thin Veneer Brick Units Made From Clay or Shale	IBC							
C 1107/C1107M-~~07~~ 08	Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)	IRC							
C 1116/C1116M -~~06~~ 08a	Standard Specification for Fiber - Reinforced Concrete and Shotcrete	IRC							
C 1157-~~03~~ 08a	Performance Specification for Hydraulic Cement	IRC							
C 1173-~~06~~ 08	Specification for Flexible Transition Couplings for Underground Piping Systems	IPC	IPSDC	IRC					
C 1177/C 1177M-~~06~~ 08	Specification for Glass Mat Gypsum Substrate for Use as Sheathing	IBC	IRC						
C 1178/C 1178M-~~06~~ 08	Specification for Coated Mat Water-Resistant Gypsum Backing Panel	IBC	IRC						
C 1186-~~07~~ 08	Specification for Flat ~~Nonasbestos~~ Fiber Cement Sheets	IBC	IRC						
C 1277-~~06~~ 08	Specification for Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings	IPC	IPSDC	IRC					
C 1278/C 1278M-~~06~~ 07a	Specification for Fiber-Reinforced Gypsum Panels	IBC	IRC						
C 1280-~~04~~ 09	Specification for Application of Gypsum Sheathing	IBC							
C 1283-07a	Practice for Installing Clay Flue Lining	IBC	IRC						
C 1288-99(2004)e1	Standard Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets	IBC	IRC						
C 1289~~—07~~ 08	Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board	IBC	IRC						
C 1325-~~04~~ 08b	Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitous Backer Units ~~Interior Substrate Sheets~~	IBC	IRC						
C 1396M/ C1396M-06a	Specification for Gypsum Board	IBC	IRC						
C 1405-~~07~~ 08	Standard Specification for Glazed Brick (Single Fired, Solid Brick Units)	IBC							
C 1440-~~03~~ 08	Specification for Thermoplastic Elastomeric (TPE) Gasket Materials for Drain, Waste, and Vent (DWV), Sewer, Sanitary and Storm Plumbing Systems	IPC	IPSDC	IRC					

C 1460-~~04~~ 08	Specification for Shielded Transition Couplings for Use with Dissimilar DWV Pipe and Fittings Above Ground	IPC	IPSDC	IRC					
C 1461-~~06~~ 08	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	IPSDC	IRC					
C 1540-~~04~~ 08	Specification for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings	IPC							
C 1563-~~04~~ 08	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	IPC							
D 86-~~07a~~ 09	Test Method for Distillation of Petroleum Products at Atmospheric Pressure	IBC	IFC						
D 93-~~07~~ 08	Test Method for Flash Point by Pensky-Martens Closed Cup Tester	IBC	IFC	IMC					
D 225-~~04~~ 07	Specification for Asphalt Shingles (Organic Felt) Surfaced with Mineral Granules	IBC	IRC						
D 323-~~06~~ 08	Test Method for Vapor Pressure of Petroleum Products (Reid Method)	IFC							
D 422-63(200~~2~~ 7)~~E01~~	Test Method for Particle-Size Analysis of Soils	IBC	IRC						
D 448~~—03a~~ 08	Standard Classification for Sizes of Aggregate for Road and Bridge Construction	IBC							
D 449-03(2008)	Specification for Asphalt Used in Dampproofing and Waterproofing	IRC							
D 1003-~~00~~ 07e1	Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics	IECC							
D 1143/D1143M-07e1	Test Method for Piles Under Static Axil Compressive Load	IBC							
D 1557-~~02e01~~ 07	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft3(2,700kN-m/m3))	IBC							
D 1586-~~99~~ 08a	Specification for Penetration Test and Split-Barrel Sampling of Soils	IBC							
D 1622-~~03~~ 08	Standard Test Method for Apparent Density of Rigid Cellular Plastics	IRC							
D 1623-~~78(1995)~~ 03	Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics	IRC							
D 1693-~~07~~ 08	Test Method for Environmental Stress-Cracking of Ethylene Plastics	IRC	IMC						
D 1784-~~06a~~ 08	Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds	IRC							

D 1869-95 (2005)e1	Specification for Rubber Rings for Asbestos-Cement Pipe	IPC	IPSDC	IRC					
D 1970-~~01~~ 09	Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roof Underlayment for Ice Dam Protection	IBC	IRC						
D 2412-02(2008)	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading	IMC	IRC						
D 2487-06e1	Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)	IBC							
D 2513-~~07a~~ 08b	Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings	IFGC	IMC	IRC					
D 2609-02(2008)	Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe	IPC	IRC						
D 2661-~~06~~ 08	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings	IPC	IPSDC	IRC					
D 2665-~~07~~ 09	Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings	IPC	IPSDC	IRC					
D 2729-~~04e01~~ 03	Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings	IPC	IRC	IPSDC					
D 2822-~~(2005)~~	Specification for Asphalt Roof Cement, Asbestos Containing	IBC	IRC						
D 2823-05	Specification for Asphalt Roof Coatings, Asbestos Containing	IBC	IRC						
D 2837-~~04e01~~ 08	Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products	IMC	IRC						
D 2846/D 2846M-~~06~~ 09	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems	IPC	IRC	IMC					
D 2850-03a(2007)	Test Method for Unconsolidated, Undrained Triaxial Compression Test on Cohesive Soils	IBC							
D 2898-~~04~~ (2008e01)	Standard Test Methods for Accelerated Weathering of Fire-Retardant-treated Wood for Fire Testing	IWUIC							
D 2949 – 01~~ae01~~a(2008)	Specification for 3.25-in. Outside Diameter Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings	IPC	IPSDC	IRC					
D 3019-~~94(2007)~~ 08	Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, Asbestos Fibered, and Non-Asbestos Fibered	IBC	IRC						
D 3034 - ~~06~~ 08	Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings	IPC	IPSDC	IRC					
D 3035-~~06~~ 08	Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter	IPC	IRC	IMC					

D 3161-~~06~~ 09	Test Method for a Wind Resistance of Asphalt Shingles (Fan Induced Method)	IBC	IRC						
D 3201-~~07~~ 08a	Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Base Products	IBC	IRC	IWUIC					
D 3212-~~96a(2003)e01~~ 07	Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals	IPC	IPSDC	IRC					
D 3261-03	~~Standard Practice~~ Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings ~~Joining of Polyolefin~~ Plastic Pipe and ~~Fittings~~ Tubing	IMC	IPC						
D 3278-~~2004e01~~ 96(2004)e~~0~~1	Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus	IBC	IFC	IMC					
D 3311-~~06a~~ 08	Specification for Drain, Waste and Vent (DWV) Plastic Fittings Patterns	IPC	IRC						
D 3350-~~06~~ 08	Specification for Polyethylene Plastics Pipe and Fittings Materials	IMC	IRC						
D 3462-~~07~~ 09	Specification for Asphalt Shingles Made From Glass Felt and Surfaced with Mineral Granules	IBC	IRC						
D 3679-~~06a~~ 09	Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding	IBC	IRC						
D 3689-~~90 (1995)~~ 07	~~Method for Testing Individual Piles~~ Test Methods for Deep Foundations Under Static Axial Tensile Load	IBC							
D 3737-~~07~~ 08	Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam)	IBC	IRC						
D 3746-85(~~2002~~) 2008	Test Method for Impact Resistance of Bituminous Roofing Systems	IBC							
D 3909-97b(2004)e~~0~~1	Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules	IBC	IRC	IWUIC					
D 4272-~~03~~ 08a	Test Method for Total Energy Impact of Plastic Films by Dart Drop	IBC							
D 4434/D4434M ~~-06~~ 09	Specification for Poly (Vinyl Chloride) Sheet Roofing	IBC	IRC						
D 4551-96 (200~~4~~ 8)e1	Specification for Poly (Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane	IPC	IRC						
D 4586-~~00~~ 07	Specification for Asphalt Roof Cement, Asbestos-Free	IBC	IRC						
D 4637-~~04~~ 08	Specification for EPDM Sheet Used in Single-Ply Roof Membrane	IBC	IRC						
D 4829-~~07~~ 08a	Test Method for Expansion Index of Soils	IBC	IRC						
D 4945-~~00~~ 08	Test Method for High-Strain Dynamic Testing of Piles	IBC							
D 5019 - 07a	Specification for Reinforced Nonvulcanized Polymeric Sheet Used in Roofing Membrane	IBC	IRC						
D 5055-~~05~~ 09	Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-Joists	IBC	IRC						

D 5456-~~05a~~ 09	Specification for Evaluation of Structural Composite Lumber Products	IBC							
D 5664-~~02~~ 08	Test Methods for Evaluating the Effects of Fire-Retardant Treatments and Elevated Temperatures on Strength Properties of Fire-Retardant Treated Lumber	IBC	IRC						
D 6162-00a(2008)	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements	IBC	IRC						
D 6163-00(2008)	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements	IBC	IRC						
D 6164-05e1	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements	IBC	IRC						
D 6221-00(2006)	Specification for Reinforced Bituminous Flashing Sheets for Roofing and Waterproofing	IRC							
D 6222-02~~e01~~ 08	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements	IBC	IRC						
D 6223-02e~~01~~2	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements	IBC	IRC						
D 6298-05e1	Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface	IBC	IRC						
D 6305-~~02e01~~ 08	Practice for Calculating Bending Strength Design Adjustment Factors for Fire-Retardant-Treated Plywood Roof Sheathing	IBC	IRC						
D 6380-03(2009)	Standard Specification for Asphalt Roll Roofing (Organic) Felt	IBC	IRC						
D 6509/D6509M —~~00~~ 09	Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Base Sheet Materials Using Glass Fiber Reinforcements	IBC							
D 6662-~~06~~ 09	Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards	IWUIC							
D 6694-~~07~~ 08	Standard Specification for Liquid-applied Silicone Coating Used In Spray Polyurethane Foam Roofing	IBC	IRC						
D 6841-~~03~~ 08	Standard Practice for Calculating Design Value Treatment Adjustment Factors for Fire-Retardant-Treated Lumber	IBC	IRC						

D 6878-~~06a~~ 08e1	Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing	IBC	IRC						
D 7032-~~07~~ 08	Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails)	IRC							
D 7158-~~07~~ 08d	Standard Test Method for Wind Resistance of Sealed Asphalt Shingles (Uplift Force/Uplift Resistance Method)	IBC	IRC						
E 84-~~07~~ 09	Test Method for Surface Burning Characteristics of Building Materials	IBC	IRC	IFC	IMC	IWUIC			
E 119-~~07~~ 08a	Test Methods for Fire Tests of Building Construction and Materials	IBC	IRC	IMC					
E 136-~~04~~ 09	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C	IBC	IRC	IMC	IWUIC				
E 283-04	Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences Across the Specimen	IRC	IECC						
E 331-00(2009)	Test Method for Water Penetration of Exterior Windows, Skylights, Doors and Curtain Walls by Uniform Static Air Pressure Difference	IBC	IRC						
E 492-~~04~~ 09	Test Method for Laboratory Measurement of Impact Sound Transmission Through Floor-Ceiling Assemblies Using the Tapping Machine	IBC	IRC						
E 814-~~06~~ 08b	Test Method of Fire Tests of Through-Penetration Firestops	IBC	IRC	IMC					
E 970-~~00~~ 08a	Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Using a Radiant Heat Energy Source	IBC	IRC						
E 1300-~~04~~ 07e01	Practice for Determining Load Resistance of Glass in Buildings	IBC							
E 1354-~~04a~~ 09	Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter	IBC	IFC						
E 1592-~~01~~ 05	Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference	IBC							
E 1886-~~06~~ 05	Test Method for Performance of Exterior Windows, Curtain Walls, Doors and Storm Shutters Impacted by Missiles and Exposed to Cyclic Pressure Differentials	IBC	IRC						
E 1966-~~01~~ 07	Test Method for Fire Resistant Joint Systems	IBC							
E 1996-~~06~~ 09	Specification for Performance of Exterior Windows, Glazed Curtain Walls, Doors and Impact Protective Systems Impacted by Windborne Debris in Hurricanes	IBC	IRC						

E 2404—~~07a~~ 08	Standard Practice for Specimen Preparation and Mounting of Textile, Paper or Vinyl Wall or Ceiling Coverings to Assess Surface Burning Characteristics	IBC	IFC							
E 2568—~~07~~ 09e1	Standard Specification of PB Exterior Insulation and Finish Systems (EIFS)	IBC	IRC							
E 2573—07a	Standard Practice for Specimen Preparation and Mounting of Site-Fabricated Stretch Systems to Assess Surface Burning Characteristics	IBC	IFC							
F 405-05	Specification for Corrugated Polyethylene (PE) Pipe ~~Tube~~ and Fittings	IPC	IPSDC	IRC						
F 409-02(2008)	Specification for Thermoplastic Accessible and Replaceable Plastic Tube and Tubular Fittings	IPC	IRC							
F 441/F 441M-02 (2008)	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80	IPC	IRC	IMC						
F 442/F 442M-99(2005)e1	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)	IPC	IRC	IMC						
F 477-~~07~~ 08	Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe	IPC	IPSDC	IRC						
F 547-~~01~~ 06	Terminology of Nails for Use with Wood and Wood-based Materials	IBC								
F 628-~~06e01~~ 08	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core	IPC	IPSDC	IRC						
F 656-~~02~~ 08	Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings	IPC	IPSDC	IRC						
F 714-~~06a~~ 08	Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter	IPC	IRC							
F 876-~~06~~ 08b	Specification for Crosslinked Polyethylene (PEX) Tubing	IPC	IRC	IMC						
F 891-~~04~~ 07	Specification for Coextruded Poly (Vinyl Chloride) (PVC) Plastic Pipe with a Cellular Core	IPC	IPSDC	IRC						
F 1055-98(2006)	Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and ~~Fittings~~ Tubing	IPC	IRC	IMC						
F 1412-01~~e01~~ 09	Specification for Polyolefin Pipe and Fittings for Corrosive Waste Drainage	IPC	IRC							
F 1476-~~(2006)~~ 07	Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications	IMC								
F 1499-01(2008)	Specification for Coextruded Composite Drain, Waste, and Vent Pipe (DWV)	IPSDC								

F 1554-~~04e1~~ 07a	Specification for Anchor Bolts, Steel 36, 55 and 105 ksi Yield Strength	IRC							
F 1807-~~07~~ 08	Specifications for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing	IPC	IRC						
F 1960-~~07~~ 09	Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing	IPC	IRC						
F 1973-~~05~~ 08	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	IRC						
F 1974-~~04~~ 08	Specification for Metal Insert Fittings for Polyethylene/Aluminum/Polyethylene and Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene Composite Pressure Pipe	IPC	IRC	IMC					
F 2006-~~00(2005)~~ 08	Standard/Safety Specification for Window Fall Prevention Devices for Non-Emergency Escape (Egress) and Rescue (Ingress) Windows	IBC							
F 2080-~~05~~ 08	Specification for Cold-Expansion Fittings with Metal Compression-Sleeves for Cross-linked Polyethylene (PEX) Pipe	IPC	IRC						
F 2090-~~01a(2007)~~ 08	Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms	IBC	IRC						
F 2098-~~04e1~~ 08	Standard Specification for Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert and Plastic Insert Fittings	IPC	IRC						
F 2158-~~01~~ 08	Standard Specification for Residential Central-Vacuum Tubes and Fittings	IRC							
F 2306/F 2306M-~~05~~ 08	Specification for 12~~"~~ to 60~~"~~ in. 300 to 1500 mm annular Corrugated Profile-Wall Polyethylene (PE) Pipe and Fittings for Gravity-Flow Storm Sewer and Subsurface Drainage Applications	IPC							
F 2389-~~06~~ 07e1	Specification for Pressure-Rated Polypropylene (PP) Piping Systems	IPC	IRC	IMC					
F2434-~~05~~ 08	Standard Specification for Metal Insert Fittings Utilizing a Copper Crimp ring for SDR9 Cross-Linked Polyethylene (PEX) Tubing and SDR9 Cross-Linked Polyethylene/Aluminum/Cross-Linked Polyethylene (PEX-AL-PEX) Tubing	IPC	IRC						
F 2623-~~07~~ 08	Standard Specification for Polyethylene of Raised Temperature (PE-RT) SDR 9	IMC	IRC						

	Tubing								
G 154-~~05~~ 06	Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials	IBC							
AWPA	**American Wood Protection Association**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
M4-~~06~~ 08	Standard for the Care of Preservative-Treated Wood Products	IBC	IRC						
U1-~~07~~ 11	USE CATEGORY SYSTEM: User Specification for Treated Wood except Section 6, Commodity Specification H	IBC	IRC						
BHMA	**Builders Hardware Manufacturers' Association**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
A 156.10.~~06~~ 2011	Power Operated Pedestrian Doors	IBC	IFC						
A 156.19-20~~02~~ 07	Power Assist and Low Energy Power Operated Doors	IBC	IFC						
CPA	**Composite Panel Association**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
A135.6-~~1998~~ 2006	Hardboard Siding	IBC	IRC						
A208.1-~~99~~ 2009	Particleboard	IBC	IRC						
CPSC	**Consumer Product Safety Commission**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
16 CFR Part 1201(~~1977~~) 2002	Safety Standard for Architectural Glazing Material	IBC	IRC						
16 CFR Part 1209 (~~1979~~) 2002	Interim Safety Standard for Cellulose Insulation	IBC	IRC						
16 CFR Part 1404 (~~1979~~) 2002	Cellulose Insulation	IBC	IRC						
16 CFR Part 1500 (~~1991~~) 2009	Hazardous Substances and Articles; Administration and Enforcement Regulations	IBC	IFC						
16 CFR Part 1500.41 (~~1984~~) 2009	Method for Testing Primary Irritant Substances	IFC							
16 CFR Part 1500.42 (~~1994~~) 2009	Test for Eye Irritants	IFC							
16 CFR Part 1500.44 (~~2001~~) 2009	Method for Determining Extremely Flammable and Flammable Solids	IBC	IFC						
16 CFR Part 1507 (~~2001~~) 2002	Firework Devices	IBC	IFC						
16 CFR Part 1630 (2000) (2007)	Standard for the Surface Flammability of Carpets and Rugs	IBC	IFC						
CSA	**Canadian Standards Association**								

Standard Reference Number	Title	Referenced in Code(s):							
ASME A112.9.2/CSA B45.1—~~02~~ 08	Ceramic Plumbing Fixtures	IPC	IRC						
ASME A112.19.1/CSA B45.2—~~02~~ 08	Enameled Cast-iron and Enameled Steel Plumbing Fixtures	IPC	IRC						
ASME A112.19.3/CSA B45.4—~~02~~ 08	Stainless-steel Plumbing Fixtures	IPC	IRC						
B45.5—02 (R2008)	Plastic Plumbing Fixtures	IPC	IRC						
B45.9—99 (R2008)	Macerating Systems and Related Components	IPC	IRC						
B64.1.1-~~01~~ 07	Atmospheric Vacuum Breakers ~~Vacuum Breakers, Atmospheric Type~~ (AVB)	IPC	IRC						
B64.1.2—~~01~~ 07	Pressure Vacuum Breakers~~,~~ ~~Type~~ (PVB)	IPC	IRC						
B64.2-~~01~~-07	Hose connection vacuum breakers ~~Vacuum breakers, hose connection type~~ (HCVB)	IPC	IRC						
B64.2.1—~~01~~ 07	Hose Connection Vacuum Breakers~~, Type~~ (HCVB) with Manual Draining Feature	IPC	IRC						
B64.2.1.1—~~01~~ 07	Hose Connection Dual Check Vacuum Breakers~~,Type~~ (HCDVB)	IPC	IRC						
B64.2.2-~~01~~-07	Hose connection vacuum breakers ~~Vacuum breakers, hose connection type~~ (HCVB) with automatic draining feature	IPC	IRC						
B64.3-~~01~~-07	Dual check valve backflow preventers ~~Backflow preventers, dual check valve type~~ with atmospheric port (DCAP)	IPC	IRC						
B64.4-~~01~~-07	~~Backflow preventers,~~ Reduced pressure principle backflow preventers (RP)	IPC	IRC						
B64.4.1—~~01~~ 07	~~Backflow Preventers,~~ Reduced Pressure Principle ~~Type~~ for Fire Sprinklers (RPF)	IPC	IRC						
B64.5—~~01~~ 07	Double Check Backflow Preventers~~,Type~~ (DCVA)	IPC	IRC						
B64.5.1—~~01~~ 07	Double Check Valve Backflow Preventers~~, Type~~ for Fire Systems (DCVAF)	IPC	IRC						
B64.6—~~01~~ 07	Dual Check Backflow Preventers, Valve ~~Type~~ (DuC)	IPC							
B64.7—~~94~~ 07	Laboratory Faucet Vacuum Breakers, ~~Type~~ (LFVB)	IPC	IRC						
B64.10/~~B64.10.1—01~~ 07	Manual for the Selection and Installation of Backflow Prevention Devices~~/Manual for the Maintenance and Field Testing of Backflow Prevention Devices~~	IPC							
~~B64.10/~~B64.10.1—~~01~~ 07	~~Manual for the Selection and Installation of Backflow Prevention Devices/~~Manual for the Maintenance and Field Testing of Backflow Prevention	IPC							

	Devices								
B79~~—94(2000)~~ 08	Commercial and residential ~~Floor, Area and Shower~~ Drains~~,~~ and Cleanouts ~~for Residential Construction~~	IPC							
ASME A112.18.1/CSA B125—~~01~~ 05	Plumbing Supply Fittings	IPC	IRC						
ASME A112.18.2/CSA B125.2—2005	Plumbing Waste Fittings	IPC	IRC						
B125.3—2005	Plumbing Fittings	IPC	IRC						
B137.1~~—02~~ 05	Polyethylene (PE) Pipe, Tubing and Fittings for Cold Water Pressure Services	IPC	IRC						
B137.2~~—02~~ 05	Polyvinylchloride PVC Injection-moulded Gasketed Fittings for Pressure Applications	IPC	IRC						
B137.3~~—02~~ 05	Rigid poly~~(~~vinylchloride~~)~~ (PVC) Pipe for Pressure Applications	IPC	IRC	IPSDC					
B137.5~~—02~~ 05	Cross-linked Polyethylene (PEX) Tubing Systems for Pressure Applications~~—with Revisions through September 1992~~	IPC	IRC						
B137.6~~—02~~ 05	Chlorinated polyvinylchloride CPVC Pipe, Tubing and Fittings for Hot and Cold Water Distribution Systems~~—with Revisions through May 1986~~	IPC	IRC						
B137.9~~-02~~ 05	Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure -Pipe Systems	IPC	IRC	IMC					
B137.10M~~—02~~ 05	Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Composite Pressure Pipe Systems	IPC	IRC	IMC					
B137.11~~—02~~ 05	Polypropylene (PP-R) Pipe and Fittings for Pressure Applications	IPC	IRC						
B181.1~~—02~~ 06	Acrylonitrile-butadiene-styrene (ABS) Drain, Waste and Vent Pipe and Pipe Fittings	IPC	IRC	IPSDC					
B181.2~~—02~~ 06	Polyvinylchloride (PVC) and chlorinated polyvinylchloride (CPVC) Drain, Waste, and Vent Pipe and Pipe Fittings~~—with Revisions through December 1993~~	IPC	IRC	IPSDC					
B181.3~~—02~~ 06	Polyolefin and polyvinylidene (PVDF) Laboratory Drainage Systems	IPC	IRC						
B182.1~~—02~~ 06	Plastic Drain and Sewer Pipe and Pipe Fittings	IPC	IPSDC						
B182.2~~—02~~ 06	~~(~~PSM Type~~)~~ polyvinylchloride (PVC) Sewer Pipe and Fittings	IPC	IRC	IPSDC					
B182.4~~—02~~ 06	Profile polyvinylchloride (PVC) Sewer Pipe and Fittings	IPC	IRC	IPSDC					
B182.6~~—02~~ 06	Profile Polyethylene Sewer Pipe and Fittings ~~for Leak-proof Sewer Applications~~	IPC	IRC						
B182.8~~—02~~ 06	Profile Polyethylene (PE) Storm Sewer and Drainage Pipe and Fittings	IPC	IRC						

B602—~~02~~ <u>05</u>	Mechanical Couplings for Drain, Waste and Vent Pipe and Sewer Pipe.	IPC	IRC	IPSDC					

DOC	United States Department of Commerce								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
16 CFR Part 1632-~~1999~~ (2009)	Standard for the Flammability of Mattress and Mattress Pads (FF4-72 Amended)	IFC							
PS 1-~~07~~ 09	Structural Plywood	IBC							
PS 2-~~04~~10	Performance Standard for Wood-based Structural-use Panels	IBC							
DOL	**U.S. Department of Labor**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
29 CFR Part 1910.1000 (~~1974~~) 2009	Air Contaminants	IBC	IFC	IMC					
29 CFR Part 1910.1200 (~~1999~~) 2009	Hazard Communication	IFC							
29 CFR Part 1910-1025 (2009)	Toxic and Hazardous Substances	IMC							
DOTn	**U.S. Department of Transportation**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
49 CFR Parts 100-185-2005	Hazardous Materials Regulations	IBC	IFC						
49 CFR—1998	Specification of Transportation of Explosive and Other Dangerous Articles, UN 0335,UN 0336 Shipping Containers	IBC							
49 CFR Part 172— ~~2005~~ 2009	Hazardous Materials Tables, Special Provisions, Hazardous Materials Communications, Emergency Response Information and Training Requirements	IFC							
49 CFR Part 173~~—2005~~ 2009	Shippers—General Requirements for Shipments and Packagings	IFC							
49 CFR Parts 173.137 ~~-2005~~ (2009)	Shippers-General Requirements for Shipments and Packaging-Class 8-Assignment of Packing Group	IBC	IFC						
49 CFR, Parts 192.281(e) & 192.283 (b) - (2009)	Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards	IRC	IFGC						
FEMA	**Federal Emergency Management Agency**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
FEMA-TB-2-~~93~~ 08	Flood Damage-Resistant Materials Requirements	IRC							
FEMA ~~FIA~~-TB-11-01	Crawlspace Construction for Buildings Located in Special Flood Hazard Areas	IBC	IRC						

GA — Gypsum Association

Standard ReferenceNumber	Title	Referenced in Code(s):							
GA 600-~~06~~ 09	Fire Resistance Design Manual, 18th Edition	IBC							

HPVA — Hardwood Plywood and Veneer Association

Standard Reference Number	Title	Referenced in Code(s):							
ANSI/HP-1-20~~04~~ 09	Standard for Hardwood and Decorative Plywood	IBC	IRC						

HUD — U.S. Department of Housing and Urban Development

Standard Reference Number	Title	Referenced in Code(s):							
HUD 24 CFR Part 3280 (~~1994~~) 2008	Manufactured Home Construction and Safety Standards	IBC							

ICC — International Code Council

Standard Reference Number	Title	Referenced in Code(s):							
ICC/ANSI A117-~~03~~ 2009	Accessible and Usable Buildings and Facilities	IBC	IFC	IZC	IEBC				
ICC 300-~~07~~ 12	ICC Standard on Bleachers, Folding and Telescopic Seating, and Grandstands	IBC	IFC						
ICC 400-~~07~~ 12	Standard for the Design and Construction of Log Structures	IRC							
ICC~~/ANSI~~ A117.1-~~03~~ 09	Accessible and Usable Buildings and Facilities	IBC	IFC	IZC	IEBC	IRC			
IBC-~~09~~ 12	International Building Code	IRC	IFC	IMC	IPC	IPSDC	IFGC	IECC	IEBC
ICCPC-~~09~~ 12	International Performance Code								
IEBC-~~09~~ 12	International Existing Building Code	IBC	IRC	IFC	IMC	IFGC	IECC	IPMC	
IECC-~~09~~ 12	International Energy Conservation Code	IBC	IRC	IMC	IPC	IFGC	IEBC		
IFC-~~09~~ 12	International Fire Code	IBC	IRC	IMC	IPC	IFGC	IECC	IEBC	IPMC
IFGC-~~09~~ 12	International Fuel Gas Code	IBC	IRC	IFC	IMC	IPC	IECC	IEBC	
IMC-~~09~~ 12	International Mechanical Code	IBC	IRC	IFC	IPC	IFGC	IECC	IEBC	IPMC
IPC-~~09~~ 12	International Plumbing Code	IBC	IRC	IFC	IMC	IPSDC	IFGC	IECC	IEBC
IPMC-~~09~~ 12	International Property Maintenance Code	IBC	IRC	IFC	IEBC				
IPSDC-~~09~~ 12	International Private Sewage Disposal Code	IBC	IRC	IPC					
IRC-~~09~~ 12	International Residential Code	IBC	IFC	IMC	IFGC	IEBC	IPC		
IWUIC-~~09~~ 12	International Wildland-Urban Interface Code	IBC	IFC						
IZC-~~09~~ 12	International Zoning Code	IPMC							

NAAMM	National Association of Architectural Metal Manufacturers								
Standard Reference Number	Title	Referenced in Code(s):							
FP 1001-~~97~~ 07	Guide Specification for Design of Metal Flag Poles	IBC							

NAIMA	North American Insulation Manufacturers Association								
Standard Reference Number	Title	Referenced in Code(s):							
AH 116-~~02~~ 09	Fibrous Glass Duct Construction Standards, Fifth Edition	IMC	IRC						

NFPA	National Fire Protection Association								
Standard Reference Number	Title	Referenced in Code(s):							
10-~~07~~ 10	Portable Fire Extinguishers	IFC	IBC						
11-~~05~~ 10	Low-, Medium-, and High-Expansion Form	IFC	IBC						
12-~~05~~ 11	Carbon Dioxide Extinguishing Systems	IFC	IBC						
12A-~~04~~ 09	Halon 1301 Fire Extinguishing Systems	IFC	IBC						
13-~~07~~ 10	Installation of Sprinkler Systems	IFC	IBC	IRC					
13D-~~07~~ 10	Installation of Sprinkler Systems in One- and Two Family Dwellings and Manufactured Homes	IFC	IRC	IBC					
13R-~~07~~ 10	Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height	IFC	IBC	IEBC					
14-~~07~~ 10	Installation of Standpipe and Hose Systems	IFC	IBC						
15-~~07~~ 12	Water Spray Fixed Systems for Fire Protection	IFC							
16 - ~~07~~ 11	Installation of Foam-Water Sprinkler and Foam-Water Spray Systems	IFC	IBC						
17-~~02~~ 09	Dry Chemical Extinguishing Systems	IFC	IBC						
17A-~~02~~ 09	Wet Chemical Extinguishing Systems	IFC	IBC						
20-~~07~~ 10	Installation of Stationary Pumps for Fire Protection	IFC	IBC						
22-~~03~~ 08	Water Tanks for Private Fire Protection	IFC							
24-~~07~~ 10	Installation of Private Fire Service Mains and Their Appurtenances	IFC							
25-~~08~~ 11	Inspection, Testing and Maintenance of Water-Based Fire Protection Systems	IFC	IPMC						

30-~~08~~ 12	Flammable and Combustible Liquids Code	IFC	IBC						
30A-~~08~~ 12	Code for Motor Fuel Dispensing Facilities and Repair Garages	IFC	IMC	IFGC					
30B-~~07~~ 11	Manufacture and Storage of Aerosol Products	IFC							
31-~~06~~ 11	Installation of Oil-Burning Equipment	IFC	IRC	IMC					
32-~~07~~ 11	Drycleaning Plants	IFC	IBC						
33-~~07~~ 11	Spray Application Using Flammable or Combustible Materials	IFC							
34-~~07~~ 11	Dipping and Coating Processes Using Flammable or Combustible Liquids	IFC							
35-~~05~~ 11	Manufacture of Organic Coatings	IFC							
37-~~06~~ 10	Installation and Use of Stationary Combustion Engines and Gas Turbines	IMC	IFGC	IBC					
40-~~07~~ 11	Storage and Handling of Cellulose Nitrate Film	IFC	IBC						
45-~~04~~ 10	Standard on Fire Protection for Laboratories Using Chemicals	IBC							
51A-~~06~~ 11	Acetylene Cylinder Charging Plants	IFC							
52-~~06~~ 10	Vehicular Fuel System Code	IFC							
55–~~05~~ 10	Standard for the Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationery Containers Cylinders and Tanks	IFC							
58-~~08~~ 11	Liquefied Petroleum Gas Code	IFC	IBC	IRC	IMC	IFGC			
59A—~~06~~ 09	Production, Storage and Handling of Liquefied Natural Gas (LNG)	IFC							
70-~~08~~ 11	National Electrical Code	IFGC	IPC	IEBC	IBC	IWUIC	IFC	IRC	IMC
72-~~07~~ 10	National Fire Alarm Code	IFC	IBC	IRC	IMC	IEBC			
80-~~07~~ 10	Fire Doors and Other Opening Protectives	IFC	IBC						
82-~~04~~ 09	Incinerators, Waste and Linen Handling Systems and Equipment	IMC	IFGC						
85-~~07~~ 11	Boiler and Construction Systems Hazards Code	IFC	IBC	IRC	IFGC				
86-~~07~~ 11	Ovens and Furnaces	IFC							
88A-~~02~~ 11	Parking Structures	IFGC							
91-~~04~~ 10	Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Noncombustible Particulate Solids	IMC							
92B—~~05~~- 09	Smoke Management Systems in Malls, Atria, and Large Spaces	IFC	IBC	IMC					
99-~~05~~ 10	Health Care Facilities	IBC	IFC	IEBC					
101-~~06~~ 12	Life Safety Code	IBC	IFC	IEBC					
105-~~07~~ 10	Installation of Smoke Door Assemblies and Other Opening Protectives	IBC	IFC						
110-~~05~~ 10	Emergency and Standby Power Systems	IFC	IBC						
111-~~05~~ 10	Stored Electrical Energy Emergency and Standby Power Systems	IFC	IBC						

120-~~04~~ 10	Fire Prevention and Control in Coal Mines	IFC	IBC						
160-~~06~~ 11	Flame Effects Before an Audience	IFC							
170-~~06~~ 09	Standard for Fire Safety and Emergency Symbols	IFC	IBC						
211-~~06~~ 10	Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances	IMC	IBC	IRC	IFC	IFGC			
241-~~04~~ 09	Safeguarding Construction, Alteration, and Demolition Operations	IFC							
252-~~03~~ 12	Standard Methods of Fire Tests of Door Assemblies	IBC							
253-~~06~~ 11	Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source	IBC							
257-~~07~~ 12	Standard on Fire Test for Window and Glass Block Assemblies	IBC							
259-~~03~~ 08	Test Method for Potential Heat of Building Materials	IBC	IRC						
260-~~03~~ 09	Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture	IFC							
261-~~03~~ 09	Method of Test for Determining Resistance of Mock-Up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes	IFC							
262-~~07~~ 11	Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces	IMC	IBC						
265-~~07~~ 11	Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Coverings on Full Height Panels and Walls	IBC	IFC						
268-~~07~~ 12	Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source	IBC							
285-~~06~~ 11	Method of Test for the Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components	IBC							
286-~~06~~ 11	Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth	IFC	IBC	IRC					
288-~~07~~ 12	Standard Methods of Fire Tests of Floor Fire Door Assemblies Installed Horizontally Fire-Resistance-Rated Floor Systems	IBC							
303-~~06~~ 11	Fire Protection Standards for Marinas and Boatyards	IFC	IBC						
407-~~07~~ 12	Aircraft Fuel Servicing	IFC							
409-~~04~~ 10	Aircraft Hangers	IFC	IBC						
418-~~06~~ 11	Heliports	IBC							
430-~~04~~ 10	Storage of Liquid and Solid Oxidizers	IFC							
484-~~06~~ 12	Combustible Metals	IFC							

490-~~02~~ 10	Storage of Ammonium Nitrate	IFC							
495-~~06~~ 10	Explosive Materials Code	IFC							
498-~~06~~ 10	Safe Havens and Interchange Lots for Vehicles Transporting Explosives	IFC							
501-~~05~~ 10	Manufactured Housing	IRC							
505-~~06~~ 10	Powered Industrial Trucks Including Type Designations, Areas of Use, Conversions, Maintenance, and Operations	IFC							
654-~~06~~ 11	Prevention of Fire & Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids	IBC	IFC						
655-~~07~~ 12	Prevention of Sulfur Fires and Explosions	IBC	IFC						
664-~~07~~ 12	Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities	IBC	IFC						
701-~~04~~ 10	Methods of Fire Tests for Flame-Propagation of Textiles and Films	IFC	IBC						
703-~~06~~ 12	Fire Retardant Treated Wood and Fire Retardant Coatings for Building Materials	IFC							
704-~~07~~ 12	System for the Identification of the Hazards of Materials for Emergency Response	IFC	IMC	IBC					
750-~~06~~ 10	Water Mist Fire Protection Systems	IFC							
853-~~07~~ 10	Installation of Stationary Fuel Cell Power Systems	IMC	IBC	IFGC	IRC				
1123-~~06~~ 10	Fireworks Display	IFC							
1124-~~06~~ 12	Manufacture, Transportation, Storage and Retail Sales of Fireworks and Pyrotechnic Articles	IFC	IBC						
1125-~~07~~ 12	Manufacture of Model Rocket and High Power Rocket Motors	IFC							
1126-~~06~~ 11	Use of Pyrotechnics Before a Proximate Audience	IFC							
1142-~~07~~ 12	Water Supply for Suburban and Rural Fire Fighting	IFC							
1620-~~03~~ 10	Recommended Practice for Pre-Incident Planning	IBC							
2001-~~08~~ 11	Clean Agent Fire Extinguishing Systems	IFC	IBC						
NFRC	**National Fenestration Rating Council Inc.**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
100-~~2004~~ 2009	Procedure for Determining Fenestration Product U-factors	IRC	IECC						
200-~~2004~~ 2009	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence	IRC	IECC						
400-~~2004~~ 2009	Procedure for Determining Fenestration Product Air Leakage - Second Edition	IRC	IECC						

NSF	NSF International								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
3—~~2007~~ 2008	Commercial Warewashing Equipment	IPC							
14—~~2007~~ 2008e	Plastics Piping System Components and Related Materials	IPC	IRC						
40-~~2000~~2005	Residential Wastewater Treatment Systems	IPSDC							
41-~~1999~~2005	Non-Liquid Treatment Systems (Composting Toilets)	IPSDC							
42—2007a~~e~~	Drinking Water Treatment Units—Aesthetic Effects	IPC							
44—~~2000~~2007	Residential Cation Exchange Water Softeners	IPC	IRC						
53—2007a	Drinking Water Treatment Units—Health Effects	IPC	IRC						
58—~~2006~~2007	Reverse Osmosis Drinking Water Treatment Systems	IPC	IRC						
61—~~2007e~~2008	Drinking Water System Components—Health Effects	IPC	IRC						
62—~~2004~~2007	Drinking Water Distillation Systems	IPC							
PCA	**Portland Cement Association**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
100-~~07~~ 10	Prescriptive Design of Exterior Concrete Walls for One- And Two- Family Dwellings (Pub. No. EB241)	IRC							
SDI	**Steel Deck Institute**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
NC~~1.0-06~~ 10	Standard for Non-Composite Steel Floor Deck	IBC							
RD~~1.0-06~~ 10	Standard for Steel Roof Deck	IBC							
SJI	**Steel Joist Institute**								
Standard ReferenceNumber	**Title**	**Referenced in Code(s):**							
~~CJ-1.0-06~~ CJ-10	Standard Specification for Composite Steel Joists, CJ-Series	IBC							
~~JG-1.1 (2005)~~ JG-10	Standard Specification for Joist Girders	IBC							
~~K-1.1 (2005)~~ K-10	Standard Specification for Open Web Steel Joists, K-Series	IBC							
~~LH/DLH-1.1 (2005)~~ LH/DLH-10	Standard Specification for Longspan Steel Joists, LH Series and Deep Longspan Steel Joists, DLH Series	IBC							

SMACNA	Sheet Metal & Air Conditioning Contractors National Assoc. Inc.								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
SMACNA-~~85~~ 10	HVAC Air Duct Leakage Test Standard 2010	IECC							

SPRI	Single-Ply Roofing Institute								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
ANSI/SPRI/FM4435-ES-1	Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems	IBC							
ANSI/SPRI RP-4-~~02~~ 08	Wind Design Guide for Ballasted Single-ply Roofing Systems	IBC							

TIA	Telecommunications Industry Association								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
222-G-2005	Structural Standards for Antenna Supporting Structures and Antennas, including - Addendum 1, 222-G-1 Dated 2007 and Addendum 2, 222-G-2 Dated 2009	IBC							

TMS	The Masonry Society								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
402-~~08~~ 11	Building Code for Masonry Structures	IBC	IRC						
602-~~08~~ 11	Specification for Masonry Structures	IBC	IRC						

UL	Underwriters Laboratories								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
10A-~~1998~~ 2009	Tin Clad Fire Doors ~~- with Revisions through March 2003~~	IBC							
10B-~~1997~~ 2008	Fire Tests of Door Assemblies - with Revisions through ~~October 2001~~ April 2009	IBC							
10C-~~1998~~ 2009	Positive Pressure Fire Tests of Door Assemblies ~~- with Revisions through November 2001~~	IBC							
14B-~~1998~~ 2008	Sliding Hardware for Standard Horizontally Mounted Tin Clad Fire Doors ~~- with Revisions through July 2000~~	IBC							
14C-2006	Swinging Hardware for Standard Tin Clad Fire Doors Mounted Singly and in Pairs - with revisions through December 2008	IBC							

17-1994	Vent or Chimney Connector Dampers for Oil-Fired Appliances ~~- with Revisions through September 1999~~	IMC	IRC						
30-~~04~~ 95	Metal Safety Cans - with Revisions through December 2004	IFC							
80-20~~04~~ 07	Steel Tanks for Oil-Burner Fuel	IRC							
127-~~96~~ 08	Factory-Built Fireplaces ~~- with Revisions through November 2006~~	IMC	IRC	IBC	IFGC				
174-04	Household Electric Storage Tank Water Heaters - with Revisions through ~~November 2005~~ April 2009	IMC	IRC						
181-2005	Factory-Made Air Ducts and Connectors - with revisions through October 2008	IMC	IRC						
181A-2005	Closure Systems for Use with Rigid Air Ducts - with revisions through February 2008	IMC	IRC						
181B-2005	Closure Systems for Use with Flexible Air Ducts and Air Connectors - with revisions through February 2008	IMC	IRC						
207-~~2001~~ 2009	Refrigerant-Containing Components and Accessories, Nonelectrical~~-with Revisions through November 2004~~	IMC							
217–2006	Single and Multiple Stations Smoke Alarms - with revisions through ~~May 2007~~ October 2008	IBC	IRC	IFC					
263~~–~~2003	Standard for Fire Tests of Building Construction and Materials	IBC	IRC	IMC					
268A-~~1998~~ 2008	Smoke Detectors for Duct Application - ~~with Revisions through April 2006~~	IMC							
300-2005	Fire Testing of Fire Extinguishing Systems for Protection of ~~Restaurant~~ Commercial Cooking Equipment	IBC	IFC						
305-~~07~~ 97	Panic Hardware - with revisions through January 2007	IBC							
325-2002	Door, Drapery, Gate, Louver and Window Operators and Systems - with Revisions through ~~February 2006~~ January 2009	IRC	IFC	IBC					
343-~~1997~~ 2008	Pumps for Oil-Burning Appliances~~- with Revisions through May 2006~~	IMC	IRC						
412-2004	Refrigeration Unit Coolers - with Revisions through ~~February 2007~~ January 2009	IMC							
471-2006	Commercial Refrigerators and Freezers - with Revisions through ~~March 2006~~ October 2008	IMC							
508—99	Industrial Control Equipment - with Revisions through ~~July 2005~~ September 2008	IMC	IPC	IRC					
555–2006	Fire Dampers - with revisions through February 2009	IBC	IMC						
555C–2006	Ceiling Dampers - with revisions through March 2009	IBC	IMC						
555S–1999	Smoke Dampers - with Revisions through ~~July 2006~~ March 2009	IBC	IMC						

586–1996	High-Efficiency, Particulate, Air Filter Units - with Revisions through August ~~2004~~ 2008	IMC							
651–05	Schedule 40 and 80 Rigid PVC Conduit and Fittings - with revisions through July 2008	IFGC	IRC						
710B-2004	Recirculating Systems with Revisions through April 2006	IMC	IFC	IBC					
723—~~03~~ 2008	Standard for Test for Surface Burning Characteristics of Building Materials, ~~with Revisions through May 2005~~	IBC	IFC	IWUIC	IRC	IMC			
729-03	Oil-Fired Floor Furnaces – with revisions through ~~January 1999~~ October 2008	IMC	IRC						
730-03	Oil-Fired Wall Furnaces-with revisions through ~~January 1999~~ October 2008	IMC	IRC						
731-1995	Oil-Fired Unit Heaters with Revisions ~~through February 2006~~ December 2008	IMC	IECC						
737-~~1996~~ 2007	Fireplaces Stoves ~~– with Revisions through January 2000~~	IMC	IRC						
790-04	Standard Test~~s~~ Methods for Fire Tests ~~Resistance~~ of Roof Coverings ~~Materials~~ - with revisions through October 2008	IBC	IRC						
793-~~03~~ 08	Automatically Operated Roof Vents For Smoke and Heat ~~with Revisions through April 2004~~	IBC	IFC						
834-04	Heating, Water Supply, and Power Boilers - Electric with Revisions through ~~March 2006~~ April 2009	IRC	IMC						
858-05	Household Electric Ranges - with Revisions through ~~April 2006~~ November 2007	IMC							
864-03	Standard for Control Units and Accessories for Fire Alarm Systems-with Revisions through ~~March 2006~~ May 2007	IBC	IFC						
867-00	Electrostatic Air Cleaners-with Revisions through ~~February 2004~~ December 2007	IMC							
875-~~04~~ 09	Electric Day Bath Heaters - with ~~Revisions through March 2006~~	IMC	IRC						
896-1993	Oil-Burning Stoves - with Revisions through ~~May 2004~~ December 2008	IMC	IRC						
900-04	Air Filter Units - with revisions through November 2007	IMC	IFC						
923-~~2002~~ 2008	Microwave Cooking Appliances ~~- with Revisions through February 2006~~	IMC	IRC						
924-06	Emergency Lighting and Power Equipment - with revisions through January 2009	IBC	IFC						

1040-1996	Fire Test of Insulated Wall Construction - with Revisions through ~~June 2001~~ September 2007	IBC	IRC						
1240-2005	Electric Commercial Clothes~~-Drying Equipment~~	IMC							
1261-2001	Electric Water Heaters for Pools and Tubs - with Revisions through ~~April 2006~~ May 2008	IMC	IRC						
1313-93	Standard for Nonmetallic Safety Cans for Petroleum Products-with Revisions through ~~May 2003~~ August 2007	IFC							
1315-95	Standard for Safety for Metal Waste Paper containers-with Revisions through ~~December 2003~~ August 2007	IFC							
1363-2007	Relocatable Power Taps - with revisions through August 2008	IFC							
1453-04	Electric Booster and Commercial Storage Tank Water Heaters - with Revisions through ~~May 2006~~ April 2009	IMC	IRC						
1479-03	Fire Tests of Through-Penetration Firestops with Revisions through ~~April 2007~~ December 2008	IBC	IRC						
1715-1997	Fire Test of Interior Finish Material - with Revisions through ~~March 2004~~ April 2008	IBC	IRC						
1738-~~06~~ 1993	Venting Systems for Gas-Burning Appliances, Categories II, III and IV - with revisions through October 2006	IRC	IFGC						
1777-~~04~~ 2007	Chimney Liners	IMC	IRC	IBC	IFGC				
1812-~~05~~ 1995	Standard for Ducted Heat Recovery Ventilators - with revisions through ~~January 2006~~ March 2009	IMC							
1820-2004	Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics - with revisions through February 2009	IMC							
1887-2004	Fire Tests of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics~~-~~ - with revisions through February 2009	IMC							
1897-2004	Uplift Tests for Roof Covering Systems - with revisions through May 2008	IBC							
1978-~~95~~ 05	Grease Ducts	IMC							
2017-~~2000~~ 2008	Standards for General-Purpose Signaling Devices and Systems~~-with Revisions through August 2005~~	IBC	IRC						
2034-2008	Standard for Single and Multiple Station Carbon Monoxide Alarms~~-~~ - with revisions through February 2009	IRC							

2043-~~1996~~ 2008	Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces ~~- with Revisions through June 2001~~	IBC	IMC						
2075-~~2007~~ 2004	Standard for Gas and Vapor Detectors and Sensors - with revisions through September 2007	IFC							
2079-2004	Tests for Fire Resistance of Building Joint Systems with Revisions through ~~March 2006~~ June 2008	IBC	IFC						
2158-1997	For Electric Clothes Dryers - with Revisions through ~~May 2004~~ March 2009	IMC							
2200-~~04~~ 98	Stationary Engine Generator Assemblies with Revisions through July 2004	IBC	IFC	IMC	IFGC				
WDMA	**Window and Door Manufacturers Association**								
Standard Reference Number	**Title**	**Referenced in Code(s):**							
AAMA/WDMA/CSA 101/i.S.2/A440-~~08~~ 11	North American Fenestration	IBC	IRC	IECC					

Reason: *The CP 28 Code Development Policy, Section 4.5.1 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 May 2009, 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. Above is the list of the referenced standards that are to be updated based upon responses from standards developer*

Public Hearing: Committee: AS AM D
Assembly: ASF AMF DF

Public Hearing Results

Committee Action: **Approved as Modified**

Modify the proposal as follows:

Add ANSI Standard as follows:
A137.1 – ~~88~~ 2008 Standard Specifications for Ceramic Tile (Referenced in IBC)

Committee Reason: The update of standards is necessary to keep the I-Codes current with industry.

Assembly Action: **None**

Individual Consideration Agenda

These items are on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

AISI

Bonnie Manley, representing American Iron and Steel Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

AISI S100-07/S~~1~~2-10 North American Specification for the Design of Cold Formed Steel Structural Members, with Supplement 2~~1~~, dated 2010

Commenter's Reason: The purpose of this comment is to update the Standard Reference Number and Title to reflect the latest edition of AISI S100.

Public Comment 2:

AISI

Bonnie Manley, representing American Iron and Steel Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

AISI S213-07/S1-09~~10~~ North American Standard for Cold Formed Steel Framing – Lateral Design, with Supplement 1, dated 2009 ~~2010~~

Commenter's Reason: The purpose of this comment is to update the Standard Reference Number and Title to reflect the latest edition of AISI S213.

Public Comment 3:

AISI

Bonnie Manley, representing American Iron and Steel Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

AISI S213-07/S2-11 ~~10~~ North American Standard for Cold Formed Steel Framing – Lateral Design, with Supplement 2 ~~1~~, dated 2011 ~~2010~~

Commenter's Reason: The purpose of this comment is to update the Standard Reference Number and Title to reflect the latest edition of AISI S213.

Public Comment 4:

AISC

Bonnie Manley, AISI, representing American Iron and Steel Construction requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

ANSI/AISC 341-10
ANSI/AISC 360-10

Commenter's Reason: The purpose of this comment is to add the organization and ANSI designation to the Standard Reference Number.

Public Comment 5:

ANSI

Paul Cabot, representing American Gas Association requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

LC 1/CSA 6.26 -~~97~~ 05	~~Interior Gas Piping Systems Using Corrugated Stainless Steel Tubing with Addenda LC1a-1999 and LC1b-2001~~ Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)
Z21.1- ~~03~~ 05	Household Cooking Gas Appliances ~~– with Addenda Z21.1a-2003 and Z21.1b-2003~~
Z21.5.1/CSA 7.1 – ~~02~~ 06	Gas Clothes Dryers — Volume I — Type 1 Clothes Dryers ~~with Addenda Z21.5.1a-2003~~
Z21.5.2/CSA 7.2 – ~~01~~ 05	Gas Clothes Dryers — Volume II — Type 2 Clothes Dryers ~~– with Addenda Z21.5.2a-2003 and Z21.5.2b-2003~~
Z21.10.1/CSA 4.1 - ~~04~~ 09	Gas Water Heaters — Volume I — Storage, Water Heaters with Input Ratings of 75,000 Btu per Hour or Less

Z21.10.3/CSA 4.3 – ~~01~~ 04	Gas Water Heaters — Volume III — Storage, Water Heaters with Input Ratings above 75,000 Btu per Hour, Circulating and Instantaneous ~~– with Addenda Z21.10.3a-2003 and Z21.10.3b-2004~~
Z21.11.2 – ~~02~~ 07	Gas-Fired Room Heaters - Volume II, Unvented Room Heaters ~~– with Addenda Z21.11.2a-2003~~
Z21.13/CSA 4.9 – ~~04~~ 10	Gas-Fired Low-Pressure Steam and Hot Water Boilers
Z21.15/CGA 9.1 – ~~97(R2002)~~ 09	Manually Operated Gas Valves for Appliances, Appliance Connector Valves, and Hose End Valves ~~– with Addenda Z21.15a-2001(R2003)~~
Z21.19/CSA 1.4 – 02(R2007)	Refrigerators Using Gas Fuel
Z21.24/CGA 6.10 – ~~97~~ 06	Connectors for Gas Appliances
Z21.40.1/CGA 2.91 – 96 (R2002)	Gas-Fired, Heat Activated Air-Conditioning and Heat Pump Appliances ~~– with Addendum Z21.40.1a-1997 (R2002)~~
Z21.40.2/CGA 2.92 – 96 (R2002)	Gas-Fired, Work Activated Air-Conditioning and Heat Pump Appliances (Internal Combustion) ~~– with Addenda Z21.40.2a-1997 (R2002)~~
Z21.47/CSA 2.3 – ~~03~~ 06	Gas-Fired Central Furnaces
Z21.50/CSA 2.22 – ~~03~~ 07	Vented Gas Fireplaces ~~– with Addenda Z21.50a-2003~~
Z21.56/CSA 4.7 – ~~01~~ 06	Gas-Fired Pool Heaters ~~– with Addenda Z21.56a-2004 and Z21.56b-2004~~
Z21.58/CSA 1.6 – ~~95(R2002)~~ 07	Outdoor Cooking Gas Appliances ~~– with Addenda Z21.58a-1998 (R2002) and Z21.58b-2002~~
Z21.60/CSA 2.26 – 03	Decorative Gas Appliances for Installation in Solid-Fuel Burning Fireplaces ~~– with Addenda Z21.60a-2003~~
Z21.61 – 83(R~~1996~~ 2004)	~~Toilets,~~ Gas-Fired Toilets
Z21.69/CSA 6.16 – ~~02~~ 09	Connectors for Movable Gas Appliances ~~– with Addenda Z21.69a-2003~~
Z21.75/CSA 6.27 – ~~01~~ 07	Connectors for Outdoor Gas Appliances and Manufactured Homes
Z21.80 – 03(R2008)	Line Pressure Regulators
Z21.86 – ~~04~~ 08	Vented Gas-Fired ~~Vented~~ Space Heating Appliances
Z21.88/CSA 2.33 – ~~02~~ 09	Vented Gas Fireplace Heaters ~~– with Addenda Z21.88a-2003 and Z21.88b-2004~~
Z21.91 – ~~01~~ 07	Ventless Firebox Enclosures for Gas-Fired Unvented Decorative Room Heaters
Z83.4/CSA 3.7 - 03	Non-Recirculating Direct Gas-Fired Industrial Air Heaters
Z83.8/CSA 2.6 – ~~02~~ 09	Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces
Z83.11/CSA 1.8 – ~~02~~ 06	Gas Food Service Equipment ~~– with Addenda Z83.11a-2004~~
Z83.18 – ~~00~~ 04	Recirculating Direct Gas-Fired Industrial Air Heaters ~~– with Addenda Z83.18a-2001 and Z83.18b-2003~~

Commenter's Reason: To update the fuel-gas appliances and equipment ANSI Standards to their current approval date/title and to add the CSA (or CGA) standard designation.

Public Comment 6:

ASTM

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association (AAMA) requests Approval as Modified by this Public Comment.

F 2006-00(2005) ~~08~~ 10	Standard/Safety Specification for Window Fall Prevention Devices for Non-Emergency Escape (Egress) and Rescue (Ingress) Windows
F 2090-01a(2007) ~~08~~ 10	Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms

Commenter's Reason: This Public Comment seeks the update of ASTM F2006 and ASTM F2090 to the 2010 Edition. The 2010 edition of ASTM F2090 includes more specific requirements for Window Opening Control Devices (WOCDs) than are contained in the 2008 edition. RB122, Part I and II, which were approved during the Code Development Hearings and whose approval was upheld during the Final Action Hearings, rely upon ASTM F2090 to establish the criteria for WOCDs.

ASTM F2006 is a companion standard to ASTM F2090, and gives the criteria for window fall prevention devices on operable windows that are not required to be Emergency Escape and Rescue Openings. While ASTM F2090 addresses the more difficult task of reducing the likelihood of falls through operable windows that are required to be Emergency Escape and Rescue Openings, ASTM F2006 has been developed, and is being maintained, as a companion standard that has also been recently revised. Its update in the 2012 I-codes is appropriate.

Public Comment 7:

SJI

Bonnie Manley, AISI representing Steel Joist Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

CJ-2010
JG-2010
K-2010
LH/DHL-2010

Commenter's Reason: The purpose of this comment is to add the full year to the Standard Reference Number.

Public Comment 8:

UL

Robert Eugene, representing Underwriters Laboratories requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

9~~–2000~~ 2009	Fire Tests of Window Assemblies~~, with Revisions through April 2005~~
17-~~1994~~ 2008	Vent or Chimney Connector Dampers for Oil-Fired Appliances
30-95	Metal Safety Cans - with Revisions through ~~December 2004~~ July 2009
80-07	Steel Tanks for Oil-Burner Fuels and Other Combustible Liquids - with revisions through ~~January 2008~~ August 2009
103-2001	Factory-Built Chimneys, for Residential Type and Building Heating Appliances with Revisions through ~~June 2006~~ March 2010
127-08	Factory-Built Fireplaces –with revisions through January 2010
197-~~2003~~ 2010	Commercial Electric Cooking Appliances~~– with revisions through March 2006~~
217–2006	Single and Multiple Station Smoke Alarms - with revisions through ~~October 2008~~ April 2010
263–2003	Standard for Fire Tests of Building Construction and Materials, with revisions through October 2007
268-~~2006~~ 2009	Smoke Detectors for Fire Alarm Signaling Systems
268A-2008	Smoke Detectors for Duct Application, with revisions through September 2009
325-2002	Door, Drapery, Gate, Louver and Window Operators and Systems - with Revisions through ~~January 2009~~ February 2010
391-2006	Solid-Fuel and Combination-Fuel Central and Supplementary Furnaces, with revisions through March 2010
441-~~1996~~ 2010	Gas Vents ~~– with Revisions through August 2006~~
471-2006	Commercial Refrigerators and Freezers - with Revisions through ~~October 2008~~ March 2010
508—99	Industrial Control Equipment - with Revisions through ~~September 2008~~ April 2010
555–2006	Fire Dampers - with revisions through ~~February 2009~~ May 2010
555C–2006	Ceiling Dampers - with revisions through ~~March 2009~~ May 2010
555S–1999	Smoke Dampers - with Revisions through ~~March 2009~~ May 2010
580–2006	Tests for Uplift Resistance of Roof Assemblies with revisions through July 2009
586-~~1996~~ 2009	High-Efficiency, Particulate, Air Filter Units ~~– with Revisions through August 2008~~
641-1995	Type L Low-Temperature Venting Systems - with Revisions through ~~August 2005~~ July 2009

651-05	Schedule 40 and 80 Rigid PVC Conduit and Fittings - with revisions through ~~July 2008~~ March 2010
710-1995	Exhaust Hoods for Commercial Cooking Equipment - with Revisions through ~~February 2007~~ December 2009
710B-2004	Recirculating Systems with Revisions through ~~April 2006~~ December 2009
726-1995	Oil-Fired Boiler Assemblies - with Revisions through ~~March 2006~~ April 2010
727-2006	Oil-Fired Central Furnaces – with revisions through April 2010
729-03	Oil-Fired Floor Furnaces - with revisions through ~~October 2008~~ April 2010
730-03	Oil-Fired Wall Furnaces - with revisions through ~~October 2008~~ April 2010
731-1995	Oil-Fired Unit Heaters - with revisions through ~~December 2008~~ April 2010
732-1995	Oil-Fired Storage Tank Water Heaters - with Revisions through ~~February 2005~~ April 2010
737-2007	Fireplaces Stoves with revisions through January 2010
762-~~03~~ 2010	Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances
791-2006	Residential Incinerators – with revisions through April 2010
795-2006	Commercial-Industrial Gas Heating Equipment – with revisions through April 2010
834-04	Heating, Water Supply, and Power Boilers - Electric with Revisions through ~~April~~ December 2009
858-05	Household Electric Ranges - with Revisions through ~~November 2007~~ May 2010
864-03	Standard for Control Units and Accessories for Fire Alarm Systems-with Revisions through ~~May 2007~~ February 2010
867-00	Electrostatic Air Cleaners-with Revisions through ~~December 2007~~ February 2010
875-~~04~~ 2009	Electric Dry-Bath Heaters - with Revisions through ~~May 2008~~ October 2009
896-1993	Oil-Burning Stoves - with Revisions through ~~December 2008~~ May 2010
900-04	Air Filter Units - with revisions through November ~~2007~~ 2009
923-2008	Microwave Cooking Appliances – with revisions through June 2010
959-2001	Medium Heat Appliance Factory-Built Chimneys - with Revisions through ~~September 2006~~ June 2010
1240-2005	Electric Commercial Clothes-Drying Equipment – with revisions through October 2009
1275-2005	Flammable Liquid Storage Cabinets with Revisions through ~~May 2006~~ February 2010
1363-2007	Relocatable Power Taps - with revisions through ~~August 2008~~ October 2009
1453-04	Electric Booster and Commercial Storage Tank Water Heaters - with Revisions through ~~April~~ December 2009
1479-03	Fire Tests of Through-Penetration Firestops - with Revisions through ~~December 2008~~ March 2010
1482-~~96~~ 2010	Solid-Fuel Type Room Heaters ~~– with Revisions through November 2006~~
1777-04	Chimney Liners – with revisions through July 2009
1784-2001	Air Leakage Tests of Door Assemblies - with Revisions through ~~December 2004~~ July 2009
1812-~~1995~~ 2009	Standard for Ducted Heat Recovery Ventilators - with revisions through ~~March 2009~~ June 2010
1815-~~01~~ 2009	Standard for Nonducted Heat Recovery Ventilators~~-with Revisions through January 2006~~
1978-05	Grease Ducts – with revisions through June 2009
1994-04	Luminous Egress Path Marking Systems - with Revisions through ~~February 2005~~ April 2010
1995-2005	Heating and Cooling Equipment – with revisions through July 2009
2017-2008	Standard for General-Purpose Signaling Devices and Systems – with revisions through October 2009
2200-98	Stationary Engine Generator Assemblies - with Revisions through ~~July 2004~~ December 2009
2208-2005	Solvent Distillation Units - with Revisions through December ~~2006~~ 2009

2335-01 Fire Tests of Storage Pallets-with Revisions through ~~September 2004~~ March 2010

Commenter's Reason: Update reference standards to include most recent revisions.

Final Action: AS AM AMPC____ D

Z2-09/10

801.4.3 (New), Chapter 14

Proposed Change as Submitted

Proponent: Stephen V. Skalko, PE, representing Portland Cement Association

1. Revise as follows:

801.4 Design of parking facilities. The design of parking facilities shall be in accordance with Sections 801.4.1 through ~~801.4.7~~ 801.4.8.

801.4.1 Driveway width. Every parking facility shall be provided with one or more access driveways, the width of which shall be the following:

1. Private driveways at least 9 feet (2743 mm).
2. Commercial driveways:
   - 2.1. Twelve feet (3658 mm) for one-way enter/exit.
   - 2.2. Twenty-four feet (7315 mm) for two-way enter/exit.

801.4.2 Driveway and ramp slopes. The maximum slope of any *driveway* or ramp shall not exceed 20 percent. Transition slopes in driveways and ramps shall be provided in accordance with the standards set by the code official and the jurisdiction's engineer.

2. Add new text as follows:

801.4.3 Minimum pavement design. The design of ground supported pavement for parking facilities shall comply with Sections 801.4.3.1 through 801.4.3.3

Exceptions:

1. Concrete pavements designed in accordance with ACI 330R.
2. Asphalt pavements designed in accordance with IS-181.

801.4.3.1. Sub-base. The soil supporting the pavement for parking facilities shall have a minimum California Bearing Ratio (CBR) of 3 determined in accordance with ASTM D1883 and a minimum resistance value (R) of 6 determined in accordance with ASTM D2844.

801.4.3.2 Concrete surfaces. The minimum compressive strength of the concrete (f'_c) for concrete pavements shall be 4000 psi. The minimum thickness of the concrete pavement shall be 4.0 inches

801.4.3.3 Asphalt concrete surfaces. The asphalt pavement shall comply with Section 801.4.3.3.1 or 801.4.3.3.2.

801.4.3.3.1 Full depth asphalt pavement: Where full depth asphalt pavements are constructed using asphalt concrete and emulsified asphalt base mixes the minimum thickness of the asphalt pavement shall be one of the following:

1. A minimum of 1 inch of asphalt concrete for the top surface and 3.5 inches of asphalt concrete or Type I emulsified asphalt mix for the base.
2. A minimum of 2 inches of asphalt concrete for the top surface and 2.5 inches of Type II emulsified asphalt mix for the base.
3. A minimum of 2 inches of asphalt concrete for the top surface and 4.5 inches of Type III emulsified asphalt mix for the base.

801.4.3.3.2 Asphalt pavement with untreated aggregate base and sub-base: Where asphalt pavements are constructed using asphalt concrete placed over untreated aggregate bases and sub-bases the thickness of the asphalt pavement shall be a minimum of 1 inch of asphalt concrete for the top surface, 2.5 inches of asphalt concrete base and 4.0 inches of untreated aggregate base. The untreated aggregate base shall comply with ASTM D2940.

(Renumber subsequent sections)

2. **Add the following standards to Chapter 14 as follows:**

ACI

330-08	Guide for the Design and construction of Concrete Parking Lots

AI

IS-181-81	Asphalt Pavement Thickness Design. A simplified and Abridged Version of 1981 Edition AI Thickness Design Manual

ASTM

D1833-87 (2007)	Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils
D2844-07	Standard Test Method for resistance R-value and Expansion Pressure of Compacted Soils
D2940-03	Standard Specification for Graded Aggregate Material for Bases or Sub-bases for Highways or Airports

Reason: The *International Zoning Code* provides the minimum requirements for the design of parking facilities. However, the provisions are not complete without specifying the minimum requirements for the pavement thickness. This proposal places requirements for concrete and asphalt pavement thicknesses into the IZC to make it more complete for parking facilities and to give jurisdictions guidance on the commonly used pavement sections.

The provisions were based on the pavement design procedures in ACI 330R-08, *Guide for the Design and Construction of Concrete Parking Lots,* published by American Concrete Institute, and *Asphalt Pavement Thickness Design,* 2nd Edition, January 1983 by The Asphalt Institute. The design assumed minimum acceptable soil conditions for the sub-base (CBR = 3 and R = 6). In addition, the designs assumed a light volume of heavy truck traffic (Traffic Category A for concrete and Traffic Class I for asphalt).

The minimum compressive strength of the concrete was set at 4,000 psi to insure a minimum level of durability for the pavement.

Cost Impact: The code change proposal should not increase the cost of construction if proper pavement design is presently followed in a jurisdiction.

ICCFILENAME: SKALKO-Z1-801.4.3

Public Hearing Results

Note: The following analysis was not in the Code Change monograph but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf :

Analysis ACI 330-08: Standard was not received by ICC.
Analysis AI IS-181-81: Standard was not received by ICC.
Analysis ASTM D1833-87 (2007): Standard was not received by ICC.
Analysis ASTM D2844-07: Standard was not received by ICC.
Analysis ASTM D2940-03: Review of the proposed new standard indicated that, in the opinion of ICC staff, the standard did comply with ICC standards criteria.

Committee Action: **Disapproved**

Committee Reason: The committee felt that specifications on pavement design and construction were beyond the scope of this code.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Stephen V. Skalko, PE, representing Portland Cement Association requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

801.4.3 Minimum Pavement Design. The design of ground supported portland cement and asphalt concrete pavements for parking facilities shall comply with Sections 801.4.3.1 through 801.4.3.3

Exceptions

~~1. Concrete pavements designed in accordance with ACI 330R.~~
~~2. Asphalt pavements designed in accordance with IS-181~~.

801.4.3.1. Sub-base. The soil supporting the pavement for parking facilities shall have a minimum California Bearing Ratio (CBR) of 3 determined in accordance with ASTM D1883 and a minimum resistance value (R) of 6 determined in accordance with ASTM D2844.

801.4.3.2 Concrete Surfaces. The minimum compressive strength of the concrete (f'_c) for concrete pavements shall be 4000 psi. The minimum thickness of the concrete pavement shall be 4.0 inches

801.4.3.3 Asphalt Concrete Surfaces. The asphalt pavement shall comply with 801.4.3.3.1 or 801.4.3.3.2.

801.4.3.3.1 Full Depth Asphalt Pavement: Where full depth asphalt pavements are constructed using asphalt concrete and emulsified asphalt base mixes the minimum thickness of the asphalt pavement shall be one of the following:

1. A minimum of 1 inch of asphalt concrete for the top surface and 3.5 inches of asphalt concrete or Type I emulsified asphalt mix for the base.
2. A minimum of 2 inches of asphalt concrete for the top surface and 2.5 inches of Type II emulsified asphalt mix for the base.
3. A minimum of 2 inches of asphalt concrete for the top surface and 4.5 inches of Type III emulsified asphalt mix for the base.

801.4.3.3.2 Asphalt Pavement With Untreated Aggregate Base and Sub-Base: Where asphalt pavements are constructed using asphalt concrete placed over untreated aggregate bases and sub-bases the thickness of the asphalt pavement shall be a minimum of 1 inch of asphalt concrete for the top surface, 2.5 inches of asphalt concrete base and 4.0 inches of untreated aggregate base. The untreated aggregate base shall comply with ASTM D2940.

CHAPTER 14
REFERENCED STANDARDS

~~**ACI**~~	~~American Concrete Institute 388000 Country Club Drive Farmington Hills, MI 48331~~	
~~**Standard reference number**~~	~~**Title**~~	~~**Referenced in code section number**~~
~~ACI 330-08~~	~~*Guide for the Design and Construction of Concrete Parking Lots*~~	~~801.4.1~~

~~**AI**~~	~~The Asphalt Institute 2696 Research Park Drive Lexington, KY 40511~~	
~~**Standard reference number**~~	~~**Title**~~	~~**Referenced in code section number**~~
~~IS-181-81~~	~~*Asphalt Pavement Thickness Design.* A Simplified and Abridged Version of 1981 Edition AI Thickness Design Manual~~	~~801.4.1~~

ASTM	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428-2959	
Standard reference number	**Title**	**Referenced in code section number**
D1833-87 (2007)	Standard Test Method for CBR (California Bearing Ratio) of Laboratory-Compacted Soils	801.4.3.1
D2844-07	Standard Test Method for Resistance R-value and Expansion	801.4.3.1

	Pressure of Compacted Soils	
D2940-03	Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways or Airports	801.4.3.3.2

Commenters Reason: The International Zoning Code provides the minimum requirements for the design of parking facilities. However, the provisions are not complete without specifying the minimum requirements for the pavement thickness. This proposal places needed minimum requirements for concrete and asphalt pavement thicknesses into the IZC to make it more complete for parking facilities and to give jurisdictions guidance on the commonly used pavement sections.

These requirements can be viewed as necessary minimum serviceability requirements, similar to the requirements for minimum thickness of slab-on-ground construction in buildings in the International Building Code or the International Residential Code. The International Zoning Code is the most appropriate place for these needed minimum pavement thicknesses in lieu of either the IBC or the IRC.

The primary reason for the original code change was to insure that pavements are constructed to the proper minimum thickness. That objective is accomplished with the requirements specified in Sections 801.4.3.2 and 801.4.3.3. These absolute minimum thicknesses are consistent with industry design practices as identified in:

American Concrete Institute ACI 330-08 ***Guide for the Design and Construction of Concrete Parking Lots*** and the

Asphalt Institute *Asphalt Pavement Thickness Design*. A minimum Simplified and Abridged Version of the 1981 Edition of AI Thickness Design Manual.

Though the technical references included in the original code change are commonly used for pavement design there is no reason to limit pavement design to these two references therefore they are being deleted from the original code change.

Setting minimum criteria for the thickness of materials for parking areas and drives will increase serviceability, result in minimum durability requirements and reduce vehicular and pedestrian hazards related to rapid deterioration, unraveling, cracking, and faulting of the pavements. We recommend the members overturn the committee action and APPROVE AS MODIFIED by this proposal IZC-02.

Final Action: AS AM AMPC____ D

EC1-09/10 PART I
Table 301.1, Figure 301.1;

Proposed Change as Submitted

Proponent: Thomas F. Johnson, Code Official for the Town of Durham, NH, representing the NH Seacoast Code Officials Association and NH Building Officials Association

PART I – IECC

1. Revise as follows:

TABLE 301.1
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID DESIGNATIONS
BY STATE, COUNTY AND TERRITORY

NEW HAMPSHIRE

~~6A Belknap~~
~~6A Carroll~~
~~5A Cheshire~~
~~6A Coos~~
~~6A Grafton~~
~~5A Hillsborough~~
~~6A Merrimack~~
~~5A Rockingham~~
~~5A Strafford~~
~~6A Sullivan~~

6A All

(Portions of table not shown remain unchanged)

2. Figure 301.1 shading of the 4 NH southern counties should also be changed to reflect Zone 6 shading statewide.

Reason
(Part I): The State of New Hampshire thru the N.H. Public Utilities Commission and N.H. Building Code Review Board had previously amended the adopted 2000 IECC, and then the adopted 2006 IECC Table 301.1 and Figure 301.1 to delete all of the Zone 5 counties and effectively placed all of New Hampshire in Zone 6. It is expected that the current 2009 IECC soon to be adopted will similarly be amended. By not carrying this statewide amendment into the 2012 IECC document provides improper guidance to all those users of the I-Codes that may not be aware of the statewide amendments during design drawings or installations using the printed code document text and tables based on our enforcement experiences with the 2000 and 2006 IECC.

Cost Impact: The change in the IECC and the IRC will not impact the cost of construction; the State of New Hampshire has already mandated the proposed change therefore no increase to NH construction. In fact, the change will reduce the cost of construction by eliminating errors using the current code text during the design phase of construction which gets rejected during code plan review; or improper installations rejected upon code compliance inspections.

ICCFILENAME: JOHNSON(THOMAS)-EC-1-T. 301.1-RE-1-T. N1101.2

Public Hearing Results

PART I - IECC
Committee Action: **Disapproved**

Committee Reason: The proponent requested changes in a technical map based upon administrative issues in a local state. Maps should not be changed based upon administrative issues.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Jonathan Osgood, representing New Hampshire Public Utilities Commission, requests Approval as Submitted

Commenter's Reason: Please adopt the referenced code change for the reasons indicated:

The proposed amendment terminates the preposterous practice of the code dividing of the state into two climate zones, the extreme northern edge of Zone 5 and the southern border of Zone 6, with only Cheshire, Hillsborough, Rockingham and Strafford counties in Zone 5. Zone 5 also incorporates substantial portions of New Mexico, Arizona and most of Nevada while Zone 6 includes all of Vermont, most of New York and all but Aroostook County Maine (which is in colder Zone 7). Even when the energy code included over 20 climate zones with more modest climate differences than those in today's codes, it was clear to elected officials that a single zone for the state made common sense. One glance at Figure 301.1 clearly demonstrates that the boundaries of Zone 6 were drawn to maintain the integrity of the state lines of both Maine and Vermont resulting in a protrusion of Zone 5 into New Hampshire. The integrity of New Hampshire's boundaries should also be maintained.

This amendment will make the code consistent with the long-time practice of State of New Hampshire of limiting itself to only one climate zone, that being Zone 6 in the 2006 consistent with state law, and the amendments made to the IECC and IRC 2006 by the state's Building Code Review Board. Since 1986, when the New Hampshire legislature adopted RSA 155-D:4,IX, the energy code was limited to only one climate zone for residential purposes. The single zone was further defined under the rules of the Public Utilities Commission (PUC) Puc1802.02(a)(13) that reads: *The exterior design conditions attributable to residential construction described in chapter* 3 *section 302 of the M(odel) E(nergy) C(ode) shall be those attributable to Concord New Hampshire* [which is in Merrimack County in Zone 6].

It is inappropriate to split a small geographic region like this state because it can cause confusion and inconsistent practices by designers, suppliers, and builders in New Hampshire, many of whom also work in Maine or Vermont. It also fails to recognize the essentially homogeneous climate of the New Hampshire. Given the geographic areas included in the two zones, Zone 6 is the more representative of New Hampshire's climate. Also the climate of southwestern Maine (e.g. Kittery) and southeastern Vermont (e.g. Brattleboro), both in Zone 6, is essentially identical to neighboring communities in southern New Hampshire Zone 5 (e.g. Portsmouth and Keene). To use Zone 5 requirements anywhere in the state, allows the construction of clearly less efficient homes. When code administration agencies such as the PUC are facing the federal mandate to achieve 90% code compliance by 2017, a sensible code simplification as proposed in amendment EC1 is appropriate.

Based on the history of the application of Climate Zones in the State of New Hampshire, the Public Utilities Commission, as legal administrator of the energy code, urges the International Code Council to adopt amendment EC1 09-10.

Final Action: AS AM AMPC____ D

EC1-09/10 PART II
IRC Table N1101.2, Figure N1101.2

<u>Proposed Change as Submitted</u>

Proponent: Thomas F. Johnson, Code Official for the Town of Durham, NH, representing the NH Seacoast Code Officials Association and NH Building Officials Association

PART II – IRC BUILDING/ENERGY

1. Revise as follows:

**TABLE N1101.2
CLIMATE ZONES, MOISTURE REGIMES AND WARM-HUMID
DESIGNATIONS BY STATE, COUNTY AND TERRITORY**

NEW HAMPSHIRE
~~6A Belknap~~
~~6A Carroll~~
~~5A Cheshire~~
~~6A Coos~~
~~6A Grafton~~
~~5A Hillsborough~~
~~6A Merrimack~~
~~5A Rockingham~~
~~5A Strafford~~
~~6A Sullivan~~
<u>6A All</u>

(Portions of table not shown remain unchanged)

2. Figure N1101.2 shading of the 4 NH southern counties should also be changed to reflect Zone 6 shading statewide.

Reason (Part II): The State of New Hampshire thru the N.H. Public Utilities Commission and N.H. Building Code Review Board had previously amended the adopted 2000 IRC, and then the adopted 2006 IRC to delete all of the Zone 5 counties and effectively placed all of New Hampshire in Zone 6. It is expected that the current 2009 IRC soon to be adopted will similarly be amended. By not carrying this statewide amendment into the 2012 IRC document provides improper guidance to all those users of the I-Codes that may not be aware of the statewide amendments during design drawings or installations using the printed code document text and tables based on our enforcement experiences with the 2000 and 2006 IRC.

Cost Impact: The change in the IECC and the IRC will not impact the cost of construction; the State of New Hampshire has already mandated the proposed change therefore no increase to NH construction. In fact, the change will reduce the cost of construction by eliminating errors using the current code text during the design phase of construction which gets rejected during code plan review; or improper installations rejected upon code compliance inspections.

ICCFILENAME: JOHNSON(THOMAS)-EC-1-T. 301.1-RE-1-T. N1101.2

<u>Public Hearing Results</u>

PART I - IECC
Committee Action: **Disapproved**

Committee Reason: The proponent requested changes in a technical map based upon administrative issues in a local state. Maps should not be changed based upon administrative issues.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Jonathan Osgood, representing New Hampshire Public Utilities Commission, requests Approval as Submitted

Commenter's Reason: Please adopt the referenced code change for the reasons indicated:

The proposed amendment terminates the preposterous practice of the code dividing of the state into two climate zones, the extreme northern edge of Zone 5 and the southern border of Zone 6, with only Cheshire, Hillsborough, Rockingham and Strafford counties in Zone 5. Zone 5 also incorporates substantial portions of New Mexico, Arizona and most of Nevada while Zone 6 includes all of Vermont, most of New York and all but Aroostook County Maine (which is in colder Zone 7). Even when the energy code included over 20 climate zones with more modest climate differences than those in today's codes, it was clear to elected officials that a single zone for the state made common sense. One glance at Figure 301.1 clearly demonstrates that the boundaries of Zone 6 were drawn to maintain the integrity of the state lines of both Maine and Vermont resulting in a protrusion of Zone 5 into New Hampshire. The integrity of New Hampshire's boundaries should also be maintained.

This amendment will make the code consistent with the long-time practice of State of New Hampshire of limiting itself to only one climate zone, that being Zone 6 in the 2006 consistent with state law, and the amendments made to the IECC and IRC 2006 by the state's Building Code Review Board. Since 1986, when the New Hampshire legislature adopted RSA 155-D:4,IX, the energy code was limited to only one climate zone for residential purposes. The single zone was further defined under the rules of the Public Utilities Commission (PUC) Puc1802.02(a)(13) that reads: *The exterior design conditions attributable to residential construction described in chapter* 3 *section 302 of the M(odel) E(nergy) C(ode) shall be those attributable to Concord New Hampshire* [which is in Merrimack County in Zone 6].

It is inappropriate to split a small geographic region like this state because it can cause confusion and inconsistent practices by designers, suppliers, and builders in New Hampshire, many of whom also work in Maine or Vermont. It also fails to recognize the essentially homogeneous climate of the New Hampshire. Given the geographic areas included in the two zones, Zone 6 is the more representative of New Hampshire's climate. Also the climate of southwestern Maine (e.g. Kittery) and southeastern Vermont (e.g. Brattleboro), both in Zone 6, is essentially identical to neighboring communities in southern New Hampshire Zone 5 (e.g. Portsmouth and Keene). To use Zone 5 requirements anywhere in the state, allows the construction of clearly less efficient homes. When code administration agencies such as the PUC are facing the federal mandate to achieve 90% code compliance by 2017, a sensible code simplification as proposed in amendment EC1 is appropriate.

Based on the history of the application of Climate Zones in the State of New Hampshire, the Public Utilities Commission, as legal administrator of the energy code, urges the International Code Council to adopt amendment EC1 09-10.

Final Action: AS AM AMPC____ D

EC3-09/10
202 (New), 303.1.3, Table 303.1.3(3)

Proposed Change as Submitted

Proponent: Garrett Stone, Brickfield, Burchette, Ritts & Stone, representing Cardinal Glass Industries

1. Add new definition as follows:

VISIBLE TRANSMITTANCE (VT). The ratio of visible light entering the space through the fenestration product assembly to the incident visible light. VT includes the effects of glazing material and frame and is expressed as a number between 0 and 1.

2. Revise as follows:

303.1.3 Fenestration product rating. *U*-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled *U*-factor shall be assigned a default *U*-factor from Table 303.1.3(1) or 303.1.3(2). The solar heat gain coefficient (SHGC) and *visible transmittance* (VT) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC shall be assigned a default SHGC from Table 303.1.3(3).

TABLE 303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC AND VT

	SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
	Clear	Tinted	Clear	Tinted	
SHGC	0.8	0.7	0.7	0.6	0.6
VT	0.6	0.3	0.6	0.3	0.6

Reason: The visible transmittance (VT) of fenestration products represents the amount of light that enters the building through the fenestration product. It is the key performance parameter in encouraging proper daylighting, which can reduce lighting and internal heat loads. The effective use of daylighting in commercial construction has long been recognized as bringing energy savings and benefits to a building's occupants.
In order to better utilize VT in the code, the code needs to include a definition of VT and specify a method for determining this performance feature. This proposal satisfies both of these needs.

Visible transmittance is currently determined for the fenestration industry according to NFRC 200 – *Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidents*, which is already a referenced standard in the *IECC* and is referenced in *IECC* Section 303.1.3 for determining SHGC. This proposal offers the appropriate modification to the language of 303.1.3 to include VT.

This proposal also establishes default values where rated values are not available. The values proposed for the default table are taken from the *ASHRAE Handbook of Fundamentals*, Table 13, pages 31.26 - 31.28 as the worst-case (lowest) visible light values for any frame with clear and tinted glass and rounded off using the same approach as currently incorporated into the code for SHGC. This produces reasonable, conservative values for VT for default products. Because values for glass block were not available in the *Handbook*, we set the value equal to the double pane clear product.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: STONE-EC-3-202-303.1.3

Public Hearing Results

Committee Action: **Approved as Modified**

Modify the proposal as follows:

1. Add new definition as follows:

VISIBLE TRANSMITTANCE (VT). The ratio of visible light entering the space through the fenestration product assembly to the incident visible light. VT includes the effects of glazing material and frame and is expressed as a number between 0 and 1.

2. Revise as follows:

303.1.3 Fenestration product rating. *U*-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled *U*-factor shall be assigned a default *U*-factor from Table 303.1.3(1) or 303.1.3(2). The solar heat gain coefficient (SHGC) and *visible transmittance* (VT) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC or VT shall be assigned a default SHGC or VT from Table 303.1.3(3).

Committee Reason: The change provides a useful mechanism for measuring how much light is going through the windows. It will encourage the use of daylighting in designs.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Amanda Hickman, InterCode Incorporated, representing 3M Renewable Energy Division and The International Window Film Association, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

TABLE 303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC AND VT

	SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
	Clear	Tinted	Clear	Tinted	
SHGC	0.8	0.7	0.7	0.6	0.6
VT	~~0.6~~ 0.7	~~0.3~~ 0.4	~~0.6~~ 0.7	~~0.3~~ 0.4	0.6

Portion of code change proposal not shown remain unchanged

Commenter's Reason: NFRC 200 already has established default values for both SHGC and VT. It is difficult to understand why the proponent chose to keep the current SHGC values from the NFRC 200 procedure in the table and then decided to use a second source for VT values, namely, the worst case values for VT from the ASHRAE Handbook of Fundamentals. Since NFRC 200 is the cited procedure in the code for determining the SHGC and VT, it would seem very logical to also use the default values for SHGC and VT from the same procedure.

Public Comment 2:

Jonathan McHugh, representing McHugh Energy Consultants Inc., requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

303.1.3 Fenestration product rating. *U*-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled *U*-factor shall be assigned a default *U*-factor from Table 303.1.3(1) or 303.1.3(2). The solar heat gain coefficient (SHGC) ~~and *visible transmittance* (VT)~~ of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. The visible transmittance (VT) of clear planar glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200, the visible transmittance (VT) of all other fenestration products not covered by NFRC 200 including diffusing and projecting fenestration products (windows, glazed doors and skylights) shall be determined by the measurement of the visible transmittance of the glazing assembly materials in accordance with ASTM E972-2007. The VT rating shall be conducted by independent laboratory and labeled and certified by the manufacturer. Products lacking such a labeled SHGC or VT shall be assigned a default SHGC or VT from Table 303.1.3(3).

Add new standard to Chapter 6 as follows:

ASTM
ASTM E972 - 96(2007) Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: Ratioanale: NFRC 200 does not have a test method for measuring the visible transmittance of diffusing glazing or noplanar glazings such as might be found in a plastic dome skylight.[1] A technically valid way to measure the visible light transmittance of diffusing skylights is to measure the glazing of the skylight material under sunlight in the port of an integrating sphere as specified in ASTM E972. It would be allowed to rate the material before it is formed as the thermoforming process increases the transmittance of dome skylights above the transmittance of the base material. This is detailed in the daylighting chapter of the IESNA Handbook.[2]

Plastic dome skylights are the lowest life cycle coast methods of providing daylighting to commercial spaces. Wal-Mart has over 1,000 stores using this technique in conjunction with daylighting dimming of the electric lighting and has effectively replicated this throughout the United States. Similarly COSTCO has over 300 stores using the same technique. The ASHRAE 90.1 standard recognizes the immense energy savings from combining daylighting with electric lighting controls and has exempted skylights from their SHGC requirements and reduced the U-factor requirements for skylights with visible transmittances greater than 40%.

The original proposal indicates this has not cost impact. If however the SHGC requirements are tied to VT as in some proposed daylighting requirements (including those in the soon to be released version of the ASHRAE 90.1), the cost impacts are huge. This proposal would have the restraint of trade impact of preventing the use of plastic skylights on a flat roof as is found on many commercial buildings, the installed cost of the titled curb and glass skylight is approximately three times greater than that of a similar sized plastic dome skylight. In addition, the low sun angle transmittance of the flat skylight is lower and results in less daylighting savings.

The changes proposed here allow all products to be rated and only apply the extremely low VT values where an applicable rating is not received.

The changed prescribed above match closely the path taken by ASHRAE 90.1-2010. ASHRAE 90.1 relies on NFRC 200 for rating fenestration products that are covered by that test method and then relying on the ASTM E972 measurement of solar photometric transmittance of the glazing materials for fenestration that is not covered by NFRC 200 (i.e. non-planar or diffusing glazing).[3]

[1]p.4. Section 2.2.2 "Products and Effects Not Covered (VT)". *NFRC 200-2010 Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence,* National Fenestration Rating Council. http://www.nfrc.org/documents/NFRC200-2010_EOA1.pdf

[2]p. 373 "Lumen Method for Toplighting". *Lighting Handbook, 8th Edition*. Illuminating Engineering Society America of North America, 1993, New York

[3] ASHRAE 90.1-2010, Section 5.8.2.6 "Visible Light Transmittance"

Analysis: ASTM E972-2002 in was proposed for review EC179. Copies were supplied to the IECC Committee. The version proposed in this public comment is dated 2007.

Final Action: AS AM AMPC____ D

EC9-09/10
202

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

Revise as follows:

RESIDENTIAL BUILDING. For this code, includes <u>detached one- and two-family dwellings and multiple single-family dwellings (townhouses)</u> ~~R-3 buildings~~, as well as <u>Group</u> R-2<u>, R-3</u> and R-4 buildings three stories or less in height above grade.

Reason: To clarify that the residential portion of the IECC applies to the buildings under the scope of the IRC (one/two family dwellings and townhouses) as well as low-rise R-2 and R-3 and R-4 buildings.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: MAJETTE-EC-79-202

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The code change proposal tries to close a loophole that the committee believes does not exist. The relationship of the IECC and the IRC are clear.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, US Department of Energy, requests Approval as Submitted

Commenter's Reason: This proposal removes what is believed to be by some as an ambiguity where the R2, R-3, and R-4 classifications from the IBC do not include IRC-covered buildings (one- and two-family dwellings and townhouses). The Committee's reason for disapproval is that they didn't believe this loophole exists. While this is debatable, at worse this proposal provides clarification and does no harm and therefore should be approved.

Public Comment 2:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Submitted.

Commenters' Reason: *EC9-09/10 should be approved as submitted.* The Energy Efficient Codes Coalition supports this DOE proposal because we believe it adds clarity to the scope of the IECC.

The IECC covers all buildings, commercial or residential (see section 101.2), and contains different requirements depending on whether the building is residential or commercial. Commercial buildings are defined as all buildings not included in the definition of "Residential buildings." Therefore the definition of residential buildings is very important.

The IECC is designed to operate as a stand-alone energy efficiency code. Jurisdictions that do not adopt the IRC or IBC may adopt the IECC. As a result, it is important that it be crystal clear, even to those not familiar with the IBC or IRC, and who may not understand the "R" building type designations, that these types of buildings fall under the residential requirements of the IECC.

Moreover, the proposed additional language will forestall any attempt to interpret the IECC as not applicable to dwellings under the purview of the IRC (i.e., detached one and two family dwellings and townhouses). While we believe that this is already clear, the proposed language will underscore this point

Final Action: AS AM AMPC____ D

EC13-09/10-PART I

202 (New), 401.2, Table 402.1.1, 401.3, Table 402.1.3, Table 402.2.5, Section 402.4, 402.4.1.1 (New), 402.4.1.2.1 (New),403.2, 403.2.4 (New), 403.4, Table 403.4.2 (new), 403.5, 404 (New), Table 405.5.2(1)

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART I – IECC

1. Add new definition as follows:

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where pump(s) prime the service hot water piping with heated water upon demand for hot water.

2. Revise as follows:

401.2 Compliance. Projects shall comply with Sections identified as "mandatory" and with either sections identified as "prescriptive" or the performance approach in Section 406. ~~Sections 401, 402.4, 402.5, and 403.1, 403.2.2, 403.2.3, and 403.3 through 403.9 (referred to as the mandatory provisions) and either:~~

~~1. Sections 402.1 through 402.3, 403.2.1 and 404.1 (prescriptive); or~~
~~2. Section 405 (performance).~~

401.3 Certificate (Mandatory). A permanent certificate shall be completed and posted on or in the electrical distribution panel by the builder or registered design professional. The certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. ~~The certificate shall be completed by the builder or registered design professional.~~ The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, *basement wall*, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration, and the results from any duct system and building envelope air leakage testing done on the building. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list 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 list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be *listed* for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters.

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[A]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	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	CRAWL SPACE[c] WALL *R*-VALUE
1	~~1.20~~ NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	~~0.65~~ 0.50[j]	0.65 ~~0.75~~	0.30	30	13	4 / 6	13	0	0	0
3	~~0.50~~ 0.40[j]	0.55 ~~0.65~~	0.30[e]	~~30~~38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55 ~~0.60~~	NR	38	~~13~~ 20 or 13+5[h]	~~5 / 10~~ 8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	~~38~~49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	49	20+5 or 13+~~5~~ 10[h]	15 / ~~19~~ 20	30[g]	15/19	10,4ft	10/13
7 and 8	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	49	~~21~~ 20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. 15/19" means R-15 continuous ~~insulated sheathing~~ insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous

~~insulated sheathing~~ insulation on the interior or exterior of the home. "10/13" means R-10 continuous ~~insulated sheathing~~ insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.

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 301.1 and Table 301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

i. The second R-value applies when more than half the insulation is on the interior of the mass wall.

j. For impact rated fenestration in wind-borne debris regions ~~complying with Section R301.2.1.2 of the IRC or Section 1608.1.2 of the IBC~~, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

TABLE 402.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	~~1.20~~ 0.65	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	~~0.65~~ 0.50	~~0.75~~ 0.65	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.50~~ 0.40	~~0.65~~ 0.55	~~0.035~~0.030	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	~~0.60~~ 0.55	0.030	~~0.082~~ 0.057	~~0.141~~ 0.098	0.047	0.059	0.065
5 and Marine 4	~~0.35~~ 0.32	~~0.60~~ 0.55	~~0.030~~0.026	0.057	0.082	0.033	0.059	0.065
6	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	~~0.057~~ 0.048	0.060	0.033	0.050	0.065
7 and 8	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	~~0.057~~ 0.048	0.057	0.028	0.050	0.065

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 except Marine, 0.087 in zone 5 and Marine 4, and the same as the frame wall U-factor in Marine zone 4 and zones 5 through 8.

c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.2.

TABLE 402.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(*R*-VALUE)

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL 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
R-13	R -13+5 o rR-15+4 or R-21+3 or R-0+10
R-19	R -13+9 or R-19+8 or R-25+7
R-20 or R-21	R-13+10 or R-19+9 or R-25+8
R-20+5	R-13+15 or R-19+14 or R-25+13
	Steel Joist Floor
R-13	R-19 in 2×6; R-19+6 in 2×8 or 2×10
R-19	R-19+6 in 2×6; R-19+12 in 2×8 or 2×10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.

b. Insulation exceeding the height of the framing shall cover the framing.

402.4 Air leakage (Mandatory).

402.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections 402.4.1.1 and 402.4.1.2. ~~be durably sealed to limit infiltration.~~ The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

~~1. All joints, seams and penetrations.~~

~~2. Site-built windows, doors and skylights.~~

~~3. Openings between window and door assemblies and their respective jambs and framing.~~
~~4. Utility penetrations.~~
~~5. Dropped ceilings or chases adjacent to the thermal envelope.~~
~~6. Knee walls.~~
~~7. Walls and ceilings separating a garage from conditioned spaces.~~
~~8. Behind tubs and showers on exterior walls.~~
~~9. Common walls between dwelling units.~~
~~10. Attic access openings.~~
~~11. Rim joist junction.~~
~~12. Other sources of infiltration.~~

3. Add new text as follows:

402.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table 402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table 402.4.1.1, as applicable to the method of construction. Where required by the *code official*, an *approved* party shall inspect all components and verify compliance.

4. Revise as follows:

Table ~~402.4.2~~ 402.4.1.1
AIR BARRIER AND INSULATION ~~INSPECTION COMPONENT CRITERIA~~ INSTALLATION

COMPONENT	CRITERIA
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. ~~Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.~~ Breaks or joints in the air barrier ~~are~~ ~~filled or repaired~~ shall be sealed. Air permeable insulation ~~is~~ shall not be used as a sealing material. Any ~~A~~air permeable insulation shall be installed ~~is~~ inside of an air barrier.
Ceiling / attic	The air barrier in any dropped ceiling / soffit ~~is substantially~~ shall be aligned with the insulation and any gaps ~~are~~ in the air barrier sealed. ~~Attic access (except unvented attic), knee wall door, or drop down stair is sealed.~~ Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be ~~are~~ insulated and the~~.~~ junction of the foundation and sill plate ~~is~~ shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing ~~is~~ shall be sealed.
Rim joists	Rim joists ~~are~~ shall be insulated and include ~~an~~ the air barrier.
Floors (including above garage and cantilevered floors)	Insulation ~~is~~ shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier ~~is~~ shall be installed at any exposed edge of insulation.
Crawlspace walls	Where provided in lieu of floor insulation, insulation ~~is~~ shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawlspaces ~~is~~ shall be covered with a class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, ~~knee walls,~~ and flue shafts opening to exterior or unconditioned space ~~are~~ shall be sealed.
Narrow cavities	Batts in narrow cavities ~~are~~ shall be cut to fit, or narrow cavities ~~are~~ shall be filled by ~~spayed/blown~~ insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing ~~is~~ shall be provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope ~~are~~ shall be airtight, IC rated, and sealed to the drywall. ~~Exception--fixtures in conditioned space.~~
Plumbing and Wiring	~~Insulation is placed between outside and pipes.~~ Batt insulation ~~is~~ shall be cut neatly to fit around wiring and plumbing in exterior walls, or ~~sprayed/blown~~ insulation that on installation readily conforms to available space shall extend~~s~~ behind piping and wiring.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs ~~on exterior walls~~ shall be ~~have~~ insulation~~ed~~ and ~~an~~ the air barrier installed separating them from the ~~exterior wall~~ showers and tubs.
Electrical / phone box on exterior walls	The air barrier ~~extends~~ shall be installed behind electrical or communication boxes or ~~an~~ air sealed ~~type~~ boxes ~~are~~ shall be installed.
Common wall	An air barrier ~~is~~ shall be installed in the common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building thermal envelope ~~are~~ shall be sealed to the subfloor or drywall.
Fireplace	An air barrier shall be installed on fireplace walls. ~~include an air barrier.~~ Fireplaces shall have gasketed doors.

5. Delete and substitute as follows:

~~**402.4.2 Air sealing and insulation.** Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Section 402.4.2.1 or 402.4.2.2.~~

~~**402.4.2.1 Testing option.** Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than seven air changes per hour (ACH) when tested with a blower door at a pressure of 33.5 psf (50 Pa). Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances.~~

<u>**402.4.1.2 Testing.** The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding 5 air changes per hour (ACH50) in zones 1 and 2, and 3 air changes per hour in zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* 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 rough in and creation of all penetrations of the *building thermal envelope*</u>

> <u>**Exception:** Where heating and cooling equipment meets the requirements of Section 404, maximum leakage rate shall be seven air changes per hour (ACH50) in zones 1 and 2 and five air changes per hour in zones 3 through 8. Additions less than 1000 square feet are exempt from testing.</u>

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed~~;~~ <u>beyond the intended weatherstripping or other infiltration control measures;</u>
2. Dampers <u>including exhaust, intake, makeup air, backdraft and flue dampers</u> shall be closed, but not sealed, ~~including exhaust, intake, makeup air, backdraft and flue dampers~~ <u>beyond intended infiltration control measures</u>;
3. Interior doors<u>, if installed at the time of test,</u> shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s)<u>, if installed at the time of the test,</u> shall be turned off; <u>and</u>
6. ~~HVAC ducts shall not be sealed; and~~
~~7~~ <u>6</u>. Supply and return registers<u>, if installed at the time of the test,</u> shall ~~not~~ be ~~sealed~~ <u>fully open</u>.

6. Add new text as follows:

<u>**402.4.1.2.1 Sampling.** Where groups of seven or more buildings of similar design and construction are completed and are issued occupancy permits during a 120-day period, or where a multifamily structure contains more than four dwelling units, testing of less than 100 percent, but not less than 1 in 7 or 15 percent, of the buildings from a specific builder and/or contractor or of dwelling units in a multifamily structure shall be permitted when *approved* by the *code official*. The specific buildings or dwelling units to be tested shall be selected by the *code official*. If any tested building or dwelling unit fails to comply with the maximum air leakage requirement in Section 402.4.1.2 then all buildings or dwelling units shall be tested until a minimum of three consecutive buildings or dwelling units comply from that specific builder and/or contractor or multifamily structure before the *code official* may permit sampling to resume.</u>

7. Delete without substitution:

~~**402.4.2.2 Visual inspection option.** Building envelope tightness and insulation installation shall be considered acceptable when the items listed in Table 402.4.2, applicable to the method of construction, are field verified. Where required by the *code official*, an *approved* party independent from the installer of the insulation shall inspect the air barrier and insulation.~~

8. Revise as follows:

402.4.3 Fireplaces. New wood-burning fireplaces shall have ~~gasketed doors and~~ outdoor combustion air.

403.2.2 Sealing (Mandatory). All ducts, air handlers, <u>and</u> filter boxes ~~and building cavities used as ducts~~ shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*.

Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage ~~to outdoors~~ shall be less than or equal to ~~8~~ 4 cfm (~~226.5~~ 113.3 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* ~~or a total leakage less than or equal to 12 cfm (12 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*~~ when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to ~~6~~ 4 cfm (~~169.9~~ 113.3 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the ~~roughed in~~ system, including the manufacturer's air handler enclosure. All register ~~boots~~ shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to ~~4~~ 3 cfm (~~113.3~~ 85.0 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area*.

~~**Exceptions:** Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*~~.

Exception: Where heating and cooling equipment meets the requirements of Section 404:

1. Maximum total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 square feet (9.29m^2) of conditioned floor area for ducts located outside conditioned space, and
2. The maximum leakage test is not required for ducts and air handlers located entirely within conditioned space.

9. Add new text as follows:

403.2.4 Location (Prescriptive). All ducts and air handlers shall be located within the conditioned space.

Exception: Where heating and cooling equipment meets the requirements of Section 404.

10. Revise as follows:

403.4 Service hot water systems.

~~403.4~~ 403.4.1 Circulating hot water systems (Mandatory). ~~All circulating service hot water piping shall be insulated to at least R-2.~~ Circulating hot water systems shall ~~include~~ be provided with an automatic or readily accessible manual switch that can turn off the hot water circulating pump when not in use.

11. Add new text and table as follows:

403.4.2 Hot water pipe insulation (Prescriptive). Insulation with a minimum thermal resistance (R-value) of at least R-3 shall be applied to the following:

1. Piping larger than 3/4 inch nominal diameter;
2. Piping serving more than one dwelling unit;
3. Piping from the water heater to kitchen outlets;
4. Piping located outside the conditioned space;
5. Piping from the water heater to a distribution manifold;
6. Piping located under a floor slab;
7. Buried piping; and
8. Supply and return piping in recirculation systems other than demand recirculation systems.

All remaining piping shall be insulated to at least R-3 or meet the run length requirements of Table 403.4.2.

TABLE 403.4.2
MAXIMUM RUN LENGTH (feet)[a]

Nominal Pipe Diameter of Largest Diameter Pipe in the Run (in.)	3/8	1/2	3/4	> 3/4
Maximum Run Length	30	20	10	5

a. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.

12. Revise as follows:

403.5 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of Section M1507 of the *International Residential Code* 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.

13. Add new text as follows:

404 Improved equipment efficiency alternative. (Prescriptive) For new residences, Sections 404.1 and 402.2 shall be permitted as an alternative to certain requirements as specified by Exceptions in Sections 402.4.1.2, 403.2.2, and 403.2.4.

404.1 Heating equipment. In zones 3 and 4 gas furnace AFUE shall be at least 90. In zones 5 through 8, gas furnace AFUE shall be at least 92. In zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). All-electric heated buildings shall utilize either an air-source or ground source heat pump.

404.2 Cooling equipment. In zones 1 and 2, vapor compression air conditioning SEER shall be at least 16.0 and EER at least 12.5. In zone 3, vapor compression air conditioning SEER shall be at least 15.0 and EER at least 12.5. In zones 1 through 3, room air conditioner EER shall be at least 11.0 for air conditioners with capacity less than 20,000 Btu/hr, or 10.0 for capacities equal to or greater than 20,000 Btu/hr. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2).

404.2.3 Future updates to federal manufacturing standards. If applicable Federal manufacturing standards as specified in 10 CFR 430 are updated to establish new efficiency requirements, equipment efficiency requirements in this section shall be improved by a percentage equivalent to the percentage improvement from the efficiency required by 10 CFR 430 as of January 1, 2011 to the efficiency required by 10 Code of Federal Regulations 430 at the date of plan check approval.

> **Exception:** AFUEs for furnaces and boilers shall not be required to exceed the higher of 95 or the requirement in 10 CFR 430 at the date of plan check approval.

14. Revise as follows:

SECTION ~~404~~ 405
ELECTRICAL POWER AND LIGHTING SYSTEMS

~~404.1~~ 405.1 Lighting equipment (Prescriptive). A minimum of ~~50~~ seventy-five percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps or a minimum of seventy-five percent of the permanently installed lighting fixtures shall contain only high efficacy lamps.

> **Exception:** Low-voltage lighting.

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	~~Specific leakage area (SLA)[d] = 0.00036~~ Air leakage rate of 5 air changes per hour in zones 1 and 2, and 3 air changes per hour in zones 3 through 8 at a pressure of 0.2 inches w.g. (50 Pa). ~~assuming no energy recovery~~. The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than 0.01 x *CFA* + 7.5 x (*Nbr*+1) where: *CFA* = conditioned floor area *Nbr* = number of bedrooms	For residences that are not tested, the same air leakage rate as the standard reference design. ~~For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate[e] but not less than 0.35 ACH~~ For tested residences ~~with mechanical ventilation that are tested in accordance with ASHRAE 119,~~

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	Energy recovery shall not be assumed for mechanical ventilation.	~~Section 5.1~~, the measured air exchange rate[e] ~~combined with the proposed mechanical ventilation rate, *f* which shall not be less than 0.01 x *CFA* + 7.5 x (*Nbr*+1)~~ ~~where:~~ ~~*CFA* = conditioned floor area~~ ~~*Nbr* = number of bedrooms~~ The mechanical ventilation rate shall be in addition to the air leakage rate and shall be as proposed.
Thermal distribution systems	~~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. Duct insulation: From Section 403.2.1. For tested duct systems, the leakage rate shall be the applicable maximum rate from Section 403.2.2. 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of conditioned floor area at a pressure differential of 0.1 inches w.g. (25 Pa).~~	Thermal distribution system efficiency shall be as tested or as specified by Table 405.5.2(2) if not tested. Duct insulation shall be as proposed.

e. Where required by the *code official*, testing shall be conducted by an *approved* party. ~~Tested envelope leakage shall be determined and documented by an independent party approved by the *code official*.~~ Hourly calculations as specified in the ~~2001~~ASHRAE *Handbook of Fundamentals*~~, Chapter 26, page 26.21, Equation 40 (Sherman-Grimsrud model)~~ or the equivalent shall be used to determine the energy loads resulting from infiltration.

(Portions of table and footnotes not shown remain unchanged)

Reason: The purpose of this proposal is to substantially improve the energy performance of residential buildings that comply with the IECC. This proposal is one part of an effort by DOE and other stakeholders to improve the energy efficiency of the IECC by 30% compared to the 2006 edition of the code. DOE recognizes that recent federal legislation, potential new legislation, movements in numerous state and local building code jurisdictions, and general environmental concerns dictate an unquestionable call for substantial reductions in the energy consumption of residential buildings. This proposal addresses that need via improvements to several key areas of the IECC, while minimizing the extent of structural/format change in the code, an important consideration for maximizing returns on past investments in training and infrastructure by code jurisdictions.
There are four key areas of improvement in this proposal:

Reduced leakage in duct systems and building envelopes, verified by testing. The proposal requires that all ductwork be inside conditioned space, sets new leakage limits on the ductwork, and adds a new requirement for testing the air tightness of the building envelope. As an alternative, homes with high-efficiency HVAC equipment are exempted from the requirement for ducts inside the conditioned space and are subject to less stringent duct and whole-house testing requirements.

Several studies of recently built residences in states with the IECC code or other codes that require building envelope sealing show a distribution of air leakage rates, varying from low to high leakage. Based on these studies, DOE believes the proposed maximum leakage rates are already being achieved in well-sealed homes. The main effect of the proposed leakage rate limits will be to improve the considerable share of homes that have higher leakage rates.
The proposal would allow the code official to permit sampling (of not less than 1 in 7 buildings) for air tightness testing from a specific builder. The idea is that once the code official has gained confidence that the builder has a good track record of sealing properly to code, the sampling could be permitted to lower costs associated with the air leakage testing. The code official would still be required to do a visual inspection of air sealing in every new building.

Improved envelope insulation. Fenestration U-factors (including skylights) are reduced in most zones. The proposed U-factors for fenestration other than skylights in zones 2 and 3 match those that were approved by the IECC committee in the 07/08 cycle though these improvements were ultimately overturned at the final action hearings. Wood-frame wall insulation is increased from R-13 to R-20 in zone 4 and ceiling insulation levels are increased on zones 3 and 5.

New provisions to limit energy loss from domestic hot water pipes. The IECC and IRC currently have minimal requirements for energy efficiency related to water heating. This proposed pipe insulation requirement represent a modest initial investment that will save energy for the life of the home, even through water heating equipment changeouts. The proposed requirements are structured to encourage “short and skinny” pipe runs that will minimize energy losses due to stranded water in pipes. Hot water pipes that are longer and/or larger in diameter will require insulation. Either way, these requirements help save water and limit the energy wasted when a faucet or appliance is turned off and the pipes are left full of hot water.

Larger fraction of high efficacy lighting. The proposal increases the fraction of lamps that must be high-efficacy from 50% to 75%, a reasonable improvement given the advances in efficient lighting and the approaching Federal standards that will require efficient lighting by 2014.
This proposal has a number of other more minor changes to improve and clarify code language and save energy.

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

Analysis: A review of the standard(s) proposed for inclusion in the code, DOE 10 CFR 430, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: MAJETTE-EC-65-202-CH 4-IRC R202-CH 11-

Public Hearing Results

PART I-IECC

Committee Action: **Approved as Submitted**

Committee Reason: The proposal accomplishes a needed increase in stringency. The proposal is the result of work done with many stakeholders to accomplish a reasonable and workable approach to reaching a necessary level of energy conservation.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Chris Baumgartner, re presenting Basin Electric Power Cooperative, Kristyn Clayton, Green House Effects, representing North American Electrical Heating Industry Coalition, John W. Holt, representing National Rural Electric Cooperative Association requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

404.1 Heating equipment. In zones 3 and 4 gas furnace AFUE shall be at least 90. In zones 5 through 8, gas furnace AFUE shall be at least 92. In zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). ~~All electric heated buildings shall utilize either an air-source or ground source heat pump.~~ In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not available in the market or is not able to be installed for economic reasons, the equipment with the highest rated efficiency that is commercially available can be substituted, when approved by the code official.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: (Chris Baumgartner) This proposal addresses the source fuel and essentially the generation mix. That is outside the scope of a building code. The generation source is almost always outside the control of the occupant of the building. The building code should be more concerned with how a building is utilizing the provided energy, not how that energy is produced. Fossil fuels prices have skyrocketed in recent years (Gas up 200%, Fuel oil up 250%), while electricity has remained relatively stable. On-site electric heat generation (resistive electric heat) is 100% efficient at the point of consumption. This is far above the average fossil fuel efficiency levels seen in homes today.

The current wording requires all electrically heated buildings to use either air-source or ground-source heat pumps for heating. This is eliminating resistive electric heating from being utilized in residential homes. Compared to allowable oil and gas-fired heating sources, resistive heating is 8 to 15% more efficient. Why would the code allow for lesser efficiency technologies to be used and then eliminate efficient resistive electric heat? Resistive electric heat also eliminates the issue of duct leakage as duct work is not required to distribute the heat produced.

(Kristyn Clayton) There have been several attempts in this code cycle to restrict the use of electric resistance heating as an option for primary heating. These attempts are short-sighted, not directly applicable to a site application of electricity, oversteps its bounds as a building energy conservation code and is ignorant of new technologies and innovation. More specifically this proposal should be modified for the following reasons:

1. ***The proposal is source fuel directed and a "building code" should not be concerned with the source generation if it is out of the control of the owner and occupant of the building only with how the building uses the provided energy.***

a. If the cost of a particular states' power mix and/or local utility rates is the driver for this justification as submitted, then this proposal favors site fossil-fueled equipment (natural gas or fuel oil) over electrical resistance heating supplied by electricity from a utility or site located alternative source. Therefore, this proposal has failed to take into account the extreme variability of the cost of site based fuels. Furthermore it completely ignores site generated sources of electricity which can be used for heating. A few examples of the variable cost issues are:
gas furnace -the cost of gas has increased nearly 200% in recent years while the cost of electricity has fallen slightly or stayed largely the same on the average for the nation,
fuel oil furnaces - some areas have seen a 250% increase in recent years in the cost of fuel oil. This comparison highlights the complex issue of site generation versus source generation, and
alternative energy – the cost of wind, solar thermal or geothermal generation has fallen drastically in recent years and will continue to fall to a point that it will be an economically feasible, non-polluting choice for residential application.

b. The basic premise of this proposal focuses on cost of generation, not efficient use of the resource ***in a building.*** The IECC is a code to insure the optimum efficiency of a building, not the entire infrastructure of energy and power supply. Electric resistance heat is 100% efficient at the site. If the code is now concerned about the supply of energy to a site, then the proponents should have submitted the total energy and environmental cost of importing, drilling, refining oil, or of delivering natural gas, fuel oil or propane to the home. It is a dangerous precedent that has already made its way into the codes unchecked so far. If the entire cycle is now under scrutiny, then all proposals need to look at the entire cycle of every energy source from creation to delivery. Passage of this proposal will further entrench an unfair standard that is far outside the scope of a building code.

2. **This proposal negates years of research and product development that is finally allowing designers and contractors to make use of affordable, green alternative generation and storage components for large and small scale applications.** Furthermore, the following issues have been completely ignored in the preparation of this proposal:

a. These technologies are going to be crucial to achieving the drastic green house gas reduction targets currently legislated or pledged by most federal, state and larger municipalities.

b. The fact that many renewable sources are located at or close to the end user, eliminates the argument of inefficient generation and distribution. Clean, renewable power from wind, solar, and other emerging technologies will increase exponentially in the foreseeable future, making electric resistance heating a more, not less, desirable option.

c. Punishing the most efficient heating technology there is at a time when the source generation problems are receiving unprecedented funding is uninformed at best, simplistically naïve and could restrict trade unnecessarily. Alternative energy creation and distribution is finally contributing a viable percentage to the electric power mix on a global scale. This proposal is a short-sighted approach and will cut off a viable source of quiet, non-forced air heat that can be applied effectively and efficiently regardless of the source of electricity.

d. This proposal essentially guarantees that fossil-fuel based, forced air systems continue to be the norm while research is showing that Indoor Air Quality is quite often negatively affected by forced air and that the generation of green house gasses by fossil fuels are not healthy for the environment. Furthermore, standard ductwork wastes up to 30-40% of the total energy in residential units in actual practice thereby reducing the anticipated savings from heating equipment that relies on forced air for its distribution.

(John W. Holt) This is another example of restriction or banning of electric resistance heat which has many beneficial and economic uses. This should be beyond the scope of building energy conservation. The source of generation is not under the control fo the building owner and it could come from non-polluting sources such as hydro, wired, solar or nuclear as well as natural gas or coal. Cost of generation is also beyond the buildings control and should not be a consideration

Public Comment 2:

Paul Coats, representing American Wood Council requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR [d]	MASS WALL *U*-FACTOR[b] [d]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 except Marine, 0.087 in zone 5 and Marine 4, and the same as the frame wall U-factor in Marine zone 4 and zones 5 through 8.
c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.2.
d. For a wall assembly where the actual fenestration area is less than 30 percent of the total wall area, the reference condition in the total UA calculation of Section 402.1.4 is permitted to use an assumed fenestration area of 30 percent of the total wall area.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This proposed modification provides needed flexibility for framing design and the adjustment of wall assembly U-factors while still requiring the same total performance of designs permitted by EC13. It establishes a baseline wall assembly, for total UA comparison purposes only, as having 30% fenestration area and 70% opaque wall area in the total wall assembly area, which is consistent with the current limit in the International Green Construction Code Table 606.1.1 for the use of prescriptive U-factors. Currently provisions in the IECC permit up to 100% fenestration area in the total UA calculations. While a similar method for the ceiling assembly area (skylights and opaque ceilings) was considered, no established baseline could be determined at this time. It should be noted that with or without this modification, the code permits buildings with unlimited fenestration and skylights, and therefore buildings with much greater total energy usage are permitted than the baseline established with this proposal.

Public Comment 3:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

402.4.1.2.1 Sampling. ~~Where groups of seven or more buildings of similar design and construction are completed and are issued occupancy permits during a 120-day period, or where a multifamily structure contains more than four dwelling units, testing~~ Testing of less than 100 percent, but not less than 1 in 7 or 15 percent, of the buildings from a specific builder and/or contractor or of dwelling units in a multifamily structure shall be permitted when *approved* by the *code official*. The specific buildings or dwelling units to be tested shall be selected by the *code official*. If any tested building or dwelling unit fails to comply with the maximum air leakage requirement in Section 402.4.1.2 then all buildings or dwelling units shall be tested until a minimum of three consecutive buildings or dwelling units comply from that specific builder and/or contractor or multifamily structure before the *code official* may permit sampling to resume.

403.5 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of Section M1507 of the *International Residential Code* 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.
All combustion equipment in new residences in zones 3 to 8 shall be sealed combustion, induced draft, or power vented.

Exception: stoves and ovens in kitchens with vents and fireplaces that meet the applicable requirements of Section 402.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Two changes to DOE's comprehensive residential proposal (EC13) are recommended here. One change makes compliance based on testing a sample of the residences for air tightness practical. The second change helps ensure combustion products in these air tight residences are vented outside. If RE4 is approved, Part II of this comment is not needed.

As approved EC13 allows a sample of the residences, instead of all residences, to be tested for air tightness. Testing a sample of homes to verify air tightness has long been used by Energy Star and other programs, in part because it greatly lowers the cost and time involved in testing. This comment simplifies sampling by removing the unenforceable requirement for determining what buildings are of "*similar design and construction*". What is the definition of "*buildings of similar design and construction*"? This comment also removes the impractical and unclear record keeping related to groups of homes. What does "*completed and issued occupancy permits during a 120-day period*" mean? Any rolling 120 day period? Start to finish in the same 120 days? Are code enforcement staff going to track the timing of all the residences completed by each builder to see which residences can be grouped together? If the code official can choose whether to allow the sampling option, then the same code official should have the flexibility to make the sampling option practical.

EC13 will result in tighter residences, sometimes much tighter residences. Tighter residences are more vulnerable to air quality and moisture problems. Combustion products need to be vented outside the residence. The more energy-efficient HVAC equipment likely to be used with EC13 sends much less heat up the chimney, weakening the natural draft. The combination of a weaker natural draft and a tighter building enclosure can lead to back drafting and other problems, therefore this public comment requires combustion equipment to be sealed combustion, induced draft, or power vented to avoid indoor air quality and moisture problems.

These changes only modify small parts of the otherwise excellent comprehensive residential improvements in EC13.

Public Comment 4:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

CONTINUOUS INSULATION. Insulation installed continuously across all structural members on the interior, exterior, or integral to any opaque surface of the building envelope, without intervening vented air spaces or thermal bridges other than fasteners and service openings.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This proposal and various other proposals and modifications from the code development hearings use or introduce the term, "continuous insulation", but the term is not defined. This public comment corrects that problem and provides needed clarification of the meaning of continuous insulation to ensure proper application in compliance with the intent of the energy code.

ASHRAE 90.1 defines continuous insulation as "insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope." This definition is adopted in this PC for sake of consistency and is further improved to clarify an important concern with the proper and consistent characterization of continuous insulation. The ASHRAE definition addresses a concern with thermal bridging but does not address the similar concern with intervening vented air spaces which can create a disconnect of continuous insulation thermal resistance such that its contribution to a layered wall assembly R-value cannot be simply summed. Thus, wording is included in the definition to address this concern. Air exchange rates for vented airspaces behind claddings can exceed 90 air-changes per hour (see references 1 and 2) which significantly impacts the R-value of the air-space or disconnects the R-value of material on the exterior side of the airspace. A robust definition for continuous insulation is needed in the IECC.

References:

1. Straube, J. and Finch, G. (2009). Ventilated Wall Claddings: Review, Field Performance, and Hygrothermal Modeling, Research Report – 0907, Building Science Press, www.buildingscience.com.
2. Salonvarra, M., Karagiozis, A.N., Pazera, M., Miller W. (2007). "Air Cavities Behind Claddings – What Have We Learned?", Buildings X, ASHRAE

Public Comment 5:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	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	CRAWL SPACE[c] WALL *R*-VALUE

(Portions of table and footnotes not shown remain unchanged)

h. ~~First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~ First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This public comment achieves two things:

1. corrects a severe problem with footnote 'h' that erodes the energy code, regardless of which version of the energy code is approved; and,
2. provides a rational and flexible application of footnote 'h' in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote 'h' is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote 'h', the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote 'h' allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Public Comment 6:

Jean-Marie Falquet, Convectair-NMT Inc, representing herself, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

404.1 Heating equipment. In zones 3 and 4 gas furnace AFUE shall be at least 90. In zones 5 through 8, gas furnace AFUE shall be at least 92. In zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). ~~All electric heated buildings shall utilize either an air source or ground source heat pump.~~ <u>In all zones, buildings may utilize electric resistance healing system provided that the meet the requirements of paragraph 4.3 of CSA C828. The CSA C828 requirements shall be waived for heaters located in bathrooms or outside the living areas of the home.</u>

Add new standard to Chapter 6 as follows:

Canadian Standards Association (CSA)

<u>C828-2006 (paragraph 4.3) "Performance requirements for thermostats used with individual room electric space heating devices"</u>

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: 1) It makes the point that electric resistance heat is 100% efficient and should not be put in the same bag as older low efficiency gas or oil-fired furnaces. The issue of the inefficient generation of electricity by older power plants may in some case result in higher electric rates. In those cases, the market will dictate that builders will seek other means of heating homes. Even in such cases, there are many situations where a good quality electric heater will provide efficient comfort in complement to a central system (for example in bathrooms, entry halls and basements), especially in the shoulder seasons.

2) Duct loss considerations do not apply to room by room electric heating (there are no ducts). In this sense, zoned room by room electric heating is often more efficient than a central system and should be recognized as such.

3) Several performance standards[1] have been developed to improve the energy efficiency of electric heaters. While electric resistance heaters are 100% efficient in the way they produce heat, these standards have addressed the issue of how that heat is controlled and how it is distributed in the heated space.

CSA C828-2006 applies to line-voltage thermostats (built-in or wall-mounted) used with location-dedicated individual room heaters. It sets standards for temperature differential, droop and set-point precision. This standard was created in response to studies showing that better thermostats reduce energy consumption[2].

Because of practical limitations, CSA C828-2006 does not apply to fan-forced heaters or towel-warmers found in bathroom. This exclusion has negligible impact on total household energy consumption.

The exclusion also covers heaters used for frost protection in crawl spaces or pump-houses which are set at lower temperature and typically operate only in extremely cold weather.

1. These standards include:
- IEC60675 (International) : Household electric direct-acting room heaters - Methods for measuring performance
- CSA C828-2006 (Canada) : Performance requirements for thermostats used with individual room heaters.
- LCIE 103-13 / C (France): NF Performance for fixed individual room heaters.

2. Savings of 10% are quoted by the largest Canadian public utility which has conducted extensive studies.
(<u>http://www.hydroquebec.comlresidential/thermostats/economies.html</u>)

Excerpt from the Preface of C828-2006 :
This standard deals with the thermal regulation used with individual room electric space heating devices.
The requirements specified in this standard are intended to enhance user comfort and facilitate energy conservation.

Scope of the standard:
This standard specifies requirements for thermostat models intended for line-voltage (120 V and 240 V) switching of a controlled resistive heating load. It includes single- and double-pole thermostats that control their load by fast or slow ON/OFF switching. The models covered by this Standard are as follows:

(a) wall-mounted line-voltage thermostats;
(b) built-in line-voltage (up to 1500 W); and

(c) two-component thermostats.
This Standard's requirements apply only to local zone thermostats; they do not apply to central heating units under the control of a central thermostat or to thermostats used exclusively to control radiant heating systems.

Description:
CSA C828-2006 describes a testing set-up and procedure (chapter 5) as well as acceptable limits for three performance parameters (section 4.3). In order to pass this standard, thermostats are also required to comply with applicable safety requirements.

CSA C828-2006 Performance Parameters

	Standard requirement	**Remarks**
Differential	< 1.5ºC	Measures the ability of a thermostat to maintain a steady temperature in the center of the room.
Droop	< 0.5ºC	Measures the ability of a thermostat to maintain a constant room temperature over a wide range of outside temperatures.
Set point precision	Within 0.5ºC of the original set point of 22ºC	Measures the difference between the temperature at the center of the room and the temperature set on the thermostat.

Analysis: The standard, CSA 828, was not reviewed or considered by the Energy Code Development Committee prior to the Baltimore hearings and it was not considered by the hearing attendees at the time of the code development hearings. Section 3.6.3.1 of Council Policy # 28, *Code Development,* requires that new standards be introduced in the original code change proposal, therefore, the introduction of a new standard via a public comment is not in accordance with the process required by CP # 28 for adding new standards to the code.

Public Comment 7:

Chuck Foster, Foster and Jamison, representing himself, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

404.1 Heating Equipment. In zones 3 and 4 gas furnace AFUE shall be at least 90. In zones 5 through 8, gas furnace AFUE shall be at least 92. In zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). All-electric heated buildings containing ductwork for heated and cooled air distribution shall utilize either an air-source or ground source heat pump.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Electric space heat comes in many forms; electric baseboard, electric radiant, electric resistance central furnace, air source heat pump, and water source heat pump to name a few.

Each has its own niche and operating characteristics. For instance, electric radiant heat is very efficient in that it allows homeowners to heat objects (like people) rather than air, thus allowing lower thermostat settings than other forced air heating systems. It also allows homeowners the flexibility of zoning where only areas that are occupied can heated. Data shows that houses heated with electric radiant heat enjoy significant energy savings over central warm air furnaces.

Likewise, electric baseboard heating is typically zoned and allows homeowners to heat smaller spaces than central warm air furnaces.

Radiant and electric baseboard heating can be an energy efficient choice for homeowners, especially where they don't intent to use central ducted space heating, such as homes without central air-conditioning.

Thus, EC 13's provision to require the use of heat pumps (air or water source) appears to be overly broad. If a person is going to install central, ducted cooling, the use of a heat pump may be more efficient than the use of an electric furnace. (Even this assumption may not be universally accurate – e.g., a weekend cabin without central air-conditioning might be an efficient application for a ducted electric furnace).

This proposal would prevent the use of an electric furnace when ducted central air-conditioning will also be installed, but it will allow zoned electric radiant and baseboard heating.

Public Comment 8:

Mark Halverson,representing APA requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	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	CRAWL SPACE[c] WALL *R*-VALUE

(Portions of table and footnotes not shown remain unchanged)

h. First value is cavity insulation, second is continuous insulation or insulating sheathing, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or ~~insulated~~ insulating sheathing; "20+5" means R-20 cavity insulation in addition to a layer of R-5 continuous or insulating sheathing; and "13+10" means R-13 cavity insulation in addition to a layer of R-10 continuous or insulating sheathing. ~~If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used~~. In locations where structural sheathing is used, continuous insulation or insulating sheathing shall be permitted to be reduced by no more than R-2~~covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2~~.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This modification simplifies and clarifies footnote h. of Table 402.1.1 when both R-5 and R-10 continuous sheathing or insulating sheathing is required regardless of the amount of structural sheathing that is used. The amount of structural sheathing needed to adequately brace the walls is not limited, so the structural capacity of the wall is not impacted. This modification also assures that all opaque wall areas are covered by continuous insulation or insulating sheathing while maintaining the same combined sheathing thickness in all the wall envelope areas.

Instead of a fixed minimum requirement of R-2 continuous sheathing as before, a reduction of R-2 sheathing from the specified amount works for both R-5 or R10 continuous sheathing requirements. A R-5 requirement reduced by R-2 yields a R-3 continuous insulation applied over the structural sheathing and a R-10 reduced by R-2 yields a R-8 continuous insulation over the structural sheathing.

We ask that the code body support the Committee's recommendation for approval as modified by this Public Comment.

Public Comment 9:

Patrick A. McLaughlin, McLaughlin & Associates, representing Air-Conditioning, Heating and Refrigeration Institute; and Stephen Turchen, Department of Public Works, Fairfax County, VA, representing Virginia Building and Code Officials Association, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding 5 air changes per hour (ACH50) in zones 1 and 2, and 3 air changes per hour in zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* 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 rough in and creation of all penetrations of the *building thermal envelope*

~~**Exception:** Where heating and cooling equipment meets the requirements of Section 404, maximum leakage rate shall be seven air changes per hour (ACH50) in zones 1 and 2 and five air changes per hour in zones 3 through 8. Additions less than 1000 square feet are exempt from testing.~~

403.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*.

Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85.0 L/min) per 100 square feet (9.29 m2) of *conditioned floor area*.

~~**Exception:** Where heating and cooling equipment meets the requirements of Section 404:~~
~~1. Maximum total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 square feet (9.29m2) of conditioned floor area for ducts located outside conditioned space, and~~
~~2. The maximum leakage test is not required for ducts and air handlers located entirely within conditioned space.~~

403.2.4 Location (Prescriptive). All ducts and air handlers shall be located within the conditioned space.

~~**Exception:** Where heating and cooling equipment meets the requirements of Section 404.~~

Delete Section 404 in its entirety.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: (Patrick A. McLaughlin) AHRI is oppose to the provisions of this proposal to trade-off more efficient HVAC equipment for less stringent air leakage or duct sealing requirements without demonstrating that the trade-offs are equivalent in terms of energy use. Energy Policy and Conservation Act does exempt from federal preemption performance-based building codes for residential new construction as long as they satisfy specified statutory criteria in 42 U.S.C. § 6297(f)(3). These criteria allow state and local building codes flexibility to incorporate equipment efficiencies in "whole building" energy conservation measures. The code may provide credits for installing more efficient HVAC equipment or water heaters and allow those credits to be used to offset anticipated energy losses resulting from the choice of other less efficient building features. However, any such trade-offs cannot be weighted in favor of one building component or feature over another, i.e. they must be on a one-for-one equivalent energy use or equivalent cost basis. The credits therefore must be transparent so that comparisons of energy consumption can be made.

No analysis was provided by DOE. However, a closer look at these trade-offs shows that they are likely arbitrary and based on engineering judgment rather than technical analyses. For example, how could DOE say with certitude that the energy lost by allowing ducts and air handlers in the unconditioned space is equivalent to the energy saved by installing a 16 SEER air conditioner in zone 1 or a 92% AFUE furnace in zone 5 when the percentage of duct length in the unconditioned space varies from home to home and region to region? Similarly, how could DOE prove that the energy lost by two air changes per hour is equivalent to the energy saved by a 15 SEER or a 90% AFUE furnace in zone 3? Without an analysis showing that the trade-offs are truly equivalent, the proposal cannot be implemented in the code as written as it will be in violation of federal preemption.

If the intent of EC 13 is to require a minimum air leakage, or that ducts and air handlers be sealed and installed in the conditioned space, AHRI is proposing a modification proposal by deleting section 404 in its entirety and the exceptions in sections 402.4.1.2, 403.2.2 and 403.2.4. Modifying the proposal as suggested will achieve the desired energy savings without violating federal preemption.

(Stephen Turchen) The new section 404 allows some relaxation of other prescriptive requirements in Chapter 4 if "high efficiency" (HE) heating or cooling equipment is installed. Enforcing the installation of HE equipment has always been and continues to be problematic for field inspectors in jurisdictions attempting to conscientiously and fairly implement the energy code. The equipment may only be installed at "final" inspection, the very last to be performed. If the installed equipment efficiency can be verified as too low, removal and replacement with the "right" efficiency equipment at this point is difficult, expensive, and time-consuming. The efficiencies are not labeled on the equipment in most cases (not required by IRC section M1303). An inspector will have to know how to access the databases of all equipment manufacturers in order to verify the ratings and then compare them to the required ratings on the approved plans, assuming that the plans show this information. If equipment of the required HE rating was simply not available at the time that the HVAC subcontractor had to do his installation, will the AHJ demand a new blower door test under section 402.4.1.2 because the original test was performed using the relaxed ACH value for high efficiency equipment?

Under EC13 as proposed, the basic "tradeoff" for HE equipment is a leakier duct system and house; i.e., the building will theoretically use no more energy than one that is "tight" but has only "standard" efficiency equipment. Such an approach has serious implications for the house owners in the future. If they are unaware of the efficiency of the originally installed equipment (the "panel certificate" is being proposed for deletion – see EC24), they will not have any guidance as to what sort of equipment they should purchase when the original equipment eventually needs replacing. In a perfect world, a house built and qualified to the 2012 IECC with a 95% AFUE gas furnace will have its replacement gas furnaces also rated at 95% AFUE or above. But there is nothing in the code or in human nature to ensure that that favorable outcome will consistently occur. Even if a homeowner is perfectly aware that he should install the HE unit, there may be exigencies of the moment (a breakdown in the middle of winter when the only unit available is 87% AFUE) that will cause an unfavorable outcome.

So long as the IECC has no provision to ensure that "Replacement equipment shall be no less efficient than the equipment it is replacing," basing any provisions of the code on HE equipment will have serious enforcement problems and serious implications for maintaining energy-saving benefits for the life of the residential building.

This suggested change comports with the VBCOA position that the new section 404 on "Improved equipment efficiency alternative" should not be implemented. See item 13.

Public Comment 10:

Ron Nickson, representing National Multi Housing Council requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.4.1.2 Testing. The dwelling shall be tested and verified as having an air leakage rate not exceeding 5 air changes per hour (ACH50) in zones 1 and 2, and 3 air changes per hour in zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* party independent of the builder and the installer of insulation, air barrier, and other sealing materials. 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 rough in and creation of all penetrations of the *building thermal envelope*

Exceptions:

1. Where heating and cooling equipment meets the requirements of section 404, maximum leakage rate shall be seven air changes per hour (ACH50) in zones 1 and 2 and five air changes per hour in zones 3 through 8. Additions less than 1000 ft^2 (m^2) are exempt from testing.
2. Dwelling units of R-2 occupancies with more than four individual units that meet the requirements of Section 502.4.

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, if installed at the time of test, shall be open;
4. Exterior openings 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; and
6. Supply and return registers, if installed at the time of the test, shall be fully-open.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This change is based on proposal EC-13 approved at the preliminary hearings. The proposed revisions will provide a means to insure that a functioning air barrier is installed in all R-2. This change will also provide for a uniform means of compliance for R-2 occupancies three-or-less stories in height by requiring them to meet the same air barrier requirements as approved in EC-147 for commercial occupancies, which also by definition include R-2 occupancies four-or-more stories in height.

The change also establishes consistency in the IECC format, per Section 403.7 that establishes requirements for multiple dwelling unit mechanical system requirements by reference to Section 503 and multiple dwelling unit service water heating by reference to Section 504 in the commercial portion of the IECC.

Public Comment 11:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding 5 air changes per hour (ACH50) ~~in zones 1 and 2, and 3 air changes per hour in zones 3 through 8~~. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* 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 rough in and creation of all penetrations of the *building thermal envelope*.

> **Exception:** ~~Where heating and cooling equipment meets the requirements of Section 404, maximum leakage rate shall be seven air changes per hour (ACH50) in zones 1 and 2 and five air changes per hour in zones 3 through 8.~~ Additions less than 1000 square feet (m^2) are exempt from testing.

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, 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; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

403.2.2 Sealing (<u>Prescriptive</u> ~~Mandatory~~). All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*.

Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All registers shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85.0 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area*

   Exception: Where <u>ducts and air handlers are located entirely within conditioned space, maximum</u> ~~heating and cooling equipment meets the requirements of Section 404:~~

   ~~1.~~ ~~Maximum~~ total leakage shall be less than or equal to <u>8</u> ~~6~~ cfm (<u>226.5</u> ~~169.9~~ L/min) per 100 square feet (9.29m^2) of conditioned floor area<u>.</u> ~~for ducts located outside conditioned space, and~~
   ~~2. The maximum leakage test is not required for ducts and air handlers located entirely within conditioned space.~~

Delete Section 403.2.4 in its entirety.

403.5 Mechanical ventilation (Mandatory). ~~The building shall be provided with ventilation that meets the requirements of Section M1507 of the *International Residential Code* 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.

Delete Section 404 in its entirety.

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	Air leakage rate of 5 air changes per hour in zones 1 ~~and 2, and 3 air changes per hour in zones 3~~ through 8 at a pressure of 0.2 inches w.g., (50 Pa). The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than 0.01 x CFA +7.5 x (Nbr + 1) where: *CFA* = conditioned floor area N_{br} = number of bedrooms Energy recovery shall not be assumed for	~~For residences that are not tested, the same air leakage rate as the standard reference design.~~ ~~For tested residences, t~~ <u>T</u>he measured air exchange rate[e] <u>as determined through testing in accordance with section 402.4.1.2</u>. The mechanical ventilation rate shall be in addition to the air leakage rate and shall be as proposed. <u>Exception: For additions less than 1000 square feet that are not tested, the same air leakage rate</u>

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	mechanical ventilation.	as the standard reference design.
Thermal distribution systems	A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies. Duct insulation: from Section 403.2.1	The air leakage rate or DSE shall be as tested in accordance with Section 403.2.2. ~~Thermal distribution system efficiency shall be as tested or as specified by Table 405.5.2(2) if not tested.~~ Duct insulation shall be as proposed. **Exception**: Proposed distribution systems that qualify for default values under Table 405.5.2(2) shall use the DSE specified in Table 405.5.2(2) in lieu of tested air leakage values. Forced air systems located entirely in conditioned space, shall use the default value only when ducts are also tested and meet the maximum value set forth in the Exception to 403.2.2. and are insulated as required in Section 403.2.1.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: EC13-09/10 should be approved as modified by this public comment.

The Energy Efficient Codes Coalition supported EC13 as submitted at the Code Development Committee hearings last October because we believe it represents a significant boost in energy efficiency in the IECC and IRC Chapter 11. However, at the hearings, the concern was raised by some stakeholders that if EC13 was adopted as submitted, state adoption of the 2012 IECC or IRC may violate federal law that preempts state regulation of certain residential mechanical equipment efficiency (more specifically, the claim is that the HVAC trade-off option proposed in Section 404 of the IECC and N1104 of the IRC is not permitted by federal law).

As a result, we are concerned that if EC13 were adopted as submitted, some parties may attempt to challenge adoption of the new energy code in state or federal courts, which would, at best, delay the adoption of the code and the energy savings that would result from it. To avoid these potential problems, we have created this modification to remove the high-efficiency equipment option and to alter other requirements in order to create a code that contains practical requirements while avoiding the preemption issue entirely.

The combined modifications in this public comment will result in slightly less energy savings than what was originally proposed in EC13, but we believe these changes are necessary to ensure that the code remains flexible and usable. Moreover, other improvements, including EC25 as modified and other proposals submitted by the Energy Efficient Codes Coalition, the U.S. Department of Energy, and others, if adopted, can yield the additional energy savings in order to meet or exceed the 30% target.

The modifications in this public comment will bring about several related changes to EC13:

(1) The improved equipment efficiency alternative (Section 404/N1104 and related provisions) has been removed, which will remove the question of Federal preemption entirely. Because Section 404/N1104 served as an alternative to several other improvements proposed in EC13 09/10, the removal of that alternative requires some additional flexibility in the remaining requirements.

(2) With the removal of the improved equipment efficiency alternative, EC13 would require that the ducts and air handler to be located inside conditioned space in all cases. Recognizing that such a requirement would, at a minimum, require substantial changes for some home designs, the modifications create another option to putting ducts and air handler in conditioned space. Under the proposed modification, where ducts or the air handler are located outside conditioned space, the system must be tested to a maximum leakage of 4cfm; where the ducts and air handler are located entirely within conditioned space, the total leakage must be tested to a maximum 8cfm.

(3) The modifications require that building air leakage be tested to meet 5 ACH50 in all climate zones. The original proposal required 3 ACH50 in climate zones 3-8, but allowed an exception of 7 ACH50 in climate zones 1-2 and 5ACH50 in climate zones 3-8 when the requirements of Section 404/N1104 were met. We recognize that a straight requirement of 3cfm without the improved equipment efficiency exception may be difficult to meet in every case and would also require energy recovery ventilation to capture energy losses through mechanical ventilation in order to achieve the benefits of this lower level of leakage. 5 ACH50 across all climate zones represents a more reasonable baseline for this code proposal. Enhanced air leakage requirements with energy recovery ventilation can be addressed in other proposals.

(4) Duct efficiency testing is also designated in the modifications as "prescriptive" rather than "mandatory" so that if these levels of duct tightness are not achieved, a builder could use the simulated performance alternative to boost efficiency elsewhere to compensate for the energy efficiency losses in ducts.

(5) The new provisions in Section 403.5 Mechanical Ventilation have also been removed. This requirement is not an energy code issue and is already covered under Section M1507 of the International Residential Code.

(6) The performance path provisions for air leakage and duct leakage have been modified for the purposes of consistency with the prescriptive requirements.

We believe that EC13 as modified by this public comment should be approved to secure substantial energy savings in a simple, practical manner based on the current format of the code while avoiding any risk of preemption challenge.

Public Comment 12:

Steve Rosenstock, representing Edison Electric Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

404.1 Heating Equipment. In zones 3 and 4 gas furnace AFUE shall be at least 90. In zones 5 through 8, gas furnace AFUE shall be at least 92. In zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). All-electric heated buildings containing ductwork for heated air distribution shall utilize either an air-source or ground source heat pump or electric heat system with an AFUE equal to or greater than 97. Gas-fired heat pumps shall have a minimum efficiency of 1.3 COP.

404.2 Cooling Equipment. In zones 1 and 2, vapor compression air conditioning SEER shall be at least 16.0 and EER at least 12.5. In zone 3, vapor compression air conditioning SEER shall be at least 15.0 and EER at least 12.5. In zones 1 through 3, room air conditioner EER shall be at least 11.0 for air conditioners with capacity less than 20,000 Btu/hr, or 10.0 for capacities equal to or greater than 20,000 Btu/hr. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). Gas-fired heat pumps shall have a minimum efficiency of 1.25 COP.

~~**404.3. Future updates to federal manufacturing standards.** If applicable Federal manufacturing standards as specified in 10 CFR 430 are updated to establish new efficiency requirement, equipment efficiency requirements in this section shall be improved by a percentage equivalent to the percentage improvement for the efficiency required by 10 CFR 430 as of January 1, 2011 to the efficiency required by 10 Code of Federal Regulations 430 at the date of plan check approval.~~

> ~~**Exception:** AFUEs for furnaces and boilers shall not be required to exceed the higher of 95 or the requirement in 10 CFR 430 at the date of plan check approval.~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This proposal should be approved for the following reasons:
-It will provide maximum flexibility to the building / home owner for installing high-efficiency electric heat equipment.
-It provides minimum requirements for gas-fired heat pump systems (which have no minimum efficiency requirements).
Section 404.3 should be taken out for technical and enforcement reasons. If the US DOE decides to increase the minimum SEER from 13.0 to 15.0 SEER in its current rulemaking process, that would be an increase of 15.38%. This would mandate that all values in Section 404.2 increase by 15.38%, which would mean that the EER value would rise to 14.4 EER. At that level, there may be very few, if any, air conditioners or heat pumps that meet such a requirement. Similar situations could occur for other cooling and heating equipment.

Public Comment 13:

Joe Rothschiller, representing Steffes Corporation requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

404.1 Heating equipment. In zones 3 and 4 gas furnace AFUE shall be at least 90. In zones 5 through 8, gas furnace AFUE shall be at least 92. In zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). All-electric heated buildings shall utilize either an air-source or ground source heat pump or an off-peak electric thermal storage heating system.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Electric heat technologies (have and are) advancing quickly and with the insurgence of renewable energy into the Electric Grid. electric heat technologies (smart heating) will play a major part in utilizing this carbon free resource. In addition. many utilities offer off-peak electric rates to encourage consumers to help them lower their system peak/demand. Some consumers are using off-peak electric thermal storage heating systems to totally remove their heating load from the utilities peak and thus improving a utilities load factor and efficiency.

Why exempt Off-peak Heating Systems:

At the heart of the electric system in this country, is the need to balance supply and demand on a moment to moment basis. Electric technologies, especially off-peak electric thermal storage (ETS) can provide significant energy, economic and environmental benefits. We *are asking for an Exemption for Off-peak Electric Thermal Storage systems.*

Electric energy storage is poised to become an important element of the electricity grid and Market place of the future. Storage has unique features and characteristics that make it useful for significant existing and emerging electric-utility-related opportunities and challenges. (Source; SANDIA *REPORT, SAND2010-0815, Unlimited Release, Printed February 2010, Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, A Study for the DOE Energy Storage Systems Program)*

Electric Thermal Storage (ETS): ETS is a heating technology whereby renewable or off-peak electricity is stored as heat in a dense ceramic brick core, for use when needed - 24 hours a day. For the U.S. to capitalize on its investment in renewable energy development and the smart grid, significant amounts of electric storage is needed. ETS is a low cost tool that can provide measurable portion of this storage.

A. Consumer Benefits (Residential. Commercial and Industrial)

i. Uses off-peak, demand free electric rates to lower consumer's heating cost by as much as 70%
ii. Safe, clean, quiet and provides superior comfort
iii. Stores off-peak and/or GREEN POWER and acts as a Smart grid heater
iv. Acts as a *"thermal battery"* for electricity storage
v. Renewable power integration with smart grid control
 1. Better grid reliability and valued demand response and reduced emissions control capabilities
 2. Significant amounts of renewable (wind) energy are curtailed or wasted at night, during heating months, that ETS systems could be storing for productive use. Thus, providing a very low or carbon free footprint for home heating.
vi. Off-peak /TOU pricing - dynamic pricing is here and expanding quickly in most states. ETS heating equipment allows consumers to take advantage of using low cost, off-peak electric rates to heat their home.
vii. With off-peak, demand free electric rates, smart controls and ETS heating can provide consumers with the lowest cost heating option on the market vs natural gas, propane, fuel oil, etc.
viii Greater Efficiency with Heat pumps - ETS combined with an air to air heat pump provides greater energy efficiency than a standard air to air heat pump. ETS/ASHP systems operate down to much lower outside temperatures, which provides greater efficiency without sacrificing comfort, and does all of this using renewable or off-peak energy. *See additional explanation of efficiency gains* at *the end of this document.*

B. Power Company and Smart Grid benefits - almost 10 GWH of ETS is installed in the United States providing load management and renewable integration benefits to hundreds of utilities.

i. Used as a demand side management tool since 1970
   1. Load shaping
   2. Load shifting

ii. ETS can be used as a tool for up/down regulation for utilities" frequency control"; which can bring a whole new dimension to conservation and efficiency in the industry.

iii. Ancillary Services - electric storage provides Regulation and Spinning Reserve benefits. Doing regulation with a non fuel consuming resource, like ETS, can yield a 70% carbon emissions reduction.

iv. Power generation, transmission and distribution efficiency - The use of storage improves system efficiency for the generation, transmission and distribution of power by reducing peak power consumption and allowing more consistent and predictable system operation.

v. Improves system reliability and power quality

vi. Instantaneous demand response tool

vii. A proven 20+ year life cycle as a thermal battery

viii. Operates in conjunction with smart meters, TOU or TOD meters and Green Power smart controls.

ix. ETS units can store up to 960 kWh of energy from renewable sources, such as wind and solar, and can do this quickly when wind gusts exists.

x. Cheapest form of electric storage readily available on the market. See table below:

	Cost	
Technology	**(/kW" h)**	**(/kW)**
Electric Thermal Storage[t]	$30 - $60	$100 - $200
CAES (above-ground)	$200 - $250	$700 - $800
ZnBr Flow Cell	$280 - $450	$425 - $1300
Pb-Acid Battery	$330 - $480	$420 - $660
NaS Battery	$350 - $400	$450 - $550
Flywheel	$1340 - $1570	$3360 - $3920

Source: EPRI2009 energy storage technology cost estimates
[t]***Source: Steffes Corp.***

Additional comments taken from the Department of Energy website:

Electric Thermal Storage

Some electric utilities structure their rates in a way similar to telephone companies and charge more for electricity during the day and less at night. They do this in an attempt to reduce their "peak" demand.

If you are a customer of such a utility, you may be able to benefit from a heating system that stores electric heat during nighttime hours when rates are lower. This is called an electric thermal storage heater, and while it does not save energy, it can save you money because you can take advantage of these lower rates. DOE website: http://www.energysavers.gov/your home/space heating cooling/index.cfm/mytopic= 12520

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Explanation of Greater Efficiency Gains with ETS combined with Air Source Heat Pumps:

Air Source Heat Pumps (ASHP) are known for providing very efficient, low cost heating and cooling. However, during colder outdoor temperatures, associated with colder climates, traditional heat pumps often times do not deliver acceptable comfort. Using ETS as the resistance supplemental heat, you can assure good comfort, while optimizing the heat pump's efficiency. By using ETS vs an electric resistance plenum heater as the supplemental heat source, the ETS stored heat provides comfort modulation 24 hours a day and does it with off-peak energy, which lowers the operating cost to the consumer.

Public Comment 14:

Sharon Stratton, representing TPI Corporation requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

404.1 Heating equipment. In zones 3 and 4 gas furnace AFUE shall be at least 90. In zones 5 through 8, gas furnace AFUE shall be at least 92. In zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). ~~All electric heated buildings shall utilize either an air source or ground source heat pump~~.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This proposal conflicts with the founding principles of the IECC as it shows restricts the use of a product and method and gives preferential treatment to using primary energy sources to heat residential homes. The IECC code states that it 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 type or classes of materials, products or methods of construction."J

This proposal also conflicts with Section 102.1 of the 2009 IECC which states that "This code is not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been approved by the code official as meeting the intent of this code.,,2 The intent of the IECC as stated in Chapter 1, Part 1, Section 101.3 is to "provide flexibility to permit the use of innovative approaches and techniques to achieve the effective use of energy.,,3 Requiring the use of only heat pumps in "all electric buildings" does not permit flexibility for the use of electric heating equipment that uses renewable energy sources to generate electricity.

Public Comment 15:

Kuma Sumathipala, representing American Wood Council requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT *U*-FACTOR[b]	GLAZED FENESTRATION SHGC[b,e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*VALUE[k]	MASS WALL *R*-VALUE[i]	FLOOR *R*VALUE	BASEMENT[c] WALL *R*VALUE	SLAB[d] *R*VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE

k. Where continuous foam plastic sheathing is used on exterior walls, it shall be protected from exterior fire exposure by a thermal barrier that will limit the average temperature rise of the unexposed surface to not more than 250 degrees F (120 degrees C) after 15 minutes of fire exposure, complying with the standard time-temperature curve of ASTM E119.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: EC13 mandates continuous insulation on exterior walls in some climate zones. This is the first time continuous insulation is required outright, and therefore represents a considerable shift in fire-related exposure risks. In particular, foam sheathing is known to accelerate fire spread, resulting in rapid fire growth on the exterior wall. This will impede egress of the building occupants and affect fire service response capabilities.

Public Comment 16:

Don Surrena, representing National Association of Home Builders (NAHB) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	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	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50[j]	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[j]	0.55	0.30[e]	38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55	NR	38	20 or 13+5[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	~~20+5 or 13+10[h]~~ 20 or 13+5[h]	15 / 20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	~~20+5 or 13+10[h]~~ 20 or 13+5[h]	19 / 21	38[g]	15/19	10,4ft	10/13

TABLE 402.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	0.65	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.50	0.65	0.035	0.082	0.165	0.064	0.360	0.477
3	0.40	0.55	0.030	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	0.55	0.030	0.057	0.098	0.047	0.059	0.065
5 and Marine 4	0.32	0.55	0.026	0.057	0.082	0.033	0.059	0.065
6	0.32	0.55	0.026	~~0.048~~ 0.057	0.060	0.033	0.050	0.065
7 and 8	0.32	0.55	0.026	~~0.048~~ 0.057	0.057	0.028	0.050	0.065

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: The energy savings associated with adding R5 to the wall system does not offset the additional cost and risk of moisture damage due to bulk water intrusion. Energy savings is estimated at $25/yr in climate zone 6 with a cost of over $1,900/yr.- making the payback in the 75 year range.

Public Comment 17:

Don Surrena, representing National Association of Home Builders (NAHB) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding ~~5~~ 7 air changes per hour (ACH50) in zones 1 and 2, and ~~3~~ 5 air changes per hour in zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* 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 rough in and creation of all penetrations of the *building thermal envelope*

> **Exception:** Where heating and cooling equipment meets the requirements of Section 404, maximum leakage rate shall be ~~seven air changes per hour (ACH50) in zones 1 and 2 and five~~ seven air changes per hour in zones 3 through 8 and climate zones 1 and 2 shall have no requirement. Additions less than 1000 square feet are exempt from testing.

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, 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; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	Air leakage rate of ~~5~~ 7 air changes per hour in zones 1 and 2, and ~~3~~ 5 air changes per hour in zones 3 through 8 at a pressure of 0.2 inches w.g. (50Pa). The mechanical ventilation rate ~~and~~ shall be the same as in the proposed design, but not greater than 0.01 x *CFA* + 7.5 x (*Nbr*+1) where: *CFA* = conditioned floor area *Nbr* = number of bedrooms Energy recovery shall not be assumed for mechanical ventilation.	For residences that are not tested, the same natural leakage rate as the standard reference design. For tested residences, Section 5.1, the measured air exchange rate[e]. The mechanical ventilation rate is in addition to the natural leakage rate and shall be as proposed.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Air tightness and duct tightness levels this modification more closely represent reasonably achievable levels.
It is extremely difficult to reach 3 ACH 50 in a smaller home over a vented crawl space. Changing the prescriptive requirement for homes in northern climates to 5 ACH50 is a practical solution.

In southern climates there is very little benefit for air sealing. Energy savings associated with going from 7 to 5 ACH50 is about $8 per year in Phoenix, AZ (climate zone 2), and if mechanical ventilation is added because of the tightness, there will be an increase in net energy used by the house.

Public Comment 18:

Don Surrena, representing National Association of Home Builders (NAHB) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*.

Duct tightness shall be verified by either of the following:

1. Postconstruction test: ~~Total l~~Leakage to outdoors shall be less than or equal to ~~4~~ 6 cfm (~~113.3~~ 170 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* or a total leakage less than or equal to 10 cfm (283 L/min) per 100 ft^2 (9.29 m2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

2. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All register shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85.0 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area*.

   Exceptions:

   1. Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.

   2. Where heating and cooling equipment meets the requirements of Section 404; ~~1. Maximum~~ maximum total leakage shall be less than or equal to ~~6~~ 8 cfm (~~169.9~~ 226 L/min) per 100 square feet (9.29m2) of conditioned floor area for ducts located outside conditioned space~~, and~~

   ~~2. The maximum leakage test is not required for ducts and air handlers located entirely within conditioned space.~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Duct tightness for ducts outside of conditioned space is a very important aspect of energy conservation; however, the tightness levels proposed in EC13 are unrealistically tight. Additionally, tightness testing for ducts in conditioned space to the same unrealistically tight levels. These levels are 2 ½ times tighter than the requirements for DOE's Building America Builders Challenge (beyond code) program. The modifications in this comment removes the need for testing ducts entirely within conditioned space and slightly loosens up the tightness requirements for duct systems partially or entirely outside conditioned space.

Public Comment 19:

Stephen Turchen, Department of Public Works, Fairfax County, VA, representing Virginia Building and Code Officials Association requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate of not exceeding 5 air changes per hour ~~(ACH50)~~ in zones 1 and 2, and 3 air changes per hour in zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *cod official.* Testing shall be performed at any time after ~~rough-in and~~ creation of all penetrations of the *building thermal envelope.*

> ~~**Exception:** Where heating and cooling equipment meets the requirements of Section 404, maximum leakage rate shall be seven air changes per hour (ACH50) in zones 1 and 2 and five air changes per hour in zones 3 through 8. Additions less than 1000 square feet are exempt from testing.~~

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, 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; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

~~**402.4.1.2.1 Sampling.** Where groups of seven or more buildings of similar design and construction are completed and are issued occupancy permits during a 120-day period, or where a multifamily structure contains more than four dwelling units, testing of less than 100 percent, but not less than 1 in 7 or 15 percent, of the buildings from a specific builder and/or contractor or of dwelling units in a multifamily structure shall be permitted when *approved* by the *code official*. The specific buildings or dwelling units to be tested shall be selected by the *code official*. If any tested building or dwelling unit fails to comply with the maximum air leakage requirement in Section 402.4.1.2 then all buildings or dwelling units shall be tested until a minimum of three consecutive buildings or dwelling units comply from that specific builder and/or contractor or multifamily structure before the *code official* may permit sampling to resume.~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: The inclusion of the term "ACH50" is redundant in this section. It merely means that the "air changes per hour" (ACH) test should be performed at a differential pressure of 50 pascals. All of this is explained within the section.

The deletion of the term "rough-in" will help to avoid confusion in interpretation and enforcement of the blower door test requirement. *Rough-in* is not defined in EC13 or in the current Chapter 2 of the IECC. How complete does a house have to be before it has achieved a state of "rough-in" and is eligible for a valid blower door test? The practical consideration for testing is what is left of this sentence: "Testing shall be performed at any time after creation of all penetrations of the building thermal envelope." If all possible penetrations of the thermal envelope (windows, doors, attic access openings, dryer exhausts, chimney flues, pipes and wires, etc.) required by the house design have been made (and, presumably, sealed), then the air tightness of the envelope and those openings can be confidently evaluated.

The Exception to section 402.4.1.2 is deleted for two reasons: (a) The first sentence relaxes blower door test results in all climate zones if high efficiency equipment is installed per new section 404. We are proposing to delete all of new section 404; see the discussion for item 13 under our separate Public Comment. (b) The second sentence allows additions under 1000 sq.ft. to be exempt from blower door testing. The inference is that additions greater than or equal to 1000 sq.ft. (wall area? Conditioned floor area?) would have to be tested. Regardless, no protocol for testing any addition is presented. Most additions to residential buildings will have one or more fixed openings to the existing house; how are these openings to be sealed while doing a blower door test? Is the whole "new" house (existing + addition) to be tested? (Very likely to fail if the existing house is old and leaky.) No methods for testing additions *per* se are provided within items 1 - 6 under "During testing." Further, even if the addition has no fixed openings to the attached house, the addition might still exceed the allowable ACH50 limit because it is leaking through the old house wall / doors / windows. But that is not a true "failure" because the conditioned air will leak from one conditioned space to the other. Absent specific test procedures, it will be impossible for code officials to know how to test for leakage in additions or to uniformly enforce blower door testing of any addition of any size.

Deleted section 402.4.1.2.1 would have allowed random sampling of residential construction to test for building air leakage. If random testing is allowed, it will cause great uncertainty in the industry as to when such testing is required and why. (Note that the code official would be required to track occupancy permits issued by date and builder and predict that more than 7 buildings would be built during any 120 day period. Our Association members believe that such a predictive tracking system is unworkable.) This would put the Code Official in a situation were he/she would be heavily scrutinized as to how they decided what buildings were actually selected for blower door leakage testing. A uniform, 100% across the board application of the section 402.4.1.2 testing requirements will eliminate any questions regarding when, where, and why testing shall be done and remove any doubt or suspicion that may be present. Random testing of houses for air leakage only fosters the potential for the perception of unscrupulous activities. Code officials do not need to be placed in any situation where the public will possibly scrutinize their behavior in these matters.

The language of proposed section 402.4.1.2 will allow the installing contractor <u>or</u> an approved testing agency to perform the blower door test proposed for the IECC. Permitting third party inspections will eliminate the installing contractors' ability to certify their own work as the exclusive evidence of compliance. A third party inspection program is a common practice and has worked well for design professionals who are required to perform special inspections on their own work / designs, so this approach should also apply to blower door testing. Allowing approved outside agencies into the blower door testing program will increase the available pool of competent testers and further decrease the need for random testing due to lack of available personnel. Nothing in the proposed language would deny the code official's prerogative to do the blower door testing himself or using his own personnel, should any building department choose to develop this capability.

Public Comment 20:

Stephen Turchen, Department of Public Works, Fairfax County, VA, representing Virginia Building and Code Officials Association requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.4.3 Fireplaces. New wood-burning fireplaces shall have <u>tight-fitting flue dampers</u> and outdoor combustion air.

403.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*.

Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage shall be less than or equal to ~~8~~ 4 cfm (113.3 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All register shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85.0 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area*.

Exception: ~~Where heating and cooling equipment meets the requirements of Section 404:~~

~~1. Maximum total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 sq.ft. (9.29 m2) of conditioned floor area for ducts located outside conditioned space, and~~

2. The ~~maximum~~ <u>total</u> leakage test is not required for ducts and air handlers located entirely within ~~conditioned space~~ <u>the building thermal envelope.</u>

Delete Section 403.2.4 in its entirety.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: [Numbers below refer to corresponding items above.]

Although not discussed in the Reason statement, the apparent justification for deleting gasketed doors from Section 402.4.3 is that the requirement has been moved to revised Table 402.4.1.1 (very last item). However, the paragraph on fireplaces appears in IECC Sec. 402 on "air leakage." Retaining gaskets on the fireplace doors will help to minimize air leakage into the firebox. However, air that leaks past a poorly gasketed fireplace door, or a door that is simply left open, will flow up the chimney if the flue is not well-sealed from the firebox. The suggested change to Section 402.4.3 corrects this oversight. There are various high-temperature gasket materials that can be used to achieve a tight seal in the flue and door areas. During the majority times of the year that the fireplace will not be operating, the combination of well-gasketed doors and a well-sealed flue damper will prevent air leakage through what is effectively an enormous hole in the thermal envelope of the building.

The Exception to Section 403.2.2 has been modified to remove any dependence on proposed Sec. 404 (see our separate Public Comment addressing item #13). If the duct system components are located 100% within the building thermal envelope (i.e., those construction elements that enclose conditioned space), the duct system leakage test serves little purpose, independent of whether any high efficiency equipment is installed. For a reasonably well-sealed duct system, any small leaks will transmit heated or cooled air back into the conditioned space.

The operational premise for Chapter 4 is contained in revised section 401.2: Do everything identified as "mandatory" first; then do everything else identified as "prescriptive" OR do a Simulated Performance Alternative under sec. 406. Sec. 406 is used extremely rarely; most code users will opt for the prescriptive approach. Therefore, under proposed section 403.2.4, they will be required to place the ducts and air handler in conditioned space as part of the prescriptive approach. If that is in fact done, what is the necessity for the duct leakage test (mandatory under proposed section 403.2.2)? See response to item 8 above. There is no need to govern duct placement in the IECC; that is the choice of the HVAC designer / contractor and will depend on many factors beyond the purview of the code official. What should be governed by the code is the need for testing of the duct system, depending on placement: Test if outside the thermal envelope, no need to test if inside.

Public Comment 21:

Theresa A. Weston, representing DuPont Building Innovations requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	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	CRAWL SPACE[c] WALL *R*-VALUE

(Portions of table and footnotes not shown remain unchanged)

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This modification changes this proposal to be consistent with other proposals modified and approved during the technical hearings. It generalizes the requirement for continuous insulation and does not require the insulation to be a sheathing thus allowing more options for meeting this requirement.

Public Comment 22:

Wanda D. Edwards, representing Institute for Business and Home Safety; Ron Nickson, representing National Multi Housing Council; Kim Pederson, Otter Tail Power Company; and Jeffrey W. Springer, representing GEN~SYS Energy, request Disapproval.

Commenter's Reason: (Wanda D. Edwards) The wood frame wall insulation requirements of EC 13 will create significant changes to conventional construction in Zone 4. Conventional wood frame construction in zone 4 most often consists of 2x4 studs with structural sheathing. EC 13 will mandate either 2 x 6 walls, or 2 x4 walls with foam sheathing. Code proposals for the IBC and the IRC were submitted to include construction requirements for foam sheathing in the code, and both failed. IBHS is concerned about the performance of foam sheathing, particularly when used with vinyl siding, and the performance of foam sheathing in high winds associated with hurricanes, thunderstorms, and seismic events. Zone 4 includes hurricane prone areas as well as seismic areas. Exterior wall coverings are often blown off during high wind events. Once the exterior wall covering is lost there is concern that the foam sheathing would be lost as well and wind-driven rain and wind borne debris can easily penetrate into the structure.

IBHS would like to see alternatives provided within the code that will preserve conventional construction and the structural integrity of the structure.

(Ron Nickson) EC-13 should be disapproved because it requires blower door testing of multifamily units (R-2) in buildings up to three stories in height. This would cause a major problem for the building official and the industry in that the only existing standard for blower door testing applies only to single family homes. There is no test standard for multifamily (R-2) occupancies and thus everyone would be doing the test differently.

(Kim Pederson) The code change aims to require the use of an air source heat pump or ground source heat pump in all electric heated bUildings. Otter Tail Power Company disapproves of this proposal as not in the public interest, the interest of its customers, or of the utility. Our primary reasons for opposing this proposed code follow.

1. Ground source heat pump systems while tremendously efficient are also tremendously expensive to install, costing four to six times what a basic heating system would cost to install. That higher upfront cost is an unfair requirement to pass on to the consumer. Customers should have the right to choose the option that is right for them.
2. The proposed code restriction is based on significantly flawed assumptions regarding electricity and the environment. Utilities, including Oller Tail Power Company, are investing in the development of renewable zero-carbon wind energy and other renewable energy sources. With it we are aggressively pursuing the use of excess off-peak wind energy to charge electric heat storage systems and provide a low-cost, high efficiency, zero-carbon electric heating to customers in our northern climate. The change to the building code which is offered presumably as environmentally beneficial does not consider that many utilities who offer electric heating options may well use renewable energy, such as wind, geothermal, and hydro, as their primary generation resources. Further, in order to install a heat pump, ductwork would be required in the installation. However not all thermal storage electric systems require or use ductwork, making thermal storage and heat pump systems incompatible in many applications.
3. Electric loads can be managed, unlike many alternative fuel sources. Otter Tail Power Company has developed a robust portfolio of controllable loads through its off-peak demand-side management tariffs that allow us to manage up to 15% of our Winter peak load. Electric heating loads represent a significant DSM load that is used for load shaping and load shifting to balance and to optimize the electric system. Erosion of this resource will have significant rate impacts to our customers.

It is clear the advocates of this proposal have not considered multiple and complex Issues. The code as proposed should be denied.

(Jeffery W. Springer) The proposed changes would eliminate the use of resistance electric heat in most housing applications. This eliminates the freedom of choice for designers and builders to choose and install the most appropriate system. Several recent "net zero" and Passivhaus homes built in the Northern United States and Canada have used resistance electric heat as a part of a comprehensive heating solution. One such home is the Riverdale Net Zero duplex near Edmonton, Alberta Canada. This home, with R100 ceiling insulation, R50 wall insulation, advanced windows, active solar water and space heating, and photovoltaic panels, uses resistance electric heating units. The designers opted to put most of the investment in reducing the energy needs of the home instead of an advanced heating system. A ground source heat pump was considered but the added cost could not be justified by the energy savings produced in an ultra efficient home. The resistance heaters were economical to install and offered room by room temperature control. Since the heaters will only be used when the solar system cannot provide adequate heat, the annual electrical use for heating energy is extremely low.

Other similar projects in the United States have reached the same conclusion; resistance heating can be a good choice, especially in areas where natural gas is not available or solar is the primary space heating source. These projects would not be possible if the changes proposed in EC13-09/10 ¶404.1 are implemented. In Northern climates, the only other viable electric option to meet the peak heating needs of the home is a ground source or geothermal heat pump. Sizing a geothermal heat pump for the peak heating load would leave it oversized for cooling unless a two speed or variable speed unit is installed. Using a closed loop multi speed geothermal heating system could easily add $30,000 to a home that already requires investing significant additional capital in energy efficient technology. Energy codes should set minimum standards for efficient design or performance and leave the choice of technology to the designer, builder, or homeowner. Electric resistance heating, in its many forms, can be a part of efficient and even super efficient dwellings.

Disapproving this proposed change leaves designers the ability to choose the most cost effective and efficient technologies appropriate to the needs of the dwelling. Approving this change would reduce designer's flexibility and result in significant barriers and additional costs for the very type of dwelling that energy efficiency codes seek to promote.

Final Action: AS AM AMPC____ D

EC13-09/10-PART II

R202 (New), N1101.9, Table N1102.1, Table N1102.1.2, Table N1102.2.5, Section N1102.4, N1102.4.1.1 (New), N1102.4.1.2.1 (New), N1103.2, N1103.2.4.1 (New), N1103.4, Table N1103.4.2 (New), N1103.5, N1104 (New), Chapter 4

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART II – IRC BUILDING/ENERGY

1. Add new definition as follows:

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where pump(s) prime the service hot water piping with heated water upon demand for hot water.

2. Revise as follows:

N1101.9 Certificate. A permanent certificate shall be completed and posted on or in the electrical distribution panel by the builder or registered design professional. The certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. ~~The certificate shall be completed by the builder or registered design professional.~~ The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, *basement wall*, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration, and the results from any duct system and building envelope air leakage testing done on the building. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list 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 list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be *listed* for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters.

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY Component

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[k]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	~~1.20~~ NR	0.75	0.30 0.35[j]	30	13	3 / 4	13	0	0	0
2	~~0.65~~ 0.50[i]	0.65 ~~0.75~~	0.30 0.35[j]	30	13	4 / 6	13	0	0	0
3	~~0.50~~ 0.40[i]	0.55 ~~0.65~~	0.30 0.35[e, j]	~~30~~38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55 ~~0.60~~	NR	38	~~13~~ 20 or 13+5[h]	~~5 / 10~~ 8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	~~38~~49	20 or 13+5[h]	13 / 17	30[~~f~~ g]	10/13	10,2ft	10/13
6	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	49	20+5 or 13+~~5~~ 10[h]	15 / ~~19~~ 20	30[g]	15/19	10,4ft	10/13
7 and 8	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	49	~~21~~ 20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. The first value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.
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 N1101.2 and Table N1101.2.
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

i. For impact rated fenestration in wind-borne debris regions ~~complying with Section R301.2.1.2~~, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

~~j. For impact rated fenestration complying with Section R301.2.1.2 of the *International Residential Code*, the maximum SHGC shall be 0.40.~~

k. The second R-value applies when more than half the insulation is on the interior of the mass wall.

TABLE N1102.1.2 EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	~~1.20~~ 0.65	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	~~0.65~~ 0.50	~~0.75~~ 0.65	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.50~~ 0.40	~~0.65~~ 0.55	~~0.035~~ 0.030	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	~~0.60~~ 0.55	0.030	~~0.082~~ 0.057	~~0.141~~ 0.098	0.047	0.059	0.065
5 and Marine 4	~~0.35~~ 0.32	~~0.60~~ 0.55	~~0.030~~ 0.026	0.057	0.082	0.033	0.059	0.065
6	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	~~0.057~~ 0.048	0.060	0.033	0.050	0.065
7 and 8	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	~~0.057~~ 0.048	0.057	0.028	0.050	0.065

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 except Marine, 0.087 in zone 5 and Marine 4, and the same as the frame wall U-factor in Marine zone 4 and zones 5 through 8.

c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.

TABLE N1102.2.5 STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (*R*-VALUE)

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT *R*-VALUE[a]
	Steel Truss Ceilingsb
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
R-13	R -13+5 o rR-15+4 or R-21+3 or R-0+10
R-19	R -13+9 or R-19+8 or R-25+7
R-20 or R-21	R-13+10 or R-19+9 or R-25+8
R-20+5	R-13+15 or R-19+14 or R-25+13
	Steel Joist Floor
R-13	R-19 in 2×6; R-19+6 in 2×8 or 2×10
R-19	R-19+6 in 2×6; R-19+12 in 2×8 or 2×10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.

b. Insulation exceeding the height of the framing shall cover the framing.

N1102.4 Air leakage (Mandatory).

N1102.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections N1102.4.1.1 and N1102.4.1.2. ~~be durably sealed to limit infiltration.~~ The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

~~1. All joints, seams and penetrations.~~
~~2. Site-built windows, doors and skylights.~~
~~3. Openings between window and door assemblies and their respective jambs and framing.~~
~~4. Utility penetrations.~~
~~5. Dropped ceilings or chases adjacent to the thermal envelope.~~
~~6. Knee walls.~~
~~7. Walls and ceilings separating a garage from conditioned spaces.~~
~~8. Behind tubs and showers on exterior walls.~~
~~9. Common walls between dwelling units.~~

~~10. Attic access openings.~~
~~11. Rim joist junction.~~
~~12. Other sources of infiltration.~~

3. Add new text as follows:

N1102.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table N1102.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table N1102.4.1.1, as applicable to the method of construction. Where required by the *building official*, an *approved* party shall inspect all components and verify compliance.

4. Revise as follows:

TABLE N1102.4.1.1 ~~N1102.4.2~~
AIR BARRIER AND INSULATION ~~INSPECTION COMPONENT CRITERIA~~ INSTALLATION

COMPONENT	CRITERIA
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. ~~Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.~~ Breaks or joints in the air barrier ~~are~~ ~~filled or repaired~~ shall be sealed. Air permeable insulation ~~is~~ shall not be used as a sealing material. Any ~~A~~air permeable insulation shall be installed ~~is~~ inside of an air barrier.
Ceiling / attic	The air barrier in any dropped ceiling / soffit ~~is substantially~~ shall be aligned with the insulation and any gaps ~~are~~ in the air barrier sealed. ~~Attic access (except unvented attic), knee wall door, or drop down stair is sealed.~~ Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be ~~are~~ insulated and the~~.~~ junction of the foundation and sill plate ~~is~~ shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing ~~is~~ shall be sealed.
Rim joists	Rim joists ~~are~~ shall be insulated and include ~~an~~ the air barrier.
Floors (including above garage and cantilevered floors)	Insulation ~~is~~ shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier ~~is~~ shall be installed at any exposed edge of insulation.
Crawlspace walls	Where provided in lieu of floor insulation, insulation ~~is~~ shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawlspaces ~~is~~ shall be covered with a class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, ~~knee walls,~~ and flue shafts opening to exterior or unconditioned space ~~are~~ shall be sealed.
Narrow cavities	Batts in narrow cavities ~~are~~ shall be cut to fit, or narrow cavities ~~are~~ shall be filled by ~~spayed/blown~~ insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing ~~is~~ shall be provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope ~~are~~ shall be airtight, IC rated, and sealed to the drywall. ~~Exception--fixtures in conditioned space.~~
Plumbing and Wiring	~~Insulation is placed between outside and pipes.~~ Batt insulation ~~is~~ shall be cut neatly to fit around wiring and plumbing in exterior walls, or ~~sprayed/blown~~ insulation that on installation readily conforms to available space shall extend~~s~~ behind piping and wiring.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs ~~on exterior walls~~ shall be ~~have~~ insulati~~on~~ed and ~~an~~ the air barrier installed separating them from the ~~exterior wall~~ showers and tubs.
Electrical / phone box on exterior walls	The air barrier ~~extends~~ shall be installed behind electrical or communication boxes or ~~an~~ air sealed ~~type~~ boxes ~~are~~ shall be installed.
Common wall	An air barrier ~~is~~ shall be installed in the common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building thermal envelope ~~are~~ shall be sealed to the subfloor or drywall.
Fireplace	An air barrier shall be installed on fireplace walls. ~~include an air barrier.~~ Fireplaces shall have gasketed doors.

5. Delete and substitute as follows:

~~**N1102.4.2 Air sealing and insulation.** Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Section N1102.4.2.1 or N1102.4.2.2.~~

~~**N1102.4.2.1 Testing option.** Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than seven air changes per hour (ACH) when tested with a blower door at a pressure of 33.5 psf (50 Pa). Testing shall occur after rough in and after installation of penetrations of the building envelope,~~

~~including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances.~~

N1102.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding 5 air changes per hour (ACH50) in zones 1 and 2, and 3 air changes per hour in zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *building official*, testing shall be conducted by an *approved* party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *building official*. Testing shall be performed at any time after rough in and creation of all penetrations of the *building thermal envelope*

> **Exception:** Where heating and cooling equipment meets the requirements of Section N1104, maximum leakage rate shall be seven air changes per hour (ACH50) in zones 1 and 2 and five air changes per hour in zones 3 through 8. Additions less than 1000 square feet are exempt from testing.

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, ~~including exhaust, intake, makeup air, backdraft and flue dampers~~ beyond intended infiltration control measures;
3. Interior doors, if installed at the time of test, shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s), if installed at the time of the test, shall be turned off; and
6. ~~HVAC ducts shall not be sealed; and~~

~~7~~ 6. Supply and return registers, if installed at the time of the test, shall ~~not~~ be ~~sealed~~ fully open.

6. Add new text as follows:

N1102.4.1.2.1 Sampling. Where groups of seven or more buildings of similar design and construction are completed and are issued occupancy permits during a 120-day period, or where a multifamily structure contains more than four dwelling units, testing of less than 100 percent, but not less than 15 percent, of the buildings from a specific builder and/or contractor or of dwelling units in a multifamily structure shall be permitted when *approved* by the *building official*. The specific buildings or dwelling units to be tested shall be selected by the *building official*. If any tested building or dwelling unit fails to comply with the maximum air leakage requirement in Section N1102.4.1.2 then all buildings or dwelling units shall be tested until a minimum of three consecutive buildings or dwelling units comply from that specific builder and/or contractor or multifamily structure before the *building official* may permit sampling to resume.

7. Delete without substitution:

~~**N1102.4.2.2 Visual inspection option.** Building envelope tightness and insulation installation shall be considered acceptable when the items listed in Table N1102.4.2, applicable to the method of construction, are field verified. Where required by the *code official*, an *approved* party independent from the installer of the insulation shall inspect the air barrier and insulation.~~

8. Revise as follows:

N1102.4.3 Fireplaces. New wood-burning fireplaces shall have ~~gasketed doors and~~ outdoor combustion air.

N1103.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes ~~and building cavities used as ducts~~ shall be sealed. Joints and seams shall comply with Section M1601.4. Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage ~~to outdoors~~ shall be less than or equal to ~~8~~ 4 cfm (~~226.5~~ 113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* ~~or a total leakage less than or equal to 12 cfm (12 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*~~ when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

2. Rough-in test: Total leakage shall be less than or equal to ~~6~~ 4 cfm (~~169.9~~ 113.3 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the ~~roughed in~~ system, including the manufacturer's air handler enclosure. All register~~ boots~~ shall be taped or

otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to ~~4~~ 3 cfm (~~113.3~~ 85.0 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*.

~~**Exceptions:** Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.~~

Exception: Where heating and cooling equipment meets the requirements of section N1104:

1. Maximum total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 ft^2 (9.29m^2) of conditioned floor area for ducts located outside conditioned space, and
2. The maximum leakage test is not required for ducts and air handlers located entirely within conditioned space.

9. Add new text as follows:

N1103.2.4 Location (Prescriptive). All ducts and air handlers shall be located within the conditioned space.

Exception: Where heating and cooling equipment meets the requirements of Section N1104.

10. Revise as follows:

N1103.4 Service hot water systems.

~~N1103.4~~ N1103.4.1 Circulating hot water systems (Mandatory). ~~All circulating service hot water piping shall be insulated to at least R-2.~~ Circulating hot water systems shall ~~include~~be provided with an automatic or readily accessible manual switch that can turn off the hot water circulating pump when not in use.

11. Add new text and table as follows:

N1103.4.2 Hot water pipe insulation (Prescriptive). Insulation with a minimum thermal resistance (R-value) of at least R-3 shall be applied to the following:

1. Piping larger than 3/4 inch nominal diameter;
2. Piping serving more than one dwelling unit;
3. Piping from the water heater to kitchen outlets;
4. Piping located outside the conditioned space;
5. Piping from the water heater to a distribution manifold;
6. Piping located under a floor slab;
7. Buried piping; and
8. Supply and return piping in recirculation systems other than demand recirculation systems.

All remaining piping shall be insulated to at least R-3 or meet the run length requirements of Table N1103.4.2.

TABLE N1103.4.2
MAXIMUM RUN LENGTH (feet)[a]

Nominal Pipe Diameter of Largest Diameter Pipe in the Run (in.)	3/8	1/2	3/4	> 3/4
Maximum Run Length	30	20	10	5

a. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.

12. Revise as follows:

N1103.5 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of Section M1507 of the *International Residential Code* 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.

13. Add new text as follows:

N1104 Improved equipment efficiency alternative. (Prescriptive) For new residences, Sections N1104.1 and N1102.2 shall be permitted as an alternative to certain requirements as specified by exceptions in Sections N1102.4.1.2, N1103.2.2, and N1103.2.4.

N1104.1 Heating equipment. In zones 3 and 4 gas furnace AFUE shall be at least 90. In zones 5 through 8, gas furnace AFUE shall be at least 92. In zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). All-electric heated buildings shall utilize either an air-source or ground source heat pump.

N1104.2 Cooling equipment. In zones 1 and 2, vapor compression air conditioning SEER shall be at least 16.0 and EER at least 12.5. In zone 3, vapor compression air conditioning SEER shall be at least 15.0 and EER at least 12.5. In zones 1 through 3, room air conditioner EER shall be at least 11.0 for air conditioners with capacity less than 20,000 Btu/hr, or 10.0 for capacities equal to or greater than 20,000 Btu/hr. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2).

N1104.2.3 Future updates to federal manufacturing standards. If applicable Federal manufacturing standards as specified in 10 CFR 430 are updated to establish new efficiency requirements, equipment efficiency requirements in this section shall be improved by a percentage equivalent to the percentage improvement from the efficiency required by 10 CFR 430 as of January 1, 2011 to the efficiency required by 10 Code of Federal Regulations 430 at the date of plan check approval.

> **Exception:** AFUEs for furnaces and boilers shall not be required to exceed the higher of 95 or the requirement in 10 CFR 430 at the date of plan check approval.

14. Revise as follows:

SECTION ~~N1104~~ N1105
LIGHTING SYSTEMS

~~N1104.1~~ N1105.1 Lighting equipment. A minimum of ~~50~~ seventy-five percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps or a minimum of seventy-five percent of the permanently installed lighting fixtures shall contain only high efficacy lamps.

> **Exception:** Low-voltage lighting.

15. Add new standard to Chapter 44 as follows:

DOE
10 CFR, Part 430   Energy Conservation Standards

Reason: The purpose of this proposal is to substantially improve the energy performance of residential buildings that comply with the IECC. This proposal is one part of an effort by DOE and other stakeholders to improve the energy efficiency of the IECC by 30% compared to the 2006 edition of the code. DOE recognizes that recent federal legislation, potential new legislation, movements in numerous state and local building code jurisdictions, and general environmental concerns dictate an unquestionable call for substantial reductions in the energy consumption of residential buildings. This proposal addresses that need via improvements to several key areas of the IECC, while minimizing the extent of structural/format change in the code, an important consideration for maximizing returns on past investments in training and infrastructure by code jurisdictions. There are four key areas of improvement in this proposal:

Reduced leakage in duct systems and building envelopes, verified by testing. The proposal requires that all ductwork be inside conditioned space, sets new leakage limits on the ductwork, and adds a new requirement for testing the air tightness of the building envelope. As an alternative, homes with high-efficiency HVAC equipment are exempted from the requirement for ducts inside the conditioned space and are subject to less stringent duct and whole-house testing requirements.

Several studies of recently built residences in states with the IECC code or other codes that require building envelope sealing show a distribution of air leakage rates, varying from low to high leakage. Based on these studies, DOE believes the proposed maximum leakage rates are already being achieved in well-sealed homes. The main effect of the proposed leakage rate limits will be to improve the considerable share of homes that have higher leakage rates.

The proposal would allow the code official to permit sampling (of not less than 1 in 7 buildings) for air tightness testing from a specific builder. The idea is that once the code official has gained confidence that the builder has a good track record of sealing properly to code, the sampling could be permitted to lower costs associated with the air leakage testing. The code official would still be required to do a visual inspection of air sealing in every new building.

Improved envelope insulation. Fenestration U-factors (including skylights) are reduced in most zones. The proposed U-factors for fenestration other than skylights in zones 2 and 3 match those that were approved by the IECC committee in the 07/08 cycle though these improvements were ultimately overturned at the final action hearings. Wood-frame wall insulation is increased from R-13 to R-20 in zone 4 and ceiling insulation levels are increased on zones 3 and 5.

New provisions to limit energy loss from domestic hot water pipes. The IECC and IRC currently have minimal requirements for energy efficiency related to water heating. This proposed pipe insulation requirement represent a modest initial investment that will save energy for the life of the home, even through water heating equipment changeouts. The proposed requirements are structured to encourage "short and skinny" pipe runs that will minimize energy losses due to stranded water in pipes. Hot water pipes that are longer and/or larger in diameter will require insulation. Either way, these requirements help save water and limit the energy wasted when a faucet or appliance is turned off and the pipes are left full of hot water.

Larger fraction of high efficacy lighting. The proposal increases the fraction of lamps that must be high-efficacy from 50% to 75%, a reasonable improvement given the advances in efficient lighting and the approaching Federal standards that will require efficient lighting by 2014.

This proposal has a number of other more minor changes to improve and clarify code language and save energy.

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

Analysis: A review of the standard(s) proposed for inclusion in the code, DOE 10 CFR 430, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: MAJETTE-EC-65-202-CH 4-IRC R202-CH 11-

Public Hearing Results

PART II-IRC B/E

Committee Action: Disapproved

Committee Reason: This proposal provides aggressive energy conservation measures that would limit the flexibility in the design of the building in all areas. The committee prefers the flexibility provided by EC16.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, representing US Department of Energy requests Approval as Submitted.

Commenter's Reason: EC13 was approved by the IECC development committee and DOE believes it is in the best interest of the building community to have the IRC match the IECC's provisions. DOE has subsequently vetted EC13 and finds widespread support for it. An energy analysis of EC13, along with other energy-saving IECC proposal recommended for approval at the Initial Action hearings, shows overall energy savings of slightly more than 30% compared to the 2006 IECC (see http://www.energycodes.gov/IECC2012/documents/residential-savings-estimate.iecc-2012-proposals.6-may-2010.pdf).

Public Comment 2:

Jeff Inks, representing the Window & Door Manufacturers Association requests Approval as Submitted.

Commenter's Reason: WDMA urges approval as submitted.

Of the various two-part comprehensive proposals for IECC Chapter 4 and IRC Chapter 11 that are intended to help achieve the 30% increase in energy efficiency above 2006 requirements, EC-13 has by far the greatest support and input from stakeholders as evidenced by the substantial testimony in support of it during the IECC proceedings where is was approved.

The IRC Building and Energy Committee disapproved EC-13 despite the same very strong testimony in support of it in the IRC proceedings. The first reason the IRC B&E committee gave for disapproval was a belief by some committee members that the provisions of EC-13 would be too limiting to design flexibility in all areas of building construction, however that is unfounded, was not substantiated and therefore should not serve as a reason for disapproval of it.

The second reason the committee gave was their preference for the flexibility provided in EC-16 which they had not yet heard testimony on. While the intent of EC-16 is greatly appreciated, there are a number of concerns with it that are avoided by EC-13.

One significant concern is the complexity of the EC-16. EC-13 achieves the same objective in a much clearer, less complex approach that does not limit design, and again has the greatest support among all stakeholders. Disapproval of EC-13 was not adequately justified and we urge approval of it as submitted.

Public Comment 3:

Shaunna Mozingo, City of Westminster, representing the Colorado Chapter of ICC requests Approval as Submitted.

Commenter's Reason: We strongly prefer that the IECC and IRC be made identical, possibly based on RE4. This is only a backup, in case RE4 is not approved.

The approval of EC13 for the IECC and EC16 for the IRC would leave substantial differences between the two sets of residential energy requirements in the I-codes. These differences would greatly impede both the adoption and enforcement of residential energy efficiency requirements in the I-codes.

The following table lists the differences between IECC and IRC energy requirements as they stand after the first hearing, each with a suggested resolution. Because so many proposals are affected, to keep our public comments brief in the monograph, this table will only be published with a few public comments. The remainder of our reason statements will refer back to this table and associated reasoning.

The International Codes (I-codes) need to be internally consistent. The I-codes provide the foundation for the building codes adopted by most jurisdictions. Although adopting entities can, and do, amend the I-codes, the adopting jurisdictions expect a set of model codes that are internally consistent. The 2009 IECC and IRC energy requirements are identical in most areas. However, this development cycle introduced many potential inconsistencies. These inconsistencies are substantial enough to affect code usability. To be effective and enforceable, the IECC and IRC need to be consistent.

The table below shows the public comments designed to realign the IECC and IRC residential energy requirements to ensure internal consistency. The code development process deals with each code change separately, so realignment requires multiple comments. The method suggested for aligning the IECC and IRC falls into one these categories:

• The code change was approved in one code and disapproved in the other. The best option is usually to disapprove the change in both codes or approve the same version in both codes. In a few instances some details of the change also need to be corrected.

• A code change was submitted to the IECC without a parallel comment on the same text in the IRC. At this stage, the code development process does not allow a change unless there was an initial public comment, so realigning the codes means rejecting any comment that would create an inconsistency.

• The code changes were treated the same way in both codes—either approved or disapproved. In this case there is consistency, and no change is needed to align the IECC and IRC. Those code changes are not listed in the table.

Suggested Corrections for Inconsistencies in the IRC & IECC Requirements

AS=Approved as Submitted AM=Approved as Modified AMPC=Approved as Modified by Public Comment D=Disapproved

EC#	Description	First Hearing	**Suggested Final Action** **Bold** indicates change from first hearing.
EC2	Add insulated sheathing R-value label	IECC–D IRC–AS	No action. Withdrawn by proponent.
EC13	Comprehensive revision- insulation, windows, air tightness, ducts, water systems, equipment, …	IECC–AS IRC–D	IECC–AS, **IRC–AS** Majority of residential energy savings. Important to approve and to make IRC consistent. EC13 had broad agreement from many parties.
EC16	Comprehensive revision- insulation, windows, air tightness, ducts, water systems, equipment, etc. Creates 4 options for each climate zone.	IECC–D IRC–AS	IECC–D, **IRC–D** Large differences between IECC's EC13 and IRC's EC16 are unacceptable. Retaining both EC13 and EC16 would greatly complicate adoption and enforcement. EC16 is a solid attempt and NAHB's participation deserves praise; however, we suggest EC13 is superior.
EC17	Defines "Insulated Siding"	IECC–AM IRC–AS	**IECC–D**, **IRC–D** There are problems in the proposed definition and the related EC54, see public comment.
EC24	Eliminate homeowner energy certificate	IECC–AS No IRC version	**IECC–D** No IRC change submitted. Energy certificate modified by EC22 in both IECC & IRC. Useful homeowner oriented energy certificate should be retained.
EC27	Increase window, skylight, insulation requirements	IECC–AM IRC–D	**IECC–AMPC**, **IRC–AMPC** Amendment by DOE public comment fixes problem in footnote "h". Rest of EC27 duplicates parts of EC13.
EC29	Set maximum SHGC for skylights and sunrooms	IECC–D IRC–AS	No Action. Withdrawn by proponent.
EC30	Compressed cavity insulation	IECC–AS IRC–D	**IECC–D**, IRC–D Makes footnote worse. Could be misread as a ban on cavity insulation below R-value in table.
EC31	Limit window/door/skylight size in prescriptive approach	IECC–AS IRC–D	**IECC–D**, IRC–D Window/door/skylight calculation too much work. Affects few homes. Includes doors and skylights in limit. Other approved changes requiring much better windows & skylights for all homes are a better option.
EC34	Lower southern window U-factor	IECC–AS IRC–D	IECC–AS, **IRC–AS** Windows required are common.
EC35	Apply same U-factor and SHGC to impact glass	IECC–AS IRC–D	**IECC–D**, IRC–D U-factors from EC34 are too low for impact glass.
EC36	Increase maximum SHGC for skylights	IECC–D IRC–AS	**IECC–AS**, IRC–AS Lower SHGC for skylights makes it harder to use skylights for daylighting.
EC39	Lower northern window U-factor	IECC–AS IRC–D	IECC–AS, **IRC–AS** Duplicates what is already in EC13. Reasonable increases in northern

EC#	Description	First Hearing	**Suggested Final Action** **Bold** indicates change from first hearing.
			window efficiency.
EC47	Increase middle US wall insulation	IECC–AM IRC–D	IECC–AM, **IRC–AM** Also good is AMPC to fix footnote “h”.
EC48	Increase northern wall insulation	IECC–AM IRC–D	IECC–AM, **IRC–AM** Reasonable wall insulation. Duplicates part of EC13.
EC50	Increase crawl space wall insulation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Acceptable increase in crawl space wall insulation.
EC54	Add insulated siding as type of insulation	IECC–AS IRC–AM	**IECC –D, IRC–D** Vinyl siding performance decreased by code requirement to attach “loosely” and leave space for expansion and contraction of siding.
EC55	Mass wall U-factor	IECC–D IRC–AS	**IECC–AS**, IRC–AS Aligns codes and fixes table.
EC60	IECC/IRC realignment, deals with several topics	IECC–D IRC–D	**IECC–AMPC, IRC–AMPC** Fixes several inconsistencies. Makes IECC definition of conditioned space match IRC. Uses IECC insulation levels. Aligns design temperatures.
EC63	Attic vent wind baffle	IECC–AS IRC–AM	**IECC–AM**, IRC–AM Baffle prevents wind blowing through insulation. Both versions are acceptable. Industry prefers IRC version.
EC68	Sun roof requirement clarification	IECC–AM IRC–D	**IECC–AMPC, IRC–AMPC** Corrected language per EECC comment.
EC70	Skylight definition	IECC–AS No IRC version	**IECC–D** Disapprove to keep consistency with existing I-code skylight definitions- IBC (202) and IRC 308.6.1.
EC74	Allow window projection factor instead of SHGC	IECC–D IRC –AS	**IECC–AMPC, IRC–AMPC** Allow projection factor as alternative based on public comment. Simplified change is proposed.
EC79	Revise air sealing requirements	IECC–AS IRC–D	IECC–AS, **IRC–AS**. Not needed if EC13 passes. Not completely consistent with EC13. Follow DOE’s lead.
EC91	Remove “listing”, leaving “labeled” for fenestration	IECC–D IRC–AS	**IECC–AS**, IRC–AS Fenestration is labeled, not listed.
EC99	Increase ventilation fan efficiency, define whole house ventilation	IECC–AM IRC–D	**IECC–AMPC, IRC–AMPC** Increases fan efficiency, which is good. Need to remove requirement to know the “intent” of a fan.
EC101	Programmable thermostats, set points, schedules, heat pumps	IECC –D/ASF IRC–D	**IECC–D**, IRC–D Thermostat set points hard to inspect. Research shows set back thermostats do not save energy.
EC102	Ground conductance calculation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Improved calculation per DOE.
EC107	Decrease duct leakage	IECC–AS IRC–D	IECC –AS, **IRC–AS** Not needed if EC13 passes, unless DOE modifies it. Follow DOE’s lead.
EC109	Eliminate framing cavities as return ducts	IECC–AS IRC–D	IECC–AS, **IRC–AS** Framing cavities make leaky ducts.
EC112	More efficient water heating pipe layout & insulation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Approved as part of EC13.
EC115	Increases circulating water heating pipe insulation	IECC–D IRC–AS	**IECC–D**, IRC–D Pipe layout & insulation handled better in EC13/EC112.
EC123	Prohibit electric resistance heating, with exceptions	IECC–AM IRC–D	No Action. Withdrawn by proponent.
EC125	Prohibit standing pilots on fireplaces	IECC–AS IRC–D	IECC–AS, **IRC–AS** Standing pilot lights waste energy.

Public Comment 4:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association (AAMA), requests Approval as Submitted.

Commenter's Reason: EC13, as submitted by the U.S. Department of Energy, provided a good step towards achieving the 30% reduction in overall energy usage of residences built under the International Energy Conservation Code that the U.S. Department of Energy has established as its goal for the 2012 IECC. One aspect of EC13 was the reduction of U-factors for the building envelope under the prescriptive provisions of the IECC.

The U-factors that are established for residential fenestration in EC13, while not commonly met, can be achieved by products that are currently available. A review of the NFRC Certified Products Directory, for example, yields products by several different manufacturers that meet the proposed new criteria of Table N1102.1.

Although EC13, Part I was approved by the IECC committee, EC13, Part II was disapproved by the IRC Building and Energy Committee. If this disparity is not corrected the energy efficiency provisions of the 2012 IECC and IRC for the same building will be radically different. This will lead to greater confusion and reduce the potential for appropriate enforcement.

It is AAMA's view that the single set of fenestration values presented in EC13 for each climate zone is preferable to multiple sets of values for each climate zone. Having one set of values for each climate zone will aid the manufacturers in providing products, assist the builders in selecting products for the homes they are building, and facilitate the code official's review and inspection of homes for compliance with the energy provisions of the 2012 IRC and the residential provisions of the 2012 IECC.

We urge the ICC membership to restore consistency between the provisions of the IECC and IRC for residential energy efficiency by approving EC13, Part II.

Public Comment 5:

Paul Coats, representing American Wood Council requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1.2
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR [d]	MASS WALL *U*-FACTOR[b, d]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 except Marine, 0.087 in zone 5 and Marine 4, and the same as the frame wall U-factor in Marine zone 4 and zones 5 through 8.
c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.
d. Where the actual fenestration area is less than 30 percent of the total wall area, the reference condition in the total UA calculation of Section N1102.1.3 is permitted to use an assumed fenestration area of 30 percent of the total wall area.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This proposed modification provides needed flexibility for framing design and the adjustment of wall assembly U-factors while still requiring the same total performance of designs permitted by EC13. It establishes a baseline wall assembly, for total UA comparison purposes only, as having 30% fenestration area and 70% opaque wall area in the total wall assembly area, which is consistent with the current limit in the International Green Construction Code Table 606.1.1 for the use of prescriptive U-factors. Currently provisions in the IECC permit up to 100% fenestration area in the total UA calculations. While a similar method for the ceiling assembly area (skylights and opaque ceilings) was considered, no established baseline could be determined at this time. It should be noted that with or without this modification, the code permits buildings with unlimited fenestration and skylights, and therefore buildings with much greater total energy usage are permitted than the baseline established with this proposal.

Public Comment 6:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

N1102.4.1.2.1 Sampling. ~~Where groups of seven or more buildings of similar design and construction are completed and are issued occupancy permits during a 120-day period, or where a multifamily structure contains more than four dwelling units, testing~~ Testing of less than 100 percent, but not less than 15 percent, of the buildings from a specific builder and/or contractor or of dwelling units in a multifamily structure shall be permitted when *approved* by the *building official*. The specific buildings or dwelling units to be tested shall be selected by the *building official*. If any tested building or dwelling unit fails to comply with the maximum air leakage requirement in Section N1102.4.1.2 then all buildings or dwelling units shall be tested until a minimum of three consecutive buildings or dwelling units comply from that specific builder and/or contractor or multifamily structure before the *building official* may permit sampling to resume.

N1103.5 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of Section M1507 of the *International Residential Code* 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.
All combustion equipment in new residences in zones 3 to 8 shall be sealed combustion, induced draft, or power vented.

Exception: stoves and ovens in kitchens with vents and fireplaces that meet the applicable requirements of Section N1102.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Two changes to DOE's comprehensive residential proposal (EC13) are recommended here. One change makes compliance based on testing a sample of the residences for air tightness practical. The second change helps ensure combustion products in these air tight residences are vented outside. If RE4 is approved, Part II of this comment is not needed.

As approved EC13 allows a sample of the residences, instead of all residences, to be tested for air tightness. Testing a sample of homes to verify air tightness has long been used by Energy Star and other programs, in part because it greatly lowers the cost and time involved in testing. This comment simplifies sampling by removing the unenforceable requirement for determining what buildings are of "*similar design and construction*". What is the definition of "*buildings of similar design and construction*"? This comment also removes the impractical and unclear record keeping related to groups of homes. What does "*completed and issued occupancy permits during a 120-day period*" mean? Any rolling 120 day period? Start to finish in the same 120 days? Are code enforcement staff going to track the timing of all the residences completed by each builder to see which residences can be grouped together? If the code official can choose whether to allow the sampling option, then the same code official should have the flexibility to make the sampling option practical.

EC13 will result in tighter residences, sometimes much tighter residences. Tighter residences are more vulnerable to air quality and moisture problems. Combustion products need to be vented outside the residence. The more energy-efficient HVAC equipment likely to be used with EC13 sends much less heat up the chimney, weakening the natural draft. The combination of a weaker natural draft and a tighter building enclosure can lead to back drafting and other problems, therefore this public comment requires combustion equipment to be sealed combustion, induced draft, or power vented to avoid indoor air quality and moisture problems.

These changes only modify small parts of the otherwise excellent comprehensive residential improvements in EC13.

Public Comment 7:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition requests Approval as Modified by this Public Comment.

Revise Section R202 as follows*:*

CONTINUOUS INSULATION. Insulation installed continuously across all structural members on the interior, exterior, or integral to any opaque surface of the building envelope, without intervening vented air spaces or thermal bridges other than fasteners and service openings.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This proposal and various other proposals and modifications from the code development hearings use or introduce the term, "continuous insulation", but the term is not defined. This public comment corrects that problem and provides needed clarification of the meaning of continuous insulation to ensure proper application in compliance with the intent of the energy code.

ASHRAE 90.1 defines continuous insulation as "insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope." This definition is adopted in this PC for sake of consistency and is further improved to clarify an important concern with the proper and consistent characterization of continuous insulation. The ASHRAE definition addresses a concern with thermal bridging but does not address the similar concern with intervening vented air spaces which can create a disconnect of continuous insulation thermal resistance such that its contribution to a layered wall assembly R-value cannot be simply summed. Thus, wording is included in the definition to address this concern. Air exchange rates for vented airspaces behind claddings can exceed 90 air-changes per hour (see references 1 and 2) which significantly impacts the R-value of the air-space or disconnects the R-value of material on the exterior side of the airspace. A robust definition for continuous insulation is needed in the IECC.

References:

1. Straube, J. and Finch, G. (2009). Ventilated Wall Claddings: Review, Field Performance, and Hygrothermal Modeling, Research Report – 0907, Building Science Press, www.buildingscience.com.

2. Salonvarra, M., Karagiozis, A.N., Pazera, M., Miller W. (2007). "Air Cavities Behind Claddings – What Have We Learned?", Buildings X, ASHRAE

Public Comment 8:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY Component

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[k]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE

h. ~~First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~ First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This public comment achieves two things:

1. Corrects a severe problem with footnote 'h' that erodes the energy code, regardless of which version of the energy code is approved; and,
2. Provides a rational and flexible application of footnote 'h' in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote 'h' is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote 'h', the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote 'h' allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Public Comment 9:

Mark Halverson, representing APA requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[k]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE

h. First value is cavity insulation, second is continuous insulation or insulating sheathing, so “13+5” means R-13 cavity insulation plus R-5 continuous insulation or ~~insulated~~ insulating sheathing; “20+5” means R-20 cavity insulation in addition to a layer of R-5 continuous or insulating sheathing; and “13+10” means R-13 cavity insulation in addition to a layer of R-10 continuous or insulating sheathing. ~~If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used~~. ~~If~~ In locations where structural sheathing is used, continuous insulation or insulating sheathing shall be permitted to be reduced by no more than R-2~~covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2~~.

(Portions of code change proposal not shown remain unchanged)

Commenter’s Reason: This modification simplifies and clarifies footnote h. of Table 402.1.1 when both R-5 and R-10 continuous sheathing or insulating sheathing is required regardless of the amount of structural sheathing that is used. The amount of structural sheathing needed to adequately brace the walls is not limited, so the structural capacity of the wall is not impacted. This modification also assures that all opaque wall areas are covered by continuous insulation or insulating sheathing while maintaining the same combined sheathing thickness in all the wall envelope areas.

Instead of a fixed minimum requirement of R-2 continuous sheathing as before, a reduction of R-2 sheathing from the specified amount works for both R-5 or R10 continuous sheathing requirements. A R-5 requirement reduced by R-2 yields a R-3 continuous insulation applied over the structural sheathing and a R-10 reduced by R-2 yields a R-8 continuous insulation over the structural sheathing.

We ask that the code body support the Committee’s recommendation for approval as modified by this Public Comment.

Public Comment 10:

Tom Holt, representing East River Electric Power Cooperative requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1104.1 Heating equipment. In zones 3 and 4 gas furnace AFUE shall be at least 90. In zones 5 through 8, gas furnace AFUE shall be at least 92. In zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). ~~All electric heated buildings shall utilize either an air-source or ground source heat pump~~.

(Portions of code change proposal not shown remain unchanged)

Commenter’s Reason: The proposal is source fuel directed and a “building code” should not be concerned with the source generation only with how the building uses the provided energy. The IECC and IRC are to insure the optimum efficiency of a building, not the entire infrastructure of energy and power supply. Electric resistance heat is 100% efficient at the site, levels that fossil fuel equipment cannot attain.

Public Comment 11:

Patrick A. McLaughlin, McLaughlin & Associates, representing Air-Conditioning, Heating and Refrigeration Institute and Stephen Turchen, representing Department of Public Works, Fairfax County, CA request Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding 5 air changes per hour (ACH50) in zones 1 and 2, and 3 air changes per hour in zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* 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 rough in and creation of all penetrations of the *building thermal envelope*

> ~~**Exception:** Where heating and cooling equipment meets the requirements of Section N1104, maximum leakage rate shall be seven air changes per hour (ACH50) in zones 1 and 2 and five air changes per hour in zones 3 through 8. Additions less than 1000 square feet are exempt from testing.~~

N1103.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*.

Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

2. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85.0 L/min) per 100 square feet (9.29 m2) of *conditioned floor area*.

~~**Exception:** Where heating and cooling equipment meets the requirements of Section N1104:~~

~~1. Maximum total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 square feet (9.29m2) of conditioned floor area for ducts located outside conditioned space, and~~
~~2. The maximum leakage test is not required for ducts and air handlers located entirely within conditioned space.~~

N1103.2.4 Location (Prescriptive). All ducts and air handlers shall be located within the conditioned space.

~~**Exception:** Where heating and cooling equipment meets the requirements of Section N1104.~~

Delete Section N1104 in its entirety.

Revise Chapter 44 as follows:

DOE

~~10 CFR, Part 430 Energy Conservation Standards~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: (Patrick McLaughlin) AHRI is oppose to the provisions of this proposal to trade-off more efficient HVAC equipment for less stringent air leakage or duct sealing requirements without demonstrating that the trade-offs are equivalent in terms of energy use. Energy Policy and Conservation Act does exempt from federal preemption performance-based building codes for residential new construction as long as they satisfy specified statutory criteria in 42 U.S.C. § 6297(f)(3). These criteria allow state and local building codes flexibility to incorporate equipment efficiencies in "whole building" energy conservation measures. The code may provide credits for installing more efficient HVAC equipment or water heaters and allow those credits to be used to offset anticipated energy losses resulting from the choice of other less efficient building features. However, any such trade-offs cannot be weighted in favor of one building component or feature over another, i.e. they must be on a one-for-one equivalent energy use or equivalent cost basis. The credits therefore must be transparent so that comparisons of energy consumption can be made.

No analysis was provided by DOE. However, a closer look at these trade-offs shows that they are likely arbitrary and based on engineering judgment rather than technical analyses. For example, how could DOE say with certitude that the energy lost by allowing ducts and air handlers in the unconditioned space is equivalent to the energy saved by installing a 16 SEER air conditioner in zone 1 or a 92% AFUE furnace in zone 5 when the percentage of duct length in the unconditioned space varies from home to home and region to region? Similarly, how could DOE prove that the energy lost by two air changes per hour is equivalent to the energy saved by a 15 SEER or a 90% AFUE furnace in zone 3? Without an analysis showing that the trade-offs are truly equivalent, the proposal cannot be implemented in the code as written as it will be in violation of federal preemption.

If the intent of EC 13 is to require a minimum air leakage, or that ducts and air handlers be sealed and installed in the conditioned space, AHRI is proposing a modification proposal by deleting section 404 in its entirety and the exceptions in sections 402.4.1.2, 403.2.2 and 403.2.4. Modifying the proposal as suggested will achieve the desired energy savings without violating federal preemption.

(Stephen Turchen) The new section N1104 allows some relaxation of other prescriptive requirements in IRC Chapter 11 if "high efficiency" (HE) heating or cooling equipment is installed. Enforcing the installation of HE equipment has always been and continues to be problematic for field inspectors in jurisdictions attempting to conscientiously and fairly implement the energy code. The equipment may only be installed at "final" inspection, the very last to be performed. If the installed equipment efficiency can be verified as too low, removal and replacement with the "right" efficiency equipment at this point is difficult, expensive, and time-consuming. The efficiencies are not labeled on the equipment in most cases (not required by IRC section M1303). An inspector will have to know how to access the databases of all equipment manufacturers in order to verify the ratings and then compare them to the required ratings on the approved plans, assuming that the plans show this information. If equipment of the required HE rating was simply not available at the time that the HVAC subcontractor had to do his installation, will the AHJ demand a new blower door test under section N1102.4.1.2 because the original test was performed using the relaxed ACH value for high efficiency equipment?

Under EC13 as proposed, the basic "tradeoff" for HE equipment is a leakier duct system and house; i.e., the building will theoretically use no more energy than one that is "tight" but has only "standard" efficiency equipment. Such an approach has serious implications for the house owners in the future. If they are unaware of the efficiency of the originally installed equipment (the "panel certificate" is being proposed for deletion – see EC24), they will not have any guidance as to what sort of equipment they should purchase when the original equipment eventually needs replacing. In a perfect world, a house built and qualified to the 2012 IECC with a 95% AFUE gas furnace will have its replacement gas furnaces also rated at 95% AFUE or above. But there is nothing in the code or in human nature to ensure that that favorable outcome will consistently occur. Even if a homeowner is perfectly aware that he should install the HE unit, there may be exigencies of the moment (a breakdown in the middle of winter when the only unit available is 87% AFUE) that will cause an unfavorable outcome.

So long as the IRC has no provision to ensure that "Replacement equipment shall be no less efficient than the equipment it is replacing," basing any provisions of the code on HE equipment will have serious enforcement problems and serious implications for maintaining energy-saving benefits for the life of the residential building.

These suggested changes comport with the VBCOA position that the new section N1104 on "Improved equipment efficiency alternative" should not be implemented. See item 13.

Public Comment 12:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, representing Alliance to Save Energy; Harry Misuriello, representing American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone, representing Cardinal Glass Industries; and Steven Rosenstock, representing Edison Electric Institute request Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding 5 air changes per hour (ACH50) ~~in zones 1 and 2, and 3 air changes per hour in zones 3 through 8~~. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *building official*, testing shall be conducted by an *approved* party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *building official*. Testing shall be performed at any time after rough in and creation of all penetrations of the *building thermal envelope.*

Exception: ~~Where heating and cooling equipment meets the requirements of N11404, maximum leakage rate shall be seven air changes per hour (ACH50) in zones 1 and 2 and five air changes per hour in zones 3 through 8.~~ Additions less than 1000 square feet are exempt from testing.

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, if installed at the time of test, shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s), if installed at the time of the test, shall be turned off; and
6. Supply and return registers, if installed at the time of the test, shall be fully open.

N1103.2.2 Sealing ~~(Mandatory)~~. All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4. Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All registers shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85.0 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*

   Exception: Where ducts and air handlers are located entirely within conditioned space, maximum ~~heating and cooling equipment meets the requirements of Section N1104:~~

   ~~1.~~ ~~Maximum~~ total leakage shall be less than or equal to 8~~6~~ cfm (226.5 ~~169.9~~ L/min) per 100 square feet (9.29m^2) of conditioned floor area. ~~for ducts located outside conditioned space, and~~

   ~~2. The maximum leakage test is not required for ducts and air handlers located entirely within conditioned space.~~

Delete Section N1103.2.4 in its entirety.

N1103.5 Mechanical ventilation (Mandatory). ~~The building shall be provided with ventilation that meets the requirements of Section M1507 of the *International Residential Code* 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.

Delete Section N1104 in its entirety.

Revise Chapter 44 as follows:

DOE

~~10 CFR, Part 430 Energy Conservation Standards~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: EC13-09/10 should be approved as modified by this public comment.

The Energy Efficient Codes Coalition supported EC13 as submitted at the Code Development Committee hearings last October because we believe it represents a significant boost in energy efficiency in the IECC and IRC Chapter 11. However, at the hearings, the concern was raised by some stakeholders that if EC13 was adopted as submitted, state adoption of the 2012 IECC or IRC may violate federal law that preempts state regulation of certain residential mechanical equipment efficiency (more specifically, the claim is that the HVAC trade-off option proposed in Section 404 of the IECC and N1104 of the IRC is not permitted by federal law).

As a result, we are concerned that if EC13 were adopted as submitted, some parties may attempt to challenge adoption of the new energy code in state or federal courts, which would, at best, delay the adoption of the code and the energy savings that would result from it. To avoid these potential problems, we have created this modification to remove the high-efficiency equipment option and to alter other requirements in order to create a code that contains practical requirements while avoiding the preemption issue entirely.

The combined modifications in this public comment will result in slightly less energy savings than what was originally proposed in EC13, but we believe these changes are necessary to ensure that the code remains flexible and usable. Moreover, other improvements, including EC25 as modified and other proposals submitted by the Energy Efficient Codes Coalition, the U.S. Department of Energy, and others, if adopted, can yield the additional energy savings in order to meet or exceed the 30% target.

The modifications in this public comment will bring about several related changes to EC13:

(1) The improved equipment efficiency alternative (Section 404/N1104 and related provisions) has been removed, which will remove the question of Federal preemption entirely. Because Section 404/N1104 served as an alternative to several other improvements proposed in EC13 09/10, the removal of that alternative requires some additional flexibility in the remaining requirements.

(2) With the removal of the improved equipment efficiency alternative, EC13 would require that the ducts and air handler to be located inside conditioned space in all cases. Recognizing that such a requirement would, at a minimum, require substantial changes for some home designs, the modifications create another option to putting ducts and air handler in conditioned space. Under the proposed modification, where ducts or the air handler are located outside conditioned space, the system must be tested to a maximum leakage of 4cfm; where the ducts and air handler are located entirely within conditioned space, the total leakage must be tested to a maximum 8cfm.

(3) The modifications require that building air leakage be tested to meet 5 ACH50 in all climate zones. The original proposal required 3 ACH50 in climate zones 3-8, but allowed an exception of 7 ACH50 in climate zones 1-2 and 5ACH50 in climate zones 3-8 when the requirements of Section 404/N1104 were met. We recognize that a straight requirement of 3cfm without the improved equipment efficiency exception may be difficult to meet in every case and would also require energy recovery ventilation to capture energy losses through mechanical ventilation in order to achieve the benefits of this lower level of leakage. 5 ACH50 across all climate zones represents a more reasonable baseline for this code proposal. Enhanced air leakage requirements with energy recovery ventilation can be addressed in other proposals.

(4) Duct efficiency testing is also designated in the modifications as “prescriptive” rather than “mandatory” so that if these levels of duct tightness are not achieved, a builder could use the simulated performance alternative to boost efficiency elsewhere to compensate for the energy efficiency losses in ducts.

(5) The new provisions in Section 403.5 Mechanical Ventilation have also been removed. This requirement is not an energy code issue and is already covered under Section M1507 of the International Residential Code.

(6) The performance path provisions for air leakage and duct leakage have been modified for the purposes of consistency with the prescriptive requirements.

We believe that EC13 as modified by this public comment should be approved to secure substantial energy savings in a simple, practical manner based on the current format of the code while avoiding any risk of preemption challenge.

Public Comment 13:

Joe Rothschiller, representing Steffes Corporation requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1104.1 Heating equipment. In zones 3 and 4 gas furnace AFUE shall be at least 90. In zones 5 through 8, gas furnace AFUE shall be at least 92. In zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). All-electric heated buildings shall utilize either an air-source or ground source heat pump <u>or an off-peak electric thermal storage heating system</u>.

(Portions of code change proposal not shown remain unchanged)

Commenter’s Reason: Commenter’s Reason: Electric heat technologies (have and are) advancing quickly and with the insurgence of renewable energy into the Electric Grid. electric heat technologies (smart heating) will play a major part in utilizing this carbon free resource. In addition. many utilities offer off-peak electric rates to encourage consumers to help them lower their system peak/demand. Some consumers are using off-peak electric thermal storage heating systems to totally remove their heating load from the utilities peak and thus improving a utilities load factor and efficiency.

<u>Why exempt Off-peak Heating Systems:</u>

At the heart of the electric system in this country, is the need to balance supply and demand on a moment to moment basis. Electric technologies, especially off-peak electric thermal storage (ETS) can provide significant energy, economic and environmental benefits. <u>We *are asking for an Exemption for Off-peak Electric Thermal Storage systems.*</u>

Electric energy storage is poised to become an important element of the electricity grid and Market place of the future. Storage has unique features and characteristics that make it useful for significant existing and emerging electric-utility-related opportunities and challenges. (Source; SANDIA <u>*REPORT, SAND2010-0815, Unlimited Release, Printed February 2010, Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, A Study for the DOE Energy Storage Systems Program*</u>)

Electric Thermal Storage (ETS): ETS is a heating technology whereby renewable or off-peak electricity is stored as heat in a dense ceramic brick core, for use when needed - 24 hours a day. For the U.S. to capitalize on its investment in renewable energy development and the smart grid, significant amounts of electric storage is needed. ETS is a low cost tool that can provide measurable portion of this storage.

A. Consumer Benefits (Residential. Commercial and Industrial)

i. Uses off-peak, demand free electric rates to lower consumer's heating cost by as much as 70%
ii. Safe, clean, quiet and provides superior comfort
iii. Stores off-peak and/or GREEN POWER and acts as a Smart grid heater
iv. Acts as a *"thermal battery"* for electricity storage
v. Renewable power integration with smart grid control
   1. Better grid reliability and valued demand response and reduced emissions control capabilities
   2. Significant amounts of renewable (wind) energy are curtailed or wasted at night, during heating months, that ETS systems could be storing for productive use. Thus, providing a very low or carbon free footprint for home heating.
vi. Off-peak /TOU pricing - dynamic pricing is here and expanding quickly in most states. ETS heating equipment allows consumers to take advantage of using low cost, off-peak electric rates to heat their home.
vii. With off-peak, demand free electric rates, smart controls and ETS heating can provide consumers with the lowest cost heating option on the market vs natural gas, propane, fuel oil, etc.

viii Greater Efficiency with Heat pumps - ETS combined with an air to air heat pump provides greater energy efficiency than a standard air to air heat pump. ETS/ASHP systems operate down to much lower outside temperatures, which provides greater efficiency without sacrificing comfort, and does all of this using renewable or off-peak energy. *See additional explanation of efficiency gains* at *the end of this document.*

B. <u>Power Company and Smart Grid benefits</u> - almost 10 GWH of ETS is installed in the United States providing load management and renewable integration benefits to hundreds of utilities.

i. Used as a demand side management tool since 1970
1. Load shaping
2. Load shifting

ii. ETS can be used as a tool for up/down regulation for utilities" frequency control"; which can bring a whole new dimension to conservation and efficiency in the industry.
iii. Ancillary Services - electric storage provides Regulation and Spinning Reserve benefits. Doing regulation with a non fuel consuming resource, like ETS, can yield a 70% carbon emissions reduction.
iv. Power generation, transmission and distribution efficiency - The use of storage improves system efficiency for the generation, transmission and distribution of power by reducing peak power consumption and allowing more consistent and predictable system operation.
v. Improves system reliability and power quality
vi. Instantaneous demand response tool
vii. A proven 20+ year life cycle as a thermal battery
viii. Operates in conjunction with smart meters, TOU or TOD meters and Green Power smart controls.
ix. ETS units can store up to 960 kWh of energy from renewable sources, such as wind and solar, and can do this quickly when wind gusts exists.
x. Cheapest form of electric storage readily available on the market. See table below:

Technology	Cost (/kW" h)	Cost (/kW)
Electric Thermal Storage[t]	$30 - $60	$100 - $200
CAES (above-ground)	$200 - $250	$700 - $800
ZnBr Flow Cell	$280 - $450	$425 - $1300
Pb-Acid Battery	$330 - $480	$420 - $660
NaS Battery	$350 - $400	$450 - $550
Flywheel	$1340 - $1570	$3360 - $3920

Source: EPRI2009 energy storage technology cost estimates
[t]Source: Steffes Corp.

Additional comments taken from the Department of Energy website:

Electric Thermal Storage

Some electric utilities structure their rates in a way similar to telephone companies and charge more for electricity during the day and less at night. They do this in an attempt to reduce their "peak" demand.

If you are a customer of such a utility, you may be able to benefit from a heating system that stores electric heat during nighttime hours when rates are lower. This is called an electric thermal storage heater, and while it does not save energy, it can save you money because you can take advantage of these lower rates. DOE website: http://www.energysavers.gov/your home/space heating cooling/index.cfm/mytopic= 12520
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Explanation of Greater Efficiency Gains with ETS combined with Air Source Heat Pumps:

Air Source Heat Pumps (ASHP) are known for providing very efficient, low cost heating and cooling. However, during colder outdoor temperatures, associated with colder climates, traditional heat pumps often times do not deliver acceptable comfort. Using ETS as the resistance supplemental heat, you can assure good comfort, while optimizing the heat pump's efficiency. By using ETS vs an electric resistance plenum heater as the supplemental heat source, the ETS stored heat provides comfort modulation 24 hours a day and does it with off-peak energy, which lowers the operating cost to the consumer.

Public Comment 14:

Kuma Sumathipala, representing American Wood Council requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE <u>k</u>	MASS WALL *R*-VALUE[j]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE

k. Where continuous foam plastic sheathing is used on exterior walls, it shall be protected from exterior fire exposure by a thermal barrier that will limit the average temperature rise of the unexposed surface to not more than 250 degrees F (120 degrees C) after 15 minutes of fire exposure, complying with the standard time-temperature curve of ASTM E119.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: EC13 mandates continuous insulation on exterior walls in some climate zones. This is the first time continuous insulation is required outright, and therefore represents a considerable shift in fire-related exposure risks. In particular, foam sheathing is known to accelerate fire spread, resulting in rapid fire growth on the exterior wall. This will impede egress of the building occupants and affect fire service response capabilities.

Public Comment 15:

Don Surrena, representing National Association of Home Builders (NAHB) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[k]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30 0.35[~~j~~]	30	13	3 / 4	13	0	0	0
2	0.50[i]	0.65	0.30 0.35[~~j~~]	30	13	4 / 6	13	0	0	0
3	0.40[i]	0.55	0.30 0.35[e, ~~j~~]	38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55	NR	38	20 or 13+5[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	~~38~~49	20 or 13+5[h]	13 / 17	30[~~f~~ g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	~~20+5 or 13+10[h]~~ 20 or 13+5[h]	15 / 20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	~~20+5 or 13+10[h]~~ 21 or 13+5[h]	19 / 21	38[g]	15/19	10,4ft	10/13

TABLE N1102.1.2
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	WOOD FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	0.65	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.50	0.65	0.035	0.082	0.165	0.064	0.360	0.477
3	0.40	0.55	0.030	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	0.55	0.030	0.057	0.098	0.047	0.059	0.065
5 and Marine 4	0.32	0.55	0.026	0.057	0.082	0.033	0.059	0.065
6	0.32	0.55	0.026	~~0.048~~ 0.057	0.060	0.033	0.050	0.065
7 and 8	0.32	0.55	0.026	~~0.048~~ 0.057	0.057	0.028	0.050	0.065

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: The energy savings associated with adding R5 to the wall system does not offset the additional cost and risk of moisture damage due to bulk water intrusion. Energy savings is estimated at $25/yr in climate zone 6 with a cost of over $1,900/yr.- making the payback in the 75 year range.

Public Comment 16:

Don Surrena, representing National Association of Home Builders (NAHB) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding ~~5~~ 7 air changes per hour (ACH50) in zones 1 and 2, and ~~3~~ 5 air changes per hour in zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* 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 rough in and creation of all penetrations of the *building thermal envelope*

> **Exception:** Where heating and cooling equipment meets the requirements of Section N1104, maximum leakage rate shall be ~~seven air changes per hour (ACH50) in zones 1 and 2 and five~~ seven air changes per hour in zones 3 through 8 and climate zones 1 and 2 shall have no requirement. Additions less than 1000 square feet are exempt from testing.

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, if installed at the time of test, shall be open;
4. Exterior openings 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; and
6. Supply and return registers, if installed at the time of the test, shall fully~~-~~open.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Air tightness and duct tightness levels this modification more closely represent reasonably achievable levels.

It is extremely difficult to reach 3 ACH 50 in a smaller home over a vented crawl space. Changing the prescriptive requirement for homes in northern climates to 5 ACH50 is a practical solution.

In southern climates there is very little benefit for air sealing. Energy savings associated with going from 7 to 5 ACH50 is about $8 per year in Phoenix, AZ (climate zone 2), and if mechanical ventilation is added because of the tightness, there will be an increase in net energy used by the house.

Public Comment 17:

Don Surrena, representing National Association of Home Builders (NAHB) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1103.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1.

Duct tightness shall be verified by either of the following:

1. Postconstruction test: ~~Total l~~Leakage to outdoors shall be less than or equal to 4 6 cfm (~~113.3~~ 170 L/min) per 100 square feet (9.29 m^2) of conditioned floor area or a total leakage less than or equal to 10 cfm (283 L/min) per 100 ft^2 (9.29 m2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

2. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All register shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85.0 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.

   Exceptions:

   1. Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.

   ~~**Exception:**~~ 2. Where heating and cooling equipment meets the requirements of Section N1104; ~~1. Maximum~~ maximum total leakage shall be less than or equal to ~~6~~ 8 cfm (~~169.9~~ 226 L/min) per 100 square feet (9.29m2) of conditioned floor area for ducts located outside conditioned space~~, and~~

   ~~2. The maximum leakage test is not required for ducts and air handlers located entirely within conditioned space.~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Duct tightness for ducts outside of conditioned space is a very important aspect of energy conservation; however, the tightness levels proposed in EC13 are unrealistically tight. Additionally, tightness testing for ducts in conditioned space to the same unrealistically tight levels. These levels are 2 ½ times tighter than the requirements for DOE's Building America Builders Challenge (beyond code) program. The modifications in this comment removes the need for testing ducts entirely within conditioned space and slightly loosens up the tightness requirements for duct systems partially or entirely outside conditioned space.

Public Comment 18:

Stephen Turchen, Department of Public Works, Fairfax County, VA, representing Virginia Building and Code Officials Association, requests Approval as Modified by this Public Comment.

Replace the original proposal as follows:

N1101.9 Certificate. A permanent certificate shall be completed and posted on or in the electrical distribution panel by the builder or registered design professional. The certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. ~~The certificate shall be completed by the builder or registered design professional.~~ The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, *basement wall*, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration, and the results from any duct system and building envelope air leakage testing done on the building. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list 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 list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be *listed* for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters.

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY Component

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUEk	FLOOR *R*-VALUE	BASEMENTc WALL *R*-VALUE	SLABd *R*-VALUE & DEPTH	CRAWL SPACEc WALL *R*-VALUE
1	~~1.20~~ NR	0.75	0.30 0.35~~j~~	30	13	3 / 4	13	0	0	0
2	~~0.65~~ 0.50i	0.65 ~~0.75~~	0.30 0.35~~j~~	30	13	4 / 6	13	0	0	0
3	~~0.50~~ 0.40i	0.55 ~~0.65~~	0.30 0.35e, ~~j~~	~~30~~38	13	5 / 8	19	5/13f	0	5 / 13
4 except Marine	0.35	0.55 ~~0.60~~	NR	38	~~13~~ 20 or 13+5h	~~5 / 10~~ 8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	~~38~~49	20 or 13+5h	13 / 17	30~~f~~ g	10/13	10,2ft	10/13
6	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	49	20+5 or 13+~~5~~ 10h	15 / ~~19~~ 20	30g	15/19	10,4ft	10/13
7 and 8	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	49	~~21~~ 20+5 or 13+10h	19 / 21	38g	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. The first value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.
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 N1101.2 and Table N1101.2.
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
i. For impact rated fenestration in wind-borne debris regions ~~complying with Section R301.2.1.2~~, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.
~~j. For impact rated fenestration complying with Section R301.2.1.2 of the *International Residential Code*, the maximum SHGC shall be 0.40.~~
k. The second R-value applies when more than half the insulation is on the interior of the mass wall.

TABLE N1102.1.2
EQUIVALENT *U*-FACTORSa

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTORb	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	~~1.20~~ 0.65	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	~~0.65~~ 0.50	~~0.75~~ 0.65	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.50~~ 0.40	~~0.65~~ 0.55	~~0.035~~0.030	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	~~0.60~~ 0.55	0.030	~~0.082~~ 0.057	~~0.141~~ 0.098	0.047	0.059	0.065
5 and Marine 4	~~0.35~~ 0.32	~~0.60~~ 0.55	~~0.030~~0.026	0.057	0.082	0.033	0.059	0.065
6	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	~~0.057~~ 0.048	0.060	0.033	0.050	0.065
7 and 8	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	~~0.057~~ 0.048	0.057	0.028	0.050	0.065

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 except Marine, 0.087 in zone 5 and Marine 4, and the same as the frame wall U-factor in Marine zone 4 and zones 5 through 8.
c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.

TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(*R*-VALUE)

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT *R*-VALUEa
	Steel Truss Ceilingsb
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 Ceilingsb
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
R-13	R -13+5 o rR-15+4 or R-21+3 or R-0+10
R-19	R -13+9 or R-19+8 or R-25+7
R-20 or R-21	R-13+10 or R-19+9 or R-25+8
R-20+5	R-13+15 or R-19+14 or R-25+13
	Steel Joist Floor
R-13	R-19 in 2×6; R-19+6 in 2×8 or 2×10
R-19	R-19+6 in 2×6; R-19+12 in 2×8 or 2×10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.

N1102.4 Air leakage (Mandatory).

N1102.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections N1102.4.1.1 and N1102.4.1.2. ~~be durably sealed to limit infiltration.~~ The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

1. ~~All joints, seams and penetrations.~~
2. ~~Site-built windows, doors and skylights.~~
3. ~~Openings between window and door assemblies and their respective jambs and framing.~~
4. ~~Utility penetrations.~~
5. ~~Dropped ceilings or chases adjacent to the thermal envelope.~~
6. ~~Knee walls.~~
7. ~~Walls and ceilings separating a garage from conditioned spaces.~~
8. ~~Behind tubs and showers on exterior walls.~~
9. ~~Common walls between dwelling units.~~
10. ~~Attic access openings.~~
11. ~~Rim joist junction.~~
12. ~~Other sources of infiltration.~~

N1102.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table N1102.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table N1102.4.1.1, as applicable to the method of construction. Where required by the *building official*, an *approved* party shall inspect all components and verify compliance.

TABLE N1102.4.1.1 ~~N1102.4.2~~
AIR BARRIER AND INSULATION ~~INSPECTION COMPONENT CRITERIA~~ INSTALLATION

COMPONENT	CRITERIA
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. ~~Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.~~ Breaks or joints in the air barrier ~~are filled or repaired~~ shall be sealed. Air permeable insulation ~~is~~ shall not be used as a sealing material. Any ~~A~~air permeable insulation shall be installed ~~is~~ inside of an air barrier.
Ceiling / attic	The air barrier in any dropped ceiling / soffit ~~is substantially~~ shall be aligned with the insulation and any gaps ~~are in the air barrier~~ sealed. ~~Attic access (except unvented attic), knee wall door, or drop down stair is sealed.~~ Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be ~~are~~ insulated and the~~.~~ junction of the foundation and sill plate ~~is~~ shall be sealed. The junction of the top plate and top of exterior walls shall be sealed. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing ~~is~~ shall be sealed.
Rim joists	Rim joists ~~are~~ shall be insulated and include ~~an~~ the air barrier.
Floors (including above garage and cantilevered floors)	Insulation ~~is~~ shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier ~~is~~ shall be installed at any exposed edge of insulation.
Crawlspace walls	Where provided in lieu of floor insulation, insulation ~~is~~ shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawlspaces ~~is~~ shall be covered with a class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, ~~knee walls,~~ and flue shafts opening to exterior or unconditioned space ~~are~~ shall be sealed.
Narrow cavities	Batts in narrow cavities ~~are~~ shall be cut to fit, or narrow cavities ~~are~~ shall be filled by ~~spayed/blown~~ insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing ~~is~~ shall be provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope ~~are~~ shall be airtight, IC rated, and sealed to the drywall. ~~Exception--fixtures in conditioned space.~~
Plumbing and Wiring	~~Insulation is placed between outside and pipes.~~ Batt insulation ~~is~~ shall be cut neatly to fit around wiring and plumbing in exterior walls, or ~~sprayed/blown~~ insulation that on installation readily conforms to available space shall extend~~s~~ behind piping and wiring.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs ~~on exterior walls~~ shall be ~~have~~ insulat~~ion~~ed and ~~an~~ the air barrier installed separating them from the ~~exterior wall~~ showers and tubs.
Electrical / phone box on exterior walls	The air barrier ~~extends~~ shall be installed behind electrical or communication boxes or ~~an~~ air sealed ~~type~~ boxes ~~are~~ shall be installed.
Common wall	An air barrier ~~is~~ shall be installed in the common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building thermal envelope ~~are~~ shall be sealed to the subfloor or drywall.
Fireplace	An air barrier shall be installed on fireplace walls. ~~include an air barrier.~~ Fireplaces shall have gasketed doors.

Commenter's Reason: At the Baltimore hearings in October, 2009, the IECC Code Development Committee approved EC13 Part I in its entirety and without modifications. The IRC Building / Energy Committee disapproved EC13 Part II in its entirety. Approval of items 2, 3, and 4 of Part II for inclusion in the IRC would establish substantial agreement between the IECC and IRC with respect to the very important areas of thermal envelope insulation values, fenestration U-factors, insulation installation, and thermal envelope sealing. Items 1, 2 and 3 of this public comment are identical the Items 2, 3 and 4 of the original proposal. Items 1 and 5-15 of the original proposal are not included in this public comment.

At the conclusion of the Baltimore hearings, the IECC Committee had approved EC13 for inclusion in the IECC and the IRC Committee had approved EC16 for inclusion in the IRC. There are very significant differences between the respective proposals. Perhaps the most significant difference is that while EC13 revises existing IECC Tables 402.1.1 and 402.1.3 that provide the basic ("prescriptive") thermal envelope insulation and U-factor values with improved stringency R-values and U-factors throughout all climate zones, EC16 revises these basic tables by proposing 4 alternate "paths" to (prescriptive) envelope compliance for each climate zone, with some concurrent increases in stringency. There is a basic contradiction between the proposals that will cause serious confusion for designers, plan reviewers, and field inspectors if both proposals are approved and the AHJ permits either code book to be used for energy compliance.

If the I-codes are being enforced, say, in Virginia (climate zone 4), is framed wall insulation supposed to be R20 (a permitted option under the IECC), or can it be R13 if I am complying with compliance paths 2, 3, or 4 under the IRC? Is the requirement for window U-factor to be 0.35 maximum under IECC or 0.32 if I am using paths 1 or 3 under IRC? If the I-codes are enforced in Vermont (climate zone 6), should floor insulation be R30 under IECC or R38 under IRC / path 4?

Our association firmly believes that identical requirements are essential throughout the I-codes, for uniform enforcement and interpretation among jurisdictions. This is the primary reason for our Public Comment. Our secondary reason is our conviction that there are inherent enforcement difficulties in the EC16 alternative path approach that will not occur if EC13 is ultimately approved in conformance with our recommendations.

Some of the compliance paths under EC16 in every climate zone impose "high efficiency" heating equipment, cooling equipment, and water heating equipment requirements. Enforcing the installation of high efficiency equipment has always been and continues to be an issue for plan reviewers and field inspectors in jurisdictions attempting to conscientiously and fairly implement the energy code. The space heating, air conditioning, and water heating equipment may only be installed just prior to "final" inspection, the very last inspection to be performed before a Certificate of Occupancy is granted. If the installed equipment efficiency is determined in the field to be too low, removal and replacement with the "right" efficiency equipment at this point is difficult, expensive, and time-consuming.

The code-required efficiencies are not labeled on the equipment in most cases (not required by IRC section M1303). An inspector will have to know how to access the databases of all equipment manufacturers (which may require a password) in order to verify the ratings and then compare them to the required ratings on the approved plans or the assumed compliance path, assuming that the plans show this information. If equipment of the required high efficiency rating was simply not available at the time that the subcontractor had to do his installation, will the AHJ demand compliance at this late stage of construction with an alternate compliance path that incorporates the installed efficiency? If that new path requires that additional insulation be installed in the walls / floors / ceilings because R-values have increased under that path, will the insulation actually be upgraded? Insulation upgrades may require demolition of interior finish and would ultimately delay "final inspection" approval.

When conforming to a compliance path under EC16 that requires high efficiency equipment, the basic "tradeoff" for installing high efficiency equipment is a leakier duct system, a leakier house, a thermal envelope with less insulation, or some combination thereof. Such an approach has serious implications for the house owners in the future. If they are unaware of the required efficiency of the originally installed equipment (the "panel certificate" is being proposed for deletion – see EC24), they will not have any guidance as to what sort of equipment they should purchase when the original equipment eventually needs replacing.

In a perfect world, a house built and qualified to the 2012 IRC incorporating EC16 with a SEER 17 air conditioner requirement under a specific compliance path will have its replacement air conditioner also rated at SEER 17 or above. But there is nothing in the code or in human nature to ensure that that favorable outcome will consistently occur. A homeowner may be perfectly aware that he should install the high efficiency unit, because, say, the panel certificate is still in his basement. But there may be exigencies of the moment (a breakdown in the middle of summer when the only unit available is SEER 13) that will result in a leaky, poorly insulated house with much lower efficiency equipment that will consume more energy than its original design for many years after the new air conditioner is installed.

A major flaw of EC16, if approved for inclusion in the IRC, is that it has no provision to ensure that "Replacement equipment shall be no less efficient than the equipment it is replacing" (which would not by itself solve the enforcement problems). Basing any provisions of the IRC on high efficiency equipment will have serious issues for code officials and serious implications for maintaining energy-saving benefits for the homeowner for the life of the residential building. The approval of EC13 / Part II / Items 2, 3, and 4 (as repeated in the public comment) will help to ensure that these long-term negative consequences do not develop.

Public Comment 19:

Stephen Turchen, Department of Public Works, Fairfax County, VA, representing Virginia Building and Code Officials Association requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding 5 air changes per hour ~~(ACH50)~~ in zones 1 and 2, and 3 air changes per hour in zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *building official*, testing shall be conducted by an *approved* party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *building official.* Testing shall be performed at any time after ~~rough-in and~~ creation of all penetrations of the *building thermal envelope.*

> ~~**Exception:** Where heating and cooling equipment meets the requirements of Section N1104, maximum leakage rate shall be seven air changes per hour (ACH50) in zones 1 and 2 and five air changes per hour in zones 3 through 8. Additions less than 1000 square feet are exempt from testing.~~

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, if installed at the time of test, shall be open;
4. Exterior openings 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; and
6. Supply and return registers, if installed at the time of the test, shall fully~~-~~open.

~~**N1102.4.1.2.1 Sampling.** Where groups of seven or more buildings of similar design and construction are completed and are issued occupancy permits during a 120-day period, or where a multifamily structure contains more than four dwelling units, testing of less than 100 percent, but not less than 1 in 7 or 15 percent, of the buildings from a specific builder and/or contractor or of dwelling units in a multifamily structure shall be permitted when *approved* by the *code official*. The specific buildings or dwelling units to be tested shall be selected by the *code official*. If any tested building or dwelling unit fails to comply with the maximum air leakage requirement in Section 402.4.1.2 then all buildings or dwelling units shall be tested until a minimum of three consecutive buildings or dwelling units comply from that specific builder and/or contractor or multifamily structure before the *code official* may permit sampling to resume.~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason The inclusion of the term "ACH50" is redundant in this section. It merely means that the "air changes per hour" (ACH) test should be performed at a differential pressure of 50 pascals. All of this is explained within the section.

The deletion of the term "rough-in" will help to avoid confusion in interpretation and enforcement of the blower door test requirement. *Rough-in* is defined in the IRC but only pertains to plumbing systems. There are other envelope penetrations that are relevant: electrical cables to outside light fixtures, ventilation duct terminations, setting of windows and doors and skylights, etc. How complete does a house have to be before it has achieved a state of "rough-in" and is eligible for a valid blower door test? The practical consideration for testing is what is left of this sentence: "Testing shall be performed at any time after creation of all penetrations of the building thermal envelope." If all possible penetrations of the thermal envelope (windows, doors, attic access openings, dryer exhausts, chimney flues, pipes and wires, etc.) required by the house design have been made (and, presumably, sealed), then the air tightness of the envelope and those openings can be confidently evaluated.

The Exception to section N1102.4.1.2 is deleted for two reasons: (a) The first sentence relaxes blower door test results in all climate zones if high efficiency equipment is installed per new section N1104. We are proposing to delete all of new section N1104; see the discussion for item 13 under our separate Public Comment. (b) The second sentence allows additions under 1000 sq.ft. to be exempt from blower door testing. The inference is that additions greater than or equal to 1000 sq.ft. (wall area? Conditioned floor area?) would have to be tested. Regardless, no protocol for testing any addition is presented. Most additions to residential buildings will have one or more fixed openings to the existing house; how are these openings to be sealed while doing a blower door test? Is the whole "new" house (existing + addition) to be tested? (Very likely to fail if the existing house is old and leaky.) No methods for testing additions *per* se are provided within items 1 - 6 under "During testing." Further, even if the addition has no fixed openings to the attached house, the addition might still exceed the allowable ACH50 limit because it is leaking through the old house wall / doors / windows. But that is not a true "failure" because the conditioned air will leak from one conditioned space to the other. Absent specific test procedures, it will be impossible for code officials to know how to test for leakage in additions or to uniformly enforce blower door testing of any addition of any size.

Deleted section N1102.4.1.2.1 would have allowed random sampling of residential construction to test for building air leakage. If random testing is allowed, it will cause great uncertainty in the industry as to when such testing is required and why. (Note that the code official would be required to track occupancy permits issued by date and builder and predict that more than 7 buildings would be built during any 120 day period. Our Association members believe that such a predictive tracking system is unworkable.) This would put the Code Official in a situation were he/she would be heavily scrutinized as to how they decided what buildings were actually selected for blower door leakage testing. A uniform, 100% across the board application of the section N1102.4.1.2 testing requirements will eliminate any questions regarding when, where, and why testing shall be done and remove any doubt or suspicion that may be present. Random testing of houses for air leakage only fosters the potential for the perception of unscrupulous activities. Code officials do not need to be placed in any situation where the public will possibly scrutinize their behavior in these matters.

The language of proposed section N1102.4.1.2 will allow the installing contractor or an approved testing agency to perform the blower door test proposed for the IECC. Permitting third party inspections will eliminate the installing contractors' ability to certify their own work as the exclusive evidence of compliance. A third party inspection program is a common practice and has worked well for design professionals who are required to perform special inspections on their own work / designs, so this approach should also apply to blower door testing. Allowing approved outside agencies into the blower door testing program will increase the available pool of competent testers and further decrease the need for random testing due to lack of available personnel. Nothing in the proposed language would deny the code official's prerogative to do the blower door testing himself or using his own personnel, should any building department choose to develop this capability.

Public Comment 20:

Stephen Turchen, Department of Public Works, Fairfax County, VA, representing Virginia Building and Code Officials Association requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.4.3 Fireplaces. New wood-burning fireplaces shall have tight-fitting flue dampers and outdoor combustion air.

N1103.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4. Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

2. Rough-in test: Total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All register ~~boots~~ shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85.0 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*.

Exception: ~~Where heating and cooling equipment meets the requirements of Section 404:~~
~~1. Maximum total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 sq.ft. (9.29 m2) of conditioned floor area for ducts located outside conditioned space, and~~
~~2.~~ The ~~maximum~~ total leakage test is not required for ducts and air handlers located entirely within ~~conditioned space~~ the building thermal envelope.

Delete Section N1103.2.4 in its entirety.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Although not discussed in the Reason statement, the apparent justification for deleting gasketed doors from Section N1102.4.3 is that the requirement has been moved to revised Table N1102.4.1.1 (very last item). However, the paragraph on fireplaces appears in IRC Sec. N1102.4 on "air leakage." Retaining gaskets on the fireplace doors will help to minimize air leakage into the firebox. However, air that leaks past a poorly gasketed fireplace door, or a door that is simply left open, will flow up the chimney if the flue is not well-sealed from the firebox. The suggested change to Section N1102.4.3 corrects this oversight. There are various high-temperature gasket materials that can be used to achieve a tight seal in the flue and door areas. During the majority times of the year that the fireplace will not be operating, the combination of well-gasketed doors and a well-sealed flue damper will prevent air leakage through what is effectively an enormous hole in the thermal envelope of the building.

The Exception to Section N1103.2.2 has been modified to remove any dependence on proposed Sec. N1104 (see our separate Public Comment addressing item #13). If the duct system components are located 100% within the building thermal envelope (i.e., those construction elements that enclose conditioned space), the duct system leakage test serves little purpose, independent of whether any high efficiency equipment is installed. For a reasonably well-sealed duct system, any small leaks will transmit heated or cooled air back into the conditioned space.

The operational premise for IRC Chapter 11 is contained in section N1101.2: Do everything in Chapter 11 (or use the IECC). Therefore, under proposed section N1103.2.4, a designer trying to implement the IRC approach will be required to place the ducts and air handler in conditioned space. (The terms "prescriptive" and "mandatory" are irrelevant under the IRC.) If that is in fact done, what is the necessity for the duct leakage test, which is now required under proposed section N1103.2.2? See response to item 8 above. There is no need to govern duct placement in the IRC; that is the choice of the HVAC designer / contractor and will depend on many factors beyond the purview of the code official. What should be governed by the code is the need for testing of the duct system, depending on placement: Test if outside the thermal envelope, no need to test if inside.

Public Comment 21:

Theresa A. Weston, representing DuPont Building Innovations requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[k]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE

h. First value is cavity insulation, second is continuous insulation, so “13+5” means R-13 cavity insulation plus R-5 <u>continuous insulation or</u> insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with <u>continuous insulation or</u> insulating sheathing of at least R-2.

(Portions of code change proposal not shown remain unchanged)

Commenter’s Reason: This modification changes this proposal to be consistent with other proposals modified and approved during the technical hearings. It generalizes the requirement for continuous insulation and does not require the insulation to be a sheathing thus allowing more options for meeting this requirement.

Final Action: AS AM AMPC____ D

EC16-09/10-PART I

103, 202, Chapter 4

Proposed Change as Submitted

Proponent: Ken Sagan, representing National Association of Home Builders

PART I – IECC

1. Revise as follows:

103.2 Information on construction documents. Construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when *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, as applicable, cardinal directions; insulation materials and their R-values; fenestration U-factors and SHGCs; area-weighted U-factor and SHGC calculations; projection factor calculations; mechanical system design criteria; mechanical and service water heating system and equipment types, sizes and efficiencies; economizer description; equipment and systems controls; fan motor horsepower (hp) and controls; duct sealing, duct and pipe insulation and location; lighting fixture schedule with wattage and control narrative; and air sealing details.

2. Add new definitions as follows:

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where pumps prime the service water heating with heated water when triggered by a manual button or switch, or by sensing the presence of a person where the heated water is used.

PROJECTION FACTOR. The ratio of the horizontal depth of an overhang, eave, or permanently attached shading device, divided by the distance measured vertically from the bottom of the fenestration glazing to the underside of the overhang, eave, or permanently attached shading device.

3. Revise as follows:

401.1 Scope. This chapter applies to residential buildings.

401.2 Compliance. Projects shall comply with Sections 401, ~~402.4~~ 403.4, ~~402.5,~~ ~~403.1~~ 404.1, ~~403.2.2~~ 404.2.2, ~~403.2.3~~ 404.2.3 and ~~403.3~~ 404.3 through ~~403.9~~ 404.9 (referred to as the mandatory provisions) and either:

1. Sections 402, ~~402.1~~ 403.1 through ~~402.3~~ 403.3, ~~403.2.1~~ 404.2.1, 404.2.3, and ~~404.1~~ 405.1 (prescriptive); or
2. Section ~~405~~ 406 (performance).

401.3 Certificate. A permanent certificate shall be posted on or in the electrical distribution 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 be completed by the builder or registered design professional. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration,~~; and~~ the solar heat gain coefficient (SHGC) of fenestration and tested or sampled ACH_{50}. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the types and efficiency of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace, and/or baseboard electric heater is installed in the residence, the certificate shall list “gas-fired unvented room heater”, “electric furnace”, or “baseboard electric heater” as appropriate. An efficiency shall not be listed for gas-fired unvented room heaters, electric furnaces, or electric baseboard heaters.

4. Add new text and table as follows:

401.4 Compliance testing. Where testing is required to determine air leakage of buildings or duct systems, the code official shall be permitted to require random sample testing of no fewer than one in seven residences.

SECTION 402
PRESCRIPTIVE REQUIREMENT TABLES

402.1 General (Prescriptive). The building thermal envelope and mechanical systems shall meet the requirements of one path in Table 402.1 based on the climate zone specified in Chapter 3. The prescriptive and mandatory provisions of Section 402, 403 and 404 shall be used in applying the requirements of Table 402.1.

TABLE 402.1
PRESCRIPTIVE REQUIREMENTS BY COMPONENT[a]

Climate Zone	Path Number	Fenestration U-Factor[b,c]	Skylight U-Factor[b]	Glazed Fenestration SHGC[b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
1	1	0.60	0.75	0.25	38	13+3	5/10	13	0	0	7	Cond or Tested	Standard	Standard	Standard
1	2	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	Standard	SEER 15	62G/94E
1	3	0.60	0.75	0.3	30	13	3/4	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
1	4	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	Standard	SEER 17	Standard
2	1	0.35	0.65	0.25	38	13+3	6/13	13	0	0	7	Cond or Tested	Standard	Standard	Standard
2	2	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	Standard	SEER 15	62G/94E
2	3	0.35	0.65	0.3	30	13	4/6	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
2	4	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	Standard	SEER 17	Standard
3	1	0.32	0.6	0.3	38	20 or 13+5	8/13	19	5/13[p]	0	7	Cond or Tested	Standard	Standard	Standard
3	2	0.35	0.6	0.3	30	13	5/8	19	5/13[p]	0	7	Cond or Tested	90/8.9	SEER 17	62G/94E
3	3	0.50	0.6	0.3	38	13	5/8	19	5/13[p]	0	4	Reduced Leakage	Standard	Standard	Standard
3	4	0.50	0.6	0.3	30	13	5/8	19	5/13[p]	0	4	Cond or Tested	90/8.9	SEER 15	Standard
4 except Marine 4	1	0.32	0.6	NR	38	20 or 13+5	8/13	19	10/13	10; 2 ft	7	Cond or Tested	Standard	Standard	Standard
4 except Marine 4	2	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	7	Cond or Tested	90/8.9	SEER 15	62G/94E
4 except Marine 4	3	0.32	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
4 except Marine 4	4	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Cond or Tested	90/8.9	SEER 15	Standard

Climate Zone	Path Number	Fenestration U-Factor[b,c]	Skylight U-Factor[b]	Glazed Fenestration SHGC[b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
5 and Marine 4	1	0.32	0.6	NR	49	20+5 or 13+10	15/20	30	15/19	10; 2 ft	4	Cond or Tested	Standard	Standard	Standard
5 and Marine 4	2	0.32	0.6	NR	38	20 or 13+5	13/17	30	10/13	10; 2 ft	7	Reduced Leakage	92/9.1	15 SEER	62G/94E
5 and Marine 4	3	0.32	0.6	NR	49	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
5 and Marine 4	4	0.35	0.6	NR	38	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Cond or Tested	92/9.1	Standard	Standard

Climate Zone	Path Number	Fenestration U-Factor[b,c]	Skylight U-Factor[b]	Glazed Fenestration SHGC[b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
6	1	0.30	0.6	NR	49	20+5 or 13+10	19/21	30	15/19	10; 4 ft	4	Cond or Tested	Standard	Standard	Standard
6	2	0.35	0.6	NR	49	20 or 13+5	15/19	30	15/19	10; 4 ft	7	Reduced Leakage	92/9.1	Standard	62G/94E
6	3	0.32	0.6	NR	60	20 or 13+5	15/19	30	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
6	4	0.35	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	92/9.1	Standard	Standard

Climate Zone	Path Number	Fenestration U-Factor[b,c]	Skylight U-Factor[b]	Glazed Fenestration SHGC[b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
7 and 8	1	0.27	0.6	NR	60	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Cond or Tested	Standard	Standard	Standard
7 and 8	2	0.30	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	92/9.1	Standard	62G/94E
7 and 8	3	0.32	0.6	NR	49	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
7 and 8	4	0.35	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Reduced Leakage	92/9.1	Standard	Standard

For SI: 1 foot = 304.8 mm.

(relettered and reordered in order of table)

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. "NR" means no requirement.

c~~j~~. For impact rated fenestration complying with Section R301.2.1.2 of the International Residential Code or Section 1609.1.2 of the International Building Code, the maximum U-factor in Climate Zones 1-3 shall be permitted to be 0.15 higher than that specified in Table 402.1~~0.75 in Zone 2 and 0.65 in Zone 3~~.

d~~e~~. There are no SHGC requirements in the Marine Zone.

e. SHGC calculations and exceptions are covered under Section 403.3.

f~~h~~. "xx+yy" means R-xx cavity insulation plus R-yy insulated sheathing. ~~"13+5" means R-13 cavity insulation plus R-5 insulated sheathing.~~ If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

g~~i~~. The second R-value applies when more than half the insulation is on the interior of the mass wall and applies interior cavity insulation.

h~~g~~. Or insulation sufficient to fill the framing cavity, R-19 minimum.

i~~c~~. "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

j~~d~~. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in Zones 1 through 3 for heated slabs.

k. Air tightness testing requirements are listed in Section 403.4.1.1.

l. "Cond or Tested" means that the duct system shall either be located within conditioned space or tested in accordance with Section 404.2.2. "Reduced Leakage" means that the duct system shall comply with the requirements of section 404.2.3.

m. Heating system performance tested in accordance with ASHRAE Standard 103 or ARI Standard 210/240 or equivalent. Coefficient of Performance (COP) is converted into HSPF by multiplying by 3.413. "Standard" represents the prevailing minimum efficiency acceptable under federal law.

n. Cooling system performance tested in accordance with ARI Standard 210/240 or equivalent. Energy Efficiency Ratio (EER) is converted to SEER by multiplying EER*1.143. "Standard" represents the prevailing minimum efficiency acceptable under federal law.

o. Water heater Energy Factor requirements for Gas (G) and Electric (E) water heaters. "Standard" represents the prevailing minimum efficiency acceptable under federal law.

p. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

5. Revise as follows:

SECTION 403
BUILDING THERMAL ENVELOPE

~~402.1~~ 403.1 General (Prescriptive).

~~**402.1.1 Insulation and fenestration criteria.** The building thermal envelope shall meet the requirements of Table 402.1.1 based on the climate zone specified in Chapter 3.~~

403.1.1 Insulation Installation. All insulation installed as part of the building thermal envelope to achieve compliance with Table 402.1 shall be installed in accordance with the manufacturer's installation instructions and in a manner such that as installed it meets the specified performance levels provided in Table 402.1. An area-weighted average of each component shall be permitted to satisfy the requirements in Table 402.1.

~~402.1.2~~ 403.1.2 *R*-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component *R*-value. The manufacturer's settled *R*-value shall be used for blown insulation. Computed *R*-values shall not include an *R*-value for other building materials or air films.

6. Delete table without substitution:

~~**TABLE 402.1.1**~~
~~**INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT**~~

7. Revise and renumber as follows:

TABLE ~~402.1.3~~ 403.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION U-FACTOR	SKYLIGHT U-FACTOR	Glazed Fenestration SHGC	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR[d]	CRAWL SPACE WALL U-FACTOR[c]	ENVELOPE LEAKAGE RATES (ACH50)
1	~~1.20~~0.50	0.75	.25	0.030~~5~~	0.066~~82~~	0.138~~97~~/0.120	0.064	0.360	0.477	7
2	~~0.65~~0.35	~~0.75~~0.65	.25	0.030~~5~~	0.066~~82~~	0.1~~65~~38/0.098	0.064	0.360	0.477	7
3	~~0.50~~0.32	0.65	.3	0.030~~5~~	0.058~~82~~	~~0.141~~0.098/0.087	0.047	0.091[c]	0.136	7
4 except Marine	~~0.35~~0.32	0.60	NR	0.030	0.058~~82~~	~~0.141~~0.098/0.087	0.047	0.059	0.065	4
5 and Marine 4	~~0.35~~0.32	0.60	NR	0.026~~30~~	0.048~~057~~	~~0.082~~0.058/0.057	0.033	0.050~~9~~	0.053~~65~~	4
6	~~0.35~~0.30	~~0.60~~0.55	NR	0.026	0.048~~057~~	~~0.06~~0.047/0.054	0.033	0.050	0.053~~65~~	4
7 and 8	~~0.35~~0.27	~~0.60~~0.55	NR	0.024~~6~~	0.048~~057~~	~~0.057~~0.043/0.047	0.028	0.050	0.053~~65~~	3

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.10 in Zone 4 except Marine, and the same as the frame wall U-factor in Marine Zone 4 and Zones 5 through 8.

c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.2.

d. Foundation U-factor requirements shown in Table ~~402.1.3~~ 403.1.3 include wall construction and interior air films but exclude soil conductivity and exterior air films. U-factors for determining code compliance in accordance with Section ~~402.1.4~~ 403.1.4 (total UA alternative) of Section 405 (Simulated Performance Alternative) shall be modified to include soil conductivity and exterior air film.

~~402.1.3~~ 403.1.3 *U*-factor alternative. An assembly with a *U*-factor equal to or less than the equivalent R-value specified in Table 402.1 determined by using a method consistent with the ASHRAE *Handbook of Fundamentals* including the thermal bridging effects of framing materials shall be permitted as an alternative to the required *R*-value in Table 402.1.1 for the selected path. Nonfenestration *U*-factors or R-values shall be obtained from measurement, calculation or an approved source.~~that specified in Table 402.1.3 shall be permitted as an alternative to the *R*-value in Table 402.1.1.~~

~~402.1.4~~ 403.1.4 Total UA alternative. If the total building thermal envelope UA (sum of *U*-factor times assembly area) is less than or equal to the total UA resulting from using the *U*-factors in Table ~~402.1.3~~ 403.1.3 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with the R-value and U-factor requirements of Table ~~402.1.1~~ 402.1. The UA calculation shall be done using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. The SHGC and Envelope Leakage rate requirements in Table 403.1.3 shall be met in addition to UA compliance.

~~402.2~~ 403.2 Specific insulation requirements (Prescriptive).

8. Add new text and table as follows:

403.2.1 Ceilings with attic space. Wherever full height of uncompressed insulation extends over the wall top plate at the eaves, the reduced values in Table 403.2.1 shall be deemed to satisfy the ceiling insulation requirements. This reduction shall not apply to the U-factor alternative approach in Section 403.1.3 and the Total UA alternative in Section 403.1.4.

TABLE 403.2.1
ALLOWABLE CEILING R-VALUE WITH FULL HEIGHT PERIMETER INSULATION

TABLE 402.1 LISTED CEILING R-VALUE	ALLOWABLE R-VALUE WITH FULL HEIGHT PERIMETER INSULATION
38	30
49	38
60	49

9. Delete without substitution:

~~**402.2.1 Ceilings with attic spaces.** When Section 402.1.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the U-factor alternative approach in Section 402.1.3 and the Total UA alternative in Section 402.1.4.~~

10. Revise and renumber as follows:

~~402.2.2~~ 403.2.2 Ceilings without attic spaces. Where Section ~~402.1.1~~ 402.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section 402.1.1 shall be limited to 500 square feet (46 m^2) or 20% of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section ~~402.1.3~~ 403.1.3 and the Total UA alternative in Section ~~402.1.4~~ 403.1.4.

~~402.2.3~~ 403.2.3 Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment which prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.
~~402.2.4~~ 403.2.4 Mass walls. Mass walls for the purposes of this Chapter shall be considered above grade walls of concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth block, rammed earth) and solid timber/logs.

~~402.2.5~~ 403.2.5 Steel-frame ceilings, walls and floors. Steel-frame ceilings, walls and floors shall meet the insulation requirements of Table ~~402.2.5~~ 403.2.5 or shall meet the *U*-factor requirements in Table ~~402.1.3~~ 403.1.3. The calculation of the *U*-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

> ~~**Exception:** In Climate Zones 1 and 2, the continuous insulation requirements in Table 4032.2.45 shall be permitted to be reduced to R-3 for steel frame wall assemblies with studs spaced at 24 inches (610 mm) on center.~~

TABLE ~~402.2.5~~ 403.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(*R*-VALUE)

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL 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
R-13[c]	R -13+5 or R-15+4 or R-21+3 or R-0+10
R-19	R -13+9 or R-19+8 or R-25+7
R-21	R-13+10 or R-19+9 or R-25+8
	Steel Joist Floor
R-13	R-19 in 2×6; R-19+6 in 2×8 or 2×10
R-19	R-19+6 in 2×6; R-19+12 in 2×8 or 2×10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.
c. Under prescriptive paths 2, 3, and 4, insulation for steel framed wall assemblies with studs spaced 24 inches (610mm) on center shall be permitted to be R-13+0 when ceiling insulation is increased to a wood framed equivalent of R-38 in climate zones 1 and 2 and permitted to be R-13+3 when ceiling insulation is increased to a wood framed equivalent of R-49 in climate zones 3 and 4.

~~402.2.6~~ 403.2.6 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

~~402.2.7~~ 403.2.7 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 meet this requirement unless the floor overhead is insulated in accordance with Sections ~~402.1.1~~ 402.1 and ~~402.2.6~~ 403.2.6.

~~402.2.8~~ 403.2.8 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 ~~402.1.1~~ 402.1. 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 ~~402.1.1~~ 402.1 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 a minimum of 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.

~~402.2.9~~ 403.2.9 Crawl space walls. As an alternative to insulating floors over crawl spaces, crawl space walls shall be permitted to be insulated when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished grade level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder. All 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 at least 6 inches (153 mm) up the stem wall and shall be attached to the stem wall.

~~402.2.10~~ 403.2.10 Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.

~~402.2.11~~ 403.2.11 Thermally isolated sunroom insulation. The minimum ceiling insulation *R*-values shall be R-19 in zones 1 through 4 and R-24 in zones 5 though 8. The minimum wall *R*-value shall be R-13 in all zones. New wall(s) separating a sunroom from conditioned space shall meet the building thermal envelope requirements.

~~402.3~~ 403.3 Fenestration (Prescriptive).

~~402.3.1~~ 403.3.1 *U*-factor. An area-weighted average of fenestration products shall be permitted to satisfy the *U*-factor requirements.

~~402.3.2~~ 403.3.2 Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50 percent glazed shall be permitted to satisfy the SHGC requirements.

11. Add new text and table as follows:

403.3.3 Glazed Fenestration SHGC exception. In climate zones 1-3, vertical fenestration shaded by an overhang, eave, or permanently attached shading device shall be permitted to satisfy the SHGC requirements provided the projection factor is greater than or equal to the value listed in table N1103.3.3 for the appropriate orientation. The overhang, eave, or permanently attached shading device shall have a minimum projection that shall extend beyond each side of the glazing a minimum of 12 inches. Where different windows and glazed doors have different projection factors, they shall each be evaluated separately, or an area-weighted projection factor value shall be calculated and used. Each orientation shall be rounded to the nearest cardinal orientation (+/-45 degrees or 0.79 rad) for purposes of calculations and demonstrating compliance.

TABLE 403.3.3
MINIMUM PROJECTION FACTOR REQUIRED BY ORIENTATION FOR SHGC EXCEPTION

ORIENTATION	PROJECTION FACTOR
North	>=0.30
South	>=0.20
East	>=0.50
West	>=0.50

12. Revise and renumber as follows:

~~402.3.3~~ 403.3.4 Glazed fenestration exemption. Up to 15 square feet (1.4 m^2) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section ~~402.1.1~~ 402.1. This exemption shall not apply to the U-factor alternative approach in Section ~~402.1.3~~ 403.1.3 and the Total UA alternative in Section ~~402.1.4~~ 403.1.4.

~~402.3.4~~ 403.3.5 Opaque door exemption. One side-hinged opaque door assembly up to 24 square feet (22 m^2) in area is exempted from the *U*-factor requirement in Section 402.1.1. This exemption shall not apply to the U-factor alternative approach in Section ~~402.1.3~~ 403.1.3 and the Total UA alternative in Section 403~~2~~.1.4.

~~402.3.5~~ 403.3.6 Thermally isolated sunroom *U*-factor. For Zones 4 through 8, the maximum fenestration *U*-factor shall be 0.50 and the maximum skylight *U*-factor shall be 0.75. New windows and doors separating the sunroom from conditioned space shall meet the building thermal envelope requirements.

~~402.3.6~~ 403.3.7 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the~~ applicable~~ following requirements for *U*-factor and SHGC ~~in Table 402.1.1~~. : SHGC in climate zones 1-3 of 0.30, U-Factor of 0.5 in climate zones 2, 3, 0.35 in climate zones 4,5, 0.32 in climate zones 6, 7 and 8 subject to the all the provisions in Section 403.3.

~~402.4~~ 403.4 Air leakage (Mandatory).
~~402.4.1~~ 403.4.1 Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

1. ~~All joints, seams and penetrations.~~
2. ~~Site-built windows, doors and skylights.~~
3. ~~Openings between window and door assemblies and their respective jambs and framing.~~
4. ~~Utility penetrations.~~
5. ~~Dropped ceilings or chases adjacent to the thermal envelope.~~
6. ~~Knee walls.~~
7. ~~Walls and ceilings separating a garage from conditioned spaces.~~
8. ~~Behind tubs and showers on exterior walls.~~
9. ~~Common walls between dwelling units.~~
10. ~~Attic access openings~~
11. ~~Rim joist junction~~
12. ~~Other sources of infiltration.~~

~~**402.4.2 Air sealing and insulation.**~~ Building envelope air tightness shall be demonstrated to comply with a pre-close visual inspection and air tightness testing in accordance with Sections 403.4.1.1 and 403.4.1.2. ~~and insulation installation shall be demonstrated to comply with one of the following options given by Section 402.4.2.1 or 402.4.2.2:~~

~~**402.4.2.1**~~ **403.4.1.1 Testing** ~~**option.**~~ Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than or equal to the building ~~seven~~ air changes per hour (ACH) listed in the selected path of Table 402.1 when tested with a blower door apparatus at a pressure of 0.2 in w.c.~~33.5 psi~~ (50 Pa). Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed;
2. Dampers shall be closed, but not sealed; including exhaust, intake, makeup air, back draft, and flue dampers;
3. Interior doors shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s) shall be turned off;
6. HVAC ducts shall not be sealed; and
7. Supply and return registers shall not be sealed.

13. Add new text as follows:

403.4.1.1.1 Multi-family and single family attached. For residential occupancies other than single family detached dwellings, testing shall be permitted to be the entire building tested simultaneously or a sampling of no fewer than 1 in 7 individual units within the structure. Individual unit tightness shall be permitted to be determined by either total unit leakage or leakage to unconditioned space (including outside). Where multiple tests are performed for a building, the average tightness of tested units shall be permitted to satisfy the required building envelope airtightness level.

403.4.1.1.2 Failed testing. If the dwelling does not achieve the air-leakage requirement on the initial test, after an attempt to correct, a subsequent test must be performed that demonstrates compliance or at least a 10% reduction in leakage and within 1 ACH of the required tightness.

Exception: Testing is not required in climate zones 1-4 for residences claiming an air tightness level of 7 ACH50.

14. Revise and renumber as follows:

~~**402.4.2.2**~~ **403.4.1.2 Visual inspection** ~~**option**~~**:** Building envelope tightness and insulation installation shall be considered acceptable when the items listed in Table ~~402.4.2~~ 403.4.1.2, applicable to the method of construction, are field verified~~. Where required by the code official,~~ or an approved party ~~independent from the installer of the insulation, shall inspect the air barrier and insulation~~.

~~**402.4.3**~~ **403.4.2 Fireplaces.** New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.

~~**402.4.4**~~ **403.4.3 Fenestration air leakage.** Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m^2), and swinging doors no more than 0.5 cfm per square foot (2.6

L/s/m^2), when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled by the manufacturer.

Exceptions: Site-built windows, skylights and doors.

TABLE ~~402.4.2~~ 403.4.1.2
AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material. Air permeable insulation is inside of an air barrier.
Ceiling / attic	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
Walls	Corners and headers are insulated. Junction of foundation and sill plate is sealed.
Windows and doors	Space between window/door jambs and framing is sealed.
Rim joists	Rim joists are insulated and include an air barrier.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls. Exposed earth in unvented crawlspaces is covered with class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit, or narrow cavities are filled by spayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures are airtight, IC rated, and sealed to drywall. Exception—fixtures in conditioned space.
Plumbing and Wiring	Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
Shower / tub on exterior wall	Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.
Electrical / phone box on exterior walls	Air barrier extends behind boxes or an air sealed type boxes are installed.
Common wall	Air barrier is installed in common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace	Fireplace walls include an air barrier.

~~402.4.5~~ 403.4.4 Recessed lighting. Recessed luminaires installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

15. Delete without substitution:

~~**402.5 Maximum fenestration *U*-factor and SHGC (Mandatory).** The area weighted average maximum fenestration *U*-factor permitted using trade offs from Section 402.1.4 or Section 404 shall be 0.48 in zones 4 and 5 and 0.40 in zones 6 through 8 for vertical fenestration, and 0.75 in zones 4 through 8 for skylights. The area weighted average maximum fenestration SHGC permitted using trade-offs from Section 405 in Zones 1 through 3 shall be 0.50.~~

16. Revise as follows:

SECTION ~~403~~ 404
SYSTEMS

~~403.1~~ 404.1 Controls (Mandatory). At least one thermostat shall be provided for each separate heating and cooling system.

~~403.1.1~~ 404.1.1 Programmable thermostat. Where the primary heating system is a forced air furnace, at least one thermostat per 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. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55ºF (13ºC) or up to 85ºF (29ºC). The thermostat shall initially be programmed with a heating temperature set point no higher than 70ºF (21ºC) and a cooling temperature set point no lower than 78ºF (26ºC).

~~403.1.2~~ 404.1.2 Heat pump supplementary heat (Mandatory). Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

~~403.~~2 404.2 Ducts.

~~403.2.1~~ 404.2.1 Insulation (Prescriptive). Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Ducts or portions thereof located completely inside the building thermal envelope.

~~403.2.2~~ 404.2.2 Sealing (Mandatory). All ducts, air handlers, filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*. Duct tightness shall be verified by either of the following:

1. Post-construction test: Leakage to outdoors shall be less than or equal to 8 cfm (226.5 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area or a total leakage less than or equal to 12 cfm (12 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.

   Exception: Duct tightness test is not required if the air handler and all ducts are located within conditioned space.

17. Add new text as follows:

404.2.3 Reduced Leakage ducts. (Prescriptive). When specified as part of a selected Path Number in Table 402.1, Reduced Leakage ducts must be located entirely within conditioned space and tested for total leakage and leakage to outside conditioned space. Leakage to outdoors shall be less than or equal to 3 cfm (84.9 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area, and the total leakage shall be less than or equal to 8 cfm (226.5 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. Total leakage of not greater than 3 cfm per 100 ft^2 of conditioned floor area at a pressure difference of 0.01 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure, shall be deemed to satisfy this requirement without measurement of leakage to outdoors.

18. Revise as follows:

~~403.2.3~~ 404.2.4 Building cavities (Mandatory). Building framing cavities shall not be used as supply ducts.

~~403.3~~ 404.3 Mechanical system piping insulation (Mandatory). Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) shall be insulated to a minimum of R-3.

~~403.4~~ 404.4 Service hot water systems.

19. Add new text as follows:

404.4.1 Hot water pipe insulation. At least R-3 insulation shall be applied to the following:

1. Piping larger than 3/4 in. outside diameter
2. Piping outside conditioned space
3. Piping in a floor slab or in the ground
4. Piping in a recirculating system exception: demand recirculation systems
5. Entire pipe run from water heater to kitchen sink

20. Revise as follows:

~~403.4~~ 404.4.2 Recirculating ~~Circulating~~ hot water systems. ~~All circulating service hot water piping shall be insulated to at least R-2.~~ Recirculating ~~Circulating~~ hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when not in use.

~~403.5~~ 404.5 Mechanical ventilation (Mandatory). Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

~~403.6~~ 404.6 Equipment sizing (Mandatory). Heating and cooling equipment shall be sized in accordance with Section M1401.3 of the *International Residential Code.*

~~403.7~~ 404.7 Systems serving multiple dwelling units (Mandatory). Systems serving multiple dwelling units shall comply with Sections 503 and 504 in lieu of Section ~~403~~ 404.

~~403.8~~ 404.8 Snow melt system controls (Mandatory). Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50ºF, and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40ºF.

~~403.9~~ 404.9 Pools (Mandatory). Pools shall be provided with energy conserving measures in accordance with Sections ~~403.9.1~~ 404.9.1 through ~~403.9.3~~ 404.9.3.

~~403.9.1~~ 404.9.1 Pool heaters. All pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas or LPG shall not have continuously burning pilot lights.

~~403.9.2~~ 404.9.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and-waste-heat-recovery pool heating systems.

~~403.9.3~~ 404.9.3 Pool covers. Heated pools shall be equipped with a vapor-retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12.

Exception: Pools deriving over 60 percent of the energy from heating from site-recovered or solar energy source.

SECTION ~~404~~ 405
ELECTRICAL POWER AND LIGHTING SYSTEMS

~~404.1~~ 405.4.1 Lighting equipment (Prescriptive). A minimum of ~~fifty~~ seventy-five percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps.

SECTION ~~405~~ 406
SIMULATED PERFORMANCE ALTERNATIVE
(Performance)

405.1 40~~6.1~~ Scope. This section establishes criteria for compliance using simulated energy performance analysis. Such analysis shall include heating, cooling, and service water heating energy only.

~~405.2~~ 406.2 Mandatory requirements. Compliance with this Section requires that the mandatory provisions identified in Section 401.2 be met. All supply and return ducts not completely inside the building thermal envelope shall be insulated to a minimum of R-6.

~~405.3~~ 406.3 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 Price and Expenditure Report*. 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.

~~405.4~~ 406.4 Documentation.

~~405.4.1~~ 406.4.1 Compliance software tools. Documentation verifying that the methods and accuracy of the compliance software tools conform to the provisions of this section shall be provided to the code official.

~~405.4.2~~ 406.4.2 Compliance report. Compliance software tools shall generate a report that documents that the proposed design complies with Section ~~405.3~~ 406.3. The compliance documentation shall include the following information:

1. Address or other identification of the residence;
2. An inspection checklist documenting the building component characteristics of the proposed design as listed in Table ~~405.5.2(1)~~ 406.5.2(1). The inspection checklist shall show the estimated annual energy cost results for both the standard reference design and the proposed design, and shall document all inputs entered by the user necessary to reproduce the results;
3. Name of individual completing the compliance report; and
4. Name and version of the compliance software tool.

> **Exception:** Multiple orientations. When 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 cardinal (north, east, south and west) orientations.

~~405.4.3~~ 406.4.3 Additional documentation. The code official shall be permitted to require the following documents:

1. Documentation of the building component characteristics of the standard reference design.
2. A certification signed by the builder providing the building component characteristics of the proposed design as given in Table ~~405.5.2(1)~~ 406.5.2(1).
3. Documentation of the actual values used in the software calculations for the proposed design.

~~405.5~~ 406.5 Calculation procedure.

~~405.5.1~~ 406.5.1 General. Except as specified by this section, the standard reference design and proposed design shall be configured and analyzed using identical methods and techniques.

~~405.5.2~~ 406.5.2 Residence specifications. The standard reference design and proposed design shall be configured and analyzed as specified by Table ~~405.5.2(1)~~ 406.5.2(1). Table ~~405.5.2(1)~~ 406.5.2(1) shall include by reference all notes contained in Table 402.1.1.

~~405.6~~ 406.6 Calculation software tools.

~~405.6.1~~ 406.6.1 Minimum capabilities. Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the standard reference design and the proposed design and shall include the following capabilities:

1. Computer generation of the standard reference design using only the input for the proposed design. The calculation procedure shall not allow the user to directly modify the building component characteristics of the standard reference design.
2. Calculation of whole-building (as a single zone) sizing for the heating and cooling equipment in the standard reference design residence in accordance with Section M1401.3 of the *International Residential Code*.
3. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air conditioning equipment based on climate and equipment sizing.
4. Printed code official inspection checklist listing each of the proposed design component characteristics from Table 406~~5~~.5.2(1) determined by the analysis to provide compliance, along with their respective performance ratings (e.g. *R*-Value, *U*-Factor, SHGC, HSPF, AFUE, SEER, EF, etc.).

~~405.6.2~~ 406.6.2 Specific approval. Performance analysis tools meeting the applicable sections of ~~405~~ 406 shall be permitted to be approved. Tools are permitted to be approved based on meeting a specified threshold for a jurisdiction. The code official shall be permitted to approve tools for a specified application or limited scope.

~~405.6.3~~ 406.6.3 Input values. When calculations require input values not specified by Sections 402, 403, 404, 405 and ~~405~~ 406, those input values shall be taken from an approved source.

TABLE ~~405.5.2(1)~~ 406.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass wall if proposed wall is mass; otherwise wood frame. Gross area: same as proposed *U*-factor: from Table ~~402.1.3~~ 403.1.3 Solar absorptance = 0.75 Remittance = 0.90	As proposed As proposed As proposed As proposed As proposed
Basement and crawl space walls	Type: same as proposed Gross area: same as proposed *U*-factor: from Table ~~402.1.3~~ 403.1.3, with insulation layer on interior side of walls.	As proposed As proposed As proposed
Above-grade floors	Type: wood frame Gross area: same as proposed *U*-factor: from Table 403~~2~~.1.3	As proposed As proposed As proposed
Ceilings	Type: wood frame Gross area: same as proposed *U*-factor: from Table ~~402.1.3~~ 403.1.3	As proposed As proposed As proposed
Roofs	Type: composition shingle on wood sheathing Gross area: same as proposed Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed As proposed
Attics	Type: vented with aperture = 1 ft^2 per 300 ft^2 ceiling area	As proposed
Foundations	Type: same as proposed foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed As proposed
Doors	Area: 40 ft^2 Orientation: North *U*-factor: same as fenestration from Table ~~402.1.3~~ 403.1.3.	As proposed As proposed As proposed
Glazing[a]	Total area[b] = ~~a) The proposed glazing area; where proposed glazing area is less~~ ~~than~~ 15% of the conditioned floor area.	As proposed

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	~~b) 15% of the conditioned floor area; where the proposed glazing~~ ~~area is 15% or more of the conditioned floor area.~~ Orientation: equally distributed to four cardinal compass orientations (N, E, S & W). *U*-factor: from Table ~~402.1.3~~ 403.1.3 SHGC: From Table ~~403.1.2.1.1~~ 403.1.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used. Interior shade fraction: Summer (all hours when cooling is required) = 0.70 Winter (all hours when heating is required) = 0.85[c] External shading: none	As proposed As proposed As proposed Same as standard reference design As proposed
Skylights	None	As proposed
Thermally isolated sunrooms	None	As proposed
Air exchange rate	ACH_{50} from Table 403.1.3 ~~Specific leakage area (SLA)[d] = 0.00036 assuming no energy~~ ~~Recovery~~	For residences that are not tested, ACH_{50} shall be 7. For residences without mechanical ventilation that are tested in accordance with Section 403.4.1.1, the measured air exchange rate[e] but not less than 0.35 ACH natural ventilation. For residences with mechanical ventilation that are tested in accordance with Section 403.4.1.1, ~~For residences that are not tested, the same as the standard reference design.~~ ~~For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange ratee but not less than 0.35 ACH~~ ~~For residences with mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1,~~ the measured air exchange rate[e] combined with the mechanical ventilation rate,[f] which shall not be less than $0.01 \times CFA + 7.5 \times (N_{br}+1)$ where: *CFA* = conditioned floor area N_{br} = number of bedrooms
Mechanical ventilation	None, except where mechanical ventilation is specified by the proposed design, in which case: Annual vent fan energy use: $kWh/yr = 0.03942 \times CFA + 29.565 \times (N_{br} + 1)$ where: *CFA* = conditioned floor area N_{br} = number of bedrooms	As proposed
Internal gains	$IGain = 17{,}900 + 23.8 \times CFA + 4104 \times N_{br}$ (Btu/day per dwelling unit)	Same as standard reference design

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Internal mass	An internal mass for furniture and contents of 8 pounds per square foot of floor area.	Same as standard reference design, plus any additional mass specifically designed as a thermal storage element[~~g,~~ f] but not integral to the building envelope or structure
Structural mass	For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air. For masonry basement walls, as proposed, but with insulation required by Table 402.1.3 403.1.3 located on the interior side of the walls For other walls, for ceilings, floors, and interior walls, wood frame construction	As proposed As proposed As proposed
Heating systems[~~g,~~ h, i]	Fuel type: same as proposed design Efficiencies: Electric: air-source heat pump with prevailing federal minimum efficiency Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency ~~As proposed~~ Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed As proposed As proposed As proposed As proposed
Cooling systems[~~g, i~~ h, j]	Fuel type: Electric Efficiency: in accordance with prevailing federal minimum standards ~~As proposed~~ Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed As proposed As proposed
Service water heating[~~g, i, j,~~ k]	Fuel type: same as proposed design for non-solar water heating. Where proposed design includes solar water heating, the standard reference shall include the equivalent capacity with fuel type same as the non-solar water heating. Efficiency: in accordance with prevailing Federal minimum standards Use: gal/day = 30 + 10 × *Nbr* Tank temperature: 120°F ~~As proposed~~ ~~Use: same as proposed design~~	As proposed As proposed Same as standard reference Same as standard reference ~~gal/day = 30 + (10 x N_{br})~~
Thermal distribution systems	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. Duct insulation: From Section ~~403.2.1~~ 404.2.1. For tested duct systems, the leakage rate shall be the applicable maximum rate from Section ~~403.2.2~~ 404.2.2.	As tested or as specified in Table 40~~5~~6.5.2(2) ~~if not tested~~
Thermostat	Type: Manual, cooling temperature setpoint = 75°F; Heating temperature setpoint = 72°F	Same as standard reference

For SI: 1 square foot = 0.93 m^2; 1 British thermal unit = 1055 J; 1 pound per square foot = 4.88 kg/m^2; 1 gallon (U.S.) = 3.785 L; °C = (°F-3)/1.8, 1 degree = ~~0.79~~ 0.017 rad.

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:

$AF = As \times FA \times F$

where:

AF = Total glazing area.

As = 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.

c. For fenestrations facing within 15 degrees (0.26 rad) of true south that are directly coupled to thermal storage mass, the winter interior shade fraction shall be permitted to be increased to 0.95 in the proposed design.

~~d. Where leakage area (*L*) is defined in accordance with Section 5.1 of ASHRAE 119 and where: *SLA = L/CFA* where *L* and *CFA* are in the same units.~~

e. Tested envelope leakage shall be determined and documented by an independent party approved by the *code official*. Hourly calculations as specified in the ~~2001~~ 2005 ASHRAE *Handbook of Fundamentals*, Chapter ~~26~~ 27, page ~~26.21~~ 27.21, Equation 40 (Sherman-Grimsrud model) or the equivalent shall be used to determine the energy loads resulting from infiltration.

f. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of ~~2001~~ 2005 ASHRAE *Handbook of Fundamentals,* page ~~26.24~~ 27.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals*, page ~~26.19~~ 27.19 for intermittent mechanical ventilation.

g. Thermal storage element shall mean a component 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 must be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or must be connected to such a room with pipes or ducts that allow the element to be actively charged.

h. For a proposed design with multiple heating~~,~~ or 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.

i. For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design. For electric heating systems, the prevailing federal minimum efficiency air-source heat pump shall be used for the standard reference design.

j. For a proposed design home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

k. For a proposed design with a non-storage-type water heater, a 40-gallon storage-type water heater with the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For the case of a proposed design without a proposed water heater, a 40-gallon storage-type water heater with 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.

TABLE ~~405.5.2(2)~~ 406.5.2(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 distribution systems entirely located in conditioned space[c]	0.88	1
Tested distribution system components located in unconditioned space[f]	0.88	—
"Ductless" systems[d]	1	—

For SI: 1 cubic foot per minute = 0.47 L/s; 1 square foot = $0.093 m^2$; 1 pound per square inch = 6895 Pa; 1 inch water gauge = 1250 Pa.

a. Default values given by 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 air flow across a coil but shall not have any ducted air flow external to the manufacturer's air handler enclosure.

Reason: The main purpose of this Proposal is two-fold. One is to achieve energy efficiency that is 30% above the 2006 IECC. The second is to achieve consistency between the IECC and the IRC for low-rise residential buildings. This proposal is also designed to bring together sound building science practices, energy efficiency options, code compliance verification, and practicality with respect to the construction of residential dwellings, without creating a market advantage for any one product or practice.

Significant energy savings is achieved several ways in this proposal by limiting whole house air leakage limiting fenestration area, increasing the building envelope requirements and equipment performance, resulting in a 30% improvement over the 2006 IECC.

This proposal has multiple prescriptive paths that builders and code officials can easily follow and without complicated calculations. Some paths use equipment to achieve the savings, others use air tightness and/or additional insulation.

As written in the 2009 IECC, many low SHGC windows are very dark resulting in higher lighting usage and an increased desire for more windows, thus do not save energy. Projection factor trade-offs for window SHGC requirements have successfully been used in the commercial and high rise residential energy codes for many years and have proven to be simple to calculate. The projection factor in this proposal allows builders to incorporate shading devices to satisfy the SHGC requirement.

Moreover, fenestration is a significant contributor to space conditioning costs in every climate. Solar heat gains in the Southern climates and conduction losses in the Northern climates are significantly reduced when a typical R-2 to R-3 window is replaced by an R-13 to R-21 wall. Providing an incentive for lower fenestration area by limiting window percentage in the prescriptive path will provide for increased opaque wall area, again, resulting in energy savings.

Another area that this proposal addresses is the percentage of windows (one of the least energy efficient components in a house) relative to the overall window-to-wall ratio. Recognizing the impact of the windows on the performance of the house, it is necessary to provide options to off-set the energy requirements of the windows. The window-to-floor area (UA) factor is adjusted according to the energy saving items listed in that particular climate zone and path option.

A tight building envelope and duct system are integral parts of an energy efficient home. Blower door and duct testing are recognized as tools used to evaluate these items and are addressed in this proposal. Once properly trained, contractors who perform air sealing and duct installation repeatedly install the systems in a consistent manner, testing would not necessarily be required in every home. Sample testing provides valuable periodic feedback to keep the performance levels consistent and acceptable. This has been demonstrated by the Energy Star program that has allowed sample testing for many years. Testing does not save energy, sealing ducts and the building envelope do.

Although the equipment trade-off Tables were eliminated from the 2009 IECC, increasing equipment efficiency is often a practical and cost effective means of saving energy. With the 4 option paths in this proposal, the builder can comply with the code by increased equipment efficiency or other options that would meet the required energy savings. As new technologies are developed that increases equipment efficiencies, it would only makes sense to incorporate the improved HVAC equipment to save energy.

Builders understand the need to increase energy efficiency in homes, but they must be given a variety of options and paths with which to reach their targets without being overburdened with complicated calculations that could easily lead to errors. This proposal provides that level of stringency and allows code officials an easy path to certify compliance of the code without requiring expensive testing.

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

ICCFILENAME: SAGAN-EC-7-103.2-202-CH 4-RE-1-R202-N1101-N1104

Public Hearing Results

PART I-IECC
Committee Action: Disapproved

Committee Reason: The committee prefers the approach taken in EC13. These proposed provisions would conflict with EC13.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Don Surrena, representing National Association of Home Builders (NAHB), requests Approval as Modified by this Public Comment.

Replace proposal as follows:

SECTION 103
CONSTRUCTION DOCUMENTS

Revise as Follows:

103.2 Information on construction documents. Construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when *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, as applicable, cardinal directions; insulation materials and their R-values; fenestration U-factors and SHGCs; area-weighted U-factor and SHGC calculations; projection factor calculations; mechanical system design criteria; mechanical and service water heating system and equipment types, sizes and efficiencies; economizer description; equipment and systems controls; fan motor horsepower (hp) and controls; duct sealing, duct and pipe insulation and location; lighting fixture schedule with wattage and control narrative; and air sealing details.

SECTION 202
GENERAL DEFINITIONS

Residential ~~Building~~ Occupancy. For this code, includes detached one- and two-family dwellings, and multiple single-family dwellings (townhouses) ~~R-3 buildings,~~ as well as Group R-2, R-3 and R-4 buildings ~~three stories or less in height.~~

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where pump(s) prime the service water heating with heated water when triggered by a manual button or switch, or by sensing the presence of a person where the heated water is used.

PROJECTION FACTOR. The ratio of the horizontal depth of an overhang, eave, or permanently attached shading device, divided by the distance measured vertically from the bottom of the fenestration glazing to the underside of the overhang, eave, or permanently attached shading device.

CHAPTER 4
RESIDENTIAL ENERGY EFFICIENCY
SECTION 401
GENERAL

401.1 Scope. This chapter applies to residential buildings.

401.2 Compliance. Projects shall comply with Sections 401, 403~~2~~.4, ~~402.5, 40~~4~~3~~.1, 404~~3~~.2.2, 404~~3~~.2.3 and 404~~3~~.3 through 404~~3~~.9 (referred to as the mandatory provisions) and either:

1. Sections 402, ~~402.1~~ 403.1 through ~~402.3~~ 403.3, ~~403.2.1~~ 404.2.1, 404.2.3, and ~~404.1~~ 405.1(prescriptive); or
2. Section ~~405~~ 406 (performance).

401.3 Certificate (Mandatory). A permanent certificate shall be completed and posted on or in the electrical distribution panel by the builder or registered design professional. The certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. ~~The certificate shall be completed by the builder or registered design professional.~~ The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration, and the results from any duct system and building envelope air leakage testing done on the building. the solar heat gain coefficient (SHGC) of fenestration and tested or sampled ACH_{50}. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the types and efficiency of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace, and/or baseboard electric heater is installed in the residence, the certificate shall list "gas-fired unvented room heater", "electric furnace", or "baseboard electric heater" as appropriate. An efficiency shall not be listed for gas-fired unvented room heaters, electric furnaces, or electric baseboard heaters.

401.4 Compliance testing. Where testing is required to determine air leakage of buildings or duct systems, the code official shall be permitted to require random sample testing of no fewer than one in seven residences.

SECTION 402
PRESCRIPTIVE REQUIREMENT TABLES

402.1 General (Prescriptive). The building thermal envelope and mechanical systems shall meet the requirements of one path in Table 402.1 based on the climate zone specified in Chapter 3. The prescriptive and mandatory provisions of Section 402, 403 and 404 shall be used in applying the requirements of Table 402.1.

TABLE 402.1
PRESCRIPTIVE REQUIREMENTS BY COMPONENT[a]

Climate Zone	Path Number	Fenestration U-Factor[b,c]	Skylight U-Factor[b]	Glazed Fenestration SHGC[b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE)/Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
1	1	0.60	0.75	0.25	38	13+3	5/10	13	0	0	7	Cond or Tested	Standard	Standard	Standard
1	2	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	Standard	SEER 15	62G/94E
1	3	0.60	0.75	0.3	30	13	3/4	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
1	4	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	Standard	SEER 17	Standard
2	1	0.35	0.65	0.25	38	13+3	6/13	13	0	0	7	Cond or Tested	Standard	Standard	Standard
2	2	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	Standard	SEER 15	62G/94E
2	3	0.35	0.65	0.3	30	13	4/6	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
2	4	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	Standard	SEER 17	Standard
3	1	0.32	0.6	0.3	38	20 or 13+5	8/13	19	5/13[p]	0	7	Cond or Tested	Standard	Standard	Standard
3	2	0.35	0.6	0.3	30	13	5/8	19	5/13[p]	0	7	Cond or Tested	90/8.9	SEER 17	62G/94E
3	3	0.50	0.6	0.3	38	13	5/8	19	5/13[p]	0	4	Reduced Leakage	Standard	Standard	Standard
3	4	0.50	0.6	0.3	30	13	5/8	19	5/13[p]	0	4	Cond or Tested	90/8.9	SEER 15	Standard
4 except Marine 4	1	0.32	0.6	NR	38	20 or 13+5	8/13	19	10/13	10; 2 ft	7	Cond or Tested	Standard	Standard	Standard
4 except Marine 4	2	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	7	Cond or Tested	90/8.9	SEER 15	62G/94E
4 except Marine 4	3	0.32	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
4 except Marine 4	4	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Cond or Tested	90/8.9	SEER 15	Standard
5 and Marine 4	1	0.32	0.6	NR	49	20+5 or 13+10	15/20	30	15/19	10; 2 ft	4	Cond or Tested	Standard	Standard	Standard
5 and Marine 4	2	0.32	0.6	NR	38	20 or 13+5	13/17	30	10/13	10; 2 ft	7	Reduced Leakage	92/9.1	15 SEER	62G/94E
5 and Marine 4	3	0.32	0.6	NR	49	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
5 and Marine 4	4	0.35	0.6	NR	38	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Cond or Tested	92/9.1	Standard	Standard
6	1	0.30	0.6	NR	49	20+5 or 13+10	19/21	30	15/19	10; 4 ft	4	Cond or Tested	Standard	Standard	Standard

Climate Zone	Path Number	Fenestration U-Factor[b,c]	Skylight U-Factor[b]	Glazed Fenestration SHGC[b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
6	2	0.35	0.6	NR	49	20 or 13+5	15/19	30	15/19	10; 4 ft	7	Reduced Leakage	92/9.1	Standard	62G/94E
6	3	0.32	0.6	NR	60	20 or 13+5	15/19	30	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
6	4	0.35	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	92/9.1	Standard	Standard
7 and 8	1	0.27	0.6	NR	60	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Cond or Tested	Standard	Standard	Standard
7 and 8	2	0.30	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	92/9.1	Standard	62G/94E
7 and 8	3	0.32	0.6	NR	49	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
7 and 8	4	0.35	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Reduced Leakage	92/9.1	Standard	Standard

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. "NR" means no requirement.

c~~j~~. For impact rated fenestration in wind-borne debris regions ~~complying with Section R301.2.1.2 of the International Residential Code or Section 1609.1.2 of the International Building Code~~, the maximum U-factor in Climate Zones 1-3 shall be permitted to be 0.15 higher than that specified in Table 402.~~0.75 in Zone 2 and 0.65 in Zone 3~~ 0.75 in Zone 2 and 0.65 in Zone3

d~~e~~. There are no SHGC requirements in the Marine Zone.

e. SHGC calculations and exceptions are covered under Section 403.3.

f~~h~~. First value is cavity insulation, second is continuous insulation, so "xx+yy" means R-xx cavity insulation plus R-yy insulated sheathing. ~~"13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers more than 25 percent of exterior, insulated sheating is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2~~. Where Structural sheathing is used, continuous insulation shall be permitted to be reduced by no more than R-3.

g~~i~~. The second R-value applies when more than half the insulation is on the interior of the mass wall and applies interior cavity insulation.

h~~g~~. Or insulation sufficient to fill the framing cavity, R-19 minimum.

i~~c~~. "15/19" means R-15 continuous ~~insulated sheathing~~ insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous ~~insulated sheathing~~ insulation on the interior or exterior of the home. "10/13" means R-10 continuous ~~insulated sheathing~~ insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

j~~d~~. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in Zones 1 through 3 for heated slabs.

k. Air tightness testing requirements are listed in Section 403.4.1.1.

l. "Conditioned Space or Tested" means that the duct system and air handler shall either be located within conditioned space or tested in accordance with Section 404.2.2. "Reduced Leakage" means that the duct system and air handler shall comply with the requirements of section 404.2.3.

m. Heating system performance tested in accordance with ASHRAE Standard 103 or ARI Standard 210/240 or equivalent. Coefficient of Performance (COP) is converted into HSPF by multiplying by 3.413. "Standard" represents the prevailing minimum efficiency acceptable under federal law.

n. Cooling system performance tested in accordance with ARI Standard 210/240 or equivalent. Energy Efficiency Ratio (EER) is converted to SEER by multiplying EER*1.143. "Standard" represents the prevailing minimum efficiency acceptable under federal law.

o. Water heater Energy Factor requirements for Gas (G) and Electric (E) water heaters. "Standard" represents the prevailing minimum efficiency acceptable under federal law.

p. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

SECTION 403
BUILDING THERMAL ENVELOPE

~~402.1~~ 403.1 General (Prescriptive).

~~**402.1.1 Insulation and fenestration criteria.** The building thermal envelope shall meet the requirements of Table 402.1.1 based on the climate zone specified in Chapter 3.~~

403.1.1 Insulation Installation. All insulation installed as part of the building thermal envelope to achieve compliance with Table 402.1 shall be installed in accordance with the manufacturer's installation instructions and in a manner such that as installed it meets the specified performance levels provided in Table 402.1. An area-weighted average of each component shall be permitted to satisfy the requirements in Table 402.1.~~**Insulation and fenestration criteria.** The building thermal envelope shall meet the requirements of Table 402.1.1 based on the climate zone specified in Chapter 3.~~

~~**402.1.2**~~ **403.1.2 *R*-value computation.** Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component *R*-value. The manufacturer's settled *R*-value shall be used for blown insulation. Computed *R*-values shall not include an *R*-value for other building materials or air films.

TABLE ~~402.1.3~~ 403.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	Glazed Fenestration SHGC	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR[d]	CRAWL SPACE WALL *U*-FACTOR[c]	ENVELOPE LEAKAGE RATE (ACH50)
1	~~1.20~~ 0.65	0.75	.25	0.030~~5~~	0.066~~82~~	0.138~~97~~/0.120	0.064	0.360	0.477	7
2	~~0.65~~0.35	~~0.75~~0.65	.25	0.030~~5~~	0.066~~82~~	0.1~~65~~38/0.098	0.064	0.360	0.477	7
3	~~0.50~~0.32	0.65	.3	0.030~~5~~	0.058~~82~~	~~0.141~~0.098/0.087	0.047	0.091[c]	0.136	7
4 except Marine	~~0.35~~0.32	0.60	NR	0.030	0.058~~82~~	~~0.141~~0.098/0.087	0.047	0.059	0.065	4
5 and Marine 4	~~0.35~~0.32	0.60	NR	0.026~~30~~	0. 048~~057~~	~~0.082~~0.058/0.057	0.033	0.050~~9~~	0.053~~65~~	4
6	~~0.35~~0.30	~~0.60~~0.55	NR	0.026	0.048~~057~~	~~0.06~~0.047/0.054	0.033	0.050	0.053~~65~~	4
7 and 8	~~0.35~~0.27	~~0.60~~0.55	NR	0.024~~6~~	0.048~~057~~	~~0.057~~0.043/0.047	0.028	0.050	0.053~~65~~	3

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.10 in Zone 4 except Marine, 0.087 in 0.087 in zone 5 and Marine 4, and the same as the frame wall U-factor in Marine Zone 4 and Zones 5 through 8.
c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.2.
d. Foundation U-factor requirements shown in Table 40~~2~~3.1.3 include wall construction and interior air films but exclude soil conductivity and exterior air films. U-factors for determining code compliance in accordance with Section ~~402.1.4~~ 403.1.4 (total UA alternative) of Section 405 (Simulated Performance Alternative) shall be modified to include soil conductivity and exterior air film.

~~**402.1.3**~~ **403.1.3 *U*-factor alternative.** An assembly with a *U*-factor equal to or less than ~~that specified in Table 402.1.3 shall be permitted as an alternative to the *R*-value in Table 402.1.1.~~ the equivalent R-value specified in Table 402.1 determined by using a method consistent with the ASHRAE *Handbook of Fundamentals* including the thermal bridging effects of framing materials shall be permitted as an alternative to the required *R*-value in Table 402.1.1 for the selected path. Nonfenestration *U*-factors or R-values shall be obtained from measurement, calculation or an approved source.

~~**402.1.4**~~ **403.1.4Total UA alternative.** If the total building thermal envelope UA (sum of *U*-factor times assembly area) is less than or equal to the total UA resulting from using the *U*-factors in Table ~~402.1.3~~ 403.1.3 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with the R-value and U-factor requirements of Table ~~402.1.1~~ 402.1. The UA calculation shall be done using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. The SHGC and Envelope Leakage rate requirements in Table 403.1.3 shall be met in addition to UA compliance.

~~402.2~~ 403.2 Specific insulation requirements (Prescriptive).

403.2.1 Ceilings with attic space. Wherever full height of uncompressed insulation extends over the wall top plate at the eaves, the reduced values in Table 403.2.1 shall be deemed to satisfy the ceiling insulation requirements. This reduction shall not apply to the U-factor alternative approach in Section 403.1.3 and the Total UA alternative in Section 403.1.4.

TABLE 403.2.1
ALLOWABLE CEILING R-VALUE WITH FULL HEIGHT PERIMETER INSULATION

Table 402.1 Listed Ceiling R-Value	Allowable R-Value with full height perimeter insulation
38	30
49	38
60	49

~~**402.2.1 Ceilings with attic spaces.** When Section 402.1.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the U-factor alternative approach in Section 402.1.3 and the Total UA alternative in Section 402.1.4.~~

~~**402.2.2**~~ **403.2.2 Ceilings without attic spaces.** Where Section ~~402.1.1~~ 402.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section 402.1.1 shall be limited to 500 square feet (46 m^2) or 20% of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section ~~402.1.3~~ 403.1.3 and the Total UA alternative in Section ~~402.1.4~~ 403.1.4.

~~402.2.3~~ 403.2.3 Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment which prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.

~~402.2.4~~ 403.2.4 Mass walls. Mass walls for the purposes of this Chapter shall be considered above grade walls of concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth block, rammed earth) and solid timber/logs.

~~402.2.5~~ 403.2.5 Steel-frame ceilings, walls and floors. Steel-frame ceilings, walls and floors shall meet the insulation requirements of Table ~~402.2.5~~ 403.2.5 or shall meet the *U*-factor requirements in Table ~~402.1.3~~ 403.1.3. The calculation of the *U*-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

TABLE ~~402.2.5~~ 403.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(*R*-VALUE)

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL 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
R-13[c]	R-13+5 or R-15+4 or R-21+3 or R-0+10
R-19	R-13+9 or R-19+8 or R-25+7
R-20 or R-21	R-13+10 or R-19+9 or R-25+8
R-20+5	R-13+15 or R-19+14 or R-25+13
	Steel Joist Floor
R-13	R-19 in 2×6; R-19+6 in 2×8 or 2×10
R-19	R-19+6 in 2×6; R-19+12 in 2×8 or 2×10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.
c. Under prescriptive paths 2, 3, and 4, insulation for steel framed wall assemblies with studs spaced 24 inches (610mm) on center shall be permitted to be R-13+0 when ceiling insulation is increased to a wood framed equivalent of R-38 in climate zones 1 and 2 and permitted to be R-13+3 when ceiling insulation is increased to a wood framed equivalent of R-49 in climate zones 3 and 4.

~~402.2.6~~ 403.2.6 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

~~402.2.7~~ 403.2.7 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 meet this requirement unless the floor overhead is insulated in accordance with Sections ~~402.1.1~~ 402.1 and ~~402.2.6~~ 403.2.6.

~~402.2.8~~ 403.2.8 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 ~~402.1.1~~ 402.1. 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 ~~402.1.1~~ 402.1 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 a minimum of 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.

~~402.2.9~~ 403.2.9 Crawl space walls. As an alternative to insulating floors over crawl spaces, crawl space walls shall be permitted to be insulated when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished grade level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder. All 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 at least 6 inches (153 mm) up the stem wall and shall be attached to the stem wall.

~~402.2.10~~ 403.2.10 Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.

~~402.2.11~~ 403.2.11 Thermally isolated sunroom insulation. The minimum ceiling insulation *R*-values shall be R-19 in zones 1 through 4 and R-24 in zones 5 though 8. The minimum wall *R*-value shall be R-13 in all zones. New wall(s) separating a sunroom from conditioned space shall meet the building thermal envelope requirements.

~~402.3~~ 403.3 Fenestration (Prescriptive).

~~402.3.1~~ 403.3.1 *U*-factor. An area-weighted average of fenestration products shall be permitted to satisfy the *U*-factor requirements.

~~402.3.2~~ 403.3.2 Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50 percent glazed shall be permitted to satisfy the SHGC requirements.

~~402.3.3~~ 403.3.3 Glazed fenestration exemption. Up to 15 square feet (1.4 m^2) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section ~~402.1.1~~ 402.1. This exemption shall not apply to the U-factor alternative approach in Section ~~402.1.3~~ 403.1.3 and the Total UA alternative in Section ~~402.1.4~~ 403.1.4.

~~402.3.4~~ 403.3.4 Opaque door exemption. One side-hinged opaque door assembly up to 24 square feet (22 m^2) in area is exempted from the *U*-factor requirement in Section 402.1.1. This exemption shall not apply to the U-factor alternative approach in Section ~~402.1.3~~ 403.1.3 and the Total UA alternative in Section ~~402.1.4~~ 403.1.4.

~~402.3.5~~ 403.3.5 Thermally isolated sunroom *U*-factor. For Zones 4 through 8, the maximum fenestration *U*-factor shall be 0.50 and the maximum skylight *U*-factor shall be 0.75. New windows and doors separating the sunroom from conditioned space shall meet the building thermal envelope requirements.

~~402.3.6~~ 403.3.6 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the ~~applicable~~ following requirements for *U*-factor and SHGC ~~in Table 402.1.1~~. : SHGC in climate zones 1-3 of 0.30, U-Factor of 0.5 in climate zones 2, 3, 0.35 in climate zones 4,5, 0.32 in climate zones 6, 7 and 8 subject to the all the provisions in Section 403.3.

~~402.4~~ 403.4 Air leakage (Mandatory).

~~402.4.1~~ 403.4.1 Building thermal envelope. The building thermal envelope shall comply with Section 403.4.1.1 and 403.4.1.2 ~~be durably sealed to limit infiltration~~. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

1. ~~All joints, seams and penetrations.~~
2. ~~Site-built windows, doors and skylights.~~
3. ~~Openings between window and door assemblies and their respective jambs and framing.~~
4. ~~Utility penetrations.~~
5. ~~Dropped ceilings or chases adjacent to the thermal envelope.~~
6. ~~Knee walls.~~
7. ~~Walls and ceilings separating a garage from conditioned spaces.~~
8. ~~Behind tubs and showers on exterior walls.~~
9. ~~Common walls between dwelling units.~~
10. ~~Attic access openings~~
11. ~~Rim joist junction~~
12. ~~Other sources of infiltration.~~

403.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table 403.4.1.2 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table 402.1, as applicable to the method of construction. Where required by the *code official*, an approved party shall inspect all components and verify compliance.

~~**402.4.2 Air sealing and insulation.** Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given in section 402.4.2.1 or 402.4.2.2.~~

~~402.4.2.1~~ 403.4.1.2 Testing ~~option~~. Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than or equal to the building ~~seven~~ air changes per hour (ACH) listed in the selected path of Table 402.1 for prescriptive compliance when tested with a blower door apparatus at a pressure of +/-0.2 in w.c.~~33.5 psi~~ (50 Pa). Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances.

Exception:

1. Testing is not required in climate zones 1-3 for residences reporting an air tightness level of 7 ACH50.

2. Dwelling units of multifamily residential buildings with more than four individual units shall be excepted from the testing requirements if they satisfy the requirements listed in Table 403.4.1.2, applicable to the method of construction and are field verified. Where required by the *code official*, an *approved* party independent from the installer of the insulation shall inspect the air barrier and insulation.

~~**402.4.2.2 Visual inspection option.** Building envelope tightness and insulation shall be considered acceptable when the items listed in Table 402.4.2, applicable to the method of construction, are field verified. Where required by the *code official*, an *approved* party independent from the installer of the insulation shall inspect the air barrier and insulation.~~

~~**402.4.2.1 Testing option.** Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than seven air changes per hour (ACH) when tested with a blower door at a pressure of 33.5 psf (50 Pa). testing shall occur after roughte in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances.~~

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~~; including exhaust, intake, makeup air, back draft, and flue dampers;~~ beyond intended infiltration control measures.
3. Interior doors, if installed at the time of test, shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s), if installed at the time of test, shall be turned off; and
6. ~~HVAC ducts shall not be sealed; and~~

~~7~~ 6. Supply and return registers, if installed at the time of test, shall ~~not~~ be ~~sealed~~ fully open.

403.4.1.3 Sampling. Where groups of seven or more buildings or dwelling units of similar design and construction are completed and are issued occupancy permits during a 120-day period, or where a multifamily structure contains more than four dwelling units, testing of less than 100 percent, but not less than 1 in 7 or 15 percent, of the buildings from a specific builder and/or contractor or of dwelling units in a multifamily structure shall be permitted when *approved* by the *code official*. The specific buildings or dwelling units to be tested shall be selected by the *code official*. If any tested bulding or dwelling unit fails to comply with the maximum air leakage requirement in Section 403.4.1.2 then all buildings or dwelling units shall be tested until a minimum of three consecutive buildings or dwelling units comply from that specific builder and/or contractor or multifamily structure before the *code official* may permit sampling to resume.

403.4.1.4 Multi-Family and Single Family Attached. For residential occupancies other than single family detached dwellings, testing shall be permitted to be the entire building tested simultaneously or a sampling of no fewer than 1 in 7 individual units within the structure. Individual unit tightness shall be permitted to be determined by either total unit leakage or leakage to unconditioned space. Where multiple tests are performed for a building, the average tightness of tested units shall be permitted to satisfy the required building envelope air tightness level.

403.4.1.5 Failed Testing. If the dwelling does not achieve the air-leakage requirement on the initial test, after an attempt to correct, a subsequent test must be performed that demonstrates compliance or at least a 10% reduction in leakage and within 1 ACH of the required prescriptive tightness.

~~**402.4.2.2 Visual inspection option:** Building envelope tightness and insulation installation shall be considered acceptable when the items listed in Table 4032.4.1.2, applicable to the method of construction, are field verified. Where required by the code official, an approved party independent from the installer of the insulation, shall inspect the air barrier and insulation.~~

~~**402.4.2.2 Visual inspection option.** Building envelope tightness and insulation shall be considered acceptable when the items listed in Table 402.4.2, applicable to the method of construction, are field verified. Where required by the *code official*, an *approved* party independent from the installer of the insulation shall inspect the air barrier and insulation.~~

~~**402.4.3 Fireplaces.** New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.~~

~~402.4.4~~ 403.4.2 Fenestration air leakage. Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s /m^2), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s /m^2), when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled by the manufacturer.

Exceptions: Site-built windows, skylights and doors.

TABLE ~~402.4.2~~ 403.4.1.2
AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material. Air permeable insulation in an installed wall is inside of an air barrier.
Ceiling / attic	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
Walls	Corners and headers are insulated. Junction of foundation and sill plate is sealed.
Windows and doors	Space between window/door jambs and framing is sealed.
Rim joists	Rim joists are insulated and include an air barrier.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls. Exposed earth in unvented crawlspaces is covered with class I vapor retarder with Overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit, or narrow cavities are filled by spayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures are airtight, IC rated, and sealed to drywall. Exception—fixtures in conditioned space.
Plumbing and Wiring	Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
Shower / tub on exterior wall	Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.
Electrical / phone box on exterior walls	Air barrier extends behind boxes or an air sealed type boxes are installed.
~~Common wall~~	~~Air barrier is installed in common wall between dwelling units.~~
HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace	Fireplace walls include an air barrier. New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.

~~402.4.5~~ 403.4.3 Recessed lighting. Recessed luminaries installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaries shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All recessed luminaries shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

~~**402.5 Maximum fenestration *U*-factor and SHGC (Mandatory).** The area weighted average maximum fenestration *U*-factor permitted using trade offs from Section 402.1.4 or Section 404 shall be 0.48 in zones 4 and 5 and 0.40 in zones 6 through 8 for vertical fenestration, and 0.75 in zones 4 through 8 for skylights. The area weighted average maximum fenestration SHGC permitted using trade-offs from Section 405 in Zones 1 through 3 shall be 0.50.~~

SECTION ~~403~~ 404
SYSTEMS

~~403.1~~ 404.1 Controls (Mandatory). At least one thermostat shall be provided for each separate heating and cooling system.

~~403.1.1~~ 404.1.1 Programmable thermostat. Where the primary heating system is a forced air furnace, at least one thermostat per 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. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55ºF (13ºC) or up to 85ºF (29ºC). The thermostat shall initially be programmed with a heating temperature set point no higher than 70ºF (21ºC) and a cooling temperature set point no lower than 78ºF (26ºC).

~~403.1.2~~ 404.1.2 Heat pump supplementary heat (Mandatory). Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

~~403.2~~ 404.2 Ducts.

~~403.2.1~~ 404.2.1 Insulation (Prescriptive). Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

> **Exception:** Ducts or portions thereof located completely inside the building thermal envelope.

~~403.2.2~~ 404.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*. Duct tightness shall be verified by either of the following:

1. Post-construction test: Total leakage ~~to outdoors~~ shall be less than or equal to ~~8~~ 4 cfm (~~226.5~~ 113 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* ~~or a total leakage less than or equal to 12 cfm (12 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area~~ when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All ~~register boots~~ air inlets/outlets shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to ~~6~~ 4 cfm (~~169.9~~ 113 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the ~~roughed in~~ system, including the manufacturer's air handler enclosure. All ~~register boots~~ air inlets/outlets shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to ~~4~~ 3 cfm (~~113.3~~ 85 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*.

   Exception: Duct tightness test is not required if the air handler and all ducts are located within conditioned space.

404.2.3 Reduced Leakage ducts. (Prescriptive). When specified as part of a selected Path Number in Table 402.1, Reduced Leakage ducts must be located entirely within conditioned space and tested for total leakage and leakage to outside conditioned space. Leakage to outdoors shall be less than or equal to 3 cfm (85 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area, and the total leakage shall be less than or equal to ~~8~~ 6 cfm (~~226.5~~ 170 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

~~403.2.3~~ 404.2.4 Building cavities (Mandatory). Building framing cavities shall not be used as supply ducts.

~~403.3~~ 404.3 Mechanical system piping insulation (Mandatory). Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) shall be insulated to a minimum of R-3.

~~403.4~~ 404.4 Service hot water systems.

404.4.1 Hot water pipe insulation. At least R-3 insulation shall be applied to the following metallic hot water pipe:

1. piping larger than 3/4 in. outside diameter
2. piping outside conditioned space
3. piping in a floor slab or in the ground
4. piping in a recirculating system exception: demand recirculation systems
5. entire pipe run from water heater to kitchen ~~sink~~ outlets,
6. Piping serving more than one dwelling unit,
7. Piping from the water heater to a distribution manifold,
8. Buried piping.

~~403.4~~ 404.4.2 Re~~C~~circulating hot water systems (Mandatory). ~~All circulating service hot water piping shall be insulated to at least R-2. Circulating~~ recirculating hot water systems shall ~~include~~ be provided with an automatic or readily accessible manual switch that can turn off the hot water circulating pump when not in use.

~~403.5~~ 404.5 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of Section M1507 of the *International Residential Code 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.

~~403.6~~ 404.6 Equipment sizing (Mandatory). Heating and cooling equipment shall be sized in accordance with Section M1401.3 of the *International Residential Code*.

~~403.7~~ 404.7 Systems serving multiple dwelling units (Mandatory). Systems serving multiple dwelling units shall comply with Sections 503 and 504 in lieu of Section ~~403~~ 404.

~~403.8~~ 404.8 Snow melt system controls (Mandatory). Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50ºF, and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40ºF.

~~403.9~~ 404.9 Pools (Mandatory). Pools shall be provided with energy conserving measures in accordance with Sections ~~403.9.1~~ 404.9.1 through ~~403.9.3~~ 404.9.3

~~403.9.1~~ 404.9.1 Pool heaters. All pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas or LPG shall not have continuously burning pilot lights.

~~403.9.2~~ 404.9.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and-waste-heat-recovery pool heating systems.

~~403.9.3~~ 404.9.3 Pool covers. Heated pools shall be equipped with a vapor-retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12.

Exception: Pools deriving over 60 percent of the energy from heating from site-recovered or solar energy source.

SECTION ~~404~~ 405
ELECTRICAL POWER AND LIGHTING SYSTEMS

~~404.1~~ 405.1 Lighting equipment (Prescriptive). A minimum of ~~fifty~~ seventy-five ~~fifty~~ seventy-five percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps or a minimum of severty-five percent of the permanently installed lighting fixtures shall contain only high efficacy lamps.

Exception: Low-voltage lighting.

SECTION ~~405~~ 406
SIMULATED PERFORMANCE ALTERNATIVE
(Performance)

~~405.1~~ 406.1 Scope. This section establishes criteria for compliance using simulated energy performance analysis. Such analysis shall include heating, cooling, and service water heating energy only.

~~405.2~~ 406.2 Mandatory requirements. Compliance with this Section requires that the mandatory provisions identified in Section 401.2 be met. All supply and return ducts not completely inside the building thermal envelope shall be insulated to a minimum of R-6.

~~405.3~~ 406.3 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 Price and Expenditure Report*. 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.

~~405.4~~ 406.4 Documentation.

~~405.4.1~~ 406.4.1 Compliance software tools. Documentation verifying that the methods and accuracy of the compliance software tools conform to the provisions of this section shall be provided to the code official.

~~405.4.2~~ 406.4.2 Compliance report. Compliance software tools shall generate a report that documents that the proposed design complies with Section ~~405.3~~ 406.3. The compliance documentation shall include the following information:

1. Address or other identification of the residence;
2. An inspection checklist documenting the building component characteristics of the proposed design as listed in Table ~~405.5.2(1).~~ 406.5.2(1). The inspection checklist shall show the estimated annual energy cost results for both the standard reference design and the proposed design, and shall document all inputs entered by the user necessary to reproduce the results;
3. Name of individual completing the compliance report; and
4. Name and version of the compliance software tool.

Exception: Multiple orientations. When 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 cardinal (north, east, south and west) orientations.

~~405.4.3~~ 406.4.3 Additional documentation. The code official shall be permitted to require the following documents:

1. Documentation of the building component characteristics of the standard reference design.
2. A certification signed by the builder providing the building component characteristics of the proposed design as given in Table ~~405.5.2(1).~~

406.5.2(1)

3. Documentation of the actual values used in the software calculations for the proposed design.

~~405.5~~ 406.5 Calculation procedure.

~~405.5.1~~ 406.5.1 General. Except as specified by this section, the standard reference design and proposed design shall be configured and analyzed using identical methods and techniques.

~~405.5.2~~ 406.5.2 Residence specifications. The standard reference design and proposed design shall be configured and analyzed as specified by Table ~~405.5.2(1).~~ 406.5.2(1) Table ~~405.5.2(1)~~ 406.5.2(1)shall include by reference all notes contained in Table 402.1.1.

~~405.6~~ 406.6 Calculation software tools.

~~405.6.1~~ 406.6.1 Minimum capabilities. Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the standard reference design and the proposed design and shall include the following capabilities:

1. Computer generation of the standard reference design using only the input for the proposed design. The calculation procedure shall not allow the user to directly modify the building component characteristics of the standard reference design.
2. Calculation of whole-building (as a single zone) sizing for the heating and cooling equipment in the standard reference design residence I n accordance with Section M1401.3 of the *Internationa*l *Residentia*l *Code*.
3. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air conditioning equipment based on climate and equipment sizing.
4. Printed code official inspection checklist listing each of the proposed design component characteristics from Table ~~405.5.2(1)~~ 406.5.2(1) determined by the analysis to provide compliance, along with their respective performance ratings (e.g. *R*-Value, *U*-Factor, SHGC, HSPF, AFUE, SEER, EF, etc.).

~~405.6.2~~ 406.6.2 Specific approval. Performance analysis tools meeting the applicable sections of ~~405~~ 406 shall be permitted to be approved. Tools are permitted to be approved based on meeting a specified threshold for a jurisdiction. The code official shall be permitted to approve tools for a specified application or limited scope.

~~405.6.3~~ 406.6.3 Input values. When calculations require input values not specified by Sections 402, 403, 404, 405 and ~~405~~ 406, those input values shall be taken from an approved source.

TABLE 406~~5~~.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass wall if proposed wall is mass; otherwise wood frame. Gross area: same as proposed *U*-factor: from Table ~~402.1.3~~ 403.1.3 Solar absorptance = 0.75 Remittance = 0.90	As proposed As proposed As proposed As proposed As proposed
Basement and crawl space walls	Type: same as proposed Gross area: same as proposed *U*-factor: from Table ~~402.1.3~~ 403.1.3, with insulation layer on interior side of walls.	As proposed As proposed As proposed
Above-grade floors	Type: wood frame Gross area: same as proposed *U*-factor: from Table ~~402.1.3~~ 403.1.3	As proposed As proposed As proposed
Ceilings	Type: wood frame Gross area: same as proposed *U*-factor: from Table ~~402.1.3~~ 403.1.3	As proposed As proposed As proposed
Roofs	Type: composition shingle on wood sheathing Gross area: same as proposed Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed As proposed
Attics	Type: vented with aperture = 1 ft^2 per 300 ft^2 ceiling area	As proposed
Foundations	Type: same as proposed foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed As proposed
Doors	Area: 40 ft^2 Orientation: North *U*-factor: same as fenestration from Table ~~402.1.3~~ 403.1.3.	As proposed As proposed As proposed
Glazing[a]	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.~~ Orientation: equally distributed to four cardinal compass orientations (N, E, S & W). *U*-factor: from Table ~~402.1.3~~ 403.1.3 SHGC: From Table ~~403.1.32.1.1~~ 403.1.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used. Interior shade fraction: Summer (all hours when cooling is required) = 0.70 Winter (all hours when heating is required) = 0.85[c] External shading: none	As proposed As proposed As proposed As proposed Same as standard reference design As proposed
Skylights	None	As proposed

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermally isolated sunrooms	None	As proposed
Air exchange rate	ACH_{50} from Table 403.1.3 ~~Specific leakage area (SLA)[d] = 0.00036 assuming no energy Recovery~~ Air leakage rate of 5 air changes per hour in zones 1 and 2, and 3 air changes per hour in zones 3 through 8 at a pressure of 0.2 inches w.g. (50 Pa)~~.~~ The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed desing but no greater than 0.01 x CFA + 7.5 x (Nbr+1) where: CRA = condition floor area Nbr = number of bedrooms Energy recovery shall not be assumed for mechanical ventilation.	~~For residences that are not tested, the same as the standard reference design.~~ ~~For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange ratee but not less than 0.35 ACH~~ ~~For residences with mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate[e] combined with the mechanical ventilation rate,[f] which shall not be less than 0.01 × *CFA* + 7.5 × (N_{br}+1)~~ ~~where:~~ ~~*CFA* = conditioned floor area~~ ~~N_{br} = number of bedrooms~~ For residences that are not tested, the same air leakage rate as the standard reference design. ~~For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1 the measured air exchange rate[e] but not less than 0.35 ACH.~~ For tested residences ~~with mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1,~~ the measured air exchange rate ~~combined with the proposed mechanical ventilation rate, f which shall not be less than 0.01 x CFA + 7.5 x (Nbr+1) where:~~ ~~CFA = conditioned floor area~~ ~~Nbr = number of bedrooms.~~ The mechanical ventilation rate shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	None, except where mechanical ventilation is specified by the proposed design, in which case: Annual vent fan energy use: kWh/yr = 0.03942 × *CFA* + 29.565 × (N_{br} +1) where: *CFA* = conditioned floor area N_{br} = number of bedrooms	As proposed
Internal gains	IGain = 17,900 + 23.8 × *CFA* + 4104 × N_{br} (Btu/day per dwelling unit)	Same as standard reference design
Internal mass	An internal mass for furniture and contents of 8 pounds per square foot of floor area.	Same as standard reference design, plus any additional mass specifically designed as a thermal storage element[g, f] but not integral to the building envelope or structure
Structural mass	For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air. For masonry basement walls, as proposed, but with insulation required by Table 403~~2~~.1.3 located on the interior side of the walls For other walls, for ceilings, floors, and interior walls, wood frame construction	As proposed As proposed As proposed
Heating systems[~~g,~~ h, i]	Fuel type: same as proposed design Efficiencies: Electric: air-source heat pump with prevailing federal minimum efficiency Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency ~~As proposed~~ Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed As proposed As proposed As proposed As proposed
Cooling systems[~~g, i~~h, j]	Fuel type: Electric Efficiency: in accordance with prevailing federal minimum standards ~~As proposed~~ Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed As proposed As proposed
Service water heating[~~g, i, j,~~ k]	Fuel type: same as proposed design for non-solar water heating. Where proposed design includes solar water heating, the standard reference shall include the equivalent capacity with fuel type same as the non-solar water heating. Efficiency: in accordance with prevailing Federal minimum standards Use: gal/day = 30 + 10 × *Nbr* Tank temperature: 120°F ~~As proposed~~ ~~Use: same as proposed design~~	As proposed As proposed Same as standard reference Same as standard reference ~~gal/day = 30 + (10 x N_{br})~~

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	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. Duct insulation: From Section 403.2.1 404.2.1. For tested duct systems, the leakage rate shall be the applicable maximum rate from Section 403.2.2. 404.2.2	Thermal distribution system efficiency shall be As tested or as specified in Table 4065.5.2(2) if not tested.
Thermostat	Type: Manual, cooling temperature setpoint = 75 76°F; Heating temperature setpoint = 72 70°F	Same as standard reference

For SI: 1 square foot = 0.93 m^2; 1 British thermal unit = 1055 J; 1 pound per square foot = 4.88 kg/m^2; 1 gallon (U.S.) = 3.785 L; °C = (°F-3)/1.8, 1 degree = 0.79 0.017 rad.

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:

$AF = As \times FA \times F$

where:

AF = Total glazing area.
As = 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.

c. For fenestrations facing within 15 degrees (0.26 rad) of true south that are directly coupled to thermal storage mass, the winter interior shade fraction shall be permitted to be increased to 0.95 in the proposed design.

d. Where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:
$SLA = L/CFA$
where L and CFA are in the same units.

e. Where required by the code official testing shall be conducted by an approved party. Tested envelope leakage shall be determined and documented by an independent party approved by the *code official*. Hourly calculations as specified in the 2001 ASHRAE *Handbook of Fundamentals*, Chapter 276, page 26.21, Equation 40 (Sherman-Grimsrud model) or the equivalent shall be used to determine the energy loads resulting from infiltration.

f. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 2005 ASHRAE *Handbook of Fundamentals,* page 26 27.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals*, page 26 27.19 for intermittent mechanical ventilation.

g. Thermal storage element shall mean a component 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 must be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or must be connected to such a room with pipes or ducts that allow the element to be actively charged.

h. For a proposed design with multiple heating, or 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.

i. For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design. For electric heating systems, the prevailing federal minimum efficiency air-source heat pump shall be used for the standard reference design.

j. For a proposed design home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

k. For a proposed design with a non-storage-type water heater, a 40-gallon storage-type water heater with the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For the case of a proposed design without a proposed water heater, a 40-gallon storage-type water heater with 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.

TABLE 405.5.2(2) 406.5.2(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 distribution systems entirely located in conditioned space[c]	0.88	1
"Ductless" systems[d]	1	—

For SI: 1 cubic foot per minute = 0.47 L/s; 1 square foot = 0.093m^2; 1 pound per square inch = 6895 Pa; 1 inch water gauge = 1250 Pa.

a. Default values given by 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 air flow across a coil but shall not have any ducted air flow external to the manufacturer's air handler enclosure.

Commenter's Reason: Changes in this proposal from the original include a number of small changes made at the request of the Department of Energy. The effort was collaborative including input from the National Multi Housing Council, NAHB and a large number of industry representatives. Our calculations show that a 30% savings of heating, cooling and water heating energy over the 2006 IECC will be achieved with the adoption of this proposal. NAHB realizes the importance of energy efficiency, but it critical that the builders concerns be considered when adopting code changes as they are the ones who understand the complexities of the code and are the ones who have to make it happen.

Within this comprehensive proposal are changes that provide four prescriptive paths in each climate zone. These multiple paths will both increase flexibility for the builders and simplify code enforcement. In many cases where the builder would use the performance path, they now will be able to use a prescriptive path that will provide a much more straightforward code compliance check.

Energy neutral equipment efficiency tradeoffs have been included back into the code. Using equipment efficiencies toward code compliance are often a cost effective solution providing the builder flexibility to achieve code compliance.

Air tightness and duct tightness levels in this proposal more closely represent reasonably achievable levels than are proposed in a number of other proposals. It provides flexibility for builders who don't feel comfortable that they can build tight construction (i.e. small homes on a vented crawl space)

Public Comment 2:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

<u>**CONTINUOUS INSULATION**. Insulation installed continuously across all structural members on the interior, exterior, or integral to any opaque surface of the building envelope, without intervening vented air spaces or thermal bridges other than fasteners and service openings.</u>

Commenter's Reason: This proposal and various other proposals and modifications from the code development hearings use or introduce the term, "continuous insulation", but the term is not defined. This public comment corrects that problem and provides needed clarification of the meaning of continuous insulation to ensure proper application in compliance with the intent of the energy code.

ASHRAE 90.1 defines continuous insulation as "insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope." This definition is adopted in this PC for sake of consistency and is further improved to clarify an important concern with the proper and consistent characterization of continuous insulation. The ASHRAE definition addresses a concern with thermal bridging but does not address the similar concern with intervening vented air spaces which can create a disconnect of continuous insulation thermal resistance such that its contribution to a layered wall assembly R-value cannot be simply summed. Thus, wording is included in the definition to address this concern. Air exchange rates for vented airspaces behind claddings can exceed 90 air-changes per hour (see references 1 and 2) which significantly impacts the R-value of the air-space or disconnects the R-value of material on the exterior side of the airspace. A robust definition for continuous insulation is needed in the IECC.

References:

1. Straube, J. and Finch, G. (2009). Ventilated Wall Claddings: Review, Field Performance, and Hygrothermal Modeling, Research Report – 0907, Building Science Press, www.buildingscience.com.
2. Salonvarra, M., Karagiozis, A.N., Pazera, M., Miller W. (2007). "Air Cavities Behind Claddings – What Have We Learned?", Buildings X, ASHRAE.

Public Comment 3:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1
PRESCRIPTIVE REQUIREMENTS BY COMPONENT[a]

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
1	1	0.60	0.75	0.25	38	13+3	5/10	13	0	0	7	Cond or Tested	Standard	Standard	Standard
1	2	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	Standard	SEER 15	62G/94E
1	3	0.60	0.75	0.3	30	13	3/4	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
1	4	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	Standard	SEER 17	Standard
2	1	0.35	0.65	0.25	38	13+3	6/13	13	0	0	7	Cond or Tested	Standard	Standard	Standard

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
2	2	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	Standard	SEER 15	62G/94E
2	3	0.35	0.65	0.3	30	13	4/6	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
2	4	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	Standard	SEER 17	Standard
3	1	0.32	0.6	0.3	38	20 or 13+5	8/13	19	5/13[p]	0	7	Cond or Tested	Standard	Standard	Standard
3	2	0.35	0.6	0.3	30	13	5/8	19	5/13[p]	0	7	Cond or Tested	90/8.9	SEER 17	62G/94E
3	3	0.50	0.6	0.3	38	13	5/8	19	5/13[p]	0	4	Reduced Leakage	Standard	Standard	Standard
3	4	0.50	0.6	0.3	30	13	5/8	19	5/13[p]	0	4	Cond or Tested	90/8.9	SEER 15	Standard
4 except Marine 4	1	0.32	0.6	NR	38	20 or 13+5	8/13	19	10/13	10; 2 ft	7	Cond or Tested	Standard	Standard	Standard
4 except Marine 4	2	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	7	Cond or Tested	90/8.9	SEER 15	62G/94E
4 except Marine 4	3	0.32	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
4 except Marine 4	4	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Cond or Tested	90/8.9	SEER 15	Standard
5 and Marine 4	1	0.32	0.6	NR	49	20+5 or 13+10	15/20	30	15/19	10; 2 ft	4	Cond or Tested	Standard	Standard	Standard
5 and Marine 4	2	0.32	0.6	NR	38	20 or 13+5	13/17	30	10/13	10; 2 ft	7	Reduced Leakage	92/9.1	15 SEER	62G/94E
5 and Marine 4	3	0.32	0.6	NR	49	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
5 and Marine 4	4	0.35	0.6	NR	38	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Cond or Tested	92/9.1	Standard	Standard
6	1	0.30	0.6	NR	49	20+5 or 13+10	19/21	30	15/19	10; 4 ft	4	Cond or Tested	Standard	Standard	Standard

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
6	2	0.35	0.6	NR	49	20 or 13+5	15/19	30	15/19	10; 4 ft	7	Reduced Leakage	92/9.1	Standard	62G/94E
6	3	0.32	0.6	NR	60	20 or 13+5	15/19	30	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
6	4	0.35	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	92/9.1	Standard	Standard
7 and 8	1	0.27	0.6	NR	60	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Cond or Tested	Standard	Standard	Standard
7 and 8	2	0.30	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	92/9.1	Standard	62G/94E
7 and 8	3	0.32	0.6	NR	49	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
7 and 8	4	0.35	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Reduced Leakage	92/9.1	Standard	Standard

For SI: 1 foot = 304.8 mm.

(relettered and reordered in order of table)

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. "NR" means no requirement.
c. For impact rated fenestration complying with Section R301.2.1.2 of the International Residential Code or Section 1609.1.2 of the International Building Code, the maximum U-factor in Climate Zones 1-3 shall be permitted to be 0.15 higher than that specified in Table 402.1
d. There are no SHGC requirements in the Marine Zone.
e. SHGC calculations and exceptions are covered under Section 403.3.
f. ~~"xx+yy" means R-xx cavity insulation plus R-yy insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~
<u>First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.</u>
g. The second R-value applies when more than half the insulation is on the interior of the mass wall and applies interior cavity insulation.
h. Or insulation sufficient to fill the framing cavity, R-19 minimum.
i. "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
j. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in Zones 1 through 3 for heated slabs.
k. Air tightness testing requirements are listed in Section 403.4.1.1.
l. "Cond or Tested" means that the duct system shall either be located within conditioned space or tested in accordance with Section 404.2.2. "Reduced Leakage" means that the duct system shall comply with the requirements of section 404.2.3.
m. Heating system performance tested in accordance with ASHRAE Standard 103 or ARI Standard 210/240 or equivalent. Coefficient of Performance (COP) is converted into HSPF by multiplying by 3.413. "Standard" represents the prevailing minimum efficiency acceptable under federal law.
n. Cooling system performance tested in accordance with ARI Standard 210/240 or equivalent. Energy Efficiency Ratio (EER) is converted to SEER by multiplying EER*1.143. "Standard" represents the prevailing minimum efficiency acceptable under federal law.
o. Water heater Energy Factor requirements for Gas (G) and Electric (E) water heaters. "Standard" represents the prevailing minimum efficiency acceptable under federal law.
p. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

(*Portions of code change proposal not shown remain unchanged)*

Commenter's Reason: This public comment achieves two things: (1) corrects a severe problem with footnote 'h' that erodes the energy code, regardless of which version of the energy code is approved; and, (2) provides a rational and flexible application of footnote 'h' in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote 'h' is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote ‘h’, the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote ‘h’ allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Final Action: AS AM AMPC____ D

EC16-09/10-PART II
IRC R202, N1102, N1103, N1104, N1105 (New)

Proposed Change as Submitted

Proponent: Ken Sagan, representing National Association of Home Builders

PART II – IRC BUILDING/ENERGY

1. Add new definitions as follows:

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where pump(s) prime the service water heating with heated water when triggered by a manual button or switch, or by sensing the presence of a person where the heated water is used.

PROJECTION FACTOR. The ratio of the horizontal depth of an overhang, eave, or permanently attached shading device, divided by the distance measured vertically from the bottom of the fenestration glazing to the underside of the overhang, eave, or permanently attached shading device.

2. Revise as follows:

N1101.9 Certificate. A permanent certificate shall be posted on or in the electrical distribution 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 be completed by the builder or registered design professional. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration,~~; and~~ the solar heat gain coefficient (SHGC) of fenestration and tested or sampled ACH_{50}. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the types and efficiency of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace, and/or baseboard electric heater is installed in the residence, the certificate shall list "gas-fired unvented room heater", "electric furnace", or "baseboard electric heater" as appropriate. An efficiency shall not be listed for gas-fired unvented room heaters, electric furnaces, or electric baseboard heaters.

3. Add new text as follows:

N1101.10 Compliance testing. Where testing is required to determine air leakage of buildings or duct systems, the code official shall be permitted to require random sample testing of no fewer than one in seven residences.

4. Delete Sections N1102, N1103 and N1104 and replace as follows:

SECTION N1102
PRESCRIPTIVE REQUIREMENT TABLES

N1102.1 General . The building thermal envelope and mechanical systems shall meet the requirements of one path in Table N1102.1 based on the climate zone specified in Table N1101.2.

TABLE N1102.1
PRESCRIPTIVE REQUIREMENTS BY COMPONENT[a]

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
1	1	0.60	0.75	0.25	38	13+3	5/10	13	0	0	7	Cond or Tested	Standard	Standard	Standard
1	2	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	Standard	SEER 15	62G/94E
1	3	0.60	0.75	0.3	30	13	3/4	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
1	4	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	Standard	SEER 17	Standard

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
2	1	0.35	0.65	0.25	38	13+3	6/13	13	0	0	7	Cond or Tested	Standard	Standard	Standard
2	2	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	Standard	SEER 15	62G/94E
2	3	0.35	0.65	0.3	30	13	4/6	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
2	4	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	Standard	SEER 17	Standard

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
3	1	0.32	0.6	0.3	38	20 or 13+5	8/13	19	5/13[p]	0	7	Cond or Tested	Standard	Standard	Standard
3	2	0.35	0.6	0.3	30	13	5/8	19	5/13[p]	0	7	Cond or Tested	90/8.9	SEER 17	62G/94E
3	3	0.50	0.6	0.3	38	13	5/8	19	5/13[p]	0	4	Reduced Leakage	Standard	Standard	Standard
3	4	0.50	0.6	0.3	30	13	5/8	19	5/13[p]	0	4	Cond or Tested	90/8.9	SEER 15	Standard

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
4 except Marine 4	1	0.32	0.6	NR	38	20 or 13+5	8/13	19	10/13	10; 2 ft	7	Cond or Tested	Standard	Standard	Standard
4 except Marine 4	2	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	7	Cond or Tested	90/8.9	SEER 15	62G/94E
4 except Marine 4	3	0.32	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
4 except Marine 4	4	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Cond or Tested	90/8.9	SEER 15	Standard

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value [f]	Mass Wall R-Value [g]	Floor R-Value [h]	Basement/ Crawl space Wall R-Value [i]	Slab R-Value & Depth [j]	Building Air Tightness (ACH50) [k]	Duct Tightness [l]	Furnace (AFUE) /Heat Pump (HSPF) [m]	Air Conditioning (SEER) [n]	Hot Water Heater [o]
5 and Marine 4	1	0.32	0.6	NR	49	20+5 or 13+10	15/20	30	15/19	10; 2 ft	4	Cond or Tested	Standard	Standard	Standard
5 and Marine 4	2	0.32	0.6	NR	38	20 or 13+5	13/17	30	10/13	10; 2 ft	7	Reduced Leakage	92/9.1	15 SEER	62G/94E
5 and Marine 4	3	0.32	0.6	NR	49	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
5 and Marine 4	4	0.35	0.6	NR	38	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Cond or Tested	92/9.1	Standard	Standard
6	1	0.30	0.55	NR	49	20+5 or 13+10	19/21	30	15/19	10; 4 ft	4	Cond or Tested	Standard	Standard	Standard
6	2	0.35	0.55	NR	49	20 or 13+5	15/19	30	15/19	10; 4 ft	7	Reduced Leakage	92/9.1	Standard	62G/94E
6	3	0.32	0.55	NR	60	20 or 13+5	15/19	30	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
6	4	0.35	0.55	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	92/9.1	Standard	Standard
7 and 8	1	0.27	0.55	NR	60	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Cond or Tested	Standard	Standard	Standard
7 and 8	2	0.30	0.55	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	92/9.1	Standard	62G/94E
7 and 8	3	0.32	0.55	NR	49	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
7 and 8	4	0.35	0.55	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Reduced Leakage	92/9.1	Standard	Standard

For SI: 1 foot = 304.8 mm.

(relettered and reordered in order of table)

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. "NR" means no requirement.

c~~j~~. For impact rated fenestration complying with Section R301.2.1.2 of the International Residential Code, the maximum U-factor in Climate Zones 1-3 shall be permitted to be 0.15 higher than that specified in Table N1102.1.

d~~e~~. There are no SHGC requirements in the Marine Zone.

e. SHGC calculations and exceptions are covered under Section N1103.3.

f~~h~~. "xx+yy" means R-xx cavity insulation plus R-yy insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

g~~i~~. The second R-value applies when more than half the insulation is on the interior of the mass wall and applies interior cavity insulation.

h~~g~~. Or insulation sufficient to fill the framing cavity, R-19 minimum.

i~~c~~. "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

jd. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in Zones 1 through 3 for heated slabs.

k. Air tightness testing requirements are listed in Section N1103.4.1.1.

l. “Cond or Tested” means that the duct system shall either be located within conditioned space or tested in accordance with Section N1104.2.2.“Reduced Leakage” means that the duct system shall comply with the requirements of section N1104.2.3.

m. Heating system performance tested in accordance with ASHRAE Standard 103 or ARI Standard 210/2N110 or equivalent. Coefficient of Performance (COP) is converted into HSPF by multiplying by 3.413. “Standard” represents the prevailing minimum efficiency acceptable under federal law.

n. Cooling system performance tested in accordance with ARI Standard 210/2N110 or equivalent. Energy Efficiency Ratio (EER) is converted to SEER by multiplying EER*1.143. “Standard” represents the prevailing minimum efficiency acceptable under federal law.

o. Water heater Energy Factor requirements for Gas (G) and Electric (E) water heaters. “Standard” represents the prevailing minimum efficiency acceptable under federal law.

p. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

SECTION N1103
BUILDING THERMAL ENVELOPE

N1103.1 General.

N1103.1.1 Insulation installation. All insulation installed as part of the building thermal envelope to achieve compliance with Table N1102.1 shall be installed in accordance with the manufacturer’s installation instructions and in a manner such that as installed it meets the specified performance levels provided in Table N1102.1. An area-weighted average of each component shall be permitted to satisfy the requirements in Table N1102.1.

N1103.1.2 *R*-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component *R*-value. The manufacturer’s settled *R*-value shall be used for blown insulation. Computed *R*-values shall not include an *R*-value for other building materials or air films.

TABLE N1103.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	Glazed Fenestration SHGC	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR [d]	CRAWL SPACE WALL *U*-FACTOR [c]	ENVELOPE LEAKAGE RATES (ACH50)
1	0.50	0.75	.25	0.030	0.066	0.138/0.120	0.064	0.360	0.477	7
2	0.35	0.65	.25	0.030	0.066	0.116/0.098	0.064	0.360	0.477	7
3	0.32	0.65	.3	0.030	0.058	0.098/0.087	0.047	0.091[c]	0.136	7
4 except Marine	0.32	0.60	NR	0.030	0.058	0.098/0.087	0.047	0.059	0.065	4
5 and Marine 4	0.32	0.60	NR	0.026	0. 048	0.060/0.057	0.033	0.050	0.053	4
6	0.30	0.55	NR	0.026	0.048	0.057/0.057	0.033	0.050	0.053	4
7 and 8	0.27	0.55	NR	0.024	0.048	0.057/0.057	0.028	0.050	0.053	3

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.10 in Zone 4 except Marine, and the same as the frame wall U-factor in Marine Zone 4 and Zones 5 through 8.

c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.2.

d. Foundation U-factor requirements shown in Table N11023.1.3 include wall construction and interior air films but exclude soil conductivity and exterior air films. U-factors for determining code compliance in accordance with Section N11023.1.4 (total UA alternative) of Section N1105 (Simulated Performance Alternative) shall be modified to include soil conductivity and exterior air film.

N1103.1.3 *U*-factor alternative. An assembly with a *U*-factor equal to or less than the equivalent R-value specified in Table N1102.1 determined by using a method consistent with the ASHRAE *Handbook of Fundamentals* including the thermal bridging effects of framing materials shall be permitted as an alternative to the required *R*-value in Table N1102.1.1 for the selected path. Nonfenestration *U*-factors or R-values shall be obtained from measurement, calculation or an approved source.

N1103.1.4 Total UA alternative. If the total building thermal envelope UA (sum of *U*-factor times assembly area) is less than or equal to the total UA resulting from using the *U*-factors in Table N11032.1.3 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with the R-value and U-factor requirements of Table N1102.1. The UA calculation shall be done using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. The SHGC and Envelope Leakage rate requirements in Table N1103.1.3 shall be met in addition to UA compliance.

N1103.2 Specific insulation requirements.

N1103.2.1 Ceilings with attic space. Wherever full height of uncompressed insulation extends over the wall top plate at the eaves, the reduced values in Table N1103.2.1 shall be deemed to satisfy the ceiling insulation requirements. This reduction shall not apply to the U-factor alternative approach in Section N1103.1.3 and the Total UA alternative in Section N1103.1.4.

TABLE N1103.2.1
ALLOWABLE CEILING R-VALUE WITH FULL HEIGHT PERIMETER INSULATION

TABLE N1102.1 LISTED CEILING R-VALUE	ALLOWABLE R-VALUE WITH FULL HEIGHT PERIMETER INSULATION
38	30
49	38
60	49

N1103.2.2 Ceilings without attic spaces. Where Section N1102.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section N1102.1.1 shall be limited to 500 square feet (46 m^2) or 20% of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section N1103.1.3 and the Total UA alternative in Section N1103.1.4.

N1103.2.3 Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment which prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.

N1103.2.4 Mass walls. Mass walls for the purposes of this chapter shall be considered above grade walls of concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth block, rammed earth) and solid timber/logs.

N1103.2.5 Steel-frame ceilings, walls and floors. Steel-frame ceilings, walls and floors shall meet the insulation requirements of Table N1103.2.5 or shall meet the *U*-factor requirements in Table N1103.1.3. The calculation of the *U*-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

TABLE N1103.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(*R*-VALUE)

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL 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
R-13[c]	R -13+5 or R-15+4 or R-21+3 or R-0+10
R-19	R -13+9 or R-19+8 or R-25+7
R-21	R-13+10 or R-19+9 or R-25+8
	Steel Joist Floor
R-13	R-19 in 2×6; R-19+6 in 2×8 or 2×10
R-19	R-19+6 in 2×6; R-19+12 in 2×8 or 2×10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.

c. Under prescriptive paths 2, 3, and 4, insulation for steel framed wall assemblies with studs spaced 24 inches (610mm) on center shall be permitted to be R-13+0 when ceiling insulation is increased to a wood framed equivalent of R-38 in climate zones 1 and 2 and permitted to be R-13+3 when ceiling insulation is increased to a wood framed equivalent of R-49 in climate zones 3 and 4.

N1103.2.6 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

N1103.2.7 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 meet this requirement unless the floor overhead is insulated in accordance with Sections N1102.1 and N1103.2.6.

N1103.2.8 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 N1102.1. 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 N1102.1 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 a minimum of 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.

N1103.2.9 Crawl space walls. As an alternative to insulating floors over crawl spaces, crawl space walls shall be permitted to be insulated when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished grade level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder. All 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 at least 6 inches (153 mm) up the stem wall and shall be attached to the stem wall.

N1103.2.10 Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.

N1103.2.11 Thermally isolated sunroom insulation. The minimum ceiling insulation *R*-values shall be R-19 in zones 1 through 4 and R-24 in zones 5 though 8. The minimum wall *R*-value shall be R-13 in all zones. New wall(s) separating a sunroom from conditioned space shall meet the building thermal envelope requirements.

N1103.3 Fenestration.

N1103.3.1 *U*-factor. An area-weighted average of fenestration products shall be permitted to satisfy the *U*-factor requirements.

N1103.3.2 Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50 percent glazed shall be permitted to satisfy the SHGC requirements.

N1103.3.3 Glazed Fenestration SHGC exception. In climate zones 1-3, vertical fenestration shaded by an overhang, eave, or permanently attached shading device shall be permitted to satisfy the SHGC requirements provided the projection factor is greater than or equal to the value listed in table N1103.3.3 for the appropriate orientation. The overhang, eave, or permanently attached shading device shall have a minimum projection that shall extend beyond each side of the glazing a minimum of 12 inches. Where different windows and glazed doors have different projection factors, they shall each be evaluated separately, or an area-weighted projection factor value shall be calculated and used. Each orientation shall be rounded to the nearest cardinal orientation (+/-45 degrees or 0.79 rad) for purposes of calculations and demonstrating compliance.

TABLE N1103.3.3
MINIMUM PROJECTION FACTOR REQUIRED BY ORIENTATION FOR SHGC EXCEPTION

ORIENTATION	PROJECTION FACTOR
North	>=0.30
South	>=0.20
East	>=0.50
West	>=0.50

N1103.3.4 Glazed fenestration exemption. Up to 15 square feet (1.4 m^2) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section N1102.1. This exemption shall not apply to the U-factor alternative approach in Section N1103.1.3 and the Total UA alternative in Section N1103.1.4.

N1103.3.5 Opaque door exemption. One side-hinged opaque door assembly up to 24 square feet (22 m^2) in area is exempted from the *U*-factor requirement in Section N1102.1.1. This exemption shall not apply to the U-factor alternative approach in Section N1103.1.3 and the Total UA alternative in Section N1103.1.4.

N1103.3.6 Thermally isolated sunroom *U*-factor. For Zones 4 through 8, the maximum fenestration *U*-factor shall be 0.50 and the maximum skylight *U*-factor shall be 0.75. New windows and doors separating the sunroom from conditioned space shall meet the building thermal envelope requirements.

N1103.3.7 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the following requirements for *U*-factor and SHGC. : SHGC in climate zones 1-3 of 0.30, U-Factor of 0.55 in climate zone 2, 0.45 in climate zone 3, 0.35 in climate zones 4,5, 0.32 in climate zones 6, 7 and 8 subject to the all the provisions in Section N1103.3.

N1103.4 Air leakage.

N1103.4.1 Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

N1103.4.1.1 Testing. Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than or equal to the building air changes per hour (ACH) listed in the selected path of Table N1102.1 when tested with a blower door apparatus at a pressure of 0.2 in w.c. (50 Pa). Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed;
2. Dampers shall be closed, but not sealed; including exhaust, intake, makeup air, back draft, and flue dampers;
3. Interior doors shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s) shall be turned off;
6. HVAC ducts shall not be sealed; and
7. Supply and return registers shall not be sealed.

N1103.4.1.1.1 Single Family Attached. For residential occupancies other than single family detached dwellings, testing shall be permitted to be the entire building tested simultaneously or a sampling of no fewer than 1 in 7 individual units within the structure. Individual unit tightness shall be permitted to be determined by either total unit leakage or leakage to unconditioned space (including outside). Where multiple tests are performed for a building, the average tightness of tested units shall be permitted to satisfy the required building envelope airtightness level.

N1103.4.1.1.2 Failed Testing. If the dwelling does not achieve air-leakage requirement on the initial test, after an attempt to correct, a subsequent test must be performed that demonstrates compliance or at least a 10% reduction in leakage from the initial test and within 1 ACH of the required tightness.

Exception: Testing is not required in climate zones 1-4 for residences claiming an air tightness level of 7 ACH50.

N1103.4.1.2 Visual inspection: Building envelope tightness and insulation installation shall be considered acceptable when the items listed in Table N1103.4.1.2, applicable to the method of construction, are field verified or an approved party.

N1103.4.2 Fireplaces. New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.

N1103.4.3 Fenestration air leakage. Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m^2), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s/m^2), when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled by the manufacturer.

Exceptions: Site-built windows, skylights and doors.

TABLE N1103.4.1.2
AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material. Air permeable insulation is inside of an air barrier.
Ceiling / attic	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
Walls	Corners and headers are insulated. Junction of foundation and sill plate is sealed.
Windows and doors	Space between window/door jambs and framing is sealed.
Rim joists	Rim joists are insulated and include an air barrier.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls. Exposed earth in unvented crawlspaces is covered with class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit, or narrow cavities are filled by spayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures are airtight, IC rated, and sealed to drywall. Exception—fixtures in conditioned space.
Plumbing and Wiring	Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
Shower / tub on exterior wall	Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.
Electrical / phone box on exterior walls	Air barrier extends behind boxes or an air sealed type boxes are installed.
Common wall	Air barrier is installed in common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace	Fireplace walls include an air barrier.

N1103.4.4 Recessed lighting. Recessed luminaires installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

SECTION N1104
SYSTEMS

N1104.1 Controls. At least one thermostat shall be provided for each separate heating and cooling system.

N1104.1.1 Programmable thermostat. Where the primary heating system is a forced air furnace, at least one thermostat per 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. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55ºF (13ºC) or up to 85ºF (29ºC). The thermostat shall initially be programmed with a heating temperature set point no higher than 70ºF (21ºC) and a cooling temperature set point no lower than 78ºF (26ºC).

N1104.1.2 Heat pump supplementary heat. Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

N1104.2 Ducts.

N1104.2.1 Insulation. Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

> **Exception:** Ducts or portions thereof located completely inside the building thermal envelope.

N1104.2.2 Sealing. All ducts, air handlers, filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*. Duct tightness shall be verified by either of the following:

1. Post-construction test: Leakage to outdoors shall be less than or equal to 8 cfm (226.5 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area or a total leakage less than or equal to 12 cfm (12 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area.

   Exception: Duct tightness test is not required if the air handler and all ducts are located within conditioned space.

N1104.2.3 Reduced Leakage ducts. When specified as part of a selected Path Number in Table N1102.1, Reduced Leakage ducts must be located entirely within conditioned space and tested for total leakage and leakage to outside conditioned space. Leakage to outdoors shall be less than or equal to 3 cfm (84.9 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area, and the total leakage shall be less than or equal to 8 cfm (226.5 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. Total leakage of not greater than 3 cfm per 100 ft^2 of conditioned floor area at a pressure difference of 0.01 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure, shall be deemed to satisfy this requirement without measurement of leakage to outdoors.

N1104.2.4 Building cavities. Building framing cavities shall not be used as supply ducts.

N1104.3 Mechanical system piping insulation. Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) shall be insulated to a minimum of R-3.

N1104.4 Service hot water systems.

N1104.4.1 Hot water pipe insulation. At least R-3 insulation shall be applied to the following:

1. Piping larger than 3/4 in. outside diameter

2. Piping outside conditioned space
3. Piping in a floor slab or in the ground
4. Piping in a re-circulating system

   Exception: demand recirculation systems

5. Entire pipe run from water heater to kitchen sink

N1104.4.2 Re-circulating hot water systems. Re-circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when not in use.

N1104.5 Mechanical ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

N1104.6 Equipment sizing. Heating and cooling equipment shall be sized in accordance with Section M1401.3 of the *International Residential Code.*

N1104.7 Snow melt system controls. Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50ºF, and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40ºF.

N1104.8 Pools. Pools shall be provided with energy conserving measures in accordance with Sections N1104.9.1 through N1104.9.3

N1104.8.1 Pool heaters. All pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas or LPG shall not have continuously burning pilot lights.

N1104.8.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and-waste-heat-recovery pool heating systems.

N1104.8.3 Pool covers. Heated pools shall be equipped with a vapor-retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12.

Exception: Pools deriving over 60 percent of the energy from heating from site-recovered or solar energy source.

SECTION N1105
ELECTRICAL POWER AND LIGHTING SYSTEMS

N1105.1 Lighting equipment. A minimum of seventy-five percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps.

Reason: The main purpose of this Proposal is two-fold. One is to achieve energy efficiency that is 30% above the 2006 IECC. The second is to achieve consistency between the IECC and the IRC for low-rise residential buildings. This proposal is also designed to bring together sound building science practices, energy efficiency options, code compliance verification, and practicality with respect to the construction of residential dwellings, without creating a market advantage for any one product or practice.

Significant energy savings is achieved several ways in this proposal by limiting whole house air leakage limiting fenestration area, increasing the building envelope requirements and equipment performance, resulting in a 30% improvement over the 2006 IECC.

This proposal has multiple prescriptive paths that builders and code officials can easily follow and without complicated calculations. Some paths use equipment to achieve the savings, others use air tightness and/or additional insulation.

As written in the 2009 IECC, many low SHGC windows are very dark resulting in higher lighting usage and an increased desire for more windows, thus do not save energy. Projection factor trade-offs for window SHGC requirements have successfully been used in the commercial and high rise residential energy codes for many years and have proven to be simple to calculate. The projection factor in this proposal allows builders to incorporate shading devices to satisfy the SHGC requirement.

Moreover, fenestration is a significant contributor to space conditioning costs in every climate. Solar heat gains in the Southern climates and conduction losses in the Northern climates are significantly reduced when a typical R-2 to R-3 window is replaced by an R-13 to R-21 wall.

Providing an incentive for lower fenestration area by limiting window percentage in the prescriptive path will provide for increased opaque wall area, again, resulting in energy savings.

Another area that this proposal addresses is the percentage of windows (one of the least energy efficient components in a house) relative to the overall window-to-wall ratio. Recognizing the impact of the windows on the performance of the house, it is necessary to provide options to off-set the energy requirements of the windows. The window-to-floor area (UA) factor is adjusted according to the energy saving items listed in that particular climate zone and path option.

A tight building envelope and duct system are integral parts of an energy efficient home. Blower door and duct testing are recognized as tools used to evaluate these items and are addressed in this proposal. Once properly trained, contractors who perform air sealing and duct installation repeatedly install the systems in a consistent manner, testing would not necessarily be required in every home. Sample testing provides valuable periodic feedback to keep the performance levels consistent and acceptable. This has been demonstrated by the Energy Star program that has allowed sample testing for many years. Testing does not save energy, sealing ducts and the building envelope do.

Although the equipment trade-off Tables were eliminated from the 2009 IECC, increasing equipment efficiency is often a practical and cost effective means of saving energy. With the 4 option paths in this proposal, the builder can comply with the code by increased equipment efficiency or other options that would meet the required energy savings. As new technologies are developed that increases equipment efficiencies, it would only makes sense to incorporate the improved HVAC equipment to save energy.

Builders understand the need to increase energy efficiency in homes, but they must be given a variety of options and paths with which to reach their targets without being overburdened with complicated calculations that could easily lead to errors. This proposal provides that level of stringency and allows code officials an easy path to certify compliance of the code without requiring expensive testing.

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

ICCFILENAME: SAGAN-EC-7-103.2-202-CH 4-RE-1-R202-N1101-N1104

Public Hearing Results

PART II-IRC B/E
Committee Action: Approved as Modified

Modify proposal as follows:

f. First value is cavity insulation, second is continuous insulation, so "xx+yy" means R-xx cavity insulation plus R-yy continuous insulation ~~insulated sheathing~~. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation ~~insulated sheathing~~ of at least R-2.

(Portions of code change proposal not shown remain unchanged.)

Committee Reason: The code change proposal provides aggressive energy savings with 4 options that provide different trade-offs to allow a homeowner some flexibility in the design of the energy conservation methods that will allow flexibility in the design of the remainder of the home.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Don Surrena, National Association of Home Builders (NAHB), requests Approval as Modified by this Public Comment.

Replace proposal as follows:

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where pump(s) prime the service water heating with heated water when triggered by a manual button or switch, or by sensing the presence of a person where the heated water is used.

PROJECTION FACTOR. The ratio of the horizontal depth of an overhang, eave, or permanently attached shading device, divided by the distance measured vertically from the bottom of the fenestration glazing to the underside of the overhang, eave, or permanently attached shading device.

N1101.9 Certificate. A permanent certificate shall be posted on or in the electrical distribution 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 be completed by the builder or registered design professional. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration, the solar heat gain coefficient (SHGC) of fenestration and tested or sampled ACH_{50}. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the types and efficiency of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace, and/or baseboard electric heater is installed in the residence, the certificate shall list "gas-fired unvented room heater", "electric furnace", or "baseboard electric heater" as appropriate. An efficiency shall not be listed for gas-fired unvented room heaters, electric furnaces, or electric baseboard heaters.

N1101.10 Compliance testing. Where testing is required to determine air leakage of buildings or duct systems, the code official shall be permitted to require random sample testing of no fewer than one in seven residences.

SECTION N1102
PRESCRIPTIVE REQUIREMENT TABLES

N1102.1 General . The building thermal envelope and mechanical systems shall meet the requirements of one path in Table N1102.1 based on the climate zone specified in Table N1101.2.

TABLE N1102.1
PRESCRIPTIVE REQUIREMENTS BY COMPONENT[a]

Climate Zone	Path Number	Fenestration U-Factor[b,c]	Skylight U-Factor[b]	Glazed Fenestration SHGC[b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE)/Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Water Heater[o]
1	1	0.60	0.75	0.25	38	13+3	5/10	13	0	0	7	Condoned Space or Tested	Standard	Standard	Standard
1	2	NR	0.75	0.30	30	13	3/4	13	0	0	7	Condoned Space or Tested	Standard	SEER 15	62G/94E
1	3	0.60	0.75	0.30	30	13	3/4	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
1	4	NR	0.75	0.30	30	13	3/4	13	0	0	7	Condoned Space or Tested	Standard	SEER 17	Standard
1	5	NR	0.75	0.30	30	13	3/4	13	0	0	5	Reduced Leakage	Standard	Standard	Standard
1	6	NR	0.75	0.30	30	13	3/4	13	0	0	7	Condoned Space or Tested	Standard	SEER 16	Standard
2	1	0.35	0.65	0.25	38	13+3	6/13	13	0	0	7	Condoned Space or Tested	Standard	Standard	Standard
2	2	0.60	0.65	0.30	30	13	4/6	13	0	0	7	Condoned Space or Tested	Standard	SEER 15	62G/94E
2	3	0.35	0.65	0.30	30	13	4/6	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
2	4	0.60	0.65	0.30	30	13	4/6	13	0	0	7	Condoned Space or Tested	Standard	SEER 17	Standard
2	5	0.50	0.65	0.30	30	13	4/6	13	0	0	5	Reduced Leakage	Standard	Standard	Standard
2	6	0.50	0.65	0.30	30	13	4/6	13	0	0	7	Condoned Space or Tested	Standard	SEER 16	Standard
3	1	0.32	0.6	0.30	38	20 or 13+5	8/13	19	5/13[p]	0	7	Condoned Space or Tested	Standard	Standard	Standard
3	2	0.35	0.6	0.30	30	13	5/8	19	5/13[p]	0	7	Condoned Space or Tested	90/8.9	SEER 17	62G/94E

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Water Heater[o]
3	3	0.50	0.6	0.30	38	13	5/8	19	5/13[p]	0	4	Reduced Leakage	Standard	Standard	Standard
3	4	0.50	0.6	0.30	30	13	5/8	19	5/13[p]	0	4	Condoned Space or Tested	90/8.9	SEER 15	Standard
3	5	0.40	0.55	0.30	38	13	5/8	19	5/13	0	3	Reduced Leakage	Standard	Standard	Standard
3	6	0.40	0.55	0.30	38	13	5/8	19	5/13	0	5	Condoned Space or Tested	90/8.9	SEER 15	Standard
4 except Marine 4	1	0.32	0.60	NR	38	20 or 13+5	8/13	19	10/13	10; 2 ft	7	Condoned Space or Tested	Standard	Standard	Standard
4 except Marine 4	2	0.35	0.60	NR	38	13	5/10	19	10/13	10; 2 ft	7	Condoned Space or Tested	90/8.9	SEER 15	62G/94E
4 except Marine 4	3	0.32	0.60	NR	38	13	5/10	19	10/13	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
4 except Marine 4	4	0.35	0.60	NR	38	13	5/10	19	10/13	10; 2 ft	4	Condoned Space or Tested	90/8.9	SEER 15	Standard
4 except Marine 4	5	0.35	0.55	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	3	Reduced Leakage	Standard	Standard	Standard
4 except Marine 4	5	0.35	0.55	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	5	Condoned Space or Tested	90/8.9	Standard	Standard
5 and Marine 4	1	0.32	0.60	NR	49	20+5 or 13+10	19/20	30	15/19	10; 2 ft	4	Condoned Space or Tested	Standard	Standard	Standard
5 and Marine 4	2	0.32	0.60	NR	38	20 or 13+5	13/17	30	10/13	10; 2 ft	7	Reduced Leakage	92/9.1	15 SEER	62G/94E
5 and Marine 4	3	0.32	0.60	NR	49	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
5 and Marine 4	4	0.35	0.60	NR	38	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Condoned Space or Tested	92/9.1	Standard	Standard
5 and Marine 4		0.32	0.55	NR	49	20 or 13+5	13/17	30	10/13	10, 2 ft	3	Reduced Leakage	Standard	Standard	Standard
5 and Marine 4		0.32	0.55	NR	49	20 or 13+5	13/17	30	10/13	10, 2 ft	5	Condoned Space or Tested	92/9.1	Standard	Standard

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value [f]	Mass Wall R-Value [g]	Floor R-Value [h]	Basement/ Crawl space Wall R-Value [i]	Slab R-Value & Depth [j]	Building Air Tightness (ACH50) [k]	Duct Tightness [l]	Furnace (AFUE) /Heat Pump (HSPF) [m]	Air Conditioning (SEER) [n]	Water Heater [o]
6	1	0.30	0.60	NR	49	20+5 or 13+10	19/21	30	15/19	10; 4 ft	4	Condoned Space or Tested	Standard	Standard	Standard
6	2	0.35	0.60	NR	49	20 or 13+5	15/19	30	15/19	10; 4 ft	7	Reduced Leakage	92/9.1	Standard	62G/94E
6	3	0.32	0.60	NR	60	20 or 13+5	15/19	30	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
6	4	0.35	0.60	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Condoned Space or Tested	92/9.1	Standard	Standard
6	5	0.32	0.55	NR	49	20+5 or 13+10	19/21	30	15/19	10 4 ft	3	Reduced Leakage	Standard	Standard	Standard
6	6	0.32	0.55	NR	49	20+5 or 13+10	19/21	30	15/19	10 4 ft	5	Condoned Space or Tested	92/9.1	Standard	Standard
7 and 8	1	0.27	0.6	NR	60	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Condoned Space or Tested	Standard	Standard	Standard
7 and 8	2	0.30	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Condoned Space or Tested	92/9.1	Standard	62G/94E
7 and 8	3	0.32	0.6	NR	49	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
7 and 8	4	0.35	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Reduced Leakage	92/9.1	Standard	Standard
7 and 8	5	0.32	0.55	NR	49	20+5 or 13+10	19/21	38	15/19	10, 4 ft	3	Reduced Leakage	Standard	Standard	Standard
7 and 8	6	0.32	0.55	NR	49	20+5 or 13+10	19/21	38	15/19	10, 4 ft	5	Condoned Space or Tested	92/9.1	Standard	Standard

For SI: 1 foot = 304.8 mm.

(relettered and reordered in order of table)

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. "NR" means no requirement.
c. For impact rated fenestration complying with Section R301.2.1.2 of the International Residential Code, the maximum U-factor in Climate Zones 1-3 shall be permitted to be 0.15 higher than that specified in Table N1102.1.
d~~e~~. There are no SHGC requirements in the Marine Zone.
e. SHGC calculations and exceptions are covered under Section N1103.3.
f~~h~~. First value is cavity insulation, second is continuous insulation, so "xx+yy" means R-xx cavity insulation plus R-yy insulated sheathing. Where Structural sheathing is used, continuous insulation shall be permitted to be reduced by no more than R-3.
g. The second R-value applies when more than half the insulation is on the interior of the mass wall and applies interior cavity insulation.
h. Or insulation sufficient to fill the framing cavity, R-19 minimum.
i. "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
j. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in Zones 1 through 3 for heated slabs.
k. Air tightness testing requirements are listed in Section N1103.4.1.1.
l. "Conditioned Space or Tested" means that the duct system shall either be located within conditioned space or tested in accordance with Section N1104.2.2. "Reduced Leakage" means that the duct system and air handler shall comply with the requirements of section N1104.2.3.
m. Heating system performance tested in accordance with ASHRAE Standard 103 or ARI Standard 210/2N110 or equivalent. Coefficient of Performance (COP) is converted into HSPF by multiplying by 3.413. "Standard" represents the prevailing minimum efficiency acceptable under federal law.
n. Cooling system performance tested in accordance with ARI Standard 210/2N110 or equivalent. Energy Efficiency Ratio (EER) is converted to SEER by multiplying EER*1.143. "Standard" represents the prevailing minimum efficiency acceptable under federal law.
o. Water heater Energy Factor requirements for Gas (G) and Electric (E) water heaters. "Standard" represents the prevailing minimum efficiency acceptable under federal law.
p. Basement wall insulation is not required in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.

SECTION N1103 BUILDING THERMAL ENVELOPE

N1103.1 General.

N1103.1.1 Insulation Installation. All insulation installed as part of the building thermal envelope to achieve compliance with Table N1102.1 shall be installed in accordance with the manufacturer's installation instructions and in a manner such that as installed it meets the specified performance levels provided in Table N1102.1. An area-weighted average of each component shall be permitted to satisfy the requirements in Table N1102.1.

N1103.1.2 *R*-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component *R*-value. The manufacturer's settled *R*-value shall be used for blown insulation. Computed *R*-values shall not include an *R*-value for other building materials or air films.

TABLE N1103.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	Glazed Fenestration SHGC	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR[d]	CRAWL SPACE WALL *U*-FACTOR[c]	ENVELOPE LEAKAGE RATES (ACH50)
1	0.65	0.75	.25	0.030	0.066	0.138/0.120	0.064	0.360	0.477	7
2	0.35	0.65	.25	0.030	0.066	0.138/0.098	0.064	0.360	0.477	7
3	0.32	0.65	.3	0.030	0.058	0.098/0.087	0.047	0.091[c]	0.136	7
4 except Marine	0.32	0.60	NR	0.030	0.058	0.098/0.087	0.047	0.059	0.065	4
5 and Marine 4	0.32	0.60	NR	0.026	0. 048	0.058/0.057	0.033	0.050	0.053	4
6	0.30	0.55	NR	0.026	0.048	0.047/0.054	0.033	0.050	0.053	4
7 and 8	0.27	0.55	NR	0.024	0.048	0.043/0.047	0.028	0.050	0.053	3

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.10 in Zone 4 except Marine, 0.087 in 0.087 in zone 5 and Marine 4, and the same as the frame wall U-factor in Marine Zone 4 and Zones 5 through 8.
c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.

d. Foundation U-factor requirements shown in Table N1103.1.3 include wall construction and interior air films but exclude soil conductivity and exterior air films. U-factors for determining code compliance in accordance with Section N1103.1.4 (total UA alternative) of Section N1105 (Simulated Performance Alternative) shall be modified to include soil conductivity and exterior air film.

N1103.1.3 *U*-factor alternative. An assembly with a *U*-factor equal to or less than the equivalent R-value specified in Table N1102.1 determined by using a method consistent with the ASHRAE *Handbook of Fundamentals* including the thermal bridging effects of framing materials shall be permitted as an alternative to the required *R*-value in Table N1102.1.1 for the selected path. Nonfenestration *U*-factors or R-values shall be obtained from measurement, calculation or an approved source.

N1103.1.4 Total UA alternative. If the total building thermal envelope UA (sum of *U*-factor times assembly area) is less than or equal to the total UA resulting from using the *U*-factors in Table N1103.1.3 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with the R-value and U-factor requirements of Table N1102.1. The UA calculation shall be done using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. The SHGC and Envelope Leakage rate requirements in Table N1103.1.3 shall be met in addition to UA compliance.

N1103.2 Specific insulation requirements.

N1103.2.1 Ceilings with attic space. Wherever full height of uncompressed insulation extends over the wall top plate at the eaves, the reduced values in Table N1103.2.1 shall be deemed to satisfy the ceiling insulation requirements. This reduction shall not apply to the U-factor alternative approach in Section N1103.1.3 and the Total UA alternative in Section N1103.1.4.

TABLE N1103.2.1
ALLOWABLE CEILING R-VALUE WITH FULL HEIGHT PERIMETER INSULATION

Table N1102.1 Listed Ceiling R-Value	Allowable R-Value with full height perimeter insulation
38	30
49	38
60	49

N1103.2.2 Ceilings without attic spaces. Where Section N1102.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section N1102.1.1 shall be limited to 500 square feet (46 m^2) or 20% of the total insulated ceiling area, whichever is less. This reduction shall not apply to the U-factor alternative approach in Section N1103.1.3 and the Total UA alternative in Section N1103.1.4.

N1103.2.3 Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment which prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.

N1103.2.4 Mass walls. Mass walls for the purposes of this Chapter shall be considered above grade walls of concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth block, rammed earth) and solid timber/logs.

N1103.2.5 Steel-frame ceilings, walls and floors. Steel-frame ceilings, walls and floors shall meet the insulation requirements of Table N1103.2.5 or shall meet the *U*-factor requirements in Table N1103.1.3. The calculation of the *U*-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

TABLE N1103.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (*R*-VALUE)

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL 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
R-13[c]	R-13+5 or R-15+4 or R-21+3 or R-0+10
R-19	R-13+9 or R-19+8 or R-25+7
R-20 or R-21	R-13+10 or R-19+9 or R-25+8
R-20+5	R-13+15 or R-19+14 or R-25+13
	Steel Joist Floor
R-13	R-19 in 2×6; R-19+6 in 2×8 or 2×10
R-19	R-19+6 in 2×6; R-19+12 in 2×8 or 2×10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.
c. Under prescriptive paths 2, 3, and 4, insulation for steel framed wall assemblies with studs spaced 24 inches (610mm) on center shall be permitted to be R-13+0 when ceiling insulation is increased to a wood framed equivalent of R-38 in climate zones 1 and 2 and permitted to be R-13+3 when ceiling insulation is increased to a wood framed equivalent of R-49 in climate zones 3 and 4.

N1103.2.6 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

N1103.2.7 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 meet this requirement unless the floor overhead is insulated in accordance with Sections N1102.1 and N1103.2.6.

N1103.2.8 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 N1102.1. 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 N1102.1 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 a minimum of 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.

N1103.2.9 Crawl space walls. As an alternative to insulating floors over crawl spaces, crawl space walls shall be permitted to be insulated when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished grade level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder. All 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 at least 6 inches (153 mm) up the stem wall and shall be attached to the stem wall.
N1103.2.10 Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation that supports a masonry veneer.

N1103.2.11 Thermally isolated sunroom insulation. The minimum ceiling insulation *R*-values shall be R-19 in zones 1 through 4 and R-24 in zones 5 though 8. The minimum wall *R*-value shall be R-13 in all zones. New wall(s) separating a sunroom from conditioned space shall meet the building thermal envelope requirements.

N1103.3 Fenestration.
N1103.3.1 *U*-factor. An area-weighted average of fenestration products shall be permitted to satisfy the *U*-factor requirements.

N1103.3.2 Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50 percent glazed shall be permitted to satisfy the SHGC requirements.

N1103.3.3 Glazed fenestration exemption. Up to 15 square feet (1.4 m^2) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section N1102.1. This exemption shall not apply to the U-factor alternative approach in Section N1103.1.3 and the Total UA alternative in Section N1103.1.4.

N1103.3.4 Opaque door exemption. One side-hinged opaque door assembly up to 24 square feet (22 m^2) in area is exempted from the *U*-factor requirement in Section N1102.1.1. This exemption shall not apply to the U-factor alternative approach in Section N1103.1.3 and the Total UA alternative in Section N1103.1.4.

N1103.3.5 Thermally isolated sunroom *U*-factor. For Zones 4 through 8, the maximum fenestration *U*-factor shall be 0.50 and the maximum skylight *U*-factor shall be 0.75. New windows and doors separating the sunroom from conditioned space shall meet the building thermal envelope requirements.

N1103.3.6 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the following requirements for *U*-factor and SHGC. : SHGC in climate zones 1-3 of 0.30, U-Factor of 0.5 in climate zones 2, 3, 0.35 in climate zones 4,5, 0.32 in climate zones 6, 7 and 8 subject to the all the provisions in Section N1103.3.

N1103.4 Air leakage.

N1103.4.1 Building thermal envelope. The building thermal envelope shall comply with Section N1103.4.1.1 and N1103.4.1.2. The sealing methods between dissimilar materials shall allow for differential expansion and contraction.

N1103.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table N1103.4.1.2 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table N1102.1, as applicable to the method of construction. Where required by the *code official*, an approved party shall inspect all components and verify compliance.

N1103.4.1.2 Testing. Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than or equal to the building air changes per hour (ACH) listed in the selected path of Table N1102.1 for prescriptive compliance when tested with a blower door apparatus at a pressure of +/-0.2 in w.c. (50 Pa). Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances.

Exception:

1. Testing is not required in climate zones 1-3 for residences reporting an air tightness level of 7 ACH50.
2. Dwelling units of multifamily residential buildings with more than four individual units shall be excepted from the testing requirements if they satisfy the requirements listed in Table N1103.4.1.2, applicable to the method of construction and are field verified. Where required by the *code official*, an *approved* party independent from the installer of the insulation shall inspect the air barrier and insulation.

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, if installed at the time of test, shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s), if installed at the time of test, shall be turned off; and

6. Supply and return registers, if installed at the time of test, shall be fully open.

N1103.4.1.3 Sampling. Where groups of seven or more buildings or dwelling units of similar design and construction are completed and are issued occupancy permits during a 120-day period, or where a multifamily structure contains more than four dwelling units, testing of less than 100 percent, but not less than 1 in 7 or 15 percent, of the buildings from a specific builder and/or contractor or of dwelling units in a multifamily structure shall be permitted when *approved* by the *code official*. The specific buildings or dwelling units to be tested shall be selected by the *code official*. If any tested bulding or dwelling unit fails to comply with the maximum air leakage requirement in Section N1103.4.1.2 then all buildings or dwelling units shall be tested until a minimum of three consecutive buildings or dwelling units comply from that specific builder and/or contractor or multifamily structure before the *code official* may permit sampling to resume.

N1103.4.1.4 Single Family Attached. For residential occupancies other than single family detached dwellings, testing shall be permitted to be the entire building tested simultaneously or a sampling of no fewer than 1 in 7 individual units within the structure. Individual unit tightness shall be permitted to be determined by either total unit leakage or leakage to unconditioned space. Where multiple tests are performed for a building, the average tightness of tested units shall be permitted to satisfy the required building envelope air tightness level.
N1103.4.1.5 Failed Testing. If the dwelling does not achieve the air-leakage requirement on the initial test, after an attempt to correct, a subsequent test must be performed that demonstrates compliance or at least a 10% reduction in leakage and within 1 ACH of the required prescriptive tightness.

N1103.4.2 Fenestration air leakage. Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s /m^2), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s /m^2), when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled by the manufacturer.

Exceptions: Site-built windows, skylights and doors.

TABLE N1103.4.1.2
AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	**CRITERIA**
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material. Air permeable insulation installed in a wall is inside of an air barrier.
Ceiling / attic	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
Walls	Corners and headers are insulated. Junction of foundation and sill plate is sealed.
Windows and doors	Space between window/door jambs and framing is sealed.
Rim joists	Rim joists are insulated and include an air barrier.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls. Exposed earth in unvented crawlspaces is covered with class I vapor retarder with Overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit, or narrow cavities are filled by spayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures are airtight, IC rated, and sealed to drywall. Exception—fixtures in conditioned space.
Plumbing and Wiring	Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
Shower / tub on exterior wall	Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.
Electrical / phone box on exterior walls	Air barrier extends behind boxes or an air sealed type boxes are installed.
HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace	Fireplace walls include an air barrier. New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.

N1103.4.3 Recessed lighting. Recessed luminaries installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaries shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All recessed luminaries shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

N1102.5 Maximum fenestration *U*-factor and SHGC (Mandatory). The area weighted average maximum fenestration *U*-factor permitted using trade offs from Section 402.1.4 or Section 404 shall be 0.48 in zones 4 and 5 and 0.40 in zones 6 through 8 for vertical fenestration, and 0.75 in zones 4 through 8 for skylights. The area weighted average maximum fenestration SHGC permitted using trade-offs from Section 405 in Zones 1 through 3 shall be 0.50.

SECTION N1104
SYSTEMS

N1104.1 Controls. At least one thermostat shall be provided for each separate heating and cooling system.

N1104.1.1 Programmable thermostat. Where the primary heating system is a forced air furnace, at least one thermostat per 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. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55ºF (13ºC) or up to 85º F (29ºC). T he ther mostat shall initially be pr ogrammed with a heati ng tem perature s et poi nt no hi gher than 70º F (21ºC) and a c ooling temperature set point no lower than 78ºF (26ºC).

N1104.1.2 Heat pump supplementary heat. Heat pum ps hav ing s upplementary electric-resistance heat s hall hav e c ontrols that, except du ring defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

N1104.2 Ducts.

N1104.2.1 Insulation. Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Ducts or portions thereof located completely inside the building thermal envelope.

N1104.2.2 Sealing. All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*. Duct tightness shall be verified by either of the following:

1. Post-construction test: Either total duct leakage or duct leakage outside conditioned space shall be less than or equal to 6 cfm (170 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All air inlets/outlets shall be taped or otherwise sealed during the test.
2. Rough-in test: Total duct leakage shall be less than or equal to 4 cfm (113 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All air inlets/outlets shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 3 cfm (85 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*.

Exception: Duct tightness test is not required if the air handler and all ducts are located within conditioned space.

N1104.2.3 Reduced Leakage ducts. When specified as part of a selected Path Number in Table N1102.1, Reduced Leakage ducts must be located entirely within conditioned space and tested for total leakage and leakage outside of conditioned space. Leakage to outdoors shall be less than or equal to 3 cfm (85 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area, and the total leakage shall be less than or equal to 6 cfm (170 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

N1104.2.4 Building cavities. Building framing cavities shall not be used as supply ducts.

N1104.2.4 Location. All ducts and air handlers shall be located within the conditioned space.

Exception: Where heating and cooling equipment meets the requirements of Section N1104.10.

N1104.3 Mechanical system piping insulation. Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) shall be insulated to a minimum of R-3.

N1104.4 Service hot water systems.

N1104.4.1 Hot water pipe insulation. At least R-3 insulation shall be applied to the following metallic hot water pipe:

1. piping larger than 3/4 in. outside diameter
2. piping outside conditioned space
3. piping in a floor slab or in the ground
4. piping in a recirculating system
   exception: demand recirculation systems
5. entire pipe run from water heater to kitchen outlets,
6. Piping serving more than one dwelling unit,
7. Piping from the water heater to a distribution manifold,
8. Buried piping.

N1104.4.2 Recirculating hot water systems. Recirculating hot water systems shall be provided with an automatic or readily accessible manual switch that can turn off the hot water circulating pump when not in use.

N1104.5 Mechanical ventilation. The building shall be provided with ventilation that meets the requirements of Section M1507 of the *International Residential Code 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.

N1104.6 Equipment sizing. Heating and cooling equipment shall be sized in accordance with Section M1401.3 of the *International Residential Code.*

N1104.8 Snow melt system controls. Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50ºF, and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40ºF.

N1104.9 Pools. Pools shall be provided with energy conserving measures in accordance with Sections N1104.9.1 through N1104.9.3

N1104.9.1 Pool heaters. All pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas or LPG shall not have continuously burning pilot lights.

N1104.9.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and-waste-heat-recovery pool heating systems.

N1104.9.3 Pool covers. Heated pools shall be equipped with a vapor-retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12.

Exception: Pools deriving over 60 percent of the energy from heating from site-recovered or solar energy source.

SECTION N1105
ELECTRICAL POWER AND LIGHTING SYSTEMS

N11054.1 Lighting equipment. A minimum of seventy-five percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps or a minimum of seventy-five percent of the permanently installed lighting fixtures shall contain only high efficacy lamps.

Exception: Low-voltage lighting.

Commenter's Reason: Changes in this proposal from the original include a number of small changes made at the request of the Department of Energy. The effort was collaborative including input from the National Multi Housing Council, NAHB and a large number of industry representatives. Our calculations show that a 30% savings of heating, cooling and water heating energy over the 2006 IECC will be achieved with the adoption of this proposal. NAHB realizes the importance of energy efficiency, but it critical that the builders concerns be considered when adopting code changes as they are the ones who understand the complexities of the code and are the ones who have to make it happen.

Within this comprehensive proposal are changes that provide four prescriptive paths in each climate zone. These multiple paths will both increase flexibility for the builders and simplify code enforcement. In many cases where the builder would use the performance path, they now will be able to use a prescriptive path that will provide a much more straightforward code compliance check.

Energy neutral equipment efficiency tradeoffs have been included back into the code. Using equipment efficiencies toward code compliance are often a cost effective solution providing the builder flexibility to achieve code compliance.

Air tightness and duct tightness levels in this proposal more closely represent reasonably achievable levels than are proposed in a number of other proposals. It provides flexibility for builders who don't feel comfortable that they can build tight construction (i.e. small homes on a vented crawl space).

Public Comment 2:

Kristyn Clayton, Green House Effects, representing North American Electrical Heating Industry Coalition, requests Approval as Modified by this public comment.

Further modify proposal as follows:

TABLE N1102.1
PRESCRIPTIVE REQUIREMENTS BY COMPONENT[a]

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	~~Furnace (AFUE) /Heat Pump (HSPF)[m]~~	Air Conditioning (SEER)[n]	Hot Water Heater[o]
1	1	0.60	0.75	0.25	38	13+3	5/10	13	0	0	7	Cond or Tested	~~Standard~~	Standard	Standard
1	2	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	~~Standard~~	SEER 15	62G/94E
1	3	0.60	0.75	0.3	30	13	3/4	13	0	0	7	Reduced Leakage	~~Standard~~	Standard	Standard
1	4	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	~~Standard~~	SEER 17	Standard
2	1	0.35	0.65	0.25	38	13+3	6/13	13	0	0	7	Cond or Tested	~~Standard~~	Standard	Standard
2	2	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	~~Standard~~	SEER 15	62G/94E
2	3	0.35	0.65	0.3	30	13	4/6	13	0	0	7	Reduced Leakage	~~Standard~~	Standard	Standard

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value [f]	Mass Wall R-Value [g]	Floor R-Value [h]	Basement/ Crawl space Wall R-Value [i]	Slab R-Value & Depth [j]	Building Air Tightness (ACH50) [k]	Duct Tightness [l]	~~Furnace (AFUE) /Heat Pump (HSPF)~~ [m]	Air Conditioning (SEER) [n]	Hot Water Heater [o]
2	4	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	~~Standard~~	SEER 17	Standard
3	1	0.32	0.6	0.3	38	20 or 13+5	8/13	19	5/13[p]	0	7	Cond or Tested	~~Standard~~	Standard	Standard
3	2	0.35	0.6	0.3	30	13	5/8	19	5/13[p]	0	7	Cond or Tested	~~90/8.9~~	SEER 17	62G/94E
3	3	0.50	0.6	0.3	38	13	5/8	19	5/13[p]	0	4	Reduced Leakage	~~Standard~~	Standard	Standard
3	4	0.50	0.6	0.3	30	13	5/8	19	5/13[p]	0	4	Cond or Tested	~~90/8.9~~	SEER 15	Standard
4 except Marine 4	1	0.32	0.6	NR	38	20 or 13+5	8/13	19	10/13	10; 2 ft	7	Cond or Tested	~~Standard~~	Standard	Standard
4 except Marine 4	2	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	7	Cond or Tested	~~90/8.9~~	SEER 15	62G/94E
4 except Marine 4	3	0.32	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Reduced Leakage	~~Standard~~	Standard	Standard
4 except Marine 4	4	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Cond or Tested	~~90/8.9~~	SEER 15	Standard
5 and Marine 4	1	0.32	0.6	NR	49	20+5 or 13+10	15/20	30	15/19	10; 2 ft	4	Cond or Tested	~~Standard~~	Standard	Standard
5 and Marine 4	2	0.32	0.6	NR	38	20 or 13+5	13/17	30	10/13	10; 2 ft	7	Reduced Leakage	~~92/9.1~~	15 SEER	62G/94E
5 and Marine 4	3	0.32	0.6	NR	49	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Reduced Leakage	~~Standard~~	Standard	Standard
5 and Marine 4	4	0.35	0.6	NR	38	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Cond or Tested	~~92/9.1~~	Standard	Standard
6	1	0.30	0.55	NR	49	20+5 or 13+10	19/21	30	15/19	10; 4 ft	4	Cond or Tested	~~Standard~~	Standard	Standard
6	2	0.35	0.55	NR	49	20 or 13+5	15/19	30	15/19	10; 4 ft	7	Reduced Leakage	~~92/9.1~~	Standard	62G/94E
6	3	0.32	0.55	NR	60	20 or 13+5	15/19	30	15/19	10; 4 ft	3	Reduced Leakage	~~Standard~~	Standard	Standard
6	4	0.35	0.55	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	~~92/9.1~~	Standard	Standard
7 and 8	1	0.27	0.55	NR	60	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Cond or Tested	~~Standard~~	Standard	Standard
7 and 8	2	0.30	0.55	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	~~92/9.1~~	Standard	62G/94E
7 and 8	3	0.32	0.55	NR	49	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Reduced Leakage	~~Standard~~	Standard	Standard
7 and 8	4	0.35	0.55	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Reduced Leakage	~~92/9.1~~	Standard	Standard

For SI: 1 foot = 304.8 mm.

(relettered and reordered in order of table)

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. “NR” means no requirement.

c~~j~~. For impact rated fenestration complying with Section R301.2.1.2 of the International Residential Code, the maximum U-factor in Climate Zones 1-3 shall be permitted to be 0.15 higher than that specified in Table N1102.1.
d. There are no SHGC requirements in the Marine Zone.
e. SHGC calculations and exceptions are covered under Section N1103.3.
f. “xx+yy” means R-xx cavity insulation plus R-yy insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
g. The second R-value applies when more than half the insulation is on the interior of the mass wall and applies interior cavity insulation.
h. Or insulation sufficient to fill the framing cavity, R-19 minimum.
i. “15/19” means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. “15/19” shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. “10/13” means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
j. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in Zones 1 through 3 for heated slabs.
k. Air tightness testing requirements are listed in Section N1103.4.1.1.
l. “Cond or Tested” means that the duct system shall either be located within conditioned space or tested in accordance with Section N1104.2.2.“Reduced Leakage” means that the duct system shall comply with the requirements of section N1104.2.3.
m. Heating system performance tested in accordance with ASHRAE Standard 103 or ARI Standard 210/2N110 or equivalent. Coefficient of Performance (COP) is converted into HSPF by multiplying by 3.413. “Standard” represents the prevailing minimum efficiency acceptable under federal law.
n. Cooling system performance tested in accordance with ARI Standard 210/2N110 or equivalent. Energy Efficiency Ratio (EER) is converted to SEER by multiplying EER*1.143. “Standard” represents the prevailing minimum efficiency acceptable under federal law.
o. Water heater Energy Factor requirements for Gas (G) and Electric (E) water heaters. “Standard” represents the prevailing minimum efficiency acceptable under federal law.
p. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

(Portions of code change proposal not shown remain unchanged.)

Commenter’s Reason: The notations in the Table N1102.1 for AFUE and SHPF do not apply to Electric Resistance heating equipment and as such give the impression that this type of equipment is not allowed as an option for pursuing a prescriptive path. Therefore, any building wishing to use electric resistance heating will have to demonstrate compliance with this code by spending significant money to model the proposed design. This is unfairly restricting equipment selection and use, especially in developments that can use and control electric resistance heating equipment efficiently. If a proposed design can adequately demonstrate that electric resistance heating is a viable, efficient option then it should be allowed and mentioned in these tables.

Public Comment 3:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this public comment.

Further modify proposal as follows:

Add the following definition:

CONTINUOUS INSULATION. Insulation installed continuously across all structural members on the interior, exterior, or integral to any opaque surface of the building envelope, without intervening vented air spaces or thermal bridges other than fasteners and service openings.

(Portions of code change proposal not shown remain unchanged)

Commenter’s Reason: This proposal and various other proposals and modifications from the code development hearings use or introduce the term, “continuous insulation”, but the term is not defined. This public comment corrects that problem and provides needed clarification of the meaning of continuous insulation to ensure proper application in compliance with the intent of the energy code.

ASHRAE 90.1 defines continuous insulation as “insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope.” This definition is adopted in this PC for sake of consistency and is further improved to clarify an important concern with the proper and consistent characterization of continuous insulation. The ASHRAE definition addresses a concern with thermal bridging but does not address the similar concern with intervening vented air spaces which can create a disconnect of continuous insulation thermal resistance such that its contribution to a layered wall assembly R-value cannot be simply summed. Thus, wording is included in the definition to address this concern. Air exchange rates for vented airspaces behind claddings can exceed 90 air-changes per hour (see references 1 and 2) which significantly impacts the R-value of the air-space or disconnects the R-value of material on the exterior side of the airspace. A robust definition for continuous insulation is needed in the IECC.

References:

1. Straube, J. and Finch, G. (2009). Ventilated Wall Claddings: Review, Field Performance, and Hygrothermal Modeling, Research Report – 0907, Building Science Press, www.buildingscience.com.
2. Salonvarra, M., Karagiozis, A.N., Pazera, M., Miller W. (2007). “Air Cavities Behind Claddings – What Have We Learned?”, Buildings X, ASHRAE

Public Comment 4:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this public comment.

Further modify proposal as follows:

TABLE N1102.1
PRESCRIPTIVE REQUIREMENTS BY COMPONENT[a]

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Water Heater[o]
1	1	0.60	0.75	0.25	38	13+3	5/10	13	0	0	7	Condoned Space or Tested	Standard	Standard	Standard
1	2	NR	0.75	0.30	30	13	3/4	13	0	0	7	Condoned Space or Tested	Standard	SEER 15	62G/94E
1	3	0.60	0.75	0.30	30	13	3/4	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
1	4	NR	0.75	0.30	30	13	3/4	13	0	0	7	Condoned Space or Tested	Standard	SEER 17	Standard
1	5	NR	0.75	0.30	30	13	3/4	13	0	0	5	Reduced Leakage	Standard	Standard	Standard
1	6	NR	0.75	0.30	30	13	3/4	13	0	0	7	Condoned Space or Tested	Standard	SEER 16	Standard
2	1	0.35	0.65	0.25	38	13+3	6/13	13	0	0	7	Condoned Space or Tested	Standard	Standard	Standard
2	2	0.60	0.65	0.30	30	13	4/6	13	0	0	7	Condoned Space or Tested	Standard	SEER 15	62G/94E
2	3	0.35	0.65	0.30	30	13	4/6	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
2	4	0.60	0.65	0.30	30	13	4/6	13	0	0	7	Condoned Space or Tested	Standard	SEER 17	Standard
2	5	0.50	0.65	0.30	30	13	4/6	13	0	0	5	Reduced Leakage	Standard	Standard	Standard
2	6	0.50	0.65	0.30	30	13	4/6	13	0	0	7	Condoned Space or Tested	Standard	SEER 16	Standard
3	1	0.32	0.6	0.30	38	20 or 13+5	8/13	19	5/13[p]	0	7	Condoned Space or Tested	Standard	Standard	Standard
3	2	0.35	0.6	0.30	30	13	5/8	19	5/13[p]	0	7	Condoned Space or Tested	90/8.9	SEER 17	62G/94E
3	3	0.50	0.6	0.30	38	13	5/8	19	5/13[p]	0	4	Reduced Leakage	Standard	Standard	Standard

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value [f]	Mass Wall R-Value [g]	Floor R-Value [h]	Basement/ Crawl space Wall R-Value [i]	Slab R-Value & Depth [j]	Building Air Tightness (ACH50) [k]	Duct Tightness [l]	Furnace (AFUE) /Heat Pump (HSPF) [m]	Air Conditioning (SEER) [n]	Water Heater [o]
3	4	0.50	0.6	0.30	30	13	5/8	19	5/13[p]	0	4	Condoned Space or Tested	90/8.9	SEER 15	Standard
3	5	0.40	0.55	0.30	38	13	5/8	19	5/13	0	3	Reduced Leakage	Standard	Standard	Standard
3	6	0.40	0.55	0.30	38	13	5/8	19	5/13	0	5	Condoned Space or Tested	90/8.9	SEER 15	Standard
4 except Marine 4	1	0.32	0.60	NR	38	20 or 13+5	8/13	19	10/13	10; 2 ft	7	Condoned Space or Tested	Standard	Standard	Standard
4 except Marine 4	2	0.35	0.60	NR	38	13	5/10	19	10/13	10; 2 ft	7	Condoned Space or Tested	90/8.9	SEER 15	62G/94E
4 except Marine 4	3	0.32	0.60	NR	38	13	5/10	19	10/13	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
4 except Marine 4	4	0.35	0.60	NR	38	13	5/10	19	10/13	10; 2 ft	4	Condoned Space or Tested	90/8.9	SEER 15	Standard
4 except Marine 4	5	0.35	0.55	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	3	Reduced Leakage	Standard	Standard	Standard
4 except Marine 4	5	0.35	0.55	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	5	Condoned Space or Tested	90/8.9	Standard	Standard
5 and Marine 4	1	0.32	0.60	NR	49	20+5 or 13+10	19/20	30	15/19	10; 2 ft	4	Condoned Space or Tested	Standard	Standard	Standard
5 and Marine 4	2	0.32	0.60	NR	38	20 or 13+5	13/17	30	10/13	10; 2 ft	7	Reduced Leakage	92/9.1	15 SEER	62G/94E
5 and Marine 4	3	0.32	0.60	NR	49	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
5 and Marine 4	4	0.35	0.60	NR	38	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Condoned Space or Tested	92/9.1	Standard	Standard
5 and Marine 4		0.32	0.55	NR	49	20 or 13+5	13/17	30	10/13	10, 2 ft	3	Reduced Leakage	Standard	Standard	Standard
5 and Marine 4		0.32	0.55	NR	49	20 or 13+5	13/17	30	10/13	10, 2 ft	5	Condoned Space or Tested	92/9.1	Standard	Standard
6	1	0.30	0.60	NR	49	20+5 or 13+10	19/21	30	15/19	10; 4 ft	4	Condoned Space or Tested	Standard	Standard	Standard
6	2	0.35	0.60	NR	49	20 or 13+5	15/19	30	15/19	10; 4 ft	7	Reduced Leakage	92/9.1	Standard	62G/94E
6	3	0.32	0.60	NR	60	20 or 13+5	15/19	30	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
6	4	0.35	0.60	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Condoned Space or Tested	92/9.1	Standard	Standard
6	5	0.32	0.55	NR	49	20+5 or 13+10	19/21	30	15/19	10 4 ft	3	Reduced Leakage	Standard	Standard	Standard
6	6	0.32	0.55	NR	49	20+5 or 13+10	19/21	30	15/19	10 4 ft	5	Condoned Space or	92/9.1	Standard	Standard

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	Furnace (AFUE) /Heat Pump (HSPF)[m]	Air Conditioning (SEER)[n]	Water Heater[o]
												Tested			
7 and 8	1	0.27	0.6	NR	60	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Condoned Space or Tested	Standard	Standard	Standard
7 and 8	2	0.30	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Condoned Space or Tested	92/9.1	Standard	62G/94E
7 and 8	3	0.32	0.6	NR	49	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
7 and 8	4	0.35	0.6	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Reduced Leakage	92/9.1	Standard	Standard
7 and 8	5	0.32	0.55	NR	49	20+5 or 13+10	19/21	38	15/19	10, 4 ft	3	Reduced Leakage	Standard	Standard	Standard
7 and 8	6	0.32	0.55	NR	49	20+5 or 13+10	19/21	38	15/19	10, 4 ft	5	Condoned Space or Tested	92/9.1	Standard	Standard

For SI: 1 foot = 304.8 mm.

(relettered and reordered in order of table)

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. “NR” means no requirement.

c. For impact rated fenestration complying with Section R301.2.1.2 of the International Residential Code, the maximum U-factor in Climate Zones 1-3 shall be permitted to be 0.15 higher than that specified in Table N1102.1.

d. There are no SHGC requirements in the Marine Zone.

e. SHGC calculations and exceptions are covered under Section N1103.3.

~~f. First value is cavity insulation, second is continuous insulation, so “xx+yy” means R-xx cavity insulation plus R-yy continuous insulation. “13+5” means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation of at least R-2~~.

f. First value is cavity insulation, second is continuous insulation, so “13+5” means R-13 cavity insulation plus R-5 continuous insulation. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

g. The second R-value applies when more than half the insulation is on the interior of the mass wall and applies interior cavity insulation.

h. Or insulation sufficient to fill the framing cavity, R-19 minimum.

i. “15/19” means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. “15/19” shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. “10/13” means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

j. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in Zones 1 through 3 for heated slabs.

k. Air tightness testing requirements are listed in Section N1103.4.1.1.

l. “Conditioned Space or Tested” means that the duct system shall either be located within conditioned space or tested in accordance with Section N1104.2.2. “Reduced Leakage” means that the duct system and air handler shall comply with the requirements of section N1104.2.3.

m. Heating system performance tested in accordance with ASHRAE Standard 103 or ARI Standard 210/2N110 or equivalent. Coefficient of Performance (COP) is converted into HSPF by multiplying by 3.413. “Standard” represents the prevailing minimum efficiency acceptable under federal law.

n. Cooling system performance tested in accordance with ARI Standard 210/2N110 or equivalent. Energy Efficiency Ratio (EER) is converted to SEER by multiplying EER*1.143. “Standard” represents the prevailing minimum efficiency acceptable under federal law.

o. Water heater Energy Factor requirements for Gas (G) and Electric (E) water heaters. “Standard” represents the prevailing minimum efficiency acceptable under federal law.

p. Basement wall insulation is not required in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.

Commenter’s Reason: This public comment achieves two things:

1. corrects a severe problem with footnote ‘h’ that erodes the energy code, regardless of which version of the energy code is approved; and,
2. provides a rational and flexible application of footnote ‘h’ in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote ‘h’ is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote 'h', the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote 'h' allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Public Comment 5:

Sharon Stratton, TPI Corporation, requests Approval as Modified by this public comment.

Further modify proposal as follows:

N1102.1 General . The building thermal envelope and mechanical systems shall meet the requirements of one path in Table N1102.1 based on the climate zone specified in Table N1101.2.

TABLE N1102.1
PRESCRIPTIVE REQUIREMENTS BY COMPONENT[a]

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	~~Furnace (AFUE) /Heat Pump (HSPF)[m]~~ Heating Equipment[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
1	1	0.60	0.75	0.25	38	13+3	5/10	13	0	0	7	Cond or Tested	Standard	Standard	Standard
1	2	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	Standard	SEER 15	62G/94E
1	3	0.60	0.75	0.3	30	13	3/4	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
1	4	NR	0.75	0.3	30	13	3/4	13	0	0	7	Cond or Tested	Standard	SEER 17	Standard
2	1	0.35	0.65	0.25	38	13+3	6/13	13	0	0	7	Cond or Tested	Standard	Standard	Standard
2	2	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	Standard	SEER 15	62G/94E
2	3	0.35	0.65	0.3	30	13	4/6	13	0	0	7	Reduced Leakage	Standard	Standard	Standard
2	4	0.60	0.65	0.3	30	13	4/6	13	0	0	7	Cond or Tested	Standard	SEER 17	Standard
3	1	0.32	0.6	0.3	38	20 or 13+5	8/13	19	5/13[p]	0	7	Cond or Tested	Standard	Standard	Standard
3	2	0.35	0.6	0.3	30	13	5/8	19	5/13[p]	0	7	Cond or Tested	90/8.9	SEER 17	62G/94E
3	3	0.50	0.6	0.3	38	13	5/8	19	5/13[p]	0	4	Reduced Leakage	Standard	Standard	Standard
3	4	0.50	0.6	0.3	30	13	5/8	19	5/13[p]	0	4	Cond or Tested	90/8.9	SEER 15	Standard

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d,e]	Ceiling R-Value	Wood-frame wall R-Value[f]	Mass Wall R-Value[g]	Floor R-Value[h]	Basement/ Crawl space Wall R-Value[i]	Slab R-Value & Depth[j]	Building Air Tightness (ACH50)[k]	Duct Tightness[l]	~~Furnace (AFUE) /Heat Pump (HSPF)[m]~~ Heating Equipment[m]	Air Conditioning (SEER)[n]	Hot Water Heater[o]
4 except Marine 4	1	0.32	0.6	NR	38	20 or 13+5	8/13	19	10/13	10; 2 ft	7	Cond or Tested	Standard	Standard	Standard
4 except Marine 4	2	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	7	Cond or Tested	90/8.9	SEER 15	62G/94E
4 except Marine 4	3	0.32	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
4 except Marine 4	4	0.35	0.6	NR	38	13	5/10	19	10/13	10; 2 ft	4	Cond or Tested	90/8.9	SEER 15	Standard
5 and Marine 4	1	0.32	0.6	NR	49	20+5 or 13+10	15/20	30	15/19	10; 2 ft	4	Cond or Tested	Standard	Standard	Standard
5 and Marine 4	2	0.32	0.6	NR	38	20 or 13+5	13/17	30	10/13	10; 2 ft	7	Reduced Leakage	92/9.1	15 SEER	62G/94E
5 and Marine 4	3	0.32	0.6	NR	49	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Reduced Leakage	Standard	Standard	Standard
5 and Marine 4	4	0.35	0.6	NR	38	20 or 13+5	13/17	30	15/19	10; 2 ft	4	Cond or Tested	92/9.1	Standard	Standard
6	1	0.30	0.55	NR	49	20+5 or 13+10	19/21	30	15/19	10; 4 ft	4	Cond or Tested	Standard	Standard	Standard
6	2	0.35	0.55	NR	49	20 or 13+5	15/19	30	15/19	10; 4 ft	7	Reduced Leakage	92/9.1	Standard	62G/94E
6	3	0.32	0.55	NR	60	20 or 13+5	15/19	30	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
6	4	0.35	0.55	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	92/9.1	Standard	Standard
7 and 8	1	0.27	0.55	NR	60	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Cond or Tested	Standard	Standard	Standard
7 and 8	2	0.30	0.55	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Cond or Tested	92/9.1	Standard	62G/94E
7 and 8	3	0.32	0.55	NR	49	20+5 or 13+10	19/21	38	15/19	10; 4 ft	3	Reduced Leakage	Standard	Standard	Standard
7 and 8	4	0.35	0.55	NR	49	20 or 13+5	15/19	38	15/19	10; 4 ft	4	Reduced Leakage	92/9.1	Standard	Standard

For SI: 1 foot = 304.8 mm.

(relettered and reordered in order of table)

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. "NR" means no requirement.
cj. For impact rated fenestration complying with Section R301.2.1.2 of the International Residential Code, the maximum U-factor in Climate Zones 1-3 shall be permitted to be 0.15 higher than that specified in Table N1102.1.
de. There are no SHGC requirements in the Marine Zone.
e. SHGC calculations and exceptions are covered under Section N1103.3.
f. First value is cavity insulation, second is continuous insulation, so "xx+yy" means R- xx cavity insulation plus R-yy continuous insulation . "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation of at least R-2.
gi. The second R-value applies when more than half the insulation is on the interior of the mass wall and applies interior cavity insulation.
hg. Or insulation sufficient to fill the framing cavity, R-19 minimum.
ic. "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
jd. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in Zones 1 through 3 for heated slabs.
k. Air tightness testing requirements are listed in Section N1103.4.1.1.
l. "Cond or Tested" means that the duct system shall either be located within conditioned space or tested in accordance with Section N1104.2.2."Reduced Leakage" means that the duct system shall comply with the requirements of section N1104.2.3.
m. Heating system performance tested in accordance with ASHRAE Standard 103 or ARI Standard 210/2N110 or equivalent. Coefficient of Performance (COP) is converted into HSPF by multiplying by 3.413. "Standard" represents the prevailing minimum efficiency acceptable under federal law.
n. Cooling system performance tested in accordance with ARI Standard 210/2N110 or equivalent. Energy Efficiency Ratio (EER) is converted to SEER by multiplying EER*1.143. "Standard" represents the prevailing minimum efficiency acceptable under federal law.
o. Water heater Energy Factor requirements for Gas (G) and Electric (E) water heaters. "Standard" represents the prevailing minimum efficiency acceptable under federal law.
p. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

Commenter's Reason: This proposal appears to limit use of heating components by referencing only furnace and heat pumps in Table N1102.1 and its corresponding footnote "m". By using the description "Furnace (AFUE)/Heat Pump (HSPF)" to identify component requirements in Table N1102.1 may lead builders to believe that furnace or heat pump systems are the only components that meet the prescriptive requirements. It would be more appropriate to describe the components as "Heating Equipment".

The IRC code is "founded on principles intended to establish provisions consistent with the scope of a residential code that adequately protects public health, safety and welfare; 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 type or classes of materials, products or methods of construction."[1] Identifying the components as "Furnace (AFUE)/Heat Pump (HSPF)" in Table N1102.1 is inconsistent with the IRC principles as it appears to restrict the use of heating equipment and appears to give preferential treatment to the use of furnaces and heat pumps.

For the reasons stated above, voting members of the IC should vote to approve as modified by this public comment on EC16, Part II.

[1]. 2009 *International Residential Code*, "Development", p.iii

Public Comment 6:

Jeff Inks, Window & Door Manufacturers Association, requests Disapproval.

Commenter's Reason: WDMA urges disapproval for several critical reasons. First, to prevent the creation of IRC energy provisions that are significantly inconsistent with the one- and two-family provisions of the IECC, both in terms of general requirements and in format, that will result if EC-16 is approved. In addition, EC-16 does not carry the same broad support that EC-13 does which is the better alternative among all of the comprehensive proposals intended to achieve the 30% efficiency increase objective.

One overarching concern with EC-16 is the complexity of the provisions in it which will be difficult to apply and enforce. The complexity of the provisions will also make maintenance of them through subsequent cycles more difficult and cumbersome.

There are other concerns with EC-16 as well such as the introduction of whole exceptions to the SHGC requirements in zones 1-3 based on options for the application of prescriptive projection factor which we believe should not permitted but if is to be included, should be consistent with the PF provisions included in the IECC.

EC-16 should also be disapproved because as noted above, of the various two-part comprehensive proposals for IECC Chapter 4 and IRC Chapter 11 that are intended to help achieve the 30% increase in energy efficiency above 2006 requirements, EC-16 had and still does have far less support of stakeholders than the others, specifically EC-13, as evidenced by the substantial testimony in support EC-13 and opposition to EC-16 during the IECC proceedings where EC-13 was approved and EC-16 disapproved. The IRC Building and Energy Committee approved EC-16 despite the same opposition to it.

While the intent of EC-16 is greatly appreciated, there are too many concerns with it that need to be addressed before such a change in the IRC energy provisions should be made.

Public Comment 7:

Ronald Majette US Department of Energy, requests Disapproval.

Commenter's Reason: Part II of proposal EC13-09/10 addresses the same types of energy efficiency improvements as EC16. DOE believes EC16 substantially improves energy efficiency but feels that EC13 is a superior proposal and should be therefore be approved instead of EC16. EC13 and EC16 have conflicting requirements that cannot be resolved and therefore DOE does not recommend approving EC16 in addition to EC13.

Public Comment 8:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter and Craig Conner, Building Quality, request Disapproval.

Commenter's Reason: We strongly prefer that the IECC and IRC be made identical, possibly based on RE4. This is only a backup, in case RE4 is not approved.

The incorporation of very different formats and sets of requirements for energy in the IECC and the IRC would greatly complicate code enforcement. Many jurisdictions would probably refuse to adopt two very different forms of the residential energy requirements. NAHB deserves great credit for stepping up to participating constructively in the code development process, including both offering its own solution (EC16) and offering many constructive comments on EC13, which prevailed in the IECC. However, only one of these very different code formats can be approved. EC13 is the more useable format for code requirements.

The following table lists the differences between IECC and IRC energy requirements as they stand after the first hearing, each with a suggested resolution. Because so many proposals are affected, to keep our public comments brief in the monograph, this table will only be published with a few public comments. The remainder of our reason statements will refer back to this table and associated reasoning.

The International Codes (I-codes) need to be internally consistent. The I-codes provide the foundation for the building codes adopted by most jurisdictions. Although adopting entities can, and do, amend the I-codes, the adopting jurisdictions expect a set of model codes that are internally consistent. The 2009 IECC and IRC energy requirements are identical in most areas. However, this development cycle introduced many potential inconsistencies. These inconsistencies are substantial enough to affect code usability. To be effective and enforceable, the IECC and IRC need to be consistent.

The table below shows the public comments designed to realign the IECC and IRC residential energy requirements to ensure internal consistency. The code development process deals with each code change separately, so realignment requires multiple comments. The method suggested for aligning the IECC and IRC falls into one these categories:

• The code change was approved in one code and disapproved in the other. The best option is usually to disapprove the change in both codes or approve the same version in both codes. In a few instances some details of the change also need to be corrected.

• A code change was submitted to the IECC without a parallel comment on the same text in the IRC. At this stage, the code development process does not allow a change unless there was an initial public comment, so realigning the codes means rejecting any comment that would create an inconsistency.

• The code changes were treated the same way in both codes—either approved or disapproved. In this case there is consistency, and no change is needed to align the IECC and IRC. Those code changes are not listed in the table.

Suggested Corrections for Inconsistencies in the IRC & IECC Requirements

AS=Approved as Submitted AM=Approved as Modified AMPC=Approved as Modified by Public Comment D=Disapproved

EC#	Description	First Hearing	**Suggested Final Action** **Bold** indicates change from first hearing.
EC2	Add insulated sheathing R-value label	IECC–D IRC–AS	No action. Withdrawn by proponent.
EC13	Comprehensive revision- insulation, windows, air tightness, ducts, water systems, equipment, …	IECC–AS IRC–D	IECC–AS, **IRC–AS** Majority of residential energy savings. Important to approve and to make IRC consistent. EC13 had broad agreement from many parties.
EC16	Comprehensive revision- insulation, windows, air tightness, ducts, water systems, equipment, etc. Creates 4 options for each climate zone.	IECC–D IRC–AS	IECC–D, **IRC–D** Large differences between IECC's EC13 and IRC's EC16 are unacceptable. Retaining both EC13 and EC16 would greatly complicate adoption and enforcement. EC16 is a solid attempt and NAHB's participation deserves praise; however, we suggest EC13 is superior.
EC17	Defines "Insulated Siding"	IECC–AM IRC–AS	**IECC–D**, **IRC–D** There are problems in the proposed definition and the related EC54, see public comment.
EC24	Eliminate homeowner energy certificate	IECC–AS No IRC version	**IECC–D** No IRC change submitted. Energy certificate modified by EC22 in both IECC & IRC. Useful homeowner oriented energy certificate should be retained.
EC27	Increase window, skylight, insulation requirements	IECC–AM IRC–D	**IECC–AMPC**, **IRC–AMPC** Amendment by DOE public comment fixes problem in footnote "h". Rest of EC27 duplicates parts of EC13.
EC29	Set maximum SHGC for skylights and sunrooms	IECC–D IRC–AS	No Action. Withdrawn by proponent.
EC30	Compressed cavity insulation	IECC–AS IRC–D	**IECC–D**, IRC–D Makes footnote worse. Could be misread as a ban on cavity insulation below R-value in table.
EC31	Limit window/door/skylight size in prescriptive approach	IECC–AS IRC–D	**IECC–D**, IRC–D Window/door/skylight calculation too much work. Affects few homes. Includes doors and skylights in limit. Other approved changes requiring much better windows & skylights for all homes are a better option.
EC34	Lower southern window U-factor	IECC–AS IRC–D	IECC–AS, **IRC–AS** Windows required are common.
EC35	Apply same U-factor and SHGC to impact glass	IECC–AS IRC–D	**IECC–D**, IRC–D U-factors from EC34 are too low for impact glass.
EC36	Increase maximum SHGC for skylights	IECC–D IRC–AS	**IECC–AS**, IRC–AS Lower SHGC for skylights makes it harder to use skylights for daylighting.

EC39	Lower northern window U-factor	IECC–AS IRC–D	IECC–AS, **IRC–AS** Duplicates what is already in EC13. Reasonable increases in northern window efficiency.
EC47	Increase middle US wall insulation	IECC–AM IRC–D	IECC–AM, **IRC–AM** Also good is AMPC to fix footnote "h".
EC48	Increase northern wall insulation	IECC–AM IRC–D	IECC–AM, **IRC–AM** Reasonable wall insulation. Duplicates part of EC13.
EC50	Increase crawl space wall insulation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Acceptable increase in crawl space wall insulation.
EC54	Add insulated siding as type of insulation	IECC–AS IRC–AM	**IECC –D, IRC–D** Vinyl siding performance decreased by code requirement to attach "loosely" and leave space for expansion and contraction of siding.
EC55	Mass wall U-factor	IECC–D IRC–AS	**IECC–AS**, IRC–AS Aligns codes and fixes table.
EC60	IECC/IRC realignment, deals with several topics	IECC–D IRC–D	**IECC–AMPC, IRC–AMPC** Fixes several inconsistencies. Makes IECC definition of conditioned space match IRC. Uses IECC insulation levels. Aligns design temperatures.
EC63	Attic vent wind baffle	IECC–AS IRC–AM	**IECC–AM**, IRC–AM Baffle prevents wind blowing through insulation. Both versions are acceptable. Industry prefers IRC version.
EC68	Sun roof requirement clarification	IECC–AM IRC–D	**IECC–AMPC, IRC–AMPC** Corrected language per EECC comment.
EC70	Skylight definition	IECC–AS No IRC version	**IECC–D** Disapprove to keep consistency with existing I-code skylight definitions- IBC (202) and IRC 308.6.1.
EC74	Allow window projection factor instead of SHGC	IECC–D IRC –AS	**IECC–AMPC, IRC–AMPC** Allow projection factor as alternative based on public comment. Simplified change is proposed.
EC79	Revise air sealing requirements	IECC–AS IRC–D	IECC–AS, **IRC–AS**. Not needed if EC13 passes. Not completely consistent with EC13. Follow DOE's lead.
EC91	Remove "listing", leaving "labeled" for fenestration	IECC–D IRC–AS	**IECC–AS**, IRC–AS Fenestration is labeled, not listed.
EC99	Increase ventilation fan efficiency, define whole house ventilation	IECC–AM IRC–D	**IECC–AMPC, IRC–AMPC** Increases fan efficiency, which is good. Need to remove requirement to know the "intent" of a fan.
EC101	Programmable thermostats, set points, schedules, heat pumps	IECC –D/ASF IRC–D	**IECC–D**, IRC–D Thermostat set points hard to inspect. Research shows set back thermostats do not save energy.
EC102	Ground conductance calculation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Improved calculation per DOE.
EC107	Decrease duct leakage	IECC–AS IRC–D	IECC –AS, **IRC–AS** Not needed if EC13 passes, unless DOE modifies it. Follow DOE's lead.
EC109	Eliminate framing cavities as return ducts	IECC–AS IRC–D	IECC–AS, **IRC–AS** Framing cavities make leaky ducts.
EC112	More efficient water heating pipe layout & insulation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Approved as part of EC13.
EC115	Increases circulating water heating pipe insulation	IECC–D IRC–AS	**IECC–D**, IRC–D Pipe layout & insulation handled better in EC13/EC112.
EC123	Prohibit electric resistance heating, with exceptions	IECC–AM IRC–D	No Action. Withdrawn by proponent.
EC125	Prohibit standing pilots on fireplaces	IECC–AS IRC–D	IECC–AS, **IRC–AS** Standing pilot lights waste energy.

Public Comment 9:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Disapproval.

Commenter's Reason: *EC16 should be disapproved for the following reasons:*

1. EC16 would negatively affect code compliance and enforcement; EC16 creates unnecessary complexity by replacing the single prescriptive path with four prescriptive paths that would save differing amounts of energy and abandon the current format of the code as first established as a result of US DOE proposals in 2004. A single prescriptive path promotes economies of scale, as manufacturers currently have targets by climate zone and work to effectively compete to meet those targets, thereby achieving energy efficiency at lower cost.

2. By adopting a new structure, EC16 would undercut years of familiarity and training with the current IECC structure provided by federal, state and local governments.

3. While some of the proposed provisions of EC16 could save energy, other parts of the proposal would reduce energy efficiency; in fact, EC16 goes backward by creating loopholes and eliminating important provisions or requirements that have been adopted in previous versions of the IECC and/or IRC. For example, among other flaws, the proposal would:

(a) introduce HVAC trade-offs in the prescriptive path against much longer-lived envelope measures (a tack that has been consistently rejected for both the IECC and IRC for many years);

(b) introduce an exception to fenestration SHGC requirements for windows with certain projection factors (which has been rejected for residential requirements in the IECC and IRC for many cycles);

(c) establish inconsistent requirements for new versus replacement windows without any justification; and

(d) establish requirements for air leakage that would allow a claim of certain air tightness without testing and that would allow homes that fail the test to pass without fully meeting the standard.

4. Adoption of EC16, unlike other package proposals such as EC13 (DOE) or EC25 (EECC), would preclude the adoption of other package proposals that will save substantially more energy. ICF International conducted an analysis to estimate comparative savings from EC16, EC13 and EC25. Even after ignoring the negative impact of the steps backward in EC16 identified in this public comment, the proposal was estimated to save the least energy, peak kW and AC sizing of the package proposals, far less than the goal of a 30% improvement over the 2006 IECC. Furthermore, the four individual prescriptive paths in EC16 varied substantially in estimated energy savings according to the ICF analysis.

5. Moreover, by substantially changing the code format, if EC16 were adopted, it would make it almost impossible to include or reconcile many other improvements in the code approved by the IECC committee. This, in essence would freeze savings at the level produced by EC16 in this code cycle, making it impossible to even approach the 30% goal enunciated by DOE and shared by most stakeholders. This was seen in the IRC committee hearings, where the committee rejected a number of proposals that would increase energy efficiency as inconsistent with the EC16 format.

6. By introducing equipment trade-offs into multiple prescriptive paths, EC16 is likely to result in federal preemption challenges when states attempt to adopt it.

7. The IECC performance path companion changes proposed in EC16 have additional major flaws and would constitute major retreats in energy efficiency – EC16 would:

(a) re-introduce HVAC trade-offs in the performance path, which were eliminated from the 2009 IECC as compliance loopholes given that states are unable to set a reasonable baseline due to federal preemption, and the useful life of such equipment is typically shorter than the building thermal envelope elements against which it is traded; and

(b) modify the performance compliance path so homes with less than 15% glazing can be built to be less efficient (for example, under this proposal, homes with 12% glazing, would lose an additional 1.7% in efficiency).

In sum, while we appreciate EC16 as a unique effort by NAHB to engage in the process to improve the energy code, it has far too many flaws to be adopted as a package. Instead, where appropriate, individual component pieces proposed by NAHB, often with improvements, can be adopted through other proposals in a code format that is more consistent with the IECC's existing format.

Public Comment 10:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association (AAMA), requests Disapproval.

Commenter's Reason: AAMA is requesting disapproval of EC16, Part II, for the following reasons:

1. If approval of EC16, Part II for the IRC, and the approval of EC13, Part I for the IECC are upheld, significant differences between the provisions of the IRC and IECC for residential energy efficiency will occur. Although the fact that both codes contained provisions for essentially the same buildings has been a concern in the past, that concern was been minimized by the fact that the provisions had been fairly similar up to and including the 2009 IECC.

The provisions of EC16, Part II, however, are significantly different than the provisions of EC13, Part I for essentially the same buildings. For example, EC16, Part II establishes four different prescriptive compliance paths for residences in each climate zone, while EC13, Part I only gives one compliance path for the same buildings. Also, the application of this one compliance path for the standard design when performance based design in performed is clearly defined in EC13, Part I, and would be much more difficult to determine under EC16, Part II.

2. Analysis that establishes a level of equivalency with regards to energy efficiency for each of the four prescriptive compliance paths offered in each of the 8 climate zones has not been provided. Therefore, its very difficult to determine the level of efficiency of each path, relative to previous editions of the IRC or IECC, or relative to each other.

3. Although the stated intention of the multiple paths provided in EC16, Part II is to give the home builders greater flexibility with regards to how a home is built, the end result is likely to be greater confusion in the market place with a lot more work for code officials and minimum benefit to home builders. For example, in some cases the multiple compliance paths within a climate zone results in two or three different sets of requirements for fenestration products. Does that mean that the local window distributor (such as a Loews or Home Depot) will be expected to stock not just one line of "code compliant windows", but multiple different lines that meet different requirements? And if so, who is supposed to keep track of which windows the home builder should be buying and installing in the home they are building? Are the personnel at the window distributor's (in many cases a big box store such as Loews or Home Depot) supposed to keep track of that, along with the requirements for insulation, ductwork, water heaters, etc? How much more confusing will this make the code official's job, who already has a wide myriad of requirements to verify compliance with?

Furthermore, it seems unlikely that manufacturer will provide multiple lines of products, or that distributors will carry them. This is not just a matter of providing one additions unit for each option given. If a complete product line (windows of many different sizes and operator type, swinging and sliding patio doors and sidelights, etc) is not offered for each option, it is unlikely that option will be chosen. Therefore, the manufacturer would likely decide to either offer a full product line for any given option, or not at all, the distributor would need to make the same decision with regards to which products to carry, and the home builder may not have as many options for compliance as this proposal would seem to indicate.

What seems more likely is that the less stringent set of criteria for each type of product will be the one most frequently purchased, and therefore the one more attractive to manufacture or stock. Is it "code compliant?" – well, that depends upon with which other products and building techniques it is combined. Relying upon a rather complicated procedure to determine if a single product is code compliant is counter to the simplification of the IECC that occurred between the 2003 and 2006 edition – and is an approach that should be disapproved.

Public Comment 11:

Stephen Turchen, Department of Public Works, Fairfax County, VA, representing Virginia Building and Code Officials Association, requests Disapproval.

Commenter's Reason: Both EC16 and EC13 propose major changes to the energy conservation requirements of the IRC and IECC in an attempt to improve the overall energy savings inherent in the respective codes.

At the Baltimore hearings in October, 2009, the IECC Code Development Committee approved EC13 Part I in its entirety and without modifications. The IRC Building / Energy Committee disapproved EC13 Part II in its entirety. The IECC Code Development Committee disapproved

EC16 Part I in its entirety, while the IRC Building / Energy Committee approved EC16 Part II with slight modification. While these decisions resulted in major changes to the energy-related requirements for residential construction in each code, the Committee recommendations resulted in substantial variance between the IECC and IRC in the very important areas of thermal envelope insulation values, fenestration U-factors, insulation installation, thermal envelope sealing, and paths to compliance.

Perhaps the most significant difference is that while EC13 merely revises existing IECC Tables 402.1.1 and 402.1.3 that provide the basic ("prescriptive") thermal envelope insulation and U-factor values with improved stringency throughout all climate zones, EC16 revises these basic tables by proposing 4 alternate "paths" to (prescriptive) envelope compliance for each climate zone. One of our association's main reasons for submitting this Public Comment is our conviction that there are inherent enforcement difficulties in the EC16 alternative path approach, rendering this approach impractical and unrealistic.

Some of the compliance paths under EC16 in every climate zone impose "high efficiency" heating equipment, cooling equipment, and water heating equipment requirements. Enforcing the installation of HE equipment has always been and continues to be an issue for plan reviewers and field inspectors in jurisdictions attempting to conscientiously and fairly implement the energy code, especially when inspection staff is limited, time on the job site is very limited, and inspectors' primary priority is, appropriately, life safety issues, and only secondarily energy issues.

A typical problem that an inspector might face under the EC16 regimen is that the space heating, air conditioning, and water heating equipment may only be installed just prior to "final" inspection, the very last inspection to be performed before a Certificate of Occupancy is granted. If the installed equipment efficiency is determined in the field to be too low, does the inspector order its removal and replacement with the "right" efficiency equipment, knowing that at this point in time such an order is difficult, significantly expensive, and time-consuming?

The code-required efficiencies are not labeled on the equipment in most cases (not required by IRC section M1303). An inspector will have to know how to access the databases of all equipment manufacturers (which may require a password) in order to verify the equipment ratings. The manufacturer's ratings must then be compared to the required ratings on the approved plans or the assumed compliance path, assuming that the plans show this information. If equipment of the required high efficiency rating was simply not available at the time that the subcontractor had to do his installation, will the AHJ demand compliance at this late stage of construction with an alternate compliance path that incorporates the installed efficiency? If that new path requires that additional insulation be installed in the walls / floors / ceilings because R-values have increased under that path, will the insulation actually be upgraded? Insulation upgrades may require demolition of interior finish and would ultimately delay "final inspection" approval.

When conforming to a compliance path under EC16 that requires high efficiency equipment, the basic "tradeoff" for installing high efficiency equipment is a leakier duct system, a leakier house, a thermal envelope with less insulation, o r some combination thereof. Such an approach has serious implications for the house owners in the future. If they are unaware of the efficiency of the originally installed equipment (the "panel certificate" is being proposed for deletion – see EC24), they will not have any guidance as to what sort of equipment they should purchase when the original equipment eventually needs replacing.

In a perfect world, a house built and qualified to the 2012 IRC incorporating EC16 with a SEER 17 air conditioner requirement, for example, under a specific compliance path will have its replacement air conditioner also rated at SEER 17 or above. But there is nothing in the code or in human nature to ensure that that favorable outcome will consistently occur. A homeowner may be perfectly aware that he should install the high efficiency unit, because, say, the panel certificate is still in his basement. But there may be exigencies of the moment (a breakdown in the middle of summer when the only unit available is SEER 13) that will result in a leaky, poorly insulated house with much lower efficiency equipment that will consume more energy than its original design for many years after the new air conditioner is installed.

A major flaw of EC16, if approved for inclusion in the IRC, is that it has no provision to ensure that "Replacement equipment shall be no less efficient than the equipment it is replacing" (which would not by itself solve the enforcement problems). Basing any provisions of the IRC on high efficiency equipment will have serious issues for code officials and serious implications for maintaining energy-saving benefits for the homeowner for the life of the residential building.

Our association objects to other aspects of EC16 Part II:

- Item 3 permits random sampling for testing of air leakage (whole building or duct systems). Please refer to our Public Comment for EC13 Part II, Items 5 and 6 for a discussion of why we believe that random sampling should be deleted.
- New section N1103.3.3 proposes that fixed overhangs or other shading devices exhibiting specific "projection factors" (defined in Item 1) can be used to satisfy SHGC requirements in climate zones 1 – 3. While this proposal will not directly affect Virginia officials in climate zone 4, officials in zones 1 -3 should carefully consider the increased effort involved in plan review to verify the projection factors, which vary based on cardinal orientation, whether the PFs are uniform for all windows, and how to compute overall compliance for this requirement. Inspectors in those zones should consider whether the proposed overhangs, awnings, etc. can be feasibly and practically verified in the field.
- The whole house "blower door" test for air leakage is waived for any house using a compliance path option with an air leakage rate of 7 ACH (air changes per hour) (would impact <u>all</u> of climate zones 1 and 2). For a house claiming <u>any</u> level of air tightness, no blower door testing required if a visual inspection has been performed per Table N1103.4.1.2. It is unclear why whole climate zones should be exempt from the blower door test. Hot air infiltration in cooling-dominated climates is as wasteful of energy as cold air infiltration in heating-dominated climates. It is also unclear how any claimed level of maximum air tightness (3, 4, or 7 ACH) can be verified in the absence of doing a blower door test. Thus any claimed level of Building Air Tightness under proposed Table N1102.1 is as good as any other under proposed Section N1103.4.1.2 ("envelope tightness is acceptable if visually inspected"). Further, N1103.4.1.1.2 / Exception and N1103.4.1.2, as written, appear contradictory: If I do not have to do a blower door test because I am "claiming" a 7ACH leakage rate, do I still have to do the visual inspection?

There are other issues embedded in EC16 Part II which our association has addressed in our Public Comments for EC13.

Another very important reason, in our view, for disapproving EC 16 is the possibility that two different I-codes will end up including two very dissimilar approaches to energy conservation, if both EC13 and EC16 are approved based on Code Committee recommendations.

In the event of this unfortunate outcome, there is a basic contradiction between the proposals that will cause serious confusion for designers, plan reviewers, and field inspectors if both proposals are approved and the AHJ permits either code book to be used for energy compliance. If the I-codes are being enforced, say, in Virginia (climate zone 4), is framed wall insulation supposed to be R20 (a permitted option under the IECC), or can it be R13 if I am complying with compliance paths 2, 3, or 4 under the IRC? Is the requirement for window U-factor to be 0.35 maximum under IECC or 0.32 if I am using paths 1 or 3 under IRC? If the I-codes are enforced in Vermont (climate zone 6), should floor insulation be R30 under IECC or R38 under IRC / path 4?

Our association firmly believes that identical requirements are essential throughout the I-codes, for the sake of uniform enforcement and interpretation of construction requirements among jurisdictions.

Public Comment 12:

Dan Weed, City of Louisville, Co representing Colorado Chapter of ICC, requests Disapproval.

Commenter's Reason: This change is largely a rewrite of a large part of the energy chapter as it currently stands. The recent changes to the code regarding energy have left jurisdictions with the daunting task of getting adequate training for their staff to properly understand and apply the provisions on energy. In an economy that is still unenergetic, achieving this funding remains a battle. Once staff is trained, the training is forgotten unless they take a lot of time to use it. Building Officials need some time to work with the changes that have come in the 2009 edition first. Due to a stifled economy, adoptions of the 2009 are taking off slowly, and by the time people adopt it, get trained on it, learn how to enforce it and know what works and what doesn't, the deadline for the 2012 changes will have come and gone and we will be trying to fix it in the 2015. But at that point, the code we will be trying to fix will not look anything like the current edition if this proposal is allowed to go through.

The reason statement indicates that adding all of these options helps the builder. That may have limited truth, but this is a prescriptive path; so many options don't belong in the prescriptive path. Too many options make it a performance based system. If many choices are desired, use the performance path and show how you are achieving compliance. The reason we have a Prescriptive path is to provide a simple way to achieve compliance.

There are just too many changes occurring here every three years. We need to take a rest from "big rewrite" changes such as this, and let people get practiced at understanding it, enforcing it, and building to its intent. Building Officials have reached a point of frustration where some will adopt it but not enforce it because they don't have time or funds to totally retrain their staff on a subject every three years. Others are saying they will not adopt it at all because the low economy has left them with such a minimal staff that they are going to focus on more crucial topics. This isn't the time to be making such huge changes, good or not.

Final Action: AS AM AMPC____ D

EC17-09/10-PART I
202

Proposed Change as Submitted

Proponent: Matthew Dobson, representing Vinyl Siding Institute

PART I – IECC

Add new definition as follows:

SECTION 202
GENERAL DEFINITIONS

INSULATED SIDING. A cladding system with integral insulating material, having a minimum thermal resistance of R-2

Reason: Forms of insulated siding have been commercially available for at least twelve years. Current versions of insulated vinyl siding as well as other types of insulated claddings are now being tested to show actual field R-values. Many of these tests are being conducted using the appropriate testing methodology using the "hot box" test or ASTM C1363. This building component presents a viable option. A minimal performance value of R-value is consistent with the minimal R-value requirements to establish the product as a home insulation or insulation.

In addition to the thermal resistance characteristics, insulated siding's components and other non-related energy performance characteristics are covered by the code and specific product standards. For example the foam plastic used with insulated siding is addressed in the foam plastic sections of the IBC and IRC as well as through AC12. In addition ASTM C578 is the standard for foam plastics. Over the past few years both an acceptance criteria and product standard have been developed to address the non-thermal characteristics of what is termed as "backed siding". These material standards (ASTM D7445-09 and AC 37 (both vinyl and backed vinyl siding)) provide performance criteria for the siding including areas required by the building codes for example warp, shrinkage, impact strength, expansion, appearance, and wind load resistance.

Testing relative to moisture and water management issues indicated that use of insulated siding has no negative effect on the performance of the wall panels in relationship to moisture absorption. In field studies where the product had been installed for nearly ten years there were no indications of any problems of moisture entrapment related issues. Further the industry knows of no claims or complaints relating to moisture issues and the performance insulated vinyl siding.

Included with this proposal is an example of testing that has been completed using the ASTM C1363 test method as well as recent research co-funded by VSI through the New York State Energy Research and Development Authority's High Performance Residential Development Challenge program. Both testing and research support insulated siding as a viable option to help increase the energy efficiency of buildings.

As a part of this proposal please visit the link provided of an example of testing that has been completed using the ASTM C1363 test method as well as a link to recent research co-funded by VSI through the New York State Energy Research and Development Authority's High Performance Residential Development Challenge program. Both testing and research support insulated siding as a viable option to help increase the energy efficiency of buildings.
Here is the link to the example ASTM C1363 testing results
http://www.vinylsiding.org/aboutsiding/insulatedvinylsiding/ASTM%5FC1363%5Ftest%5Fresults%2Epdf.

Here is a link to the New York State Energy Research and Development Authority report
http://www.vinylsiding.org/aboutsiding/newsroom/insulatedvs/090702_Building_Green_with_Insualted_Vinyl_Siding_Case_Study.pdf.

Cost Impact: The code change proposal will not increase the cost of construction as it will give specifiers another affordable option for achieving energy code compliance.

ICCFILENAME: DOBSON-EC-1-202-RB-1-R202

Public Hearing Results

PART I - IECC
Committee Action: **Approved as Modified**

Modify proposal as follows:

INSULATED SIDING. A cladding system with integral insulating material, having a minimum thermal resistance of R-2 attached directly over a water resistive barrier and sheathing

Committee Reason: This is a type of material that requires separate attention in the code. See Code Change Proposal EC54-09/10.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Shaunna Mozingo, City of Westminster, Co, representing the Colorado Chapter of ICC and Craig Conner, Building Quality, requests Disapproval.

Commenter's Reason: We strongly prefer that the IECC and IRC be made identical, possibly based on RE4. Part II of this change is a backup, in case RE4 is not approved.

EC17, which defines "insulated siding", and EC54, which adds "insulated siding" as a type of insulation, are primarily designed to accommodate insulated vinyl siding within the code. EC17 and EC54 share two problems, they expand the R-value to include more than the insulation and they add a product that the code requires be "loosely" attached to the exterior with a small air space to allow its expansion and contraction with temperature changes.

The code-specified R-value in Section 402.1.2 is intended to include only the insulation product's nominal R-value. Using the nominal R-value makes the energy code simpler to use by eliminating the need to fix an R-value for the various others materials, air spaces, and air films (gypboard, interior and exterior air films, framing, air spaces …). The existing Section 402.1.2 states that computed R-values used to meet the code requirement shall not include an R-value for the other (non-insulation) building materials or air films. Insulated siding as specified in EC17 and EC54 allows a test that includes the insulation plus the non-insulation portions of the siding, including coverings and imbedded air spaces. We have no problem with giving any product an R-Value for the insulation as long as they test only the R-value of the insulation itself. It is important to treat all insulation products in the same way.

The U-factor alternative, the existing Section 402.1.3, specifies a U-factor for an assembly. The U-factor alternative can be used to account for elements of a whole assembly's design, such as framing spacing and thermal breaks. Section 402.1.3 also allows tested assembly U-factors and calculations (table note "a"). The existing U-factor alternative can be used for any type of insulation or assembly, including assemblies that might include insulation as a part of the siding.

The code-required method of attachment is an additional issue for vinyl siding. Section 1405.15 of the IBC requires that vinyl siding conform to the requirements of ASTM D3679. The ASTM D3679 states that vinyl siding *"… shall be installed in accordance with Practice D4756*" (Section 1.4 of ASTM D3679).

The full name for "Practice D4756" is "*ASTM D4756 – 06*", the "*Standard Practice for Installation of Rigid Poly Vinyl Chloride (PVC) Siding and Soffit*" whose scope states: "*This practice covers the minimum requirements for and the methods of installation of rigid vinyl siding, soffits, and accessories on the exterior wall and soffit areas of buildings…."* (Section 1.1). Because "*Vinyl siding and accessories will expand when heated and contract when cooled*" the standard requires:

> "*When applied, vinyl siding products must be attached "loosely" leaving approximately a 1⁄32-in. (0.8-mm) space between the vinyl and the fastener head or crown to permit thermal movement."* (Section 9.1.1, ASTM D4756-06).

Some makers of vinyl siding suggest larger spaces.

Materials required to be installed loosely and including air spaces behind wall exteriors will not perform as well as insulators because air circulation behind the siding degrades the R-value. Therefore EC17 and EC54 should be disapproved.

The following table lists the differences between IECC and IRC energy requirements as they stand after the first hearing, each with a suggested resolution. Because so many proposals are affected, to keep our public comments brief in the monograph, this table will only be published with a few public comments. The remainder of our reason statements will refer back to this table and associated reasoning.

The incorporation of very different formats and sets of requirements for energy in the IECC and the IRC would greatly complicate code enforcement. Many jurisdictions would probably refuse to adopt two very different forms of the residential energy requirements. NAHB deserves great credit for stepping up to participating constructively in the code development process, including both offering its own solution (EC16) and offering many constructive comments on EC13, which prevailed in the IECC. However, only one of these very different code formats can be approved. EC13 is the more useable format for code requirements.

The International Codes (I-codes) need to be internally consistent. The I-codes provide the foundation for the building codes adopted by most jurisdictions. Although adopting entities can, and do, amend the I-codes, the adopting jurisdictions expect a set of model codes that are internally consistent. The 2009 IECC and IRC energy requirements are identical in most areas. However, this development cycle introduced many potential inconsistencies. These inconsistencies are substantial enough to affect code usability. To be effective and enforceable, the IECC and IRC need to be consistent.

The table below shows the public comments designed to realign the IECC and IRC residential energy requirements to ensure internal consistency. The code development process deals with each code change separately, so realignment requires multiple comments. The method suggested for aligning the IECC and IRC falls into one these categories:

- The code change was approved in one code and disapproved in the other. The best option is usually to disapprove the change in both codes or approve the same version in both codes. In a few instances some details of the change also need to be corrected.
- A code change was submitted to the IECC without a parallel comment on the same text in the IRC. At this stage, the code development process does not allow a change unless there was an initial public comment, so realigning the codes means rejecting any comment that would create an inconsistency.
- The code changes were treated the same way in both codes—either approved or disapproved. In this case there is consistency, and no change is needed to align the IECC and IRC. Those code changes are not listed in the table.

Suggested Corrections for Inconsistencies in the IRC & IECC Requirements

AS=Approved as Submitted AM=Approved as Modified AMPC=Approved as Modified by Public Comment D=Disapproved

EC#	Description	First Hearing	**Suggested Final Action** **Bold** indicates change from first hearing.
EC2	Add insulated sheathing R-value label	IECC–D IRC–AS	No action. Withdrawn by proponent.
EC13	Comprehensive revision- insulation, windows, air tightness, ducts, water systems, equipment, …	IECC–AS IRC–D	IECC–AS, **IRC–AS** Majority of residential energy savings. Important to approve and to make IRC consistent. EC13 had broad agreement from many parties.
EC16	Comprehensive revision- insulation, windows, air tightness, ducts, water systems, equipment, etc. Creates 4 options for each climate zone.	IECC–D IRC–AS	IECC–D, **IRC–D** Large differences between IECC's EC13 and IRC's EC16 are unacceptable. Retaining both EC13 and EC16 would greatly complicate adoption and enforcement. EC16 is a solid attempt and NAHB's participation deserves praise; however, we suggest EC13 is superior.
EC17	Defines "Insulated Siding"	IECC–AM IRC–AS	**IECC–D**, **IRC–D** There are problems in the proposed definition and the related EC54, see public comment.
EC24	Eliminate homeowner energy certificate	IECC–AS No IRC version	**IECC–D** No IRC change submitted. Energy certificate modified by EC22 in both IECC & IRC. Useful homeowner oriented energy certificate should be retained.
EC27	Increase window, skylight, insulation requirements	IECC–AM IRC–D	**IECC–AMPC**, **IRC–AMPC** Amendment by DOE public comment fixes problem in footnote "h". Rest of EC27 duplicates parts of EC13.
EC29	Set maximum SHGC for skylights and sunrooms	IECC–D IRC–AS	No Action. Withdrawn by proponent.
EC30	Compressed cavity insulation	IECC–AS IRC–D	**IECC–D**, IRC–D Makes footnote worse. Could be misread as a ban on cavity insulation below R-value in table.
EC31	Limit window/door/skylight size in prescriptive approach	IECC–AS IRC–D	**IECC–D**, IRC–D Window/door/skylight calculation too much work. Affects few homes. Includes doors and skylights in limit. Other approved changes requiring much better windows & skylights for all homes are a better option.
EC34	Lower southern window U-factor	IECC–AS IRC–D	IECC–AS, **IRC–AS** Windows required are common.
EC35	Apply same U-factor and SHGC to impact glass	IECC–AS IRC–D	**IECC–D**, IRC–D U-factors from EC34 are too low for impact glass.
EC36	Increase maximum SHGC for skylights	IECC–D IRC–AS	**IECC–AS**, IRC–AS Lower SHGC for skylights makes it harder to use skylights for daylighting.
EC39	Lower northern window U-factor	IECC–AS IRC–D	IECC–AS, **IRC–AS** Duplicates what is already in EC13. Reasonable increases in northern window efficiency.
EC47	Increase middle US wall insulation	IECC–AM IRC–D	IECC–AM, **IRC–AM** Also good is AMPC to fix footnote "h".
EC48	Increase northern wall insulation	IECC–AM IRC–D	IECC–AM, **IRC–AM** Reasonable wall insulation. Duplicates part of EC13.
EC50	Increase crawl space wall insulation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Acceptable increase in crawl space wall insulation.
EC54	Add insulated siding as type of insulation	IECC–AS IRC–AM	**IECC –D, IRC–D** Vinyl siding performance decreased by code requirement to attach "loosely" and leave space for expansion and contraction of siding.
EC55	Mass wall U-factor	IECC–D IRC–AS	**IECC–AS**, IRC–AS Aligns codes and fixes table.
EC60	IECC/IRC realignment, deals with several topics	IECC–D IRC–D	**IECC–AMPC, IRC–AMPC** Fixes several inconsistencies. Makes IECC definition of conditioned space match IRC. Uses IECC insulation levels. Aligns design temperatures.
EC63	Attic vent wind baffle	IECC–AS IRC–AM	**IECC–AM**, IRC–AM Baffle prevents wind blowing through insulation. Both versions are acceptable. Industry prefers IRC version.
EC68	Sun roof requirement clarification	IECC–AM IRC–D	**IECC–AMPC, IRC–AMPC** Corrected language per EECC comment.
EC70	Skylight definition	IECC–AS No IRC version	**IECC–D** Disapprove to keep consistency with existing I-code skylight definitions- IBC (202) and IRC 308.6.1.
EC74	Allow window projection factor instead of SHGC	IECC–D IRC –AS	**IECC–AMPC, IRC–AMPC** Allow projection factor as alternative based on public comment. Simplified change is proposed.
EC79	Revise air sealing requirements	IECC–AS IRC–D	IECC–AS, **IRC–AS**. Not needed if EC13 passes. Not completely consistent with EC13. Follow DOE's lead.

EC#	Description	First Hearing	**Suggested Final Action** **Bold** indicates change from first hearing.
EC91	Remove “listing”, leaving “labeled” for fenestration	IECC–D IRC–AS	**IECC–AS**, IRC–AS Fenestration is labeled, not listed.
EC99	Increase ventilation fan efficiency, define whole house ventilation	IECC–AM IRC–D	**IECC–AMPC, IRC–AMPC** Increases fan efficiency, which is good. Need to remove requirement to know the “intent” of a fan.
EC101	Programmable thermostats, set points, schedules, heat pumps	IECC –D/ASF IRC–D	**IECC–D**, IRC–D Thermostat set points hard to inspect. Research shows set back thermostats do not save energy.
EC102	Ground conductance calculation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Improved calculation per DOE.
EC107	Decrease duct leakage	IECC–AS IRC–D	IECC –AS, **IRC–AS** Not needed if EC13 passes, unless DOE modifies it. Follow DOE’s lead.
EC109	Eliminate framing cavities as return ducts	IECC–AS IRC–D	IECC–AS, **IRC–AS** Framing cavities make leaky ducts.
EC112	More efficient water heating pipe layout & insulation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Approved as part of EC13.
EC115	Increases circulating water heating pipe insulation	IECC–D IRC–AS	**IECC–D**, IRC–D Pipe layout & insulation handled better in EC13/EC112.
EC123	Prohibit electric resistance heating, with exceptions	IECC–AM IRC–D	No Action. Withdrawn by proponent.
EC125	Prohibit standing pilots on fireplaces	IECC–AS IRC–D	IECC–AS, **IRC–AS** Standing pilot lights waste energy.

Public Comment 2:

Donald J. Vigneau, Northeast Energy Efficiency Partnerships, Inc., representing himself, requests Disapproval.

Commenter’s Reason: Public Comment is for Disapproval of Part I and Part II, since approval of either presently will create inconsistency between the two codes for no valid reason. It is unknown whether the original proponent will be successful in modifying either approval to prevent different code provisions in the two documents. Coordination of approvals is essential for this to be ratified for inclusion in both codes.

Both committees agree the products deserve attention within the codes. However, they need to be consistent.

Part I was Approved as Modified (AM) by the Energy Code Development Committee.
Part II was Approved as Submitted (AS) by the Residential Building & Energy Code Development Committee.

Final Action: AS AM AMPC____ D

EC17-09/10-PART II
IRC R202

Proposed Change as Submitted

Proponent: Matthew Dobson, representing Vinyl Siding Institute

PART II – IRC ENERGY

Add new definition as follows:

SECTION R202
DEFINITIONS

INSULATED SIDING. A cladding system with integral insulating material, having a minimum thermal resistance of R-2.

Reason: Forms of insulated siding have been commercially available for at least twelve years. Current versions of insulated vinyl siding as well as other types of insulated claddings are now being tested to show actual field R-values. Many of these tests are being conducted using the appropriate testing methodology using the "hot box" test or ASTM C1363. This building component presents a viable option. A minimal performance value of R-value is consistent with the minimal R-value requirements to establish the product as a home insulation or insulation.

In addition to the thermal resistance characteristics, insulated siding's components and other non-related energy performance characteristics are covered by the code and specific product standards. For example the foam plastic used with insulated siding is addressed in the foam plastic sections of the IBC and IRC as well as through AC12. In addition ASTM C578 is the standard for foam plastics. Over the past few years both an acceptance criteria and product standard have been developed to address the non-thermal characteristics of what is termed as "backed siding". These material standards (ASTM D7445-09 and AC 37 (both vinyl and backed vinyl siding)) provide performance criteria for the siding including areas required by the building codes for example warp, shrinkage, impact strength, expansion, appearance, and wind load resistance.

Testing relative to moisture and water management issues indicated that use of insulated siding has no negative effect on the performance of the wall panels in relationship to moisture absorption. In field studies where the product had been installed for nearly ten years there were no indications of any problems of moisture entrapment related issues. Further the industry knows of no claims or complaints relating to moisture issues and the performance insulated vinyl siding.

Included with this proposal is an example of testing that has been completed using the ASTM C1363 test method as well as recent research co-funded by VSI through the New York State Energy Research and Development Authority's High Performance Residential Development Challenge program. Both testing and research support insulated siding as a viable option to help increase the energy efficiency of buildings.

As a part of this proposal please visit the link provided of an example of testing that has been completed using the ASTM C1363 test method as well as a link to recent research co-funded by VSI through the New York State Energy Research and Development Authority's High Performance Residential Development Challenge program. Both testing and research support insulated siding as a viable option to help increase the energy efficiency of buildings.
Here is the link to the example ASTM C1363 testing results
http://www.vinylsiding.org/aboutsiding/insulatedvinylsiding/ASTM%5FC1363%5Ftest%5Fresults%2Epdf
Here is a link to the New York State Energy Research and Development Authority report
http://www.vinylsiding.org/aboutsiding/newsroom/insulatedvs/090702_Building_Green_with_Insualted_Vinyl_Siding_Case_Study.pdf.

Cost Impact: The code change proposal will not increase the cost of construction as it will give specifiers another affordable option for achieving energy code compliance

ICCFILENAME: DOBSON-EC-1-202-RB-1-R202

Public Hearing Results

PART II - IRC
Committee Action: **Approved as Submitted**

Committee Reason: Insulated siding is a unique product that requires separate attention in code text.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Matthew Dobson, representing Vinyl Siding Institute and Jay Crandell, Ares Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

INSULATED SIDING. A cladding system with integral insulating material, having a minimum thermal resistance of R-2 attached directly over a water resistive barrier and sheathing.

Commenters' Reason: This modification will create consistency with the accepted definition in the IECC. This change is necessary as it is recognized that in order for insulated siding to be considered a home insulation it must be installed without an intervening ventilated air space. In other words attached directly to the water resistive barrier and sheathing, whether it be foam or wood sheathing.

Public Comment 2:

Shaunna Mozingo, City of Westminster, Co, representing Colorado Chapter of ICC and Craig Conner, Building Quality, requests Disapproval.

Commenters' Reason: We strongly prefer that the IECC and IRC be made identical, possibly based on RE4. Part II of this change is a backup, in case RE4 is not approved.

EC17, which defines "insulated siding", and EC54, which adds "insulated siding" as a type of insulation, are primarily designed to accommodate insulated vinyl siding within the code. EC17 and EC54 share two problems, they expand the R-value to include more than the insulation and they add a product that the code requires be "loosely" attached to the exterior with a small air space to allow its expansion and contraction with temperature changes.

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EC16	Comprehensive revision- insulation, windows, air tightness, ducts, water systems, equipment, etc. Creates 4 options for each climate zone.	IECC–D IRC–AS	IECC–D, **IRC–D** Large differences between IECC's EC13 and IRC's EC16 are unacceptable. Retaining both EC13 and EC16 would greatly complicate adoption and enforcement. EC16 is a solid attempt and NAHB's participation deserves praise; however, we suggest EC13 is superior.
EC17	Defines "Insulated Siding"	IECC–AM IRC–AS	**IECC–D**, **IRC–D** There are problems in the proposed definition and the related EC54, see public comment.
EC24	Eliminate homeowner energy certificate	IECC–AS No IRC version	**IECC–D** No IRC change submitted. Energy certificate modified by EC22 in both IECC & IRC. Useful homeowner oriented energy certificate should be retained.
EC27	Increase window, skylight, insulation requirements	IECC–AM IRC–D	**IECC–AMPC**, **IRC–AMPC** Amendment by DOE public comment fixes problem in footnote "h". Rest of EC27 duplicates parts of EC13.
EC29	Set maximum SHGC for skylights and sunrooms	IECC–D IRC–AS	No Action. Withdrawn by proponent.
EC30	Compressed cavity insulation	IECC–AS IRC–D	**IECC–D**, IRC–D Makes footnote worse. Could be misread as a ban on cavity insulation below R-value in table.
EC31	Limit window/door/skylight size in prescriptive approach	IECC–AS IRC–D	**IECC–D**, IRC–D Window/door/skylight calculation too much work. Affects few homes. Includes doors and skylights in limit. Other approved changes requiring much better windows & skylights for all homes are a better option.
EC34	Lower southern window U-factor	IECC–AS IRC–D	IECC–AS, **IRC–AS** Windows required are common.
EC35	Apply same U-factor and SHGC to impact glass	IECC–AS IRC–D	**IECC–D**, IRC–D U-factors from EC34 are too low for impact glass.
EC36	Increase maximum SHGC for skylights	IECC–D IRC–AS	**IECC–AS**, IRC–AS Lower SHGC for skylights makes it harder to use skylights for daylighting.
EC39	Lower northern window U-factor	IECC–AS IRC–D	IECC–AS, **IRC–AS** Duplicates what is already in EC13. Reasonable increases in northern window efficiency.
EC47	Increase middle US wall insulation	IECC–AM IRC–D	IECC–AM, **IRC–AM** Also good is AMPC to fix footnote "h".
EC48	Increase northern wall insulation	IECC–AM IRC–D	IECC–AM, **IRC–AM** Reasonable wall insulation. Duplicates part of EC13.
EC50	Increase crawl space wall insulation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Acceptable increase in crawl space wall insulation.
EC54	Add insulated siding as type of insulation	IECC–AS IRC–AM	**IECC –D, IRC–D** Vinyl siding performance decreased by code requirement to attach "loosely" and leave space for expansion and contraction of siding.
EC55	Mass wall U-factor	IECC–D IRC–AS	**IECC–AS**, IRC–AS Aligns codes and fixes table.
EC60	IECC/IRC realignment, deals with several topics	IECC–D IRC–D	**IECC–AMPC, IRC–AMPC** Fixes several inconsistencies. Makes IECC definition of conditioned space match IRC. Uses IECC insulation levels. Aligns design temperatures.
EC63	Attic vent wind baffle	IECC–AS IRC–AM	**IECC–AM**, IRC–AM Baffle prevents wind blowing through insulation. Both versions are acceptable. Industry prefers IRC version.
EC68	Sun roof requirement clarification	IECC–AM IRC–D	**IECC–AMPC, IRC–AMPC** Corrected language per EECC comment.
EC70	Skylight definition	IECC–AS No IRC version	**IECC–D** Disapprove to keep consistency with existing I-code skylight definitions- IBC (202) and IRC 308.6.1.
EC74	Allow window projection factor instead of	IECC–D	**IECC–AMPC, IRC–AMPC**

EC#	Description	First Hearing	**Suggested Final Action** **Bold** indicates change from first hearing.
	SHGC	IRC –AS	Allow projection factor as alternative based on public comment. Simplified change is proposed.
EC79	Revise air sealing requirements	IECC–AS IRC–D	IECC–AS, **IRC–AS**. Not needed if EC13 passes. Not completely consistent with EC13. Follow DOE's lead.
EC91	Remove "listing", leaving "labeled" for fenestration	IECC–D IRC–AS	**IECC–AS**, IRC–AS Fenestration is labeled, not listed.
EC99	Increase ventilation fan efficiency, define whole house ventilation	IECC–AM IRC–D	**IECC–AMPC, IRC–AMPC** Increases fan efficiency, which is good. Need to remove requirement to know the "intent" of a fan.
EC101	Programmable thermostats, set points, schedules, heat pumps	IECC –D/ASF IRC–D	**IECC–D**, IRC–D Thermostat set points hard to inspect. Research shows set back thermostats do not save energy.
EC102	Ground conductance calculation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Improved calculation per DOE.
EC107	Decrease duct leakage	IECC–AS IRC–D	IECC –AS, **IRC–AS** Not needed if EC13 passes, unless DOE modifies it. Follow DOE's lead.
EC109	Eliminate framing cavities as return ducts	IECC–AS IRC–D	IECC–AS, **IRC–AS** Framing cavities make leaky ducts.
EC112	More efficient water heating pipe layout & insulation	IECC–AS IRC–D	IECC–AS, **IRC–AS** Approved as part of EC13.
EC115	Increases circulating water heating pipe insulation	IECC–D IRC–AS	**IECC–D**, IRC–D Pipe layout & insulation handled better in EC13/EC112.
EC123	Prohibit electric resistance heating, with exceptions	IECC–AM IRC–D	No Action. Withdrawn by proponent.
EC125	Prohibit standing pilots on fireplaces	IECC–AS IRC–D	IECC–AS, **IRC–AS** Standing pilot lights waste energy.

Public Comment 3:

Donald J. Vigneau, Northeast Energy Efficiency Partnerships, Inc., representing self requests Disapproval.

Commenter's Reason: Public Comment is for Disapproval of Part I and Part II, since approval of either presently will create inconsistency between the two codes for no valid reason. It is unknown whether the original proponent will be successful in modifying either approval to prevent different code provisions in the two documents. Coordination of approvals is essential for this to be ratified for inclusion in both codes.

Both committees agree the products deserve attention within the codes. However, they need to be consistent.

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Part II was Approved as Submitted (AS) by the Residential Building & Energy Code Development Committee.

Final Action: AS AM AMPC____ D

EC24-09/10
401.3

<u>Proposed Change as Submitted</u>

Proponent: Guy Tomberlin, Fairfax County, VA, representing the VA Plumbing and Mechanical Inspectors/VA Building and Code Officials

Delete without substitution:

~~**401.3 Certificate.** A permanent certificate shall be posted on or in the electrical distribution 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 be completed by the builder or registered design professional. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, *basement wall*, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list 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 list "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be *listed* for gas-fired unvented room heaters, electric furnaces or electric baseboard heaters.~~

Reason: This section requires a certificate be placed on the electrical panel stating certain energy related building components such as R-values, U-factors etc… Unfortunately this is nothing more than a good idea with no energy conserving benefit what so ever. This information is no more useful than if the builder were required to place a label on the panel stating the joist size, framing wall sizes, etc or the type of plumbing and electrical fixtures. Yes it's nice to know but does it lend itself in anyway to increased energy conservation or enhanced building safety, no. In fact it will be create problems throughout the life of the building. For example what if the owner changes some components with out the benefit of permits and inspections, then sells the building and the next owner comes in years later to make adjustments and finds that the building is not what the certificate says it was? It may be better, what then? What does the code official do when the label contains the wrong information? Do they reject occupancy from someone moving into their new home? Lets face it when a building component needs to be replaced it is almost always financial economics and market availability that drives the decision on replacement items, not a certificate that was posted years prior. The certificate is completely useless for any and all practical purpose. In fact, it could easily cause a chaotic exercise that builders would have to deal with in the 11th hour. Finial inspections and occupancy are being withheld because this label may have not been posted. Lets not endorse rules and practice just because they are good ideas lets stay with the long standing fundamentals that the code is a minimum standard set in place to assure safety and uphold the concepts of energy conservation.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: TOMBERLIN-EC-1-401.3

<u>Public Hearing Results</u>

Committee Action: **Approved as Submitted**

Committee Reason: The committee agreed with the proponent that the certificate has little benefit and no impact on energy conservation.

Assembly Action: **None**

<u>Individual Consideration Agenda</u>

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, request Disapproval.

Commenter's Reason: This change is one several changes intended to correct inconsistencies between the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC16 and EC17.

For EC24 there was no IRC version (Part II) submitted. The required certificate was modified in EC22 and we feel that this modification as well as the certificate itself is important and should be retained. While we hear the proponent's argument against having the certificate at all we must point out that the information is not there for the inspector or Building Department, but rather for the homeowner and any future homeowners.

The information on this certificate would be of use in several ways. A few examples – For a prospective homeowner it allows a quick overview comparison of several homes. The home shopper knows that similar information will be on all homes in a specific and easy to find location. For the builder who exceeds the code, the certificate can highlight extra energy features that can't be seen directly, for example the amount of insulation in the walls, or the highly efficient air conditioner. For the prospective homeowner trying to decide whether their existing ceiling insulation is adequate, it gives quick answer to what is already in the ceiling.

Public Comment 2:

Jeff Inks, representing Window & Door Manufacturers Association, requests Disapproval.

Commenter's Reason: WDMA urges disapproval because the certificate does provide beneficial information especially with respect to the building envelope. Predominant insulation and fenestration values are particularly important to ensuring proper selection of replacement HVAC equipment which absolutely does directly impact energy conservation. While it is true the certificate can only verify the characteristics of the building components at the time the home was constructed, HVAC equipment is likely to be replaced one or more times before there are any significant changes made in the building envelope. Ensuring there is a record of the insulation and fenestration is in place and available is therefore extremely helpful when that equipment is replaced.

Final Action: AS AM AMPC____ D

EC25-09/10-PART I

101.3, 202, 402.4.1, 402.4.2, 402.4.2.1, 402.4.2.2, 402.4.2.3 (New), 403.2.1, 403.2.2, 403.2.3, 403.4, 403.4.1 (New), 403.4.2 (New), 403.4.3 (New), 403.11 (New), Tables 402.1.1, 402.1.3, 402.2.5, 402.4.2, 405.5.2(1)

Proposed Change as Submitted

Proponent: Bill Fay, representing Energy Efficient Coalition

PART I – IECC

1. Revise as follows:

101.3 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. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. ~~the effective use of energy.~~ This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

SECTION 202
GENERAL DEFINITIONS

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. Such systems include equipment referred to as an “energy recovery ventilator” (ERV) or as a “heat recovery ventilator” (HRV).

2. Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

SPECIFIC LEAKAGE AREA (SLA). The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with section 5.1 of ASHRAE 119 and where L and CFA are in the same units.

3. Revise as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	Glazed Fenestration SHGC[b,e]	Ceiling R-Value	Wood Frame Wall R-Value[h]	Mass Wall R-Value[i]	Basement [c] Wall R-Value	Crawl Space [c] Wall R-Value
1	NR ~~1.20~~	~~0.30~~ 0.25	30	13	3/4	0	0
2	0.40 ~~0.65~~ [j]	~~0.30~~ 0.25	~~30~~ 38	13	4/6	0	0
3	0.35 ~~0.50~~ [j]	~~0.30~~ 0.25	~~30~~ 38	~~13~~ 20 or 13+5	~~5/8~~ 8/13	5/13[f]	5/13
4 except Marine	0.35	NR	~~38~~ 49	~~13~~ 20 or 13+5	~~5/10~~ 8/13	10/13	10/13
5 and Marine 4	0.32 ~~0.35~~	NR	~~38~~ 49	20 or 13+5[h]	13/17	15/19 ~~10/13~~	15/19 ~~10/13~~
6	0.32 ~~0.35~~	NR	49	20+5 or 13+10~~5~~[~~h~~]	15/~~19~~20	15/19	15/19 ~~10/13~~
7 and 8	0.32 ~~0.35~~	NR	49	20+5 or 13+10 ~~21~~	19/21	15/19	15/19 ~~10/13~~

~~j. For impact rated fenestration complying with Section 301.2.1.2 of the *International Residential Code* or Section 1608.1.2 of the *International Building Code*, the maximum U factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.~~

(Portions of table and notes not shown remain unchanged)

TABLE 402.1.3
EQUIVALENT U-FACTORS[a]

Climate Zone	Fenestration U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor[b]	Basement Wall U-Factor[d]	Crawl Space Wall U-Factor[c]
1	0.50 ~~1.20~~	0.035	0.082	0.197	0.360	0.477
2	0.40 ~~0.65~~	~~0.035~~ 0.030	0.082	0.165	0.360	0.477
3	0.35 ~~0.50~~	~~0.035~~ 0.030	~~0.082~~ 0.057	~~0.141~~ 0.098	0.091[c]	0.136
4 except Marine	0.35	~~0.030~~ 0.026	~~0.082~~ 0.057	~~0.141~~ 0.098	0.059	0.065
5 and Marine 4	0.32 ~~0.35~~	~~0.030~~ 0.026	0.057	0.082	0.050 ~~0.059~~	0.055 ~~0.065~~
6	0.32 ~~0.35~~	0.026	0.048~~57~~	0.060	0.050	0.055 ~~0.065~~
7 and 8	0.32 ~~0.35~~	0.026	0.048~~57~~	0.057	0.050	0.055 ~~0.065~~

(Portions of table and notes not shown remain unchanged)

TABLE 402.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(R-VALUE)

Wood Frame R-Value Requirement	Cold-Formed Steel Equivalent R-Value[a]
Steel-Framed Wall	
R-13	R-13+5 or R-15+4 or R-21+3 or R-0+10
R-19	R-13+9 or R-19+8 or R-25+7
R-20	R-13+10 or R-19+8 or R-25+7
R-21	R-13+10 or R-19+9 or R-25+8
R-20+5	R-13+15 or R-19+14 or R-25+13

(Portions of table and notes not shown remain unchanged)

402.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Section 402.4.2 and be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:

1. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating a garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Attic access openings.
11. Rim joist junction.
12. Other sources of infiltration.

402.4.2 Air sealing and insulation. The components of the *building thermal envelope* as listed in Table 402.4.2 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table 402.4.2, as applicable to the method of construction. Building envelope air tightness and insulation installation shall be demonstrated to comply with ~~one of~~ the ~~following options given~~ requirements established by Section 402.4.2.1 ~~or~~ and 402.4.2.2:

402.4.2.1 Performance testing requirement ~~option~~. The building shall meet the air leakage standard set forth below as demonstrated by an air leakage test conducted as specified below:

1. Building envelope tightness ~~and insulation installation~~ shall be ~~considered acceptable when~~ tested by a party

approved by the code official. Where required by the code official, the *approved* party shall be independent from both the builder and any other entity responsible for installing the insulation and air barrier and otherwise sealing the building. A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and *code official*.

2. The building shall be required to have an air leakage ~~is~~ less than 0.00030 *specific leakage area (SLA)* ~~seven air changes per hour (ACH)~~ when tested with a blower door at a pressure of 33.5 psf (50 Pa). Testing shall occur any time after rough in and after (i) installation of all penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances, and (ii) completion of sealing of the *building thermal envelope* as required in section 402.4.1.
3. During testing:

    1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed beyond the weather-stripping, caulking and other intended permanent air infiltration control measures;
    2. Dampers shall be closed, but not sealed, including exhaust, intake, makeup air, backdraft, fireplace and flue dampers beyond intended permanent air infiltration control measures;
    3. Interior doors connecting conditioned spaces shall be open, doors connecting to unconditioned spaces closed but not sealed;
    4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
    5. Heating and cooling system(s) shall be turned off;
    6. ~~HVAC ducts systems shall not be sealed; and~~
    7. ~~7.~~ Supply and return registers shall be fully open at the time of the test ~~not be sealed~~.

Exception: Multi-family residential buildings, with more than four dwelling units per building, may be individually exempted from the testing requirement only when meeting all of the following requirements:

1. The exemption is approved by the *code official* after inspection of the sealing of thermal envelope in accordance with Section 402.4.1 and Table 402.4.2;
2. At least 15% of the units are tested to have an air leakage less than 0.00036 *specific leakage area (SLA)* when tested with a blower door at a pressure of 33.5 psf (50 Pa), with the units to be tested specified by the code official; and
3. The tests demonstrate compliance for such units.

When any tested dwelling unit subject to this exception fails to meet the maximum air leakage requirement stated in Section 402.4.2.1, then the builder must resolve any leakage problems so that such unit passes the test and then must continue to test each additional dwelling unit in such building until a minimum of three consecutive dwelling units pass the test before the builder can return to testing as specified in Item 2 of this exception.

402.4.2.2 Visual insulation inspection ~~option~~ (Mandatory). Building envelope ~~tightness and~~ insulation installation shall be ~~considered acceptable when the items listed in Table 402.4.2, applicable to the method of construction, are~~ field verified to meet the Insulation Installation Criteria in Table 402.4.2. Where required by the *code official*, an *approved* party independent from the builder and the installer of the insulation, shall inspect the ~~air barrier and~~ insulation; in such case, a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder before interior finish materials are applied.

402.4.2.3 Visual air barrier inspection. For any building or dwelling unit not required to be tested under section 402.4.2.1, building envelope tightness shall be field verified to meet the Air Barrier Criteria in Table 402.4.2. Where required by the *code official*, an *approved* party independent from the builder and the installer of any air barrier materials, shall inspect the air barrier; in such case, a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder before interior finish materials are applied. In cases where the building or dwelling unit satisfies the testing requirement of section 402.4.2.1, the *code official* may also require field verification to show that the building meets the Air Barrier Criteria if deemed necessary.

4. Delete Table 402.4.2 and replace with the following table:

~~**TABLE 402.4.2**~~
~~**AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA**~~
TABLE 402.4.2
VISUAL AIR BARRIER AND INSULATION INSPECTION

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
General Requirements	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.	A continuous air barrier is installed in the thermal envelope. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.
Ceiling / attic	In any dropped ceiling/soffit, the insulation is substantially aligned with the air barrier.	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access, knee wall door or drop down stair to unconditioned attic is sealed.
Walls	All corners and headers are insulated. Insulation is in substantial contact and continuous alignment with air barrier.	Junction of foundation and sill plate is sealed. Junction of exterior wall and top plate is sealed. Junction of the exterior wall and floor sheathing is sealed. Knee wall is sealed.
Fenestration		Space between fenestration jambs and framing is sealed.
Rim joists	Rim joists are insulated.	Air barrier is installed at the rim joist.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking.	Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls.	Exposed earth in unvented crawlspaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations		Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit; narrow cavities are filled by sprayed/blown insulation.	
Garage separation		Air sealing is provided between the garage and conditioned spaces.
Recessed lighting		Recessed light fixtures installed in the building thermal envelope are airtight, IC rated, and sealed to drywall.
Plumbing and Wiring	Insulation is placed between the exterior of the wall assembly and pipes. Batt insulation is cut and fitted around wiring and plumbing, or sprayed/blown insulation extends between piping and wiring and to the exterior of the wall assembly.	All plumbing and wiring penetrations shall be sealed to the air barrier.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs have insulation filling any gaps or voids between tub or shower walls and unconditioned space.	Exterior walls adjacent to showers and tubs have an air barrier separating the exterior wall from the shower and tubs.
Electrical / phone box on exterior walls	Insulation completely fills voids between the box and exterior sheathing	Air barrier extends behind boxes or air sealed type boxes are installed.
Common wall		Air barrier is installed in common wall between dwelling units.
HVAC register boots		HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace		Air barrier is installed on fireplace walls. Fireplace shall have gasketed doors.

5. Revise as follows:

403.2.1 Insulation (Prescriptive). Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Where all ducts or portions thereof are located completely within *conditioned space* inside the *building thermal envelope*, supply ducts shall be insulated to a minimum of R-4.

403.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes, and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code* or Section 603.9 of the *International Mechanical Code,* as applicable.

Duct tightness shall be verified by a test performed by a party *approved* by the *code official* after construction is completed. Where required by the code official, testing shall be conducted by an approved party independent from the builder and the installer of the ducts. either of the following: A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and the *code official*.

1. Post-construction test: L As tested, total duct lLeakage to outdoors shall be less than or equal to 8 cfm (226.5 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* or a total leakage less than or equal to 6 12 cfm (226.512 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*.

Exceptions: Duct tightness test is not required if Where the air handler and all ducts are located within conditioned space, total duct leakage shall not exceed 12 cfm per 100 ft^2 of conditioned floor area when tested as specified above.

403.2.3 Building cavities (Mandatory). Building framing cavities shall not be used as supply ducts.

403.4 Service water heating (Mandatory). Service hot water piping shall be installed in accordance with Sections 403.4.1 through 403.4.3.

403.4.1 Pipe length and Insulation. Service hot water piping shall be no more than a total of 60 linear feet of pipe length to all fixtures being served by one service water heating unit. All service hot water piping shall be insulated to at least R-3 for pipes sized 1" in diameter or less and R-4 for pipes larger than 1" in diameter for the distance between the service water heating equipment to within 5 feet of each fixture connected to the hot water pipe and the first 5 feet of hot and cold water pipes from the storage tank for non-recirculating service water heating systems.

Exception: Hot water distribution systems that are not located below ground or in a mass floor or mass wall in contact with the ground and that supply hot water from one of the following sources:

1. Condensing gas service water heating equipment,
2. Solar thermal water heating equipment that is designed to provide more than 50% of annual hot water requirements from solar heated water,
3. Heat pump electric service water heating equipment,
4. Tankless demand service gas water heating equipment, or
5. Tankless demand service electric heating equipment, where either: (a) heated water is provided through piping that is insulated to R-3 or (b) there is no more than a total of 15 linear feet of pipe length to all fixtures being served by each unit.

403.4.2 Circulating hot water systems (Mandatory). All circulating service hot water piping shall be insulated to at least R-32 for pipes sized 1" in diameter or less and R-4 for pipes larger than 1" in diameter. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

403.4.3 Heat Traps. Water heating equipment not supplied with integral heat traps and serving non-circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment.

6. Add new text as follows:

403.11 *Energy Recovery Ventilation System* and Air leakage supplemental requirements. The building shall meet the following the requirements:

1. An *energy recovery ventilation system* shall be installed. For warm humid counties as identified in table 301.1, a dehumidifier with a built in humidistat shall be installed in addition to the *energy recovery ventilation system*.
2. Building air leakage shall be tested in accordance with the procedure prescribed in Section 402.4.2.1, except that the air leakage shall not exceed 0.00015 *specific leakage area (SLA)* for all buildings except multifamily, which shall not exceed 0.00018 *specific leakage area (SLA)*, when tested with a blower door at a pressure of 33.5 psf (50 Pa) by an approved party independent of the builder and any contractors involved in any aspect of sealing the building.

   Exceptions:

   1. Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20% and meets or exceeds 12.5 EER.
   2. Buildings located in climate zones 3, 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15% and cooling equipment that meets or exceeds 12.5 EER.
   3. Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20%.
   4. In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not available in the market, the equipment with the highest rated efficiency commercially available can be substituted, when *approved* by the *code official*,
   5. As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.

6. Revise as follows:

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	*Specific leakage area (SLA)* = 0.0001536 ~~assuming no energy recovery.~~ with a 70% efficient *energy recovery ventilation system*. Exceptions: 1. For multifamily buildings, the specific leakage area shall be 0.00018 with a 70% efficient *energy recovery ventilation system*. 2. For buildings subject to the exceptions in section 403.11, SLA = 0.00030, assuming no energy recovery.	~~For residences that are not tested, the same as the standard reference design.~~ *Specific Leakage Area (SLA)* = the tested value for the proposed home and the tested value shall be in determined accordance with the methodology set out in section 402.4.2.1 and the ASHRAE 119, Section 5.1 and the SLA shall be: 1. For residences without mechanical ventilation ~~that are tested in accordance with ASHRAE 119, Section 5.1,~~ the measured air exchange rate[e] but not less than 0.35 ACH. 2. For residences with mechanical ventilation that is not an *energy recovery ventilation system* ~~that are tested in accordance with ASHRAE 119, Section 5.1,~~ the measured air exchange rate[e] combined with the mechanical ventilation rate, *f* which shall not be less than 0.01 x *CFA* + 7.5 x (N_{br} + 1) where: *CFA* = conditioned floor area N_{br} = number of bedrooms 3. For residences with *energy recovery ventilation systems*, the efficiency of the energy or heat recovery ventilation system shall be as proposed.

(Portions of table and notes not shown remain unchanged)

~~d. Where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:~~
~~SLA = L/CFA~~

~~where L and CFA are in the same units.~~

Reason: At the 2009 Final Action Hearings, a majority of voting code officials supported proposals to substantially boost energy efficiency of the 2009 IECC's energy efficiency over its 2006 counterpart (including over 60% who voted for the Energy Efficient Codes Coalition's EC14, also known as "The 30% Solution"). Even though some of those votes fell short of the 2/3 majority needed for adoption, the final version of IECC 2009 will boost efficiency by more than 10% *(http://www.thirtypercentsolution.org/solution/EECC-Savings_Analysis-Jan-2009.pdf)*.

This comprehensive proposal builds on the momentum ICC's members set in Minneapolis last year, while simultaneously responding to profound events that are shining a national spotlight on energy codes, the role buildings play in national energy use and the impact both can have on national energy policy.

Specifically, this **Core Package Proposal** was developed by the Energy Efficient Codes Coalition (EECC) to support the ICC (and its I-Code process) in reaching the energy savings targets proposed by many (including DOE) and being considered by Congress in several pending bills. Our proposal incorporates currently available technologies that are being included in new home construction every day and is designed to make the code as simple and clear as possible (to avoid undue burdens on code officials) and to be consistent with current federal law regarding efficient equipment covered by federal standards. Some of the major energy-saving improvements captured in this comprehensive package include:

(1) Improved envelope measures including better fenestration and insulation in most climate zones;
(2) Comprehensive air sealing, testing, and insulation inspection;
(3) Improved sealing and testing requirements for ducts;
(4) Requirements for efficient hot water service distribution system or equipment; and
(5) Requirements for reduced envelope infiltration along with energy recovery ventilation, or else more efficient HVAC equipment.

The elements of this and other individual EECC proposals have been reviewed by energy efficiency experts, building scientists and many others, and improved based on their comments. Individual EECC supporters are also submitting each element of this package, along with a number of other proposals, in the form of individual proposals to strengthen energy efficiency in both the *IECC* and *IRC.* The detailed reasons supporting the individual elements of this proposal can be found in these individual proposals, which are incorporated by reference into this reason statement.

We estimate that this Core Package Proposal will result in a 2012 IECC that is at least 20% more energy efficient than the 2009 IECC (and more than 30% more efficient than the 2006 IECC). Taken together with the efficiency gains in the 2009 IECC, adoption of this proposal by the full ICC will produce a 2012 IECC that comfortably exceeds Congress' initial 30% savings target (compared with IECC 2006) and puts the ICC on the path to the next target of 50% savings.

EECC is submitting this proposal to both the *IRC* and the *IECC*, in order to assure consistency between the two codes. However, EECC believes that America needs a single model energy code, the IECC (the only I-Code recognized in federal statutes)**. For this reason,** EECC is also submitting a separate proposal that would incorporate the IECC by reference in the IRC Chapter 11 (as is currently done with the International Building Code IBC).

Since September of 2008, three events have occurred that could transform the ICC's residential model energy code:

- The US Conference of Mayors and other elected officials charged with establishing and implementing national, state and local energy policies have begun to recognize the profound impact that the model energy codes can have on achieving local, regional, and national goals for sustainable economic growth, and have endorsed the concept of a 30% improvement in model energy codes. Several city and state governments have adopted their own policies to achieve at least 30% efficiency improvements in new buildings.
- Congress has also jumped into the energy code arena with legislative carrots and sticks designed to speed the rate of energy efficiency improvements in the I-Code and their adoption by state and local jurisdictions. First, Congress linked billions of dollars in stimulus funds to each state's adoption of the 2009 IECC (or equivalent), followed by the introduction of legislation that sets targets of 30%, then 50% and beyond, for ICC to meet or exceed. The proposed legislation also authorizes hundreds of millions of federal dollars for code development bodies and state and local governments for adoption, implementation and compliance with codes that meet these goals.
- Finally, the ICC's new schedule for I-Code development reduces the number of opportunities to meet these targets being considered in Congress to once in each three-year code cycle.

As the growing national interest in the ICC and its model energy code attests, our nation's energy policy is in a period of transition. As states scramble to meet increasing peak energy demands and to curb pollution and greenhouse gases, there has been an increased focus on energy efficiency at all levels of government and the private sector. Federal and state governments recognize that energy efficiency is the most cost-effective means of meeting increasing energy demand. The time has come to complete the transition to at least a 30% more efficient residential energy code before 2012, and this proposal will help to bring that about.

The Energy Efficient Codes Coalition (website: www.thirtypercentsolution.org) was established to boost the energy efficiency of the IECC, and its supporters include all forms of electric utilities, low-income homeowner groups, a wide-range of regional and national energy efficiency and environmental organizations, many levels of government, business and labor coalitions, and as well as many of the typical participants in the ICC process.

Cost Impact: This proposal will increase the cost of construction.

ICCFILENAME: FAY-EC-1-101

Public Hearing Results

PART I-IECC
Committee Action: Disapproved

Committee Reason: The proposal takes an aggressive approach to increasing the stringency of the code well beyond the levels given in EC13. At the present time, EC13 provides a reasonable approach. This code change would be too restrictive and limit the options to house design. A particular concern was that the glazing values become so restrictive that an excessive amount of light is blocked.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	Glazed Fenestration SHGC[b,e]	Ceiling R-Value	Wood Frame Wall R-Value[h]	Mass Wall R-Value[i]	Basement [c] Wall R-Value	Crawl Space [c] Wall R-Value
1	NR	0.25	30	13	3/4	0	0
2	0.40	0.25	38	13	4/6	0	0
3	0.35	0.25	38	20 or 13+5	8/13	5/13[f]	5/13
4 except Marine	0.35	NR	49	20 or 13+5	8/13	10/13	10/13
5 and Marine 4	0.32	NR	49	20 or 13+5	13/17	15/19	15/19
6	0.32	NR	49	20+5 or 13+10	15/20	15/19	15/19
7 and 8	0.32	NR	49	20+5 or 13+10	19/21	15/19	15/19

~~h. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: *NOTE TO ICC STAFF: The EC25 proposal does not make changes to footnote h, but it makes a significant change to the application of footnote h by introducing R-10 continuous insulation into the table. Thus, footnote h without a corrective/coordinating change would allow R2 to be used instead of R10 (not just R5 as the current table is limited). Thus, the existing problem with the "R2 loophole" in footnote h is greatly expanded in EC25.*

This public comment achieves two things:

1. corrects a severe problem with footnote 'h' that erodes the energy code, regardless of which version of the energy code is approved; and,
2. provides a rational and flexible application of footnote 'h' in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote 'h' is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote 'h', the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote 'h' allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Public Comment 2:

Mark Halverson, APA, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	Glazed Fenestration SHGC[b,e]	Ceiling R-Value	Wood Frame Wall R-Value[h]	Mass Wall R-Value[i]	Basement [c] Wall R-Value	Crawl Space [c] Wall R-Value
1	NR	0.25	30	13	3/4	0	0
2	0.40	0.25	38	13	4/6	0	0
3	0.35	0.25	38	20 or 13+5	8/13	5/13[f]	5/13
4 except Marine	0.35	NR	49	20 or 13+5	8/13	10/13	10/13
5 and Marine 4	0.32	NR	49	20 or 13+5	13/17	15/19	15/19
6	0.32	NR	49	20+5 or 13+10	15/20	15/19	15/19
7 and 8	0.32	NR	49	20+5 or 13+10	19/21	15/19	15/19

~~h. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~

h. First value is cavity insulation, second is continuous insulation or insulating sheathing, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing, "20+5" means R-20 cavity insulation in addition to a layer of R-5 continuous or insulating sheathing; and "13+10" means R-13 cavity insulation in addition to a layer of R-10 continuous or insulating sheathing. In locations where structural sheathing is used, continuous insulation or insulating sheathing shall be permitted to be reduced by nor more than R-2.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: This modification simplifies and clarifies footnote h. of Table 402.1.1 when both R-5 and R-10 continuous sheathing or insulating sheathing is required regardless of the amount of structural sheathing that is used. The amount of structural sheathing needed to adequately brace the walls is not limited, so the structural capacity of the wall is not impacted. This modification also assures that all opaque wall areas are covered by continuous insulation or insulating sheathing while maintaining the same combined sheathing thickness in all the wall envelope areas.

Instead of a fixed minimum requirement of R-2 continuous sheathing as before, a reduction of R-2 sheathing from the specified amount works for both R-5 or R10 continuous sheathing requirements. A R-5 requirement reduced by R-2 yields a R-3 continuous insulation applied over the structural sheathing and a R-10 reduced by R-2 yields a R-8 continuous insulation over the structural sheathing.

We ask that the code body support the Committee's recommendation for approval as modified by this Public Comment.

Public Comment 3:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

SECTION 202
GENERAL DEFINITIONS

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. ~~Such systems include equipment referred to as an "energy recovery ventilator" (ERV) or as a "heat recovery ventilator" (HRV).~~

SECTION 202
GENERAL DEFINITIONS

~~**SPECIFIC LEAKAGE AREA (SLA).** The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with section 5.1 of ASHRAE 119 and where L and CFA are in the same units.~~

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	Glazed Fenestration SHGC[b,e]	Ceiling R-Value	Wood Frame Wall R-Value[h]	Mass Wall R-Value[i]	Basement [c] Wall R-Value	Crawl Space [c] Wall R-Value
1	NR	0.25	30	13	3/4	0	0
2	0.40	0.25	38	13	4/6	0	0
3	0.35	0.25	38	20 or 13+5	8/13	5/13[f]	5/13
4 except Marine	0.35	NR	49	20 or 13+5	8/13	10/13	10/13
5 and Marine 4	0.32	NR	49	20 or 13+5[h]	13/17	15/19	15/19
6	0.32	NR	49	20+5 or 13+10	15/20	15/19	15/19
7 and 8	0.32	NR	49	20+5 or 13+10	19/21	15/19	15/19

h. First value is cavity insulation, second is continuous insulation, so “13+5” means R-13 cavity insulation plus R-5 continuous insulation ~~insulating sheathing~~. ~~If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~

(*Portions of table and notes not shown remain unchanged*)

TABLE 402.1.3
EQUIVALENT U-FACTORS[a]

Climate Zone	Fenestration U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor[b]	Basement Wall U-Factor [d]	Crawl Space Wall U-Factor [c]
1	0.50	0.035	0.082	0.197	0.360	0.477
2	0.40	0.030	0.082	0.165	0.360	0.477
3	0.35	0.030	0.057	0.098	0.091[c]	0.136
4 except Marine	0.35	0.026	0.057	0.098	0.059	0.065
5 and Marine 4	0.32	0.026	0.057	0.082	0.050	0.055
6	0.32	0.026	0.048	0.060	0.050	0.055
7 and 8	0.32	0.026	0.048	0.057	0.050	0.055

(Portions of table and notes not shown remain unchanged)

TABLE 402.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(R-VALUE)

Wood Frame R-Value Requirement	Cold-Formed Steel Equivalent R-Value[a]
Steel-Framed Wall	
R-13	R-13+5 or R-15+4 or R-21+3 or R-0+10
R-19	R-13+9 or R-19+8 or R-25+7
R-20	R-13+10 or R-19+8 or R-25+7
R-21	R-13+10 or R-19+9 or R-25+8
R-20+5	R-13+15 or R-19+14 or R-25+13

(Portions of table and notes not shown remain unchanged)

402.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Section ~~402.4.2~~ 402.4.1.1, 402.4.1.2, 402.4.1.3 and 402.4.1.4 and be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

1. ~~All joints, seams and penetrations.~~
2. ~~Site-built windows, doors and skylights.~~
3. ~~Openings between window and door assemblies and their respective jambs and framing.~~
4. ~~Utility penetrations.~~
5. ~~Dropped ceilings or chases adjacent to the thermal envelope.~~
6. ~~Knee walls.~~
7. ~~Walls and ceilings separating a garage from conditioned spaces.~~
8. ~~Behind tubs and showers on exterior walls.~~

9. ~~Common walls between dwelling units.~~
10. ~~Attic access openings.~~
11. ~~Rim joist junction.~~
12. ~~Other sources of infiltration.~~

~~402.4.2 Air sealing and insulation~~ 402.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table ~~402.4.2~~ 402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table ~~402.4.2~~ 402.4.1.1, as applicable to the method of construction. Building envelope air tightness and insulation installation shall be demonstrated to comply with the requirements established by Section ~~402.4.2.1~~ 402.4.1.2 and ~~402.4.2.2~~ 402.4.1.3

~~402.4.2.1~~ 402.4.1.2 Performance testing requirement. The building shall meet the air leakage standard set forth below as demonstrated by an air leakage test conducted as specified below:

1. Building envelope tightness shall be tested by a party *approved* by the code official. ~~Where required by the code official, the *approved* party shall be independent from both the builder and any other entity responsible for installing the insulation and air barrier and otherwise sealing the building.~~ A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and *code official*.
2. The building shall be required to have an air leakage less than ~~0.00030 *specific leakage area (SLA)*~~ five air changes per hour (ACH) when tested with a blower door at a pressure of ~~33.5 psf~~ 0.2 inches w.g. (50 Pa). Testing shall occur any time after rough in and after (i) installation of all penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances, and (ii) completion of sealing of the *building thermal envelope* as required in section 402.4.1.
3. During testing:

    1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed beyond the weather-stripping, caulking and other intended permanent air infiltration control measures;
    2. Dampers shall be closed, but not sealed, including exhaust, intake, makeup air, backdraft, fireplace and flue dampers beyond intended permanent air infiltration control measures;
    3. Interior doors connecting conditioned spaces shall be open, doors connecting to unconditioned spaces closed but not sealed;
    4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
    5. Heating and cooling system(s) shall be turned off;
    6. Supply and return registers shall be fully open at the time of the tes.

    Exception: Multi-family residential buildings, with more than four dwelling units per building, may be individually exempted from the testing requirement only when meeting all of the following requirements:

    1. The exemption is approved by the *code official* after inspection of the sealing of thermal envelope in accordance with Section 402.4.1 and Table ~~402.4.2~~ 402.4.1.1;
    2. At least 15% of the units are tested and each tested unit has to have an air leakage less than ~~0.00036 *specific leakage area (SLA)*~~ seven air changes per hour (ACH) when tested with a blower door at a pressure of ~~33.5 psf~~ 0.2 inches w.g. (50 Pa), with the units to be tested specified by the code official; and
    3. The tests demonstrate compliance for such units.

When any tested dwelling unit subject to this exception fails to meet the maximum air leakage requirement stated in ~~Section 402.4.2.1~~ in this Exception, then the builder must resolve any leakage problems so that such unit passes the test and then must continue to test each additional dwelling unit in such building until a minimum of three consecutive dwelling units pass the test before the builder can return to testing as specified in Item 2 of this exception.

~~402.4.2.2~~ 402.4.1.3 Visual insulation inspection (Mandatory). Building envelope insulation installation shall be inspected and field verified to meet the Insulation Installation Criteria in Table ~~402.4.2~~ 402.4.1.1 before interior finish materials are installed. ~~Where required by the~~ The *code official*~~,~~ or an *approved* party ~~independent from the builder and the installer of the insulation,~~ shall inspect the insulation~~; in such case,~~ Where an *approved* party conducts the inspection, a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder ~~before interior finish materials are applied~~.

~~402.4.2.3~~ 402.4.1.4 Visual air barrier inspection. For any building or dwelling unit not required to be tested under section ~~402.4.2.1~~ 402.4.1.2, building envelope tightness shall be field verified to meet the Air Barrier Criteria in Table ~~402.4.2~~ 402.4.1.1. ~~Where required by the~~ Visual air barrier inspection shall be completed prior to the installation of air permeable insulation. The *code official*~~,~~ or an *approved* party ~~independent from the builder and the installer of any air barrier materials,~~ shall inspect the air barrier~~; in such case,~~ Where an *approved* party conducts the inspection, a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder before interior finish materials are applied. In cases where the building or dwelling unit satisfies the testing requirement of section ~~402.4.2.1~~ 402.4.1.2, the *code official* may also require field verification to show that the building meets the Air Barrier Criteria if deemed necessary.

TABLE ~~402.4.2~~ 402.4.2
VISUAL AIR BARRIER AND INSULATION INSPECTION

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
General Requirements	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.	A continuous air barrier is installed in the thermal envelope. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.
Ceiling / attic	In any dropped ceiling/soffit, the insulation is substantially aligned with the air barrier.	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access, knee wall door or drop down stair to unconditioned attic is sealed.
Walls	All corners and headers are insulated.	Junction of foundation and sill plate is sealed.

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
	Insulation is in substantial contact and continuous alignment with air barrier.	Junction of exterior wall and top plate is sealed. Junction of the exterior wall and floor sheathing is sealed. Knee wall is sealed.
Fenestration		Space between fenestration jambs and framing is sealed.
Rim joists	Rim joists are insulated.	Air barrier is installed at the rim joist.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking.	Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls.	Exposed earth in unvented crawlspaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations		Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit; narrow cavities are filled by sprayed/blown insulation.	
Garage separation		Air sealing is provided between the garage and conditioned spaces.
Recessed lighting		Recessed light fixtures installed in the building thermal envelope are airtight, IC rated, and sealed to drywall.
Plumbing and Wiring	Insulation is placed between the exterior of the wall assembly and pipes. Batt insulation is cut and fitted around wiring and plumbing, or sprayed/blown insulation extends between piping and wiring and to the exterior of the wall assembly.	All plumbing and wiring penetrations shall be sealed to the air barrier.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs have insulation filling any gaps or voids between tub or shower walls and unconditioned space.	Exterior walls adjacent to showers and tubs have an air barrier separating the exterior wall from the shower and tubs.
Electrical / phone box on exterior walls	Insulation completely fills voids between the box and exterior sheathing	Air barrier extends behind boxes or air sealed type boxes are installed.
Common wall		Air barrier is installed in common wall between dwelling units.
HVAC register boots		HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace		Air barrier is installed on fireplace walls. Fireplace shall have gasketed doors.

403.2.1 Insulation (Prescriptive). Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Where all ducts are located completely within *conditioned space,* supply ducts shall be insulated to a minimum of R-4.

403.2.2 Sealing (~~Mandatory~~ Prescriptive). All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code* or Section 603.9 of the *International Mechanical Code,* as applicable.

Duct tightness shall be verified by a test performed by a party *approved* by the *code official* after construction is completed. ~~Where required by the code official, testing shall be conducted by an approved party independent from the builder and the installer of the ducts.~~ A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and the *code official*.

As tested, total duct leakage shall be less than or equal to ~~6~~ 4 cfm (~~226.5~~ 113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

Exception~~s~~: Where the air handler and all ducts are located within conditioned space, total duct leakage shall not exceed ~~12~~ 8 cfm (226.5 L/min) per 100 ft^2 (9.29m^2) of conditioned floor area when tested as specified above.

403.2.3 Building cavities (Mandatory). Building framing cavities shall not be used as ducts.

~~**403.4 Service water heating (Mandatory)**. Service hot water piping shall be installed in accordance with Sections 403.4.1 through 403.4.3.~~

~~**403.4.1 Pipe length and Insulation**. Service hot water piping shall be no more than a total of 60 linear feet of pipe length to all fixtures being served by one service water heating unit. All service hot water piping shall be insulated to at least R-3 for pipes sized 1" in diameter or less and R-4 for pipes larger than 1" in diameter for the distance between the service water heating equipment to within 5 feet of each fixture connected to the hot water pipe and the first 5 feet of hot and cold water pipes from the storage tank for non-recirculating service water heating systems.~~

~~**Exception**: Hot water distribution systems that are not located below ground or in a mass floor or mass wall in contact with the ground and that supply hot water from one of the following sources:~~

~~1. Condensing gas service water heating equipment,~~

2. ~~Solar thermal water heating equipment that is designed to provide more than 50% of annual hot water requirements from solar heated water,~~
3. ~~Heat pump electric service water heating equipment,~~
4. ~~Tankless demand service gas water heating equipment, or~~
5. ~~Tankless demand service electric heating equipment, where either: (a) heated water is provided through piping that is insulated to R-3 or (b) there is no more than a total of 15 linear feet of pipe length to all fixtures being served by each unit~~.

~~403.4.2~~ 403.4 Circulating hot water systems (Mandatory). All circulating service hot water piping shall be insulated to at least R-3 for pipes sized 1" in diameter or less and R-4 for pipes larger than 1" in diameter. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

~~**403.4.3 Heat Traps.** Water heating equipment not supplied with integral heat traps and serving non-circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment.~~

6. Add new text as follows:

~~403.11 *Energy Recovery Ventilation System*~~ and Air leakage supplemental requirements. ~~The building shall meet the following the requirements:~~

1. ~~An *energy recovery ventilation system* shall be installed. For warm humid counties as identified in table 301.1, a dehumidifier with a built in humidistat shall be installed in addition to the *energy recovery ventilation system*.~~
2. ~~Building air leakage shall be tested in accordance with the procedure prescribed in Section 402.4.2.1, except that the air leakage shall not exceed 0.00015 *specific leakage area (SLA)* for all buildings except multifamily, which shall not exceed 0.00018 *specific leakage area (SLA),* when tested with a blower door at a pressure of 33.5 psf (50 Pa) by an approved party independent of the builder and any contractors involved in any aspect of sealing the building.~~

    ~~**Exceptions:**~~

    1. ~~Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20% and meets or exceeds 12.5 EER.~~
    2. ~~Buildings located in climate zones 3, 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15% and cooling equipment that meets or exceeds 12.5 EER.~~
    3. ~~Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20%.~~
    4. ~~In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not available in the market, the equipment with the highest rated efficiency commercially available can be substituted, when *approved* by the *code official*,~~
    5. ~~As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.~~

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	~~*Specific leakage area (SLA)* = 0.00015 with a 70% efficient *energy recovery ventilation system*.~~ Air leakage rate of 5 air changes per hour in zones 1 through 8 at a pressure of 0.2 inches w.g., (50 Pa). The mechanical ventilation rate shall be in addition to the ari leakage rate and the same as in the proposed design, but no greater than 0.01 x CFA +7.5 x (Nbr +1) where: *CFA* = conditioned floor area N_{br} = number of bedrooms Energy recovery shall not be assumed for mechanical ventilation. Exceptions: 1. For multifamily buildings, the ~~specific~~ air leakage ~~area~~ shall be ~~0.00018 with a 70% efficient *energy recovery ventilation system*.~~ ~~2. For buildings subject to the exceptions in section 403.11, SLA = 0.00030, assuming no energy recovery~~ 7 ACH50 assuming no energy recovery when tested with a blower door at a pressure of 0.2 inches w.g. (50 Pa).	The measured air exchange rate as determined through testing in accordance with section 402.4.1.2. The mechanical ventilation rate shall be in addition to the air leakage rate and shall be proposed. ~~*Specific Leakage Area (SLA)* = the tested value for the proposed home and the tested value shall be in determined accordance with the methodology set out in section 402.4.2.1 and the ASHRAE 119, Section 5.1 and the SLA shall be:~~ ~~1. For residences without mechanical ventilation the measured air exchange rate[e] but not less than 0.35 ACH.~~ ~~2. For residences with mechanical ventilation that is not an *energy recovery ventilation system* the measured air exchange rate[e] combined with the mechanical ventilation rate, *f* which shall not be less than 0.01 x *CFA* + 7.5 x (N_{br} + 1) where:~~ ~~*CFA* = conditioned floor area~~ ~~N_{br} = number of bedrooms~~ ~~3. For residences with *energy recovery ventilation systems*, the efficiency of the energy or heat recovery ventilation system shall be as proposed.~~

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	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~~. Duct insulation: from Section 403.2.1 ~~For tested duct systems, the leakage rate shall be the applicable maximum rate from Section 403.2.2.~~	~~As tested or as specified in Table 405.5.2(2) if not tested.~~ The air leakage rate or DSE shall be as tested in accordance with Section 403.2.2. Duct insulation shall be as proposed. Exception: Proposed distribution systems that qualify for default values under Table 405.5.2 may use the DSE specified in Table 405.5.2(2) in lieu of tested air leakage values. Forced air systems located entirely in conditioned space, may use the default value only when ducts are also tested and meet the maximum value set forth in the Exception to 403.2.2 and are insulated as required in Section 403.2.1.

~~d. Where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:~~
~~SLA = L/CFA~~
~~Where L and CFA are in the same units.~~

(Portions of table and notes not shown remain unchanged)

Commenter's Reason: *EC25 should be approved as modified by this public comment.*

EC25 (as modified) is the heart of "The 30% Solution 2012," which has been authored by the members of the EECC, including stakeholders from government, utilities, environmental groups, energy efficiency advocates, and others. See www.thirtypercentsolution.org. EC25, taken together with the other proposals authored by the EECC, constitute the most substantial package of residential energy savings available to voting ICC Government Members at this Final Action Hearing.

The elements of "The 30% Solution 2012" incorporate readily available "state-of-the-shelf" technologies and reasonable building practices that are proven to generate substantial energy cost savings to homeowners. In fact, we have modified EC25 and other proposals to build upon the components of US DOE's EC13, which we supported and which was already recommended for approval by the IECC Code Development Committee by an overwhelming margin.

Adoption of EC25 and the other EECC proposals in "The 30% Solution 2012" would save substantial amounts of energy—savings are expected to exceed the 30% goal promoted by the U.S. Department of Energy and other national and state policy-makers. We support the ICC and I-Code development process and believe that it is the best approach to establishing a national model residential energy code to achieve national targets for building energy efficiency.

Turning to the details of the proposal, the proposed modifications to EC25 in this public comment add clarity and further simplify the IECC and IRC energy requirements. Our modifications eliminate potential preemption challenges that could jeopardize part, or even all, of the ultimate 2012 IECC that is published by ICC. These improvements to EC25 will make the code easier to understand, adopt and enforce.

As noted above, we have carefully modified EC25 to be consistent with and build upon the IECC Development Committee-recommended DOE proposal EC13 *and* the proposed modifications we have submitted in our public comment to that proposal. As a result, it is our hope that voting governmental officials will vote at the Final Action Hearings to approve:

(1) EC13, as modified by our public comment,
(2) EC25, as modified by this public comment, and finally,
(3) The individual proposals submitted by EECC, as well as and other proposals that will further improve energy efficiency under the code.

All EECC proposals have been designed to work within the existing framework of the IECC and IRC so that jurisdictions can easily update code requirements without substantial changes to training and code enforcement programs.

Our modification to EC25 responds to concerns raised at the Development Committee hearings in Baltimore and takes the following additional steps to ensure a 2012 IECC and IRC that are readily adoptable by jurisdictions and that are consistent with other code changes:

1. **ERV requirements are removed from EC25, along with exceptions for homes with high-efficiency equipment -- ERVs and improved thermal distribution systems are addressed in EECC's modification to its proposal, EC126, but without preemption issues.** EC25 incorporated an innovative approach to solve the inability of jurisdictions to set more stringent standards for HVAC equipment because of federal preemption. Although we do not believe that this approach would be preempted, one stakeholder at the Code Development Committee hearings in October claimed that the improvements may be preempted, and if adopted, could subject the 2012 IECC to lengthy litigation and delay. To ensure a rapid deployment of the 2012 IECC, we have removed the energy recovery ventilator (ERV) requirement from this proposal, along with the exceptions based on high-efficiency HVAC.
2. **Service hot water heating system pipe length and insulation requirements are also removed from EC25, along with exceptions specifying more stringent water heating unit options -- an improved version is incorporated in EECC's modification to its proposal EC114, but without equipment preemption issues.** As with the ERV/high-efficiency HVAC alternatives, some concern was raised at the Committee Hearings about potential legal challenges to these provisions on the basis of preemption. Improved insulation requirements for circulating hot water systems remain in this proposal.
3. **Air leakage metrics are changed from SLA to ACH for consistency with other proposals.** While we believe that Specific Leakage Area (SLA) is a more accurate metric for air leakage, in an effort to maintain consistency with other proposals at the Final Action Hearing, in particular DOE's proposed EC13, we have updated references in this modification to air changes per hour (ACH).
4. **Air leakage testing requirement is set at 5ACH in all zones.** The modifications above adopt an air leakage testing requirement in all climate zones that allows a maximum of 5 ACH with a limited exception for multi-family residential buildings.
5. **Duct leakage testing requirement is set at 4cfm, with exceptions.** The modified EC25 requires that ducts be tested to a leakage rate of no more than 4cfm, except where air handler and all ducts are located within conditioned space, in which case leakage shall not exceed 8cfm. The leakage requirement has also been reclassified as prescriptive (rather than mandatory), so that if 4cfm is not possible in a particular circumstance, the performance path may be utilized to show compliance.
6. **Loophole in Table 402.1.1, footnote h is closed.** The Code Development Committee heard a good deal of debate about how to properly interpret and/or correct footnote h. A revised version of the footnote, designed to address enhanced wall-bracing requirements in the code, has been incorporated into EC25's Table 402.1.1. Code officials have reported that the footnote has been used by some as a complete exemption from the use of continuous insulation, and given the increased wall R-values in many climate zones proposed EC25

and other proposals, the potential energy efficiency losses from such a broad loophole are substantial. The updated footnote h clarifies that the use of structural sheathing should not reduce the continuous insulation R-value.

The above modification also retains a number of improvements proposed in the original EC25:

1. **Thermal building envelope requirements are improved in all zones.** EC25 retains its improvements to the thermal building envelope, including comprehensive improvements to fenestration and insulation nationwide. As the most permanent elements of the building, the thermal envelope components, form the core of energy savings for the lifetime of the home. New construction is the easiest and most cost-effective time to make improvements to the building thermal envelope. Most of these upgrades were already recommended for approval as individual code proposals by the IECC Committee; this modification captures all of them in one place.
2. **Insulation installation/air barrier criteria table is simplified.** EC25 also retains its useful organization of insulation and air barrier requirements into a bifurcated table. This will greatly simplify code compliance and will streamline enforcement for code officials, by properly identifying installation and inspection requirements and by eliminating the requirement for air barrier inspection where the home's tested air leakage value meets the code requirement.

IRC and IECC requirements are consistent. The EECC wholeheartedly supports RE4, and we believe that RE4 will settle the IRC/IECC consistency problem for good. If RE4 is successful at the Final Action Hearing, Part II will be unnecessary. However, in case RE4 (or a similar proposal) is not successful, we are including changes to the IRC that will mirror the requirements in the IECC.

Public Comment 4:

Thomas Zaremba, Roetzel & Andress, representing Pilkington North America, Inc and AGC Flat Glass North America, Inc, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	Glazed Fenestration SHGC[b,e]	Ceiling R-Value	Wood Frame Wall R-Value[h]	Mass Wall R-Value[i]	Basement [c] Wall R-Value	Crawl Space [c] Wall R-Value
1	NR	0.25	30	13	3/4	0	0
2	0.40	0.25	38	13	4/6	0	0
3	0.35	0.25	38	20 or 13+5	8/13	5/13[f]	5/13
4 except Marine	0.35	NR	49	20 or 13+5	8/13	10/13	10/13
5 and Marine 4	~~0.32~~ <u>0.30</u>	NR	49	20 or 13+5[h]	13/17	15/19	15/19
6	~~0.32~~ <u>0.30</u>	NR	49	20+5 or 13+10	15/20	15/19	15/19
7 and 8	~~0.32~~ <u>0.30</u>	NR	49	20+5 or 13+10	19/21	15/19	15/19

Add new text as follows:

<u>**402.3.3 U-factor and SHGC alternative.** Window assemblies having a U-factor of 0.31 and SHGC greater than or equal to 0.35 or a U-factor of 0.32 and SHGC greater than or equal to 0.40 shall be permitted to satisfy the requirements of Table 402.1.1 in Climate Zones 5, 6, 7 and 8. For compliance with this section, default SHGC values from Table 303.1.3(3) shall not be permitted.</u>

(Other portions of table not shown and other portions of EC 25 Part I not shown remain unchanged)

Commenter's Reason: EC25 proposes to reduce SHGC in Climate Zones 1, 2 and 3 to 0.25. Currently, there are no prescriptive limits on the use of SHGC in Climate Zones 4-8. Windows with a 0.25 SHGC not only block 75% of the sun's energy, they also reduce the amount of visible light that will pass through them. If EC25 is adopted, then it is likely that manufacturers of 0.25 SHGC glazing will not only market the use of 0.25 SHGC windows in Climate Zones 1-3, but they will also market it in the adjoining climate zones 4-8 where no prescriptive limit on SHGC exists. Such an inappropriate use of an ultra-low 0.25 glass in Climate Zones 4, 5, 6, 7 or 8 would increase winter heating loads by reason of the amount of solar gain they block and it would increase electric loads in those Climate Zones by reason of the amount of visible light such low SHGC glass would block from homes.

If EC 25 is adopted, the Energy Star criteria which mandates a lower, 0.30 U-factor but matches windows that have progressively higher U-factors of 0.31 and 0.32 with windows that have SHGCs ≥0.35 and ≥ 0.40, respectively, should be allowed as an alternative to the ability of some window manufacturers to market inappropriately low 0.25 SHGC glass in these northern climate zones. Adopting this modification would promote the use of Energy Star labeled windows as an alternative in these northern climates.

Final Action: AS AM AMPC____ D

EC25-09/10 PART II

IRC R202, N1102.4.1, N1102.4.2, N1102.4.2.1, N1102.4.2.2, N1102.4.2.3, N1103.2.1, N1103.2.2, N1103.2.3, N1103.4, N1103.4.1(New), N1103.4.2 (New), N1103.4.3 (New), N1103.10 (New), Table N1102.1, N1102.1.2, N1102.2.5, N1102.4.2

Proposed Change as Submitted

Proponent: Bill Fay, representing Energy Efficient Coalition

PART II – IRC BUILDING/ENERGY

1. Add new text as follows:

SECTION R202
GENERAL DEFINITIONS

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. Such systems include equipment referred to as an "energy recovery ventilator" (ERV) or as a "heat recovery ventilator" (HRV).

SPECIFIC LEAKAGE AREA (SLA). The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where L and CFA are in the same units.

2. Revise as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	Glazed Fenestration SHGC[b,e]	Ceiling R-Value	Wood Frame Wall R-Value[h]	Mass Wall R-Value[i]	Basement [c] Wall R-Value	Crawl Space [c] Wall R-Value
1	NR ~~1.20~~	~~0.30~~ 0.25[~~j~~]	30	13	3/4	0	0
2	0.40 ~~0.65 [j]~~	~~0.30~~ 0.25[~~j~~]	~~30~~ 38	13	4/6	0	0
3	0.35 ~~0.50 [j]~~	~~0.30~~ 0.25 [e,~~j~~]	~~30~~ 38	~~13~~ 20 or 13+5	~~5/8~~ 8/13	5/13[f]	5/13
4 except Marine	0.35	NR	~~38~~ 49	~~13~~ 20 or 13+5	~~5/10~~ 8/13	10/13	10/13
5 and Marine 4	0.32 ~~0.35~~	NR	~~38~~ 49	20 or 13+5[~~h~~]	13/17	15/19 ~~10/13~~	15/19 ~~10/13~~
6	0.32 ~~0.35~~	NR	49	20+5 or 13+10~~5~~[~~h~~]	15/~~19~~20	15/19 ~~10/13~~	15/19 ~~10/13~~
7 and 8	0.32 ~~0.35~~	NR	49	20+5 or 13+10 ~~21~~	19/21	15/19 ~~10/13~~	15/19 ~~10/13~~

~~i. For impact-rated fenestration complying with Section R301.2.1.2, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.~~

~~j. For impact-resistant fenestration complying with Section R301.2.1.2 of the *International Residential Code*, the maximum SHGC shall be 0.40.~~

(Portions of table and notes not shown remain unchanged)

TABLE N1102.1.2
EQUIVALENT U-FACTORS[a]

Climate Zone	Fenestration U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor[b]	Basement Wall U-Factor [d]	Crawl Space Wall U-Factor [c]
1	0.50 ~~1.20~~	0.035	0.082	0.197	0.360	0.477
2	0.40 ~~0.65~~ [i]	~~0.035~~ 0.030	0.082	0.165	0.360	0.477
3	0.35 ~~0.50~~ [i]	~~0.035~~ 0.030	0.082	~~0.141~~ 0.098	0.091[c]	0.136
4 except Marine	0.35	~~0.030~~ 0.026	0.082	~~0.141~~ 0.098	0.059	0.065
5 and Marine 4	0.32 ~~0.35~~	~~0.030~~ 0.026	0.060	0.082	0.050 ~~0.059~~	0.055 ~~0.065~~
6	0.32 ~~0.35~~	0.026	0.048~~60~~	0.060	0.050 ~~0.059~~	0.055 ~~0.065~~
7 and 8	0.32 ~~0.35~~	0.026	0.048~~57~~	0.057	0.050 ~~0.059~~	0.055 ~~0.065~~

(Portions of table and notes not shown remain unchanged)

TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

Wood Frame R-Value Requirement	Cold-Formed Steel Equivalent R-Value[a]
Steel-Framed Wall	
R-13	R-13+5 or R-15+4 or R-21+3 or R-0+10
R-19	R-13+9 or R-19+8 or R-25+7
R-20	R-13+10 or R-19+8 or R-25+7
R-21	R-13+10 or R-19+9 or R-25+8
R-20+5	R-13+15 or R-19+14 or R-25+13

(Portions of table and notes not shown remain unchanged)

N1102.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Section N1102.4.2 and be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.

1. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating the garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Attic access openings.
11. Rim joist junction.
12. Other sources of infiltration.

N1102.4.2 Air sealing and insulation. The components of the *building thermal envelope* as listed in Table N1102.4.2 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table N1102.4.2, as applicable to the method of construction. Building envelope air tightness and insulation installation shall be demonstrated to comply with ~~one of~~ the ~~following options given~~ requirements established by Section N1102.4.2.1 ~~or~~ and N1102.4.2.2.

N1102.4.2.1 Performance testing requirement ~~option~~. The building shall meet the air leakage standard set forth below as demonstrated by an air leakage test conducted as specified below:

1. Building envelope tightness shall be tested by a party *approved* by the code official. Where required by the code official, the *approved* party shall be independent from both the builder and any other entity responsible for installing the insulation and air barrier and otherwise sealing the building. A written report specifying the

results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and *code official*.

2. ~~Tested~~ The building shall be required to have an air leakage ~~is~~ less than 0.00030 *specific leakage area (SLA)* ~~7 ACH~~ when tested with a blower door at a pressure of 33.5 psf (50 Pa) ~~pascals (0.007 psi)~~. Testing shall occur any time after rough in and after (i) installation of all penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances, and (ii) completion of sealing of the *building thermal envelope* as required in section N1102.4.1.
3. During testing:
   1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed beyond the weather-stripping, caulking and other intended permanent air infiltration control measures;
   2. Dampers shall be closed, but not sealed, including exhaust, intake, makeup air, backdraft, fireplace and flue dampers beyond intended permanent air infiltration control measures;
   3. Interior doors connecting conditioned spaces shall be open, doors connecting to unconditioned spaces closed but not sealed;
   4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
   5. Heating and cooling system(s) shall be turned off;
   6. ~~HVAC ducts systems shall not be sealed; and~~
   7. ~~7.~~ Supply and return registers shall be fully open at the time of the test ~~not be sealed~~.

Exception: Multi-family residential buildings, with more than four dwelling units per building, may be individually exempted from the testing requirement only when meeting all of the following requirements:

1. The exemption is approved by the *code official* after inspection of the sealing of thermal envelope in accordance with section N1102.4.1 and Table N1102.4.2;
2. At least 15% of the units are tested to have an air leakage less than 0.00036 *specific leakage area (SLA)* when tested with a blower door at a pressure of 33.5 psf (50 Pa), with the units to be tested specified by the code official; and
3. The tests demonstrate compliance for such units.

When any tested dwelling unit subject to this exception fails to meet the maximum air leakage requirement stated in Section N1102.4.2.1, then the builder must resolve any leakage problems so that such unit passes the test and then must continue to test each additional dwelling unit in such building until a minimum of three consecutive dwelling units pass the test before the builder can return to testing as specified in Item 2 of this Exception.

N1102.4.2.2 Visual insulation inspection ~~option~~. ~~The items listed in Table N1102.4.2, applicable to the method of construction, are~~ Building envelope insulation installation shall be field verified to meet the Insulation Installation Criteria in Table N1102.4.2. Where required by the code official, an *approved* party independent from the builder and the installer of the insulation, shall inspect the ~~air barrier and~~ insulation; in such case, a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder before interior finish materials are applied.

N1102.4.2.3 Visual air barrier inspection. For any building or dwelling unit not required to be tested under section N1102.4.2.1, building envelope tightness shall be field verified to meet the Air Barrier Criteria in Table N1102.4.2. Where required by the *code official*, an *approved* party independent from the builder and the installer of any air barrier materials, shall inspect the air barrier; in such case, a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder before interior finish materials are applied. In cases where the building or dwelling unit satisfies the testing requirement of section N1102.4.2.1, the *code official* may also require field verification to show that the building meets the Air Barrier Criteria if deemed necessary.

3. Delete Table N1102.4.2 and replace with the following table:

~~TABLE N1102.4.2~~
~~AIR BARRIER AND INSULATION INSPECTION~~

TABLE N1102.4.2
VISUAL AIR BARRIER AND INSULATION INSPECTION

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
General Requirements	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.	A continuous air barrier is installed in the thermal envelope. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.
Ceiling / attic	In any dropped ceiling/soffit, the insulation is substantially aligned with the air barrier.	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access, knee wall door or drop down stair to unconditioned attic is sealed.
Walls	All corners and headers are insulated. Insulation is in substantial contact and continuous alignment with air barrier.	Junction of foundation and sill plate is sealed. Junction of exterior wall and top plate is sealed. Junction of the exterior wall and floor sheathing is sealed. Knee wall is sealed.
Fenestration		Space between fenestration jambs and framing is sealed.
Rim joists	Rim joists are insulated.	Air barrier is installed at the rim joist.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking.	Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls.	Exposed earth in unvented crawlspaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations		Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit; narrow cavities are filled by sprayed/blown insulation.	
Garage separation		Air sealing is provided between the garage and conditioned spaces.
Recessed lighting		Recessed light fixtures installed in the building thermal envelope are airtight, IC rated, and sealed to drywall.
Plumbing and Wiring	Insulation is placed between the exterior of the wall assembly and pipes. Batt insulation is cut and fitted around wiring and plumbing, or sprayed/blown insulation extends between piping and wiring and to the exterior of the wall assembly.	All plumbing and wiring penetrations shall be sealed to the air barrier.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs have insulation filling any gaps or voids between tub or shower walls and unconditioned space.	Exterior walls adjacent to showers and tubs have an air barrier separating the exterior wall from the shower and tubs.
Electrical / phone box on exterior walls	Insulation completely fills voids between the box and exterior sheathing	Air barrier extends behind boxes or air sealed type boxes are installed.

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
Common wall		Air barrier is installed in common wall between dwelling units.
HVAC register boots		HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace		Air barrier is installed on fireplace walls. Fireplace shall have gasketed doors.

4. Revise as follows:

N1103.2.1 Insulation. Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Where all ~~D~~ducts ~~or portions thereof~~ are located completely within *conditioned space* ~~inside the *building thermal envelope*~~, supply ducts shall be insulated to a minimum of R-4.

N1103.2.2 Sealing. All ducts, air handlers, and filter boxes~~, and building cavities used as ducts~~ shall be sealed. Joints and seams shall comply with Section M1601.4 of the *International Residential Code.*

Duct tightness shall be verified by a test performed by a party *approved* by the *code official* after construction is completed. Where required by the code official, testing shall be conducted by an approved party independent from the builder and the installer of the ducts. ~~either of the following:~~ A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and the *code official*.

1. ~~Post-construction test: L~~ As tested, total duct l~~L~~eakage ~~to outdoors~~ shall be less than ~~or equal to 8 cfm (3.78 L/S) per 100 ft^2 (9.29 m^2) of conditioned floor area or a total leakage less than~~ or equal to 6 ~~12~~ cfm (226.5 L/min ~~5.66 L/S~~) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler ~~end closure~~ enclosure. All register boots shall be taped or otherwise sealed during the test.
2. ~~Rough-in test: Total leakage shall be less than or equal to 6 cfm (2.83 L/S) per 100 ft^2 (9.29 m^2) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm (1.89 L/S) per 100 ft^2 (9.29 m^2) of conditioned floor area.~~

Exception~~s~~: ~~Duct tightness test is not required if~~ Where the air handler and all ducts are located within conditioned space, total duct leakage shall not exceed 12 cfm per 100 ft^2 of conditioned floor area when tested as specified above.

N1103.2.3 Building cavities. Building framing cavities shall not be used as ~~supply~~ ducts.

N1103.4 Service water heating. Service hot water piping shall be installed in accordance with Sections 403.4.1 through 403.4.3.

N1103.4.1 Pipe length and Insulation. Service hot water piping shall be no more than a total of 60 linear feet of pipe length to all fixtures being served by one service water heating unit. All service hot water piping shall be insulated to at least R-3 for pipes sized 1" in diameter or less and R-4 for pipes larger than 1" in diameter for the distance between the service water heating equipment to within 5 feet of each fixture connected to the hot water pipe. In addition, the first 5 feet of hot and cold water pipes from the storage tank for non-recirculating service water heating systems shall be insulated to at least R-3 for pipes sized 1" in diameter or less and R-4 for pipes larger than 1" in diameter.

Exception: Hot water distribution systems that supply hot water from one of the following sources (this exception does not apply to portions of hot water distribution systems located below ground or in a mass floor or mass wall in contact with the ground):

1. Condensing gas service water heating equipment,
2. Solar thermal water heating equipment that is designed to provide more than 50% of annual hot water requirements from solar heated water,

3. Heat pump electric service water heating equipment,
4. Tankless demand service gas water heating equipment, or
5. Tankless demand service electric heating equipment, where either: (a) heated water is provided through piping that is insulated to R-3 or (b) there is no more than a total of 15 linear feet of pipe length to all fixtures being served by each unit.

N1103.4.2 Circulating hot water systems. All circulating service hot water piping shall be insulated to at least R-3~~2~~ for pipes sized 1" in diameter or less and R-4 for pipes larger than 1" in diameter. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

N1103.4.3 Heat Traps. Water heating equipment not supplied with integral heat traps and serving non-circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment.

5. Add new text as follows:

N1103.10 *Energy Recovery Ventilation System* and air leakage supplemental requirements. The building shall meet the following the requirements:

1. An *energy recovery ventilation system* shall be installed. For warm humid counties as identified in table N1101.2, a dehumidifier with a built in humidistat shall be installed in addition to the *energy recovery ventilation system*.
2. Building air leakage shall be tested in accordance with the procedure prescribed in Section N1102.4.2.1, except that the air leakage shall not exceed 0.00015 *specific leakage area (SLA)* for all buildings except multifamily, which shall not exceed 0.00018 *specific leakage area (SLA),* when tested with a blower door at a pressure of 33.5 psf (50 Pa) by an *approved* party independent of the builder and any contractors involved in any aspect of sealing the building.

Exceptions:

1. Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20% and meets or exceeds 12.5 EER.
2. Buildings located in climate zones 3, 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15% and cooling equipment that meets or exceeds 12.5 EER.
3. Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20%.
4. In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not commercially available, the equipment with the highest rated efficiency commercially available can be substituted, when *approved* by the *code official*,
5. As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.

Reason: At the 2009 Final Action Hearings, a majority of voting code officials supported proposals to substantially boost energy efficiency of the 2009 IECC's energy efficiency over its 2006 counterpart (including over 60% who voted for the Energy Efficient Codes Coalition's EC14, also known as "The 30% Solution"). Even though some of those votes fell short of the 2/3 majority needed for adoption, the final version of IECC 2009 will boost efficiency by more than 10% *(http://www.thirtypercentsolution.org/solution/EECC-Savings_Analysis-Jan-2009.pdf)*.

This comprehensive proposal builds on the momentum ICC's members set in Minneapolis last year, while simultaneously responding to profound events that are shining a national spotlight on energy codes, the role buildings play in national energy use and the impact both can have on national energy policy.

Specifically, this **Core Package Proposal** was developed by the Energy Efficient Codes Coalition (EECC) to support the ICC (and its I-Code process) in reaching the energy savings targets proposed by many (including DOE) and being considered by Congress in several pending bills. Our proposal incorporates currently available technologies that are being included in new home construction every day and is designed to make the code as simple and clear as possible (to avoid undue burdens on code officials) and to be consistent with current federal law regarding efficient equipment covered by federal standards. Some of the major energy-saving improvements captured in this comprehensive package include:

(1) Improved envelope measures including better fenestration and insulation in most climate zones;
(2) Comprehensive air sealing, testing, and insulation inspection;
(3) Improved sealing and testing requirements for ducts;
(4) Requirements for efficient hot water service distribution system or equipment; and
(5) Requirements for reduced envelope infiltration along with energy recovery ventilation, or else more efficient HVAC equipment.

The elements of this and other individual EECC proposals have been reviewed by energy efficiency experts, building scientists and many others, and improved based on their comments. Individual EECC supporters are also submitting each element of this package, along with a number of other proposals, in the form of individual proposals to strengthen energy efficiency in both the *IECC* and *IRC*. The detailed reasons supporting the individual elements of this proposal can be found in these individual proposals, which are incorporated by reference into this reason statement.

We estimate that this Core Package Proposal will result in a 2012 IECC that is at least 20% more energy efficient than the 2009 IECC (and more than 30% more efficient than the 2006 IECC). Taken together with the efficiency gains in the 2009 IECC, adoption of this proposal by the full ICC will produce a 2012 IECC that comfortably exceeds Congress' initial 30% savings target (compared with IECC 2006) and puts the ICC on the path to the next target of 50% savings.

EECC is submitting this proposal to both the *IRC* and the *IECC*, in order to assure consistency between the two codes. However, EECC believes that America needs a single model energy code, the IECC (the only I-Code recognized in federal statutes)**. For this reason,** EECC is also submitting a separate proposal that would incorporate the IECC by reference in the IRC Chapter 11 (as is currently done with the International Building Code IBC).

Since September of 2008, three events have occurred that could transform the ICC's residential model energy code:

- The US Conference of Mayors and other elected officials charged with establishing and implementing national, state and local energy policies have begun to recognize the profound impact that the model energy codes can have on achieving local, regional, and national goals for sustainable economic growth, and have endorsed the concept of a 30% improvement in model energy codes. Several city and state governments have adopted their own policies to achieve at least 30% efficiency improvements in new buildings.
- Congress has also jumped into the energy code arena with legislative carrots and sticks designed to speed the rate of energy efficiency improvements in the I-Code and their adoption by state and local jurisdictions. First, Congress linked billions of dollars in stimulus funds to each state's adoption of the 2009 IECC (or equivalent), followed by the introduction of legislation that sets targets of 30%, then 50% and beyond, for ICC to meet or exceed. The proposed legislation also authorizes hundreds of millions of federal dollars for code development bodies and state and local governments for adoption, implementation and compliance with codes that meet these goals.
- Finally, the ICC's new schedule for I-Code development reduces the number of opportunities to meet these targets being considered in Congress to once in each three-year code cycle.

As the growing national interest in the ICC and its model energy code attests, our nation's energy policy is in a period of transition. As states scramble to meet increasing peak energy demands and to curb pollution and greenhouse gases, there has been an increased focus on energy efficiency at all levels of government and the private sector. Federal and state governments recognize that energy efficiency is the most cost-effective means of meeting increasing energy demand. The time has come to complete the transition to at least a 30% more efficient residential energy code before 2012, and this proposal will help to bring that about.

The Energy Efficient Codes Coalition (website: www.thirtypercentsolution.org) was established to boost the energy efficiency of the IECC, and its supporters include all forms of electric utilities, low-income homeowner groups, a wide-range of regional and national energy efficiency and environmental organizations, many levels of government, business and labor coalitions, and as well as many of the typical participants in the ICC process.

Cost Impact: This proposal will increase the cost of construction.

ICCFILENAME: FAY-EC-1-101

Public Hearing Results

PART II-IRC B/E
Committee Action: Disapproved

Committee Reason: This proposal provides aggressive energy conservation measures that would limit the flexibility in the design of the building in all areas. The committee prefers the flexibility provided by EC16.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	Glazed Fenestration SHGC[b,e]	Ceiling R-Value	Wood Frame Wall R-Value[h]	Mass Wall R-Value[i]	Basement [c] Wall R-Value	Crawl Space [c] Wall R-Value
1	NR	0.25[~~j~~]	30	13	3/4	0	0
2	0.40	0.25[~~j~~]	38	13	4/6	0	0
3	0.35	0.25[e~~,j~~]	38	20 or 13+5	8/13	5/13[f]	5/13
4 except Marine	0.35	NR	49	20 or 13+5	8/13	10/13	10/13

Climate Zone	Fenestration U-Factor	Glazed Fenestration SHGC[b,e]	Ceiling R-Value	Wood Frame Wall R-Value[h]	Mass Wall R-Value[i]	Basement [c] Wall R-Value	Crawl Space [c] Wall R-Value
5 and Marine 4	0.32	NR	49	20 or 13+5	13/17	15/19	15/19
6	0.32	NR	49	20+5 or 13+10	15/20	15/19	15/19
7 and 8	0.32	NR	49	20+5 or 13+10	19/21	15/19	15/19

h. First value is cavity insulation, second is continuous insulation so"13+5" means R-13 cavity insulation plus R-5 ~~insulated sheathing~~ continuous insulation. If structural sheathing covers ~~25~~ 40% or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.~~R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing or at least R-2.~~

(*Portions of code change proposal not shown remain unchanged*).

Commenter's Reason: NOTE TO ICC STAFF: The EC25 proposal does not make changes to footnote h, but it makes a significant change to the application of footnote h by introducing R-10 continuous insulation into the table. Thus, footnote h without a corrective/coordinating change would allow R2 to be used instead of R10 (not just R5 as the current table is limited). Thus, the existing problem with the "R2 loophole" in footnote h is greatly expanded in EC25.
This public comment achieves two things:

1. corrects a severe problem with footnote 'h' that erodes the energy code, regardless of which version of the energy code is approved; and,
2. provides a rational and flexible application of footnote 'h' in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote 'h' is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote 'h', the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote 'h' allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Public Comment 2:

Mark Halverson, APA, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	Glazed Fenestration SHGC[b,e]	Ceiling R-Value	Wood Frame Wall R-Value[h]	Mass Wall R-Value[i]	Basement [c] Wall R-Value	Crawl Space [c] Wall R-Value
1	NR	0.25~~[j]~~	30	13	3/4	0	0
2	0.40	0.25~~[j]~~	38	13	4/6	0	0
3	0.35	0.25 [e,~~j~~]	38	20 or 13+5	8/13	5/13[f]	5/13
4 except Marine	0.35	NR	49	20 or 13+5	8/13	10/13	10/13
5 and Marine 4	0.32	NR	49	20 or 13+5	13/17	15/19	15/19
6	0.32	NR	49	20+5 or 13+10	15/20	15/19	15/19
7 and 8	0.32	NR	49	20+5 or 13+10	19/21	15/19	15/19

h. First value is cavity insulation, second is continuous insulation or insulating sheathing, so "13+5" means R-13 cavity insulation plus R-5 ~~insulated~~ continuous insulation or insulating sheathing; "20+5" means R-20 cavity insulation in addition to a layer of R-5 continuous or insulating sheathing; and "13+10" means R-13 cavity insulation in addition to a layer of R-10 continuous or insulating sheathing. ~~If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If~~ In locations where structural sheathing ~~covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2~~ is used, continuous insulation or insulating sheathing shall be permitted to be reduced by no more than R-2.
(*Portions of code changed proposal not shown remain unchanged*).

Commenter's Reason: This modification simplifies and clarifies footnote h. of Table 402.1.1 when both R-5 and R-10 continuous sheathing or insulating sheathing is required regardless of the amount of structural sheathing that is used. The amount of structural sheathing needed to adequately brace the walls is not limited, so the structural capacity of the wall is not impacted. This modification also assures that all opaque wall areas are covered by continuous insulation or insulating sheathing while maintaining the same combined sheathing thickness in all the wall envelope areas.

Instead of a fixed minimum requirement of R-2 continuous sheathing as before, a reduction of R-2 sheathing from the specified amount works for both R-5 or R10 continuous sheathing requirements. A R-5 requirement reduced by R-2 yields a R-3 continuous insulation applied over the structural sheathing and a R-10 reduced by R-2 yields a R-8 continuous insulation over the structural sheathing.

We ask that the code body support the Committee's recommendation for approval as modified by this Public Comment.

Public Comment 3:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

SECTION R202
GENERAL DEFINITIONS

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. ~~Such systems include equipment referred to as an "energy recovery ventilator" (ERV) or as a "heat recovery ventilator" (HRV).~~

~~**SPECIFIC LEAKAGE AREA (SLA).** The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where L and CFA are in the same units.~~

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	Glazed Fenestration SHGC[b,e]	Ceiling R-Value	Wood Frame Wall R-Value[h]	Mass Wall R-Value[i]	Basement [c] Wall R-Value	Crawl Space [c] Wall R-Value
1	NR	0.25[~~j~~]	30	13	3/4	0	0
2	0.40	0.25[~~j~~]	38	13	4/6	0	0
3	0.35	0.25[e,~~j~~]	38	20 or 13+5	8/13	5/13[f]	5/13
4 except Marine	0.35	NR	49	20 or 13+5	8/13	10/13	10/13
5 and Marine 4	0.32	NR	49	20 or 13+5	13/17	15/19	15/19
6	0.32	NR	49	20+5 or 13+10	15/20	15/19	15/19
7 and 8	0.32	NR	49	20+5 or 13+10	19/21	15/19	15/19

h. First value is cavity insulation, second is continuous insulation or insulating sheathing, so "13+5" means R-13 cavity insulation plus R-5 ~~insulated sheathing~~ continuous insulation. ~~If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~

TABLE N1102.1.2
EQUIVALENT U-FACTORS[a]

Climate Zone	Fenestration U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor[b]	Basement Wall U-Factor [d]	Crawl Space Wall U-Factor [c]
1	0.50	0.035	0.082	0.197	0.360	0.477
2	0.40 [i]	0.030	0.082	0.165	0.360	0.477
3	0.35 [i]	0.030	0.082	0.098	0.091[c]	0.136
4 except Marine	0.35	0.026	0.082	0.098	0.059	0.065
5 and Marine 4	0.32	0.026	0.060	0.082	0.050	0.055
6	0.32	0.026	0.048	0.060	0.050	0.055
7 and 8	0.32	0.026	0.048	0.057	0.050	0.055

TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

Wood Frame R-Value Requirement	Cold-Formed Steel Equivalent R-Value[a]
Steel-Framed Wall	
R-13	R-13+5 or R-15+4 or R-21+3 or R-0+10
R-19	R-13+9 or R-19+8 or R-25+7
R-20	R-13+10 or R-19+8 or R-25+7
R-21	R-13+10 or R-19+9 or R-25+8
R-20+5	R-13+15 or R-19+14 or R-25+13

N1102.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections N1102.4.1.1, N1102.4.1.2, N1102.4.1.4 and N1102.4.1.4 and be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.~~

1. ~~All joints, seams and penetrations.~~
2. ~~Site-built windows, doors and skylights.~~
3. ~~Openings between window and door assemblies and their respective jambs and framing.~~
4. ~~Utility penetrations.~~
5. ~~Dropped ceilings or chases adjacent to the thermal envelope.~~
6. ~~Knee walls.~~
7. ~~Walls and ceilings separating the garage from conditioned spaces.~~
8. ~~Behind tubs and showers on exterior walls.~~
9. ~~Common walls between dwelling units.~~
10. ~~Attic access openings.~~
11. ~~Rim joist junction.~~
12. ~~Other sources of infiltration.~~

N1102.4.1.1 Installation ~~**N1102.4.2 Air sealing and insulation.**~~ The components of the *building thermal envelope* as listed in Table N1102.4.1.1 ~~N1102.4.2~~ shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table N1102.4.1.1 ~~N1102.4.2~~, as applicable to the method of construction. Building envelope air tightness and insulation installation shall be demonstrated to comply with the requirements established by Section N1102.4.1.2 ~~N1102.4.2.1~~ and N1102.4.1.3 ~~N1102.4.2.2~~.

N1102.4.1.2 ~~**N1102.4.2.1**~~ **Performance testing requirement.** The building shall meet the air leakage standard set forth below as demonstrated by an air leakage test conducted as specified below:

1. Building envelope tightness shall be tested by a party *approved* by the code official. ~~Where required by the code official, the *approved* party shall be independent from both the builder and any other entity responsible for installing the insulation and air barrier and otherwise sealing the building.~~ A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and *code official*.

2. The building shall be required to have an air leakage less than ~~0.00030 *specific leakage area (SLA)*~~ five air changes per hour (ACH) when tested with a blower door at a pressure of ~~33.5 psf~~ 0.2 inches w.g. (50 Pa). Testing shall occur any time after rough in and after (i) installation of all penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances, and (ii) completion of sealing of the *building thermal envelope* as required in section N1102.4.1.

3. During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed beyond the weather-stripping, caulking and other intended permanent air infiltration control measures;
2. Dampers shall be closed, but not sealed, including exhaust, intake, makeup air, backdraft, fireplace and flue dampers beyond intended permanent air infiltration control measures;
3. Interior doors connecting conditioned spaces shall be open, doors connecting to unconditioned spaces closed but not sealed;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s) shall be turned off;
6. Supply and return registers shall be fully open at the time of the test.

Exception: Multi-family residential buildings, with more than four dwelling units per building, may be individually exempted from the testing requirement only when meeting all of the following requirements:

1. The exemption is approved by the *code official* after inspection of the sealing of thermal envelope in accordance with section N1102.4.1 and Table N1102.4.1.1 ~~N1102.4.2~~;
2. At least 15% of the units are tested and each tested unit has to have an air leakage less than ~~0.00036 *specific leakage area (SLA)*~~ seven air changes per hour (ACH) when tested with a blower door at a pressure of ~~33.5 psf~~ 0.2 inches w.g. (50 Pa), with the units to be tested specified by the code official; and
3. The tests demonstrate compliance for such units.

When any tested dwelling unit subject to this exception fails to meet the maximum air leakage requirement stated in this Exception ~~Section N1102.4.2.1~~, then the builder must resolve any leakage problems so that such unit passes the test and then must continue to test each additional dwelling unit in such building until a minimum of three consecutive dwelling units pass the test before the builder can return to testing as specified in Item 2 of this Exception.

N1102.4.1.3 ~~**N1102.4.2.2**~~ **Visual insulation inspection.** Building envelope insulation installation shall be inspected and field verified to meet the Insulation Installation Criteria in Table N1102.4.1.1 ~~N1102.4.2~~ before interior finish materials are installed. ~~Where required by t~~ The code official~~,~~ or an *approved* party ~~independent from the builder and the installer of the insulation,~~ shall inspect the insulation~~;~~. Where an *approved* party conducts the inspection, ~~in such case,~~ a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder ~~before interior finish materials are applied~~.

N1102.4.1.4 ~~**N1102.4.2.3**~~ **Visual air barrier inspection.** For any building or dwelling unit not required to be tested under section N1102.4.2.1, building envelope tightness shall be field verified to meet the Air Barrier Criteria in Table N1102.4.1.1 ~~N1102.4.2~~. Visual air barrier inspection shall be completed prior to the installation of air permeable insulation. ~~Where required by t~~ The code official~~,~~ or an *approved* party ~~independent from the builder and the installer of any air barrier materials,~~ shall inspect the air barrier~~;~~. Where an *approved* party conducts the inspection, ~~in such case,~~ a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder before interior finish materials are applied. In cases where the building or dwelling unit satisfies the testing requirement of section N1102.4.1.2 ~~N1102.4.2.1~~, the *code official* may also require field verification to show that the building meets the Air Barrier Criteria if deemed necessary.

TABLE N1102.4.1.1
VISUAL AIR BARRIER AND INSULATION INSPECTION

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
General Requirements	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.	A continuous air barrier is installed in the thermal envelope. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.
Ceiling / attic	In any dropped ceiling/soffit, the insulation is substantially aligned with the air barrier.	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access, knee wall door or drop down stair to unconditioned attic is sealed.
Walls	All corners and headers are insulated. Insulation is in substantial contact and continuous alignment with air barrier.	Junction of foundation and sill plate is sealed. Junction of exterior wall and top plate is sealed. Junction of the exterior wall and floor sheathing is sealed. Knee wall is sealed.
Fenestration		Space between fenestration jambs and framing is sealed.
Rim joists	Rim joists are insulated.	Air barrier is installed at the rim joist.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking.	Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls.	Exposed earth in unvented crawlspaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations		Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit; narrow cavities are filled by sprayed/blown insulation.	
Garage separation		Air sealing is provided between the garage and conditioned spaces.
Recessed lighting		Recessed light fixtures installed in the building thermal envelope are airtight, IC rated, and sealed to drywall.
Plumbing and Wiring	Insulation is placed between the exterior of the wall assembly and pipes. Batt insulation is cut and fitted around wiring and plumbing, or sprayed/blown insulation extends between piping and wiring and to the exterior of the wall assembly.	All plumbing and wiring penetrations shall be sealed to the air barrier.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs have insulation filling any gaps or voids between tub or shower walls and unconditioned space.	Exterior walls adjacent to showers and tubs have an air barrier separating the exterior wall from the shower and tubs.
Electrical / phone box on exterior walls	Insulation completely fills voids between the box and exterior sheathing	Air barrier extends behind boxes or air sealed type boxes are installed.
Common wall		Air barrier is installed in common wall between dwelling units.
HVAC register boots		HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace		Air barrier is installed on fireplace walls. Fireplace shall have gasketed doors.

N1103.2.1 Insulation. Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Where all ducts are located completely within *conditioned space,* supply ducts shall be insulated to a minimum of R-4.

N1103.2.2 Sealing. All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4 of the *International Residential Code.*

Duct tightness shall be verified by a test performed by a party *approved* by the *code official* after construction is completed. Where required by the code official, testing shall be conducted by an approved party independent from the builder and the installer of the ducts. A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and the *code official*.

As tested, total duct leakage shall be less than or equal to 4 6 cfm (113.3 L/min) (226.5 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* 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. All register boots shall be taped or otherwise sealed during the test.

Exception: Where the air handler and all ducts are located within conditioned space, total duct leakage shall not exceed 8 12 cfm (226,5 L/min) per 100 ft^2 (9.29 m^2)of conditioned floor area when tested as specified above.

N1103.2.3 Building cavities. Building framing cavities shall not be used as ducts.

N1103.4 Service water heating. Service hot water piping shall be installed in accordance with Sections 403.4.1 through 403.4.3.

N1103.4.1 Pipe length and Insulation. Service hot water piping shall be no more than a total of 60 linear feet of pipe length to all fixtures being served by one service water heating unit. All service hot water piping shall be insulated to at least R-3 for pipes sized 1" in diameter or less and R-4 for pipes larger than 1" in diameter for the distance between the service water heating equipment to within 5 feet of each fixture connected to the hot water pipe. In addition, the first 5 feet of hot and cold water pipes from the storage tank for non-recirculating service water heating systems shall be insulated to at least R-3 for pipes sized 1" in diameter or less and R-4 for pipes larger than 1" in diameter.

Exception: Hot water distribution systems that supply hot water from one of the following sources (this exception does not apply to portions of hot water distribution systems located below ground or in a mass floor or mass wall in contact with the ground):

1. Condensing gas service water heating equipment,
2. Solar thermal water heating equipment that is designed to provide more than 50% of annual hot water requirements from solar heated water,
3. Heat pump electric service water heating equipment,
4. Tankless demand service gas water heating equipment, or
5. Tankless demand service electric heating equipment, where either: (a) heated water is provided through piping that is insulated to R-3 or (b) there is no more than a total of 15 linear feet of pipe length to all fixtures being served by each unit.

N1103.4.2 Circulating hot water systems. All circulating service hot water piping shall be insulated to at least R-3 for pipes sized 1" in diameter or less and R-4 for pipes larger than 1" in diameter. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

N1103.4.3 Heat Traps. Water heating equipment not supplied with integral heat traps and serving non-circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment.

N1103.10 *Energy Recovery Ventilation System* and air leakage supplemental requirements. The building shall meet the following the requirements:

1. An *energy recovery ventilation system* shall be installed. For warm humid counties as identified in table N1101.2, a dehumidifier with a built-in humidistat shall be installed in addition to the *energy recovery ventilation system*.
2. Building air leakage shall be tested in accordance with the procedure prescribed in Section N1102.4.2.1, except that the air leakage shall not exceed 0.00015 *specific leakage area (SLA)* for all buildings except multifamily, which shall not exceed 0.00018 *specific leakage area (SLA),* when tested with a blower door at a pressure of 33.5 psf (50 Pa) by an *approved* party independent of the builder and any contractors involved in any aspect of sealing the building.

Exceptions:

1. Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20% and meets or exceeds 12.5 EER.
2. Buildings located in climate zones 3, 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15% and cooling equipment that meets or exceeds 12.5 EER.
3. Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20%.
4. In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not commercially available, the equipment with the highest rated efficiency commercially available can be substituted, when *approved* by the *code official*,
5. As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.

Commenter's Reason: *EC25 should be approved as modified by this public comment.*

EC25 (as modified) is the heart of "The 30% Solution 2012," which has been authored by the members of the EECC, including stakeholders from government, utilities, environmental groups, energy efficiency advocates, and others. See www.thirtypercentsolution.org. EC25, taken together with the other proposals authored by the EECC, constitute the most substantial package of residential energy savings available to voting ICC Government Members at this Final Action Hearing.

The elements of "The 30% Solution 2012" incorporate readily available "state-of-the-shelf" technologies and reasonable building practices that are proven to generate substantial energy cost savings to homeowners. In fact, we have modified EC25 and other proposals to build upon the components of US DOE's EC13, which we supported and which was already recommended for approval by the IECC Code Development Committee by an overwhelming margin.

Adoption of EC25 and the other EECC proposals in "The 30% Solution 2012" would save substantial amounts of energy—savings are expected to exceed the 30% goal promoted by the U.S. Department of Energy and other national and state policy-makers. We support the ICC and I-Code development process and believe that it is the best approach to establishing a national model residential energy code to achieve national targets for building energy efficiency.

Turning to the details of the proposal, the proposed modifications to EC25 in this public comment add clarity and further simplify the IECC and IRC energy requirements. Our modifications eliminate potential preemption challenges that could jeopardize part, or even all, of the ultimate 2012 IECC that is published by ICC. These improvements to EC25 will make the code easier to understand, adopt and enforce.

As noted above, we have carefully modified EC25 to be consistent with and build upon the IECC Development Committee-recommended DOE proposal EC13 *and* the proposed modifications we have submitted in our public comment to that proposal. As a result, it is our hope that voting governmental officials will vote at the Final Action Hearings to approve:

(1) EC13, as modified by our public comment,

(2) EC25, as modified by this public comment, and finally,

(3) The individual proposals submitted by EECC, as well as and other proposals that will further improve energy efficiency under the code.

All EECC proposals have been designed to work within the existing framework of the IECC and IRC so that jurisdictions can easily update code requirements without substantial changes to training and code enforcement programs.

Our modification to EC25 responds to concerns raised at the Development Committee hearings in Baltimore and takes the following additional steps to ensure a 2012 IECC and IRC that are readily adoptable by jurisdictions and that are consistent with other code changes:

1. **ERV requirements are removed from EC25, along with exceptions for homes with high-efficiency equipment -- ERVs and improved thermal distribution systems are addressed in EECC's modification to its proposal, EC126, but without preemption issues.** EC25 incorporated an innovative approach to solve the inability of jurisdictions to set more stringent standards for HVAC equipment because of federal preemption. Although we do not believe that this approach would be preempted, one stakeholder at the Code Development Committee hearings in October claimed that the improvements may be preempted, and if adopted, could subject the 2012 IECC to lengthy litigation and delay. To ensure a rapid deployment of the 2012 IECC, we have removed the energy recovery ventilator (ERV) requirement from this proposal, along with the exceptions based on high-efficiency HVAC.
2. **Service hot water heating system pipe length and insulation requirements are also removed from EC25, along with exceptions specifying more stringent water heating unit options -- an improved version is incorporated in EECC's modification to its proposal EC114, but without equipment preemption issues.** As with the ERV/high-efficiency HVAC alternatives, some concern was raised at the Committee Hearings about potential legal challenges to these provisions on the basis of preemption. Improved insulation requirements for circulating hot water systems remain in this proposal.
3. **Air leakage metrics are changed from SLA to ACH for consistency with other proposals.** While we believe that Specific Leakage Area (SLA) is a more accurate metric for air leakage, in an effort to maintain consistency with other proposals at the Final Action Hearing, in particular DOE's proposed EC13, we have updated references in this modification to air changes per hour (ACH).
4. **Air leakage testing requirement is set at 5ACH in all zones.** The modifications above adopt an air leakage testing requirement in all climate zones that allows a maximum of 5 ACH with a limited exception for multi-family residential buildings.
5. **Duct leakage testing requirement is set at 4cfm, with exceptions.** The modified EC25 requires that ducts be tested to a leakage rate of no more than 4cfm, except where air handler and all ducts are located within conditioned space, in which case leakage shall not exceed 8cfm. The leakage requirement has also been reclassified as prescriptive (rather than mandatory), so that if 4cfm is not possible in a particular circumstance, the performance path may be utilized to show compliance.
6. **Loophole in Table 402.1.1, footnote h is closed.** The Code Development Committee heard a good deal of debate about how to properly interpret and/or correct footnote h. A revised version of the footnote, designed to address enhanced wall-bracing requirements in the code, has been incorporated into EC25's Table 402.1.1. Code officials have reported that the footnote has been used by some as a complete exemption from the use of continuous insulation, and given the increased wall R-values in many climate zones proposed EC25 and other proposals, the potential energy efficiency losses from such a broad loophole are substantial. The updated footnote h clarifies that the use of structural sheathing should not reduce the continuous insulation R-value.

The above modification also retains a number of improvements proposed in the original EC25:

1. **Thermal building envelope requirements are improved in all zones.** EC25 retains its improvements to the thermal building envelope, including comprehensive improvements to fenestration and insulation nationwide. As the most permanent elements of the building, the thermal envelope components, form the core of energy savings for the lifetime of the home. New construction is the easiest and most cost-effective time to make improvements to the building thermal envelope. Most of these upgrades were already recommended for approval as individual code proposals by the IECC Committee; this modification captures all of them in one place.
2. **Insulation installation/air barrier criteria table is simplified.** EC25 also retains its useful organization of insulation and air barrier requirements into a bifurcated table. This will greatly simplify code compliance and will streamline enforcement for code officials, by properly identifying installation and inspection requirements and by eliminating the requirement for air barrier inspection where the home's tested air leakage value meets the code requirement.

IRC and IECC requirements are consistent. The EECC wholeheartedly supports RE4, and we believe that RE4 will settle the IRC/IECC consistency problem for good. If RE4 is successful at the Final Action Hearing, Part II will be unnecessary. However, in case RE4 (or a similar proposal) is not successful, we are including changes to the IRC that will mirror the requirements in the IECC.

Public Comment 4:

Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, and AGC Flat Glass North America, Inc, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	Glazed Fenestration SHGC[b,e]	Ceiling R-Value	Wood Frame Wall R-Value[h]	Mass Wall R-Value[i]	Basement [c] Wall R-Value	Crawl Space [c] Wall R-Value
1	NR	0.25~~[j]~~	30	13	3/4	0	0
2	0.40	0.25~~[j]~~	38	13	4/6	0	0
3	0.35	0.25 [e,~~j~~]	38	20 or 13+5	8/13	5/13[f]	5/13
4 except Marine	0.35	NR	49	20 or 13+5	8/13	10/13	10/13
5 and Marine 4	~~0.32~~ 0.30	NR	49	20 or 13+5	13/17	15/19	15/19
6	~~0.32~~ 0.30	NR	49	20+5 or 13+10	15/20	15/19	15/19
7 and 8	~~0.32~~ 0.30	NR	49	20+5 or 13+10	19/21	15/19	15/19

h. First value is cavity insulation, second is continuous insulation or insulating sheathing, so "13+5" means R-13 cavity insulation plus R-5 ~~insulated~~ continuous insulation or insulating sheathing; "20+5" means R-20 cavity insulation in addition to a layer of R-5 continuous or insulating sheathing; and "13+10" means R-13 cavity insulation in addition to a layer of R-10 continuous or insulating sheathing. ~~If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If~~ In locations where structural sheathing ~~covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2~~ is used, continuous insulation or insulating sheathing shall be permitted to be reduced by no more than R-2.

N1102.3.3 U-factor and SHGC alternative. Window assemblies having a U-factor of 0.31 and SHGC greater than or equal to 0.35 or a U-factor of 0.32 and SHGC greater than or equal to 0.40 shall be permitted to satisfy the requirements of Table 402.1.1 in Climate Zones 5, 6, 7 and 8. For compliance with this section, default SHGC values from Table 303.1.3(3) shall not be permitted.

(Portions of code change not shown remain unchanged)

Commenter's Reason: EC25 proposes to reduce SHGC in Climate Zones 1, 2 and 3 to 0.25. Currently, there are no prescriptive limits on the use of SHGC in Climate Zones 4-8. Windows with a 0.25 SHGC not only block 75% of the sun's energy, they also reduce the amount of visible light that will pass through them. If EC25 is adopted, then it is likely that manufacturers of 0.25 SHGC glazing will not only market the use of 0.25 SHGC windows in Climate Zones 1-3, but they will also market it in the adjoining climate zones 4-8 where no prescriptive limit on SHGC exists. Such an inappropriate use of an ultra-low 0.25 glass in Climate Zones 4, 5, 6, 7 or 8 would increase winter heating loads by reason of the amount of solar gain they block and it would increase electric loads in those Climate Zones by reason of the amount of visible light such low SHGC glass would block from homes.

If EC 25 is adopted, the Energy Star criteria which mandates a lower, 0.30 U-factor but matches windows that have progressively higher U-factors of 0.31 and 0.32 with windows that have SHGCs ≥0.35 and ≥ 0.40, respectively, should be allowed as an alternative to the ability of some window manufacturers to market inappropriately low 0.25 SHGC glass in these northern climate zones. Adopting this modification would promote the use of Energy Star labeled windows as an alternative in these northern climates.

Final Action: AS AM AMPC____ D

EC27-09/10-PART I

Tables 402.1.1, 402.1.3 and 402.2.5

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART I – IECC

Revise as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	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	CRAWL SPACE[c] WALL *R*-VALUE
1	~~1.20~~ NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	~~0.65~~ 0.50 j	0.65 ~~0.75~~	0.30	30	13	4 / 6	13	0	0	0
3	~~0.50~~ 0.40[j]	0.55 ~~0.65~~	0.30[e]	~~30~~38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55 ~~0.60~~	NR	38	~~13~~ 20 or 13+5g[h]	~~5 / 10~~ 8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	~~38~~49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	49	20+5 or 13+~~5~~ 10[h]	15 / ~~19~~ 20	30[g]	15/19	10,4ft	10/13
7 and 8	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	49	~~21~~ 20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. 15/19" means R-15 continuous ~~insulated sheathing~~ insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous ~~insulated sheathing~~ insulation on the interior or exterior of the home. "10/13" means R-10 continuous ~~insulated sheathing~~ insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.

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 301.1 and Table 301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

i. The second R-value applies when more than half the insulation is on the interior of the mass wall.

j. For impact rated fenestration in wind-borne debris regions ~~complying with Section R301.2.1.2 of the IRC or Section 1608.1.2 of the IBC~~, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

TABLE 402.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	~~1.20~~ 0.65	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	~~0.65~~ 0.50	~~0.75~~ 0.65	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.50~~ 0.40	~~0.65~~ 0.55	~~0.035~~0.030	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	~~0.60~~ 0.55	0.030	~~0.082~~ 0.057	~~0.141~~ 0.098	0.047	0.059	0.065
5 and Marine 4	~~0.35~~ 0.32	~~0.60~~ 0.55	~~0.030~~0.026	0.057	0.082	0.033	0.059	0.065
6	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	~~0.057~~ 0.048	0.060	0.033	0.050	0.065
7 and 8	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	~~0.057~~ 0.048	0.057	0.028	0.050	0.065

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.10 in Climate Zone 4 except Marine, 0.087 in zone 5 and Marine 4, and the same as the frame wall U-factor in Marine zone 4 and zones 5 through 8.
c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.2.

TABLE 402.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(*R*-VALUE)

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL 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
R-13	R -13+5 o rR-15+4 or R-21+3 or R-0+10
R-19	R -13+9 or R-19+8 or R-25+7
R-20 or R-21	R-13+10 or R-19+9 or R-25+8
R-20+5	R-13+15 or R-19+14 or R-25+13
	Steel Joist Floor
R-13	R-19 in 2×6; R-19+6 in 2×8 or 2×10
R-19	R-19+6 in 2×6; R-19+12 in 2×8 or 2×10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.

Reason: The proposed changes improve the thermal integrity of the building envelope by decreasing the allowed U-factors for several building components that are currently below their reasonable potential in some climate zones. Improvements in available technologies and the demonstrated viability of the proposed levels in programs such as Energy Star, Building America, and other beyond-code efforts make these changes viable improvements in the context of the current and increasing need for lower energy consumption by buildings in the U.S.

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

ICCFILENAME: MAJETTE-EC-70-T. 402-IRC T. N1102-

Public Hearing Results

PART I - IECC
Committee Action: Approved as Modified

Modify proposal as follows:

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.

Committee Reason: This is a companion change with EC13 that adds to the energy conservation stringency of the IECC. The modification is simply to use correct terminology in the footnote.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, US Department of Energy, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	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	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50 [j]	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[j]	0.55	0.30[e]	38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55	NR	38	20 or 13+5g[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15 /20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. 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. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.
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 301.1 and Table 301.1.
h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation ~~or~~ , insulating sheathing, or insulated siding. ~~If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.~~
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
i. The second R-value applies when more than half the insulation is on the interior of the mass wall.
j. For impact rated fenestration in wind-borne debris regions, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

TABLE 402.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	0.65	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.50	0.65	0.035	0.082	0.165	0.064	0.360	0.477
3	0.40	0.55	0.030	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	0.55	0.030	0.057	0.098	0.047	0.059	0.065
5 and Marine 4	0.32	0.55	0.026	0.057	0.082	0.033	0.059	0.065
6	0.32	0.55	0.026	0.048	0.060	0.033	0.050	0.065
7 and 8	0.32	0.55	0.026	0.048	0.057	0.028	0.050	0.065

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in Climate Zone 1, 0.14 in ~~Climate~~ Zone 2, 0.12 in ~~Climate~~ Zone 3, ~~0.10~~ 0.087 in ~~Climate~~ Zone 4 except Marine, ~~0.087~~ 0.065 in zone 5 and Marine 4, and 0.057 in zones 6 ~~and the same as the frame wall U-factor in Marine zone 4 and zones 5~~ through 8.
c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.2.

(*Portions of code change proposal not shown remain unchanged*)

Commenter's Reason: The Department of Energy originally proposed the text currently in footnote h in a previous code development cycle to provide guidance on how much structural sheathing was allowed to displace insulating sheathing (in terms of percent of exterior wall surface area) without failing to comply with the insulation requirements of the IECC and IRC. This was viewed as a compromise to allow a moderate amount of structural sheathing typically at corners of walls while still requiring most of the wall to be covered by continuous insulation.

This footnote has caused confusion for code users. Staff at the DOE Building Energy Codes Program have received a number of requests from code users who couldn't figure out this footnote. There has been a failure in the code development process to craft clearer code language despite multiple attempts with the best intentions of all involved. Additionally, both the insulation requirements and the structural bracing requirements in the I-codes have become more complicated in recent years, making it even more difficult to address this issue in footnote. Therefore, DOE has no choice but to recommend that all of footnote h be deleted other than the first sentence. The term "continuous insulation" proposed here is a generic term that was used in several approved code changes in the initial action hearings.

The second revision to EC27 proposed here is to correct the mass wall insulation requirement in footnote b of IECC Table 402.1.3 and IRC Table N1102.1.2. The original EC27 proposal provided two different and conflicting requirements for Climate zone 5 and Marine 4. The proposed levels here give a modest credit to mass walls compared to frame walls.

Public Comment 2:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Add the following definition:

<u>**CONTINUOUS INSULATION**. Insulation installed continuously across all structural members on the interior, exterior, or integral to any opaque surface of the building envelope, without intervening vented air spaces or thermal bridges other than fasteners and service openings.</u>

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This proposal and various other proposals and modifications from the code development hearings use or introduce the term, "continuous insulation", but the term is not defined. This public comment corrects that problem and provides needed clarification of the meaning of continuous insulation to ensure proper application in compliance with the intent of the energy code.

ASHRAE 90.1 defines continuous insulation as "insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope." This definition is adopted in this PC for sake of consistency and is further improved to clarify an important concern with the proper and consistent characterization of continuous insulation. The ASHRAE definition addresses a concern with thermal bridging but does not address the similar concern with intervening vented air spaces which can create a disconnect of continuous insulation thermal resistance such that its contribution to a layered wall assembly R-value cannot be simply summed. Thus, wording is included in the definition to address this concern. Air exchange rates for vented airspaces behind claddings can exceed 90 air-changes per hour (see references 1 and 2) which significantly impacts the R-value of the air-space or disconnects the R-value of material on the exterior side of the airspace. A robust definition for continuous insulation is needed in the IECC.

References:

1. Straube, J. and Finch, G. (2009). Ventilated Wall Claddings: Review, Field Performance, and Hygrothermal Modeling, Research Report – 0907, Building Science Press, www.buildingscience.com.
2. Salonvarra, M., Karagiozis, A.N., Pazera, M., Miller W. (2007). "Air Cavities Behind Claddings – What Have We Learned?", Buildings X, ASHRAE

Public Comment 3:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	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	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50 [j]	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[j]	0.55	0.30[e]	38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55	NR	38	20 or 13+5g[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	20+5 or 13+ 10[h]	15 /20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. 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. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.

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 301.1 and Table 301.1.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. ~~First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulating or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulated insulating sheathing of at least R-2.~~
First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

i. The second R-value applies when more than half the insulation is on the interior of the mass wall.

j. For impact rated fenestration in wind-borne debris regions, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This public comment achieves two things:

1. corrects a severe problem with footnote 'h' that erodes the energy code, regardless of which version of the energy code is approved; and,
2. provides a rational and flexible application of footnote 'h' in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote 'h' is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote 'h', the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote 'h' allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Public Comment 4:

Mark Halverson, representing APA, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	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	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50[j]	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[j]	0.55	0.30[e]	38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55	NR	38	20 or 13+5g[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	20+5 or 13+ 10[h]	15 /20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. 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. “15/19” shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. “10/13” means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.
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 301.1 and Table 301.1.
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
h. First value is cavity insulation, second is continuous insulation or insulating sheathing, so “13+5” means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing; so “20+5” means R-20 cavity insulation in addition to a layer or R-5 continuous or insulating sheathing; and “13+10” means R-13 cavity insulation in addition to a layer of R-10 continuous or insulating sheathing. ~~If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If~~ In locations where structural sheathing is used, continuous insulation or insulating sheathing shall be permitted to be reduced by no more than R-2. ~~covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.~~
i. The second R-value applies when more than half the insulation is on the interior of the mass wall.
j. For impact rated fenestration in wind-borne debris regions, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

(Portions of code change proposal not shown remain unchanged)

Commenter’s Reason: This modification simplifies and clarifies footnote h. of Table 402.1.1 when both R-5 and R-10 continuous sheathing or insulating sheathing is required regardless of the amount of structural sheathing that is used. The amount of structural sheathing needed to adequately brace the walls is not limited, so the structural capacity of the wall is not impacted. This modification also assures that all opaque wall areas are covered by continuous insulation or insulating sheathing while maintaining the same combined sheathing thickness in all the wall envelope areas.

Instead of a fixed minimum requirement of R-2 continuous sheathing as before, a reduction of R-2 sheathing from the specified amount works for both R-5 or R10 continuous sheathing requirements. A R-5 requirement reduced by R-2 yields a R-3 continuous insulation applied over the structural sheathing and a R-10 reduced by R-2 yields a R-8 continuous insulation over the structural sheathing.

We ask that the code body support the Committee’s recommendation for approval as modified by this Public Comment.

Public Comment 5:

Jeff Inks, representing Window & Door Manufacturers Association, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	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	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50 [j]	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[j]	0.55	0.30[e]	38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55	NR	38	20 or 13+5g[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	20+5 or 13+ 10[h]	15 /20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.
a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. 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. “15/19” shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. “10/13” means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.
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 301.1 and Table 301.1.
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
h. First value is cavity insulation, second is continuous insulation, so “13+5” means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.

i. The second R-value applies when more than half the insulation is on the interior of the mass wall.
~~j. For impact rated fenestration in wind-borne debris regions, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Fenestration thermal performance requirements should be independent of other performance criteria such as providing protection from wind-borne debris or structural design pressure.

This exception was original included in the code based on concerns that there was limited availability of product that complies with both the impact resistance and energy performance requirements however that is simply no longer the case and that concern can no longer be substantiated. The fenestration industry is fully capable of producing compliant product. Allowing the exception needlessly compromises the energy efficiency of the code and is counter to the overall intent of the proposal in general, and to the 30% increase in efficiency objective that has been set for the IECC. We therefore urge the approval of this modification.

Public Comment 6:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, request Approval as Modified by this Public Comment.

Further modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	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	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50 j	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[j]	0.55	0.30[e]	38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55	NR	38	20 or 13+5g[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	20+5 or 13+ 10[h]	15 /20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. 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. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.
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 301.1 and Table 301.1.
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing. ~~If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.~~
i. The second R-value applies when more than half the insulation is on the interior of the mass wall.
j. For impact rated fenestration in wind-borne debris regions, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: While we agree that EC27, which was approved AM in the IECC, is a good addition to the code and the IRC should include it as well, we do feel that the proposed public comment by DOE to simplify footnote h actually clears up the proposal and this code section even further. The proposed deleted section of this footnote has always been a difficult part to determine and enforce for the Code Official. The deletion not only makes this section more stringent but it also makes it simpler to understand.

The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes. Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

Final Action: AS AM AMPC____ D

EC27-09/10-PART II

IRC Tables N1102.1, N1102.1.2 and N1102.2.5

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART II – IRC BUILDING/ENERGY

Revise as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[k]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	~~1.20~~ NR	0.75	0.30 ~~0.35~~[j]	30	13	3 / 4	13	0	0	0
2	~~0.65~~ 0.50[i]	0.65 ~~0.75~~	0.30 ~~0.35~~[j]	30	13	4 / 6	13	0	0	0
3	~~0.50~~ 0.40[i]	0.55 ~~0.65~~	0.30 ~~0.35~~[e, j]	~~30~~38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55 ~~0.60~~	NR	38	~~13~~ 20 or 13+5g[h]	~~5 / 10~~ 8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	~~38~~49	20 or 13+5[h]	13 / 17	30[f g]	10/13	10,2ft	10/13
6	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	49	20+5 or 13+~~5~~ 10[h]	15 / ~~19~~ 20	30[g]	15/19	10,4ft	10/13
7 and 8	~~0.35~~ 0.32	0.55 ~~0.60~~	NR	49	~~21~~ 20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. The first value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.
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 N1101.2 and Table N1101.2.
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
i. For impact rated fenestration in wind-borne debris regions ~~complying with Section R301.2.1.2~~, the maximum U-factor shall be 0.75 in Climate Zone 2 and 0.65 in Climate Zone 3.
~~j. For impact rated fenestration complying with Section R301.2.1.2 of the *International Residential Code*, the maximum SHGC shall be 0.40.~~
k. The second R-value applies when more than half the insulation is on the interior of the mass wall.

TABLE N1102.1.2
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	~~1.20~~ 0.65	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	~~0.65~~ 0.50	~~0.75~~ 0.65	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.50~~ 0.40	~~0.65~~ 0.55	~~0.035~~0.030	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	~~0.60~~ 0.55	0.030	~~0.082~~ 0.057	~~0.141~~ 0.098	0.047	0.059	0.065
5 and Marine 4	~~0.35~~ 0.32	~~0.60~~ 0.55	~~0.030~~0.026	0.057	0.082	0.033	0.059	0.065
6	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	~~0.057~~ 0.048	0.060	0.033	0.050	0.065
7 and 8	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	~~0.057~~ 0.048	0.057	0.028	0.050	0.065

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.10 in Climate Zone 4 except Marine, 0.087 in zone 5 and Marine 4, and the same as the frame wall U-factor in Marine zone 4 and zones 5 through 8.
c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.

TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION
(*R*-VALUE)

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT *R*-VALUE[a]
	Steel Truss Ceilingsb
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
R-13	R -13+5 o rR-15+4 or R-21+3 or R-0+10
R-19	R -13+9 or R-19+8 or R-25+7
R-20 or R-21	R-13+10 or R-19+9 or R-25+8
R-20+5	R-13+15 or R-19+14 or R-25+13
	Steel Joist Floor
R-13	R-19 in 2×6; R-19+6 in 2×8 or 2×10
R-19	R-19+6 in 2×6; R-19+12 in 2×8 or 2×10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.

Reason: The proposed changes improve the thermal integrity of the building envelope by decreasing the allowed U-factors for several building components that are currently below their reasonable potential in some climate zones. Improvements in available technologies and the demonstrated viability of the proposed levels in programs such as Energy Star, Building America, and other beyond-code efforts make these changes viable improvements in the context of the current and increasing need for lower energy consumption by buildings in the U.S.

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

ICCFILENAME: MAJETTE-EC-70-T. 402-IRC T. N1102-

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason:. The proposed change would be inconsistent with EC16, which the committee prefers.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, US Department of Energy, requests Approval as Modified by this public comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[k]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50[i]	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[i]	0.55	0.30[e,]	38	13	5 / 8	19	5/13[f]	0	5 / 13

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[k]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
4 except Marine	0.35	0.55	NR	38	20 or 13+5g[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15 / 20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. The first value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.

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 N1101.2 and Table N1101.2.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation, ~~insulated~~ insulating sheathing, or insulated siding. ~~If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~

i. For impact rated fenestration in wind-borne debris regions, the maximum U-factor shall be 0.75 in Climate Zone 2 and 0.65 in Climate Zone 3.

k. The second R-value applies when more than half the insulation is on the interior of the mass wall.

TABLE N1102.1.2

EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	0.65	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.50	0.65	0.035	0.082	0.165	0.064	0.360	0.477
3	0.40	0.55	0.030	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	0.55	0.030	0.057	0.098	0.047	0.059	0.065
5 and Marine 4	0.32	0.55	0.026	0.057	0.082	0.033	0.059	0.065
6	0.32	0.55	0.026	0.048	0.060	0.033	0.050	0.065
7 and 8	0.32	0.55	0.026	0.048	0.057	0.028	0.050	0.065

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.

b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in zone 1, 0.14 in ~~Climate~~ Zone 2, 0.12 in ~~Climate~~ Zone 3, ~~0.10~~ 0.087 in ~~Climate~~ Zone 4 except Marine, ~~0.087~~ 0.065 in zone 5 and Marine 4, and 0.057 in zones 6 ~~the same as the frame wall U-factor in Marine zone 4 and zones 5~~ through 8.

c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.

(Portions of code changed proposal not shown remain unchanged)

Commenter's Reason: The Department of Energy originally proposed the text currently in footnote h in a previous code development cycle to provide guidance on how much **structural** sheathing was allowed to displace insulating sheathing (in terms of percent of exterior wall surface area) without failing to comply with the insulation requirements of the IECC and IRC. This was viewed as a compromise to allow a moderate amount of structural sheathing typically at corners of walls while still requiring most of the wall to be covered by continuous insulation.

This footnote has caused confusion for code users. Staff at the DOE Building Energy Codes Program have received a number of requests from code users who couldn't figure out this footnote. There has been a failure in the code development process to craft clearer code language despite multiple attempts with the best intentions of all involved. Additionally, both the insulation requirements and the structural bracing requirements in the I-codes have become more complicated in recent years, making it even more difficult to address this issue in footnote. Therefore, DOE has no choice but to recommend that all of footnote h be deleted other than the first sentence. The term "continuous insulation" proposed here is a generic term that was used in several approved code changes in the initial action hearings.

The second revision to EC27 proposed here is to correct the mass wall insulation requirement in footnote b of IECC Table 402.1.3 and IRC Table N1102.1.2. The original EC27 proposal provided two different and conflicting requirements for Climate zone 5 and Marine 4. The proposed levels here give a modest credit to mass walls compared to frame walls.

Public Comment 2:

Jay H. Crandell, ARES Consulting, Foam Sheathing Coalition, requests Approval as Modified by this public comment.

Modify the proposal as follows:

Add the following definition:

CONTINUOUS INSULATION. Insulation installed continuously across all structural members on the interior, exterior, or integral to any opaque surface of the building envelope, without intervening vented air spaces or thermal bridges other than fasteners and service openings.
(Portions of code changed proposal not shown remain unchanged)

Commenter's Reason: This proposal and various other proposals and modifications from the code development hearings use or introduce the term, "continuous insulation", but the term is not defined. This public comment corrects that problem and provides needed clarification of the meaning of continuous insulation to ensure proper application in compliance with the intent of the energy code.

ASHRAE 90.1 defines continuous insulation as "insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope." This definition is adopted in this PC for sake of consistency and is further improved to clarify an important concern with the proper and consistent characterization of continuous insulation. The ASHRAE definition addresses a concern with thermal bridging but does not address the similar concern with intervening vented air spaces which can create a disconnect of continuous insulation thermal resistance such that its contribution to a layered wall assembly R-value cannot be simply summed. Thus, wording is included in the definition to address this concern. Air exchange rates for vented airspaces behind claddings can exceed 90 air-changes per hour (see references 1 and 2) which significantly impacts the R-value of the air-space or disconnects the R-value of material on the exterior side of the airspace. A robust definition for continuous insulation is needed in the IECC.

References:

1. Straube, J. and Finch, G. (2009). Ventilated Wall Claddings: Review, Field Performance, and Hygrothermal Modeling, Research Report – 0907, Building Science Press, www.buildingscience.com.
2. Salonvarra, M., Karagiozis, A.N., Pazera, M., Miller W. (2007). "Air Cavities Behind Claddings – What Have We Learned?", Buildings X, ASHRAE.

Public Comment 3:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this public comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[k]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50[i]	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[i]	0.55	0.30[e,]	38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55	NR	38	20 or 13+5g[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15 / 20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-valueis reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. The first value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.
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 N1101.2 and Table N1101.2.
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
h. ~~First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~

First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

i. For impact rated fenestration in wind-borne debris regions, the maximum U-factor shall be 0.75 in Climate Zone 2 and 0.65 in Climate Zone 3.

k. The second R-value applies when more than half the insulation is on the interior of the mass wall.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This public comment achieves two things:

1. corrects a severe problem with footnote 'h' that erodes the energy code, regardless of which version of the energy code is approved; and,
2. provides a rational and flexible application of footnote 'h' in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote 'h' is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote 'h', the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote 'h' allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Public Comment 4:

Mark Halverson, APA, requests Approval as Modified by this public comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[k]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50[i]	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[i]	0.55	0.30[e,]	38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55	NR	38	20 or 13+5g[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15 / 20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. The first value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.
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 N1101.2 and Table N1101.2.
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
h. First value is cavity insulation, second is continuous insulation or insulating sheathing, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated sheathing, "20+5" means R-20 cavity insulation in addition to a layer of R-5 continuous or insulating sheathing; and "13+10" means R-13 cavity insulation in addition to a layer of R-10 continuous or insulating sheathing. ~~If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If~~ In locations where structural sheathing is used, continuous insulation or insulating sheathing shall be permitted to be reduced by nor more than R-2.~~covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~
i. For impact rated fenestration in wind-borne debris regions, the maximum U-factor shall be 0.75 in Climate Zone 2 and 0.65 in Climate Zone 3.
j. The second R-value applies when more than half the insulation is on the interior of the mass wall.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This modification simplifies and clarifies footnote h. of Table 402.1.1 when both R-5 and R-10 continuous sheathing or insulating sheathing is required regardless of the amount of structural sheathing that is used. The amount of structural sheathing needed to adequately brace the walls is not limited, so the structural capacity of the wall is not impacted. This modification also assures that all opaque wall areas are covered by continuous insulation or insulating sheathing while maintaining the same combined sheathing thickness in all the wall envelope areas.

Instead of a fixed minimum requirement of R-2 continuous sheathing as before, a reduction of R-2 sheathing from the specified amount works for both R-5 or R10 continuous sheathing requirements. A R-5 requirement reduced by R-2 yields a R-3 continuous insulation applied over the structural sheathing and a R-10 reduced by R-2 yields a R-8 continuous insulation over the structural sheathing.

We ask that the code body support the Committee's recommendation for approval as modified by this Public Comment.

Public Comment 5:

Jeff Inks, Window & Door Manufacturers Association, requests Approval as Modified by this public comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[k j]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50[i]	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[i]	0.55	0.30[e,]	38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55	NR	38	20 or 13+5g[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15 /20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. The first value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.
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 N1101.2 and Table N1101.2.
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
~~i. For impact rated fenestration in wind-borne debris regions, the maximum U-factor shall be 0.75 in Climate Zone 2 and 0.65 in Climate Zone 3.~~
j. The second R-value applies when more than half the insulation is on the interior of the mass wall.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Fenestration thermal performance requirements should be independent of other performance criteria such as providing protection from wind-borne debris or structural design pressure.

This exception was original included in the code based on concerns that there was limited availability of product that complies with both the impact resistance and energy performance requirements however that is simply no longer the case and that concern can no longer be substantiated. The fenestration industry is fully capable of producing compliant product. Allowing the exception needlessly compromises the energy efficiency of the code, and is counter to the 30% increase in efficiency objective set for the IECC. We therefore urge the approval of this modification.

The remainder of the proposal should be approved for consistency with the original action taken on Part I.

Public Comment 6:

Shaunna Mozingo, City of Westminster, Co, representing Colorado Chapter of ICC, Inc and Craig Conner, request Approval as Modified by this public comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[kj]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50[i]	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[i]	0.55	0.30[e,]	38	13	5 / 8	19	5/13[f]	0	5 / 13
4 except Marine	0.35	0.55	NR	38	20 or 13+5g[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30[g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15 / 20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. The first value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.
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 N1101.2 and Table N1101.2.
g. Or insulation sufficient to fill the framing cavity, R-19 minimum.
h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 <u>continuous insulation or</u> ~~insulated~~ <u>insulating</u> sheathing. ~~If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2~~.
i. For impact rated fenestration in wind-borne debris regions, the maximum U-factor shall be 0.75 in Climate Zone 2 and 0.65 in Climate Zone 3.
j. The second R-value applies when more than half the insulation is on the interior of the mass wall.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: While we agree that EC27, which was approved AM in the IECC, is a good addition to the code and the IRC should include it as well, we do feel that the proposed public comment by DOE to simplify footnote h actually clears up the proposal and this code section even further. The proposed deleted section of this footnote has always been a difficult part to determine and enforce for the Code Official. The deletion not only makes this section more stringent but it also makes it simpler to understand.

The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes. Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

Public Comment 7:

Theresa A. Weston, DuPont Building Innovations, requests Approval as Modified by this public comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[kj]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.50[i]	0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.40[i]	0.55	0.30[e,]	38	13	5 / 8	19	5/13[f]	0	5 / 13

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[~~k~~ j]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
4 except Marine	0.35	0.55	NR	38	20 or 13+5g[h]	8 / 13	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13 / 17	30 [g]	10/13	10,2ft	10/13
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15 / 20	30[g]	15/19	10,4ft	10/13
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19 / 21	38[g]	15/19	10,4ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

c. The first value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 ft, whichever is less, in zones 1 through 3 for heated slabs.

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 N1101.2 and Table N1101.2.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or ~~insulated~~ insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with ~~insulated~~ continuous insulation or insulating sheathing of at least R-2.

i. For impact rated fenestration in wind-borne debris regions, the maximum U-factor shall be 0.75 in Climate Zone 2 and 0.65 in Climate Zone 3.

j. The second R-value applies when more than half the insulation is on the interior of the mass wall.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This modification changes this proposal to be consistent with committee action on EC27 P1 which was modified and approved during the technical hearings. It generalizes the requirement for continuous insulation and does not require the insulation to be a sheathing thus allowing more options for meeting this requirement.

Final Action: AS AM AMPC____ D

EC30-09/10-PART I
Table 402.1.1

Proposed Change as Submitted

Proponent: Charles C. Cottrell, North American Insulation Manufacturers (NAIMA)

PART I – IECC

Revise table footnote as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT
(No change to table contents)

a. R-values are minimums. U-factors and SHGC are maximums. ~~R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.~~ When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the actual R-value of the insulation shall not be less than the R-value specified in the table.

b. through j. *(No change)*

Reason: The proposed change in wording is an improvement in the current code language for 2 reasons.

First, this new language does not change the intent of the existing language. Additionally it prohibits all types of insulation from being compressed to less than its design/ label thickness and meeting the code. The current language only addresses compression of R-19 batts being compressed to less than their design/label thickness (typically 6 ¼"), while the new language would prevent all insulation materials from being compressed to less than their design/label thickness and being presumed to meet the code requirements.

Second, as written, the code language is a violation of the Federal Trade Commission's ("FTC") "Labeling and Advertising of Home Insulation" Rule, 16 C.F.R. Part 460, also known as the R-value Rule because the code language requires insulation to be "marked" or labeled. The FTC has established jurisdiction over the advertising and labeling of insulation products sold or marketed to consumers in the United States. Specifically, the FTC has preempted conflicting laws:

> 16 C.F.R. 460.23(b).
> State and local laws and regulations that are inconsistent with, or frustrate the purposes of, the provisions of this regulation are preempted. However, a State or local government may petition the Commission, for good cause, to permit the enforcement of any part of a State or local law or regulation that would be preempted by this section.

Federal preemption essentially means that a federal law supersedes and supplants any inconsistent state or local law or regulation. Currently this ICC code provision is in violation of the FTC R-value rule and is preempted by Federal law.

Making this proposed change will cover all instances of compressed insulation that may not meet the code requirements and eliminates the additional marking or labeling requirements, which are in conflict with the FTC Rule.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: COTTRELL-EC-1-T. 402.1.1-T. N1102.1.DOC

Public Hearing Results

PART I - IECC
Committee Action: **Approved as Submitted**

Committee Reason: The proposed revised footnote appropriately addresses the original intent of the code to require that the actual R-Value such as the R-Value of compressed insulation, is the R-Value required to meet the code. Presently, the code only addresses R-19 insulation. This could also occur with other types of insulation.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Charles C. Cottrell, representing North American Insulation Manufacturers Association (NAIMA), requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT
(No change to table contents)

a. R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the ~~actual~~ installed R-value of the insulation shall not be less than the R-value specified in the table.

b. through j. *(No change)*

Commenter's Reason: The proposed change in wording is an improvement to the language currently approved by the IECC Committee. The term "installed R-value" more clearly defines the code requirements than "actual R-value."

Public Comment 2:

Shaunna Mozingo, City of Westminser, Co, representing Colorado Chapter of ICC; and Craig Conner, Building Quality request Disapproval.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building c ode. T his c hange i s one of a s eries of c hanges i ntended to c orrect a l arge nu mber of i nconsistencies i n the r esidential ener gy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This proposal creates confusion and could be easily misread. Does the added sentence that includes "*the actual R-value of the insulation shall not be less than the R-value specified in the table*" help or hurt the clarity? Could this be taken to mean an R19 batt, which is always must be compressed to fit into a 2x6 cavity, cannot ever be used where R20 is required? Although this is not the proponent's intention, it could be the result of this language. We feel that it would be best to disapprove this proposal in both codes at this time

Final Action: AS AM AMPC____ D

EC30-09/10-PART II
IRC Table N1102.1

Proposed Change as Submitted

Proponent: Charles C. Cottrell, North American Insulation Manufacturers (NAIMA)

PART II – IRC ENERGY

Revise table footnote as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT
(No change to table contents)

a. R-values are minimums. U-factors and SHGC are maximums. ~~R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.~~ When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the actual R-value of the insulation shall not be less than the R-value specified in the table.
b. through k. *(No change)*

Reason: The proposed change in wording is an improvement in the current code language for 2 reasons.

First, this new language does not change the intent of the existing language. Additionally it prohibits all types of insulation from being compressed to less than its design/ label thickness and meeting the code. The current language only addresses compression of R-19 batts being compressed to less than their design/label thickness (typically 6 ¼"), while the new language would prevent all insulation materials from being compressed to less than their design/label thickness and being presumed to meet the code requirements.

Second, as written, the code language is a violation of the Federal Trade Commission's ("FTC") "Labeling and Advertising of Home Insulation" Rule, 16 C.F.R. Part 460, also known as the R-value Rule because the code language requires insulation to be "marked" or labeled. The FTC has established jurisdiction over the advertising and labeling of insulation products sold or marketed to consumers in the United States. Specifically, the FTC has preempted conflicting laws:

16 C.F.R. 460.23(b).

State and local laws and regulations that are inconsistent with, or frustrate the purposes of, the provisions of this regulation are preempted. However, a State or local government may petition the Commission, for good cause, to permit the enforcement of any part of a State or local law or regulation that would be preempted by this section.

Federal preemption essentially means that a federal law supersedes and supplants any inconsistent state or local law or regulation. Currently this ICC code provision is in violation of the FTC R-value rule and is preempted by Federal law.

Making this proposed change will cover all instances of compressed insulation that may not meet the code requirements and eliminates the additional marking or labeling requirements, which are in conflict with the FTC Rule.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: COTTRELL-EC-1-T. 402.1.1-T. N1102.1.DOC

Public Hearing Results

PART II - IRC
Committee Action: Disapproved

Committee Reason: The revised footnote confuses the issue more, as it does not specifically describe what it means by "actual" r-values.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Charles C. Cottrell, representing North American Insulation Manufacturers Association (NAIMA), requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT
(No change to table contents)

a. R-values are minimums. U-factors and SHGC are maximums. When insulation is installed in a cavity which is less than the label or design thickness of the insulation, the ~~actual~~ installed R-value of the insulation shall not be less than the R-value specified in the table.

b. through k. *(No change)*

Commenter's Reason: This proposal is intended to make the footnotes and requirements in the IECC and IRC identical. The proposed language is the same as that approved by the IECC code committee - except for "installed R-value" was "actual R-value" in the IECC Committee approved language. The term "installed R-value" more clearly defines the code requirements than "actual R-value." And a public comment has been submitted to the EC30 Part I to make these footnotes identical.

The proposed change in wording is an improvement in the current code language for 2 reasons.

First, this new language does not change the intent of the existing language. Additionally it prohibits all types of insulation from being compressed to less than its design/ label thickness and meeting the code. The current language only addresses compression of R-19 batts being compressed to less than their design/label thickness (typically 6 ¼"), while the new language would prevent all insulation materials from being compressed to less than their design/label thickness and being presumed to meet the code requirements.

Second, as written, the code language is a violation of the Federal Trade Commission's ("FTC") "Labeling and Advertising of Home Insulation" Rule, 16 C.F.R. Part 460, also known as the R-value Rule because the code language requires insulation to be "marked" or labeled. The FTC has established jurisdiction over the advertising and labeling of insulation products sold or marketed to consumers in the United States. Specifically, the FTC has preempted conflicting laws: 16 C.F.R. 460.23(b).

State and local laws and regulations that are inconsistent with, or frustrate the purposes of, the provisions of this regulation are preempted. However, a State or local government may petition the Commission, for good cause, to permit the enforcement of any part of a State or local law or regulation that would be preempted by this section. Federal preemption essentially means that a federal law supersedes and supplants any inconsistent state or local law or regulation. Currently this ICC code provision is in violation of the FTC R-value rule and is preempted by Federal law.

Making this proposed change will cover all instances of compressed insulation that may not meet the code requirements and eliminates the additional marking or labeling requirements, which are in conflict with the FTC Rule.

This proposal should be approved as modified by this public comment.

Final Action: AS AM AMPC____ D

EC31-09/10-PART I
402.1.1, Table 402.1.1

Proposed Change as Submitted

Proponent: Donald J. Vigneau, AIA, Northeast Energy Efficiency Partnerships, Inc.

PART I – IECC

Revise as follows:

402.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the minimum requirements of Table 402.1.1 based on the climate *zone* specified in Chapter 3. Use of the Table 402.1.1 prescriptive component option shall be limited to a maximum fenestration area of 20 percent of the gross conditioned floor area. U-factor and SHGC exemptions allowed under Sections 402.3.2 and 402.3.3 shall be included in the maximum allowable percentage area.

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]
COMBINED WINDOW, SKYLIGHT AND DOOR AREAS NOT GREATER THAN 20 PERCENT OF GROSS CONDITIONED FLOOR AREA

(Table contents and footnotes remain unchanged)

Reason: (Part I): Table 402.1.3 provides direct evidence that the use of glazing without limitation, as adopted in the IECC 2004 Supplement, allows for enormous energy waste and directly impacts both first cost and energy use, by allowing unlimited use of a thermal envelope component with inferior performance and a greater total installed cost. Affordability is NOT an issue in glazing allowed by a limited prescriptive option, only light, ventilation and emergency egress.

The proposed 20 percent of gross conditioned floor area limitation is greater than twice the minimum areas required to satisfy the above code requirements; including opaque door assemblies. The greater area proposed allows for flexibility in window selections and placement to accommodate design and construction issues. It applies uniformly to single and multi-family dwelling construction.

Currently, each square foot of code-compliant glazing still uses greater than 4 to over 10 TIMES as much energy as the adjacent complying envelope wall (see Table 402.1.3 for specific zone), and about twice the performance of the best windows available. Thus, each square foot of glazing beyond a reasonable minimum allows for undue waste of energy.

Since glazing area percentage has been changed to a percentage of the gross conditioned floor area (IECC 2004 Supplement), the prior IECC 2003 Chapter 6 limitation of 15 percent of thermal wall envelope area is proposed as 20 percent of conditioned floor area to realize about twice the glazing required by the above minimum standards possible within the prescriptive option.

The proposed change does not limit glazing; it only restricts the use of the prescriptive option to demonstrate compliance. The applicant is still able to use more than 20 percent fenestration by demonstrating compliance through the Section 402.1.3 U-factor alternative, the Section 402.1.4 Total UA alternative, or the Section 404.5 Simulated Performance Alternative.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: VIGNEAU-EC-1-402.1.1-RE-1-N1102.1

Public Hearing Results

PART I - IECC
Committee Action: **Approved as Submitted**

Committee Reason: As stated, glazing is an inferior performer to opaque walls as a thermal building envelope element. Therefore, it makes sense to limit the amount of glazing.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc, and AGC Flat Glass North America, Inc., requests Disapproval.

Commenter's Reason: EC31-09/10 should be disapproved for at least 3 reasons. 1. EC31 is completely arbitrary. The proponent has not put forward any technical justification or substantiation for selecting 20% as a limit on the ratio of windows to walls. Why not 25%? 30%? 2. EC31 will not save any energy. The Proponent's supporting statement fails to mention that fact that the vast majority of homes built today have window to wall ratios of 20% or less. Accordingly, imposing a 20% prescriptive limit on the window to wall ratio of homes will save no energy. This, in turn, leads to the third and, perhaps, most important reason EC31 should be disapproved. 3. Since most homes are already built with window to wall ratios of 20% or less, imposing this prescriptive requirement will require building code officials to complete time consuming and completely unnecessary measurements and computations of window to wall ratios for all new homes, both at the plan review and field verification stages of inspections. Simply put, building code officials have more important things to do than conduct needless inspections that serve no energy conservation or other useful purpose.

We urge all Final Action voters to vote against the standing motion to approve EC31 as submitted in order to vote to disapprove EC31.

Public Comment 2:

Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee and Aluminum Extruders Council, requests Disapproval.

Commenter's Reason: We ask for your disapproval of EC31. As written, this proposal creates a problem for small alterations. For example, an alteration of a 100 ft2 corner bathroom would allow only 20 square feet of fenestration. This would mean a single small 2½ x 4 ft window on each wall, and no skylights. This is borderline for egress requirements, and inadequate for the desired design for lighting and view. Ironically, this limitation is easier to comply with for larger spaces and buildings, which was likely not the intention.

Furthermore, when the residential energy code was completely revised in 2004, the ICC membership made a conscious decision to remove the calculation of window area in order to simplify enforcement. This was supported by the U.S. Department of Energy, with research conducted by Pacific Northwest National Laboratory indicating that removal of window area limitations would not have a detrimental impact on energy use (http://www.energycodes.gov/implement/pdfs/wwr_elimination.pdf). In contrast, this proposal would require code officials to compute both window area *and* gross conditioned floor area, as well as try to verify these values in the field. Why would we want to force these time consuming tasks and added complexity on the code official, when DOE's previous analysis indicates this would save little or no energy?

Public Comment 3:

Shaunna Mozingo, City of Westminster, representing Colorado Chapter of ICC, and Craig Conner, Building Quality, request Disapproval.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This proposal creates a cumbersome calculation process in the prescriptive path. The calculation includes not just windows, but also doors and skylights since these are fenestration too. Most houses have less than 20% fenestration, so although the calculation would be required for all homes, it would not affect most homes. Instead of trying to constrain windows with an area limiting calculation, as is done with EC31, the better approach is to require all windows to be more energy efficient. This code cycle has lead to a substantial increase in window and skylight energy efficiency, which will not constrain design but will yield a bigger increase in energy efficiency.

One more observation- the table title proposed in EC31 would be a contender for longest table title in the I-codes, it is the "INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a] COMBINED WINDOW, SKYLIGHT AND DOOR AREAS NOT GREATER THAN 20 PERCENT OF GROSS CONDITIONED FLOOR AREA" table.

We feel that it would be best to disapprove this proposal in both codes at this time.

Final Action: AS AM AMPC____ D

EC31-09/10-PART II
IRC N1102.1, Table N1102.1

Proposed Change as Submitted

Proponent: Donald J. Vigneau, AIA, Northeast Energy Efficiency Partnerships, Inc.

PART II – IRC BUILDING/ENERGY

Revise as follows:

1102.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Table N1102.1.1 based on the climate *zone* specified in Table N1101.2. Use of the Table N1102.1 prescriptive component alternative shall be limited to a maximum fenestration area of 20 percent of the gross conditioned floor area. U-factor and SHGC exemptions allowed under Sections N1102.3.3 and N1102.3.4 shall be included in the maximum allowable percentage area.

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]
COMBINED WINDOW, SKYLIGHT AND DOOR AREAS NOT GREATER THAN 20 PERCENT OF GROSS CONDITIONED FLOOR AREA

(Table contents and footnotes remain unchanged)

Reason PART II- Table N1102.1.2 provides direct evidence that the use of glazing without limitation, as adopted in the IRC 2006 Edition, allows for enormous energy waste and directly impacts both first cost and energy use, by allowing unlimited use of thermal envelope components with inferior performance and a greater total installed cost. Affordability is NOT an issue in glazing allowed by a limited prescriptive option; only light, ventilation and emergency egress.

The proposed 20 percent of gross conditioned floor area limitation is greater than twice the minimum areas required to satisfy the above code requirements; including opaque door assemblies. The greater area proposed allows for flexibility in window selections and placement to accommodate design and construction issues. It applies uniformly to single and townhouse dwelling construction.

Currently, each square foot of code-compliant glazing still uses greater than 4 to over 10 TIMES as much energy as the adjacent complying envelope wall (see Table N1102.1.2 for specific zone), and about twice the energy of the best windows available. Thus, each square foot of code-compliant glazing beyond a reasonable minimum allows for undue waste of energy.

Since glazing area percentage has been changed to a percentage of the gross conditioned floor area (IRC 2006), the prior IECC 2003 Chapter 6 limitation of 15 percent of thermal wall envelope area for detached One and Two Family homes is proposed as 20 percent of conditioned floor area to realize about twice the glazing required by the above minimum standards possible within the prescriptive option.

The proposed change does not limit glazing; it only restricts the use of the prescriptive option to demonstrate compliance. The applicant is still able to use more than 20 percent fenestration by demonstrating compliance through the Section N1102.1.2 U-factor alternative or the Section N1102.1.3 Total UA alternative, the method available in the RES*Check* energy software.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: VIGNEAU-EC-1-402.1.1-RE-1-N1102.1

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: No technical justification was provided to support the choice of 20% for the limit on glazing. Therefore, the proposal is providing an arbitrary number.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Donald J. Vigneau, AIA, Northeast Energy Efficiency Partnerships, Inc, representing self, requests Approval as Submitted.

Commenter's Reason: Proposal would limit the use of the Prescriptive Thermal Envelope Table N1102.1.1 to a maximum combined fenestration of not more than 20 percent of the gross conditioned floor area, without imposing fenestration limits on any other compliance option (N1102.1.3 U-factor alternative, N1102.1.4 UA alternative. Note also that Section N1101.2 also permits the user to demonstrate compliance using IECC Section 405 Simulated Performance Alternative). Table N1102.1.1 contents and footnotes all remain unchanged by this proposal.
Part I was Approved as Submitted (AS) by the Energy Code Development Committee.
Part II was Disapproved (D) by the Residential Building and Energy Code Development Committee and is submitted for reconsideration; to assure consistency between the IECC Chapter 4 and the IRC Chapter 11.

IRC B/E Committee Reason: "No technical justification was provided to support the choice of 20% for the limit on glazing. Therefore, the proposal is providing an arbitrary number."

However, the "arbitrary number" was supported by:
1) Prior energy code prescriptive requirements for "glazing area not exceeding 15% of gross wall area" (IECC 2000 and 2003, Section 601.2.1, Type A-1 detached residential buildings); and
2) The original comments discussion that carefully considered the minimum light, ventilation and emergency escape requirements, together with respect to these requirements for the various types of window styles and minimum sizes now on the market; and
3) The technical justification demonstrates by inspection of thermal transmittance factors in Table 402.1.3, that between 4.27 times as much energy (in Zone 4) to 14.6 times as much energy (in Zone 1) is lost through a minimum code-compliant window as is lost through the adjacent minimum code-compliant wall assemblies.

In summary, the proposed prescriptive option limitation on percentage of window area more than adequately satisfies safety and health requirements, is a reasonable restriction on use of the Table, has self-evident technical justification, and preserves several compliance alternatives.

Final Action: AS AM AMPC____ D

EC34-09/10-PART I

Table 402.1.1, Table 402.1.3

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Revise tables as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb, [e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	~~1.2~~ NR	0.75	0.30	30	13	3/4	13	0	0	0
2	~~0.65[j]~~ 0.40	0.75	0.30	30	13	4/6	13	0	0	0
3	~~0.50[j]~~ 0.35	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE 402.1.3
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[d]	CRAWL SPACE WALL U-FACTOR[c]
1	~~1.20~~ 0.50	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	~~0.65~~ 0.40	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.50~~ 0.35	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.028	0.050	0.065

(Footnotes remain unchanged)

Reason: This proposal substantially increases energy efficiency in climate zones 1-3 by specifying lower, more realistic fenestration U-factors that more closely resemble actual windows used to meet current requirements in these zones and, as a result, will close a significant gap in trade-off compliance paths and performance path calculations as well as make the code more efficient.

The current window U-factor requirements in the three southernmost climate zones are unreasonably high, given the current *IECC* SHGC requirement of 0.30 and *IRC* SHGC requirement of 0.35. To meet the SHGC requirement in these three zones, builders typically use low solar gain, low-e glass. As a result, the only issue is a reasonable choice of frame to meet increasing energy efficiency demands. With such a frame, the resulting product has a much lower U-factor than the current requirements for these climate zones. The practical effect of this lower U-factor for actual windows is that users who follow the Total UA alternative or the Simulated Performance Alternative automatically receive unnecessary free trade-off credit (the difference between the artificially high U-factor requirement and the window's actual U-factor), which is then used to reduce efficiency elsewhere in the home.

The proposed change sets U-factors at reasonable levels designed to match reasonably efficient windows available in all markets. According to the *2005 ASHRAE Handbook of Fundamentals* (page 31.8, Table 4), a low solar gain, low-e window (0.05 emissivity) with a ½ inch air space typically achieves the following U-factors:

	Operable w/o Argon	Fixed w/o Argon	Operable w/Argon	Fixed w/Argon
Aluminum Thermal Break	0.47	0.41	0.44	0.37
Wood/Vinyl	0.39	0.35	0.36	0.31

This proposal would continue to allow, under the prescriptive compliance path, any frame in climate zone 1, but would require a builder to use a more reasonable 0.50 U-factor (reflecting the range of U-factors portrayed above) where they elect to use a UA trade-off or the performance path. In climate zone 2, this proposal would use a vinyl framed window without argon as the baseline prescriptive path window (wood and clad-wood framed windows would also meet this requirement as well as some aluminum thermal break framed windows). In zone 3, to achieve a 0.35 U-factor, this proposal would typically require the addition of argon (beyond the level for climate zone 2) for the prescriptive path window. While this proposal may require some to switch from aluminum to vinyl windows if they choose to use the prescriptive path, there does not appear to be an additional cost to achieve the 0.40 or better U-factor, given that the cost of vinyl and aluminum window frames are reportedly very competitive. While there is a slight additional cost to add argon, such cost is relatively minimal and more than offset by the benefits of a better U-factor in climate zone 3. There is also precedent for much lower U-factors in these climate zones. For example, under the 2009 American Recovery and Reinvestment Act (Stimulus Bill), the federal tax credit for replacement windows specifies a 0.30 U-factor nationwide.

This proposal substantially increases energy efficiency in climate zones 1-3. The table below illustrates the estimated energy cost savings from the prescriptive changes in climate zones 2 and 3 over the current 2009 *IECC* and *IRC* values. . These savings are significant and when coupled with other proposed code modifications can lead to significant overall energy savings for homes.

	Climate Zone 1	Climate Zone 2	Climate Zone 3
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	-	7.5%	6.2%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	-	5.3%	4.5%

The proposed change is designed to match windows available in all markets. While most wood or vinyl-framed double-pane windows already meet the 0.35 U-factor requirement, any frame type could also be used under either the Total UA alternative or the Simulated Performance Alternative. In our experience, these values are already achieved by many, if not most, of the windows sold in these climate zones.

This proposal represents a reasonable and cost effective improvement that will provide states and local jurisdictions with an option to easily increase the efficiency of their code.

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

ICCFILENAME: PRINDLE-EC-14-T. 402.1.1-T. N1102.1

Public Hearing Results

PART I - IECC
Committee Action: Approved as Submitted

Committee Reason: This proposal represents an increase in stringency and therefore energy savings that is reasonably easy and cost effective to achieve.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Thomas D. Culp, Ph.D., Birch Point Consulting LLC, representing The Glazing Industry Code Committee and the Aluminum Extruders Council, requests Disapproval.

Commenter's Reason: We ask for your strong disapproval of EC34, and instead support the improved energy efficiency in the U.S. Department of Energy's proposal EC13. EC34 is simply not justified in terms of energy savings or building requirements unique to the south.

The claimed energy savings just do not hold weight. Not only are these claims counterintuitive to experience that U-factors are less important in the warmer south where the temperature differential is less, but also the numbers do not add up. EnergyGuage and RESFEN runs in ten cities in Zone 2 show an average energy cost savings of only $24 per year. The claim that this proposal saves 7.5% is nonsensical – that would require the heating and cooling costs for the *entire year* to be only $320, or $26.67 per month. The proponent may be including other measures (they mention hot water?), but has provided no detailed analysis, and no calculation of savings directly associated with this change in window U-factor. Simply stated, they have not provided *any* analysis to sufficiently justify the proposal.

Furthermore, by the proponents' own admission, this proposal will largely eliminate aluminum windows in favor of PVC vinyl products. Aluminum framing remains an important technology in the southern zones. Central and northern housing markets saw a large switch to plastic windows over the last 15-20 years, but there are reasons the south and southwest stayed aluminum. Durability and structural performance are especially important in these regions. For example, the intense climate in Phoenix can easily lead to frame distortion and degradation (including increased air infiltration), and the structural and life safety concerns from tropical storm and hurricane events along the Gulf Coast and Florida are obvious. Aluminum framing provides an important way to cost-effectively meet these requirements, while also being a sustainable, green material with proven recyclability. Recyclability and more efficient use of materials reduces the ecological impact of a building. This includes reduced landfill waste, as well as reduced energy and emissions associated with manufacturing, transportation, and disposal.

In contrast, this proposal would strongly hinder the use of aluminum in favor of PVC plastic framing with lower structural performance and potential concerns about recyclability and sustainability -- all for a change in U-factor that only has minor importance in these warm southern zones anyway. Where a proposal (i) saves minimal energy and (ii) provides a significant advantage to one product in the marketplace over another, the credibility of the energy code effort is materially diminished.

Instead, we ask your support of EC13, which provides the desired increase in energy efficiency, while also properly accounting for durability, structural, and sustainability in these regions.

Public Comment 2:

Amanda Hickman, Intercode Incorporated, representing 3M Renewable Energy Division and The International Window Film Association, requests Disapproval.

Commenter's Reason: We are philosophically opposed to any change that is not product neutral and/or does not save energy. Lower U-factors in the south do not save energy. The proponent has not shown valid substantiation that this proposal will provide any energy savings. Therefore, we believe that EC34 should be disapproved.

Public Comment 3:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association (AAMA), requests Disapproval.

Commenter's Reason: EC 34 establishes U-factors with no definitive benefit over the values approved in EC13, Part I, with regards to energy efficiency. A comparison of the three sets of values for residential fenestration under the prescriptive path (current, as proposed and approved in EC13, Part I, and as proposed in EC34, Part I) is given below.

Climate Zone	**1**	**2**	**3**	**4 except Marine**	**5 & Marine 4**	**6**	**7**	**8**
U-factor								
2009 IECC	1.2	0.65	0.50	0.35	0.35	0.35	0.35	0.35
EC13, Part I – 09/10	0.65	0.50	0.40	0.35	0.32	0.32	0.32	0.32
EC34, Part I – 09/10	0.50	0.40	0.35	0.35	0.35	0.35	0.35	0.35

In cooling dominated climates such as Climate Zones 1, 2 and 3, the benefit of reducing fenestration U-factor is marginal. To some extent the reduction in heat loss during the short heating season is offset by the reduced ability of the home to radiate internal heat to the exterior environment during cooler times of the day in the transitional seasons (spring and fall) when external air temperatures may be higher than indoor conditioned air during the day, but cooler than indoor conditioned air in the evening and overnight. The point at which these two parts of the energy use equation become balanced depend upon a number of different factors, but it is clear that simply reducing the U-factor in cooling dominated climates will not reduce energy efficiency anymore than wearing a winter coat will assure comfort year round in these same zones (i.e. it is not always energy efficient to trap heat inside a thermal envelop).

As can be seen in the table above, EC13, Part I, which AAMA supported and which was approved for the IECC during the Code Development Hearings in Baltimore, reduced the U-factor for residential fenestration in Climate Zone 2 from 0.65 to 0.50 and in Climate Zone 3 from 0.50 to 0.40. EC13, Part I also reduced the equivalent U-factor used for fenestration (Table 402.1.3) from 1.2 to 0.65 in Climate Zone 1.

EC34 would also restrict the available frame type options in Climate Zones 2 and 3. The proponent of EC34 argues that it would not restrict choice of framing type in Climate Zones 1, 2 and 3. That is incorrect.

The proponent is correct that SHGC limits already in place in Climate Zones 1, 2 and 3 will inherently reduce the U-factor of all windows. They will not, however, reduce the inherent U-factor of aluminum framed windows to less than 0.50, as they claim it will. This argument is incorrect for two reasons:

1. The values presented in the supporting statement of EC34 are based upon the *2005 ASHRAE Handbook of Fundamentals,* not actual products that have been rated in accordance with NFRC 100. The 2009 IECC requires the U-factor of fenestration products to be determined in accordance with NFRC 100.

2. Achieving the 0.35 U-factor currently required for northern climates can be obtained by placing a double glazed, low-e insulating glass unit in a vinyl frame. If that same glass package is placed in a fairly good thermally broken aluminum frame the resultant U-factor will be in the neighborhood of 0.50 to 0.60, depending upon the width of the framing, the operator type (which can affect the ratio of framing to vision area), etc.

Furthermore, even if the SHGC value did inherently result in windows with U-factor less than 0.50, that would only be of benefit in Climate Zone 1 if the approval of EC34, Part I is upheld. EC34, Part I only permits a U-factor of 0.50 in Climate Zone 1. It further reduces the maximum U-factor to 0.40 in Climate Zone 2 and 0.35 in Climate Zone 3. A search of the NFRC Certified Products Directory found several aluminum framed windows with SGHC < 0.30, and U-factor > 0.35, and some with SHGC < 0.30 and U-factor > 0.40. It is clear that approval of EC34, Part I would not permit the installation of these products in Climate Zones 2 and 3, and therefore would restrict the choice of framing type in these climate zones.

For these reasons, we feel EC34 unduly restricts the choice of window framing type, particularly in Climate Zones 2 and 3, with little or no benefit with regards to increased energy efficiency over EC13, Part I. We urge the members of ICC to Disapprove EC34, Part I and up hold the approval of EC13, Part I as submitted and without further modification.

Public Comment 4:

Thomas S. Zaremba, Roetzel and Andress, representing Pilkington North America, Inc., and AGC Flat Glass North America, Inc., requests Disapproval.

Commenter's Reason: EC34-09/10 should be disapproved for at least three reasons. 1. The Proponent has put forward no credible evidence that its revised U-factor values will yield any measurable energy savings. While the Proponent's supporting statement ***claims*** that the proposed U-factor values in zones 2 and 3 will save "significant" energy, there is a noticeable absence of any reference to either a source or any authority for the energy savings claimed by the proponent. Moreover, the Proponent includes "***hot water***" in one of its estimates and "***major appliances and lighting***" in another. Nothing in any of the Proponent's supporting statement gives any clue as to whether its estimates of energy savings are related to the new U-factor values proposed, or, do they result from the "**hot water**," "**major appliances**," and "**lighting**" that the Proponent has admittedly included in its estimates? 2. While the Proponent used an unsubstantiated claim of some sort of energy savings to secure the Committee's recommendation in support of this proposal, the real impact of this change will be to eliminate the use of aluminum framed windows from zones 2 and 3 in favor of the use of vinyl framed windows. 3. Final Action voters should demand a high level of proof of a real, substantial and measurable energy benefit before adopting proposed code changes, especially ones that openly favor one product over others in the marketplace. This is true because the adoption of code change proposals that yield no significant or verifiable energy savings do little more than impose the unjustified burden on building code officials of having to learn new energy code requirements for no real, genuine or beneficial reason.

The Committee recommended the adoption of EC34 without seeking verification that its adoption will yield any significant energy benefit. Any energy savings resulting from EC34 will be nominal at best. We urge Final Action voters to vote against the standing motion to approve EC34 as submitted in order to then vote to Disapprove EC34-09/10.

Final Action: AS AM AMPC____ D

EC34-09/10-PART II
IRC Table N1102.1, Table N1102.1.2

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise tables as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	~~1.2~~ NR	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	~~0.65i~~ 0.40	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	~~0.50i~~ 0.35	0.65	0.35[e, j]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5[h]	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5[h]	15/19	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30[g]	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE N1102.1.2
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	CRAWL SPACE WALL U-FACTOR
1	~~1.20~~ 0.50	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	~~0.65~~ 0.40	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.50~~ 0.35	0.65	0.035	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.060	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.059	0.065

(Footnotes remain unchanged)

Reason: This proposal substantially increases energy efficiency in climate zones 1-3 by specifying lower, more realistic fenestration U-factors that more closely resemble actual windows used to meet current requirements in these zones and, as a result, will close a significant gap in trade-off compliance paths and performance path calculations as well as make the code more efficient.

The current window U-factor requirements in the three southernmost climate zones are unreasonably high, given the current *IECC* SHGC requirement of 0.30 and *IRC* SHGC requirement of 0.35. To meet the SHGC requirement in these three zones, builders typically use low solar gain, low-e glass. As a result, the only issue is a reasonable choice of frame to meet increasing energy efficiency demands. With such a frame, the resulting product has a much lower U-factor than the current requirements for these climate zones. The practical effect of this lower U-factor for actual windows is that users who follow the Total UA alternative or the Simulated Performance Alternative automatically receive unnecessary free trade-off credit (the difference between the artificially high U-factor requirement and the window's actual U-factor), which is then used to reduce efficiency elsewhere in the home.

The proposed change sets U-factors at reasonable levels designed to match reasonably efficient windows available in all markets. According to the *2005 ASHRAE Handbook of Fundamentals* (page 31.8, Table 4), a low solar gain, low-e window (0.05 emissivity) with a ½ inch air space typically achieves the following U-factors:

	Operable w/o Argon	Fixed w/o Argon	Operable w/Argon	Fixed w/Argon
Aluminum Thermal Break	0.47	0.41	0.44	0.37
Wood/Vinyl	0.39	0.35	0.36	0.31

This proposal would continue to allow, under the prescriptive compliance path, any frame in climate zone 1, but would require a builder to use a more reasonable 0.50 U-factor (reflecting the range of U-factors portrayed above) where they elect to use a UA trade-off or the performance path. In climate zone 2, this proposal would use a vinyl framed window without argon as the baseline prescriptive path window (wood and clad-wood framed windows would also meet this requirement as well as some aluminum thermal break framed windows). In zone 3, to achieve a 0.35 U-factor, this proposal would typically require the addition of argon (beyond the level for climate zone 2) for the prescriptive path window. While this proposal may require some to switch from aluminum to vinyl windows if they choose to use the prescriptive path, there does not appear to be an additional cost to achieve the 0.40 or better U-factor, given that the cost of vinyl and aluminum window frames are reportedly very competitive. While there is a slight additional cost to add argon, such cost is relatively minimal and more than offset by the benefits of a better U-factor in climate zone 3. There is also precedent for much lower U-factors in these climate zones. For example, under the 2009 American Recovery and Reinvestment Act (Stimulus Bill), the federal tax credit for replacement windows specifies a 0.30 U-factor nationwide.

This proposal substantially increases energy efficiency in climate zones 1-3. The table below illustrates the estimated energy cost savings from the prescriptive changes in climate zones 2 and 3 over the current 2009 *IECC* and *IRC* values. . These savings are significant and when coupled with other proposed code modifications can lead to significant overall energy savings for homes.

	Climate Zone 1	Climate Zone 2	Climate Zone 3
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	-	7.5%	6.2%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	-	5.3%	4.5%

The proposed change is designed to match windows available in all markets. While most wood or vinyl-framed double-pane windows already meet the 0.35 U-factor requirement, any frame type could also be used under either the Total UA alternative or the Simulated Performance Alternative. In our experience, these values are already achieved by many, if not most, of the windows sold in these climate zones.

This proposal represents a reasonable and cost effective improvement that will provide states and local jurisdictions with an option to easily increase the efficiency of their code.

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

ICCFILENAME: PRINDLE-EC-14-T. 402.1.1-T. N1102.1

Public Hearing Results

PART II - IRC
Committee Action: Disapproved

Committee Reason: This proposal is not supported by cost data to demonstrate reasonable return on investment for such an aggressive change in stringency.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Submitted.

Commenter's Reason: *EC34 should be approved as submitted.* It has already been approved by the IECC committee and should be approved as submitted and incorporated into the IRC as well for code consistency and improvement in energy efficiency. The proposal substantially increases energy efficiency in climate zones 1-3 by requiring lower, more realistic fenestration U-factors and is designed to match windows which are cost-effective and available in all markets. A lower glazing U-factor is a proven energy saver for both heating and cooling energy, thereby providing savings on natural gas, heating oil and electric bills.

As recognized by the IECC Committee in its reason statement, "this proposal represents an increase in stringency and therefore energy savings that is reasonably easy and cost effective to achieve." While the IRC committee complained of the lack of supporting cost data, a review of the proposal itself shows that it directly addresses the cost issue. Low-e windows are already required in these climate zones due to the SHGC requirements and there is no market upgrade cost to move from aluminum to vinyl frames – as a result, the substantial energy cost savings from the windows required by this proposal comes at virtually no increased window cost. Windows that meet the U-factors proposed in EC34-09/10 are widely available. In fact, according to a review of the NFRC Certified Products Directory database, over 93% of all products certified have a U-factor of 0.50 or less; 79% have a U-factor of 0.40 or less, and 67% have a U-factor of 0.35 or less. By using cost-effective technology already widely available in the market, this proposal achieves substantial energy savings over the U-factors currently in the IECC and those contained in other code proposals.

Public Comment 2:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, requests Approval as Submitted.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

The windows required to comply with this proposal are fairly common and we feel compliance could easily be obtained. Therefore we recommend approval As Submitted in both codes.

Final Action: AS AM AMPC____ D

EC35-09/10-PART I

Table 402.1.1

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

Proponent: Jeff Lowinski, representing Window and Door Manufacturers Association (WDMA)

PART I – IECC

Revise table as follows:

TABLE 402.1.1
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	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	~~0.65[j]~~	0.75	0.30	30	13	4/6	13	0	0	0
3	~~0.50[j]~~	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

~~j. For impact rated fenestration complying with Section R301.2.1.2 of the *International Residential Code* or Section 1608.1.2 of the *International Building Code*, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.~~

(Portions of footnotes not shown remain unchanged)

Commenter's Reason:

(Prindle) This proposal will increase energy efficiency by eliminating unnecessary exceptions to the fenestration requirements for impact rated fenestration. The IECC exception for U-factor and the IRC exceptions for U-factor and SHGC should all be removed. The exceptions are written too broadly and create an unnecessary loophole in fenestration requirements.

Exceptions are Too Broad. Although impact rated fenestration may not be required (or even advisable) in every home in climate zones 1 through 3, these exception could apply to any home in this part of the country. These footnotes are not limited to those situations in which the *IBC* or I*RC* would *require* impact rated fenestration. The *IRC* only requires impact-rated glazing in Wind-Borne Debris Regions, and it defines Wind-Borne Debris Region as follows:

Areas within hurricane-prone regions within one mile of the coastal mean high water line where the basic wind speed is 110 miles per hour (49 m/s) or greater; or where the basic wind speed is equal to or greater than 120 miles per hour (54 m/s); or Hawaii.

IRC page 22. Regions that fit within that definition are much narrower than climate zones 2 and 3. See Figure R301.2(4), Basic Wind Speeds for 50-Year Mean Recurrence Interval. While Wind-Borne Debris Regions typically only cover coastal counties, the U-factor exception reaches all counties in these climate zones, even as far inland as Las Vegas, Nevada. The result is a significant wasted opportunity to make new homes more energy efficient, in exchange for windows that are unnecessary in these regions.

Products are Widely Available. Both exceptions were rejected by the *IECC* Committee in the 07/08 code cycle because they are unnecessary: The committee agreed with opponents that there were a sufficient amount of impact resistant products readily available that will meet fenestration U-factors for hurricane prone regions; therefore the exception for impact resistant windows is unnecessary.

There are many products already available on the market that meets both the prescriptive requirements and the wind-borne debris requirement. The exception simply wastes an opportunity to bring more energy efficiency to climate zones 1 through 3.

Weighted Average and Flexibility. Even if a builder installs windows that do not meet the prescriptive requirements, users may simply engage the Total UA Alternative or the Simulated Performance Alternative in Section 405 of the *IECC*, or the Department of Energy's free *RES*check software, and trade efficiency among all the envelope components. Because of the flexibility afforded by multiple compliance options, exceptions like these unnecessarily weaken the energy efficiency of the code.

(Lowinski) Fenestration thermal performance requirements should be independent of other performance criteria, such as providing protection from wind-borne debris or structural design pressure. This proposal seeks to undo a weakening of the energy code included in the 2009 IECC. There's plenty of windows and doors available in the market that can meet the thermal performance requirements as proposed, and meet the impact-resistant requirements of Section 1608.1.2.

Cost Impact: (Lowinski) The code change proposal will increase the cost of construction.

ICCFILENAME: PRINDLE-EC-16-Lowinski-EC-2-T. 402.1.1-T. N1102.1

Public Hearing Results

PART I - IECC
Committee Action: Approved as Submitted

Committee Reason: More product is available that can meet impact requirements and still have the low E values desired. The market will only advance to provide more products.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Thomas D. Culp, Ph.D, Birch Point Consulting LLC, representing The Glazing Industry Code Committee and the Aluminum Extruders Council, requests Disapproval.

Commenter's Reason: EC35, which was only approved by the IECC committee by a narrow vote of 6-5, raises serious safety concerns and must be disapproved. Both the IECC and IRC recognize that hurricane impact resistant windows are different products than normal windows and warrant separate consideration, just as skylights perform differently from windows. However, EC35 would remove this distinction for hurricane impact resistant products.

Building codes in coastal areas all the way from Texas to Massachusetts are being updated at a dramatic rate to greatly increase structural wind load and impact requirements, yet this proposal does not account for the heavier framing materials used in hurricane impact products. Hurricane products have higher U-factors from using heavier metal and/or reinforced framing to meet strict life safety requirements. To ensure that <u>both</u> the energy and structural safety requirements are satisfied and enforced in these regions, the requirements must account for the important differences of hurricane products.

Because of the SHGC requirement, double glazing with low-e will still be standard regardless of this proposal, so the primary effect is in framing type. While it is true that impact-resistant products are now available in multiple frame types, there is no doubt that a reduction in U-factor would come at the expense of structural performance. Looking at the Miami-Dade listings, the average design pressure for vinyl framed products is 60 psf, compared to 92 psf for aluminum framed products. Although both "pass", <u>this proposal would strongly promote the product that is 35% weaker!</u> Furthermore, although the 60 psf vinyl products may pass the criteria for being listed, they may not always meet the load requirements for specific buildings depending on location, geometry, etc.

Furthermore, this proposal potentially jeopardizes life safety and property for very minor energy savings in these warm southern climates. For nine coastal cities in Zone 2, the average energy savings from this proposal is only between $9 - $23 per year, with an extremely long payback period. This is not an acceptable trade-off between structural and energy performance.

Finally, it is important to note that the U.S. Department of Energy specifically chose to retain this footnote for hurricane impact resistant products in its proposal EC13. EC13 also corrects the footnote wording to limit its application only to wind-borne debris regions in coastal areas. Even though it would be extremely unlikely for an inland homeowner to add the cost of impact glazing just to use this footnote, this is a minor correction consistent with the original intent, and also addresses one of the concerns of the proponent. At best, EC35 is unnecessary, and at worst, EC35 raises serious safety concerns.

We ask for strong disapproval of EC35 part I, consistent with the recommendation of the IRC code development committee for part II.

Public Comment 2:

Amanda Hickman, InterCode Incorporated, representing 3M Renewable Energy Division and The International Window Film Association requests Disapproval.

Commenter's Reason: We are philosophically opposed to any change that is not product neutral and/or does not save energy. Therefore, we believe that EC35 should be disapproved. Additionally, this proposal raises questions regarding structural safety issues as it would delete foot note "j" to Table 402.1.1 which includes an exemption from U-factor values in wind borne debris areas. Lower U-factors in the south do not save energy, so it is perplexing as to why the proponent chose to trade minimal if any energy savings for structural safety.

Public Comment 3:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, request Disapproval.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

Because EC34 already lowered the U-factor for glazing in southern regions, adding this additional requirement to impact rated glass would be too restrictive. We prefer the verbiage that is currently found in the EC13 proposal.

Public Comment 4:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association, requests Disapproval.

Commenter's Reason: EC35, Part I would remove a footnote to Table 402.1.1 that permits impact resistant fenestration that complies with Section R301.2.1.2 of the *International Residential Code* or Section 1608.1.2 of the *International Building Code* to have a maximum U-factor of 0.75 in Zone 2 and 0.65 in Zone 3. This footnote was added to Table 402.1.1 in the 2009 IECC. The purpose of the footnote was to not require manufacturers of impact resistant fenestration to have to retest their products twice due to changes in the IECC. In most cases reducing the maximum U-factor for these products would require a new glass package to be used. Manufacturers would first need to have the U-factor and SHGC of their products with the new glass package determined by an accredited laboratory using NFRC 100 and 200, and then have the products with the new glass package tested, labeled and approved as complying with the impact resistance requirements of the IBC or IRC.

EC13, Part I, which AAMA supported and which was approved during the Code Development Hearings in Baltimore, restricts the scope of this footnote to wind borne debris areas. It is within these areas that impact resistant fenestration is needed to protect the integrity of the building envelop, and thereby the interior of the home. It is AAMA's view that the change of scope put in place on this footnote by EC13, Part I is appropriate, and the footnote should be maintained as revised by EC13, Part I.

We urge the ICC membership to uphold the approval of EC13, Part I, as submitted and without further modification by EC35, Part I.

Public Comment 5:

Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc, and AGC Flat Glass North America, Inc, requests Disapproval.

Commenter's Reason: EC35-09/10 should be disapproved. Proponent's supporting statement says: "Fenestration thermal requirements should be independent of other performance criteria such as providing protection from wind-borne debris or structural design pressure." In other words, the basis of this proposal is proponent's belief that "energy should trump the structural and safety considerations of the code." The drive for energy conservation need not and must not "trump" the structural and safety considerations of the building codes. Foot note "j" to Table 402.1.1 includes an appropriate allowance from U-factor values in wind borne debris areas based on structural and impact safety considerations. This proposal would delete them. At the same time, the adoption of this proposal would clearly benefit vinyl framed window products over much stronger aluminum framed window products.

Moreover, there are no measurements, or even estimates, of any energy savings of any kind included anywhere in any of the Proponents' supporting statements – just Proponent's unsubstantiated claim that "energy will be saved." But, how much, if any? Is it substantial? Or, is it merely a nominal savings of a magnitude that will be eliminated by someone absent mindedly going to bed and leaving a light on? In the absence of clear proof that some measureable, significant benefit will result, the availability of aluminum and other products with equally important structural properties should not be eliminated under the "guise" of energy conservation.

Final Action voters are urged to vote against the standing motion to approve EC35 and then to vote to Disapprove EC35.

Final Action: AS AM AMPC____ D

EC35-09/10-PART II
IRC Table N1102.1

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

Proponent: Jeff Lowinski, representing Window and Door Manufacturers Association (WDMA)

PART II – IRC BUILDING/ENERGY

Revise table as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35~~[j]~~	30	13	3/4	13	0	0	0
2	0.65~~[i]~~	0.75	0.35~~[j]~~	30	13	4/6	13	0	0	0
3	0.50~~[i]~~	0.65	0.35[e, ~~j~~]	30	13	5/8	19	5/13f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5h	13/17	30f	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5h	15/19	30g	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30g	10/13	10, 4 ft	10/13

~~i. For impact-rated fenestration complying with Section R301.2.1.2, the maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.~~
~~j. For impact-resistant fenestration complying with Section R301.2.1.2 of the *International Residential Code*, the maximum SHGC shall be 0.40.~~

(Portions of footnotes not shown remain unchanged)

Reason:
(Prindle) This proposal will increase energy efficiency by eliminating unnecessary exceptions to the fenestration requirements for impact rated fenestration. The IECC exception for U-factor and the IRC exceptions for U-factor and SHGC should all be removed. The exceptions are written too broadly and create an unnecessary loophole in fenestration requirements.

Exceptions are Too Broad. Although impact rated fenestration may not be required (or even advisable) in every home in climate zones 1 through 3, these exception could apply to any home in this part of the country. These footnotes are not limited to those situations in which the *IBC* or I*RC* would *require* impact rated fenestration. The *IRC* only requires impact-rated glazing in Wind-Borne Debris Regions, and it defines Wind-Borne Debris Region as follows:

Areas within hurricane-prone regions within one mile of the coastal mean high water line where the basic wind speed is 110 miles per hour (49 m/s) or greater; or where the basic wind speed is equal to or greater than 120 miles per hour (54 m/s); or Hawaii.

IRC page 22. Regions that fit within that definition are much narrower than climate zones 2 and 3. See Figure R301.2(4), Basic Wind Speeds for 50-Year Mean Recurrence Interval. While Wind-Borne Debris Regions typically only cover coastal counties, the U-factor exception reaches all counties in these climate zones, even as far inland as Las Vegas, Nevada. The result is a significant wasted opportunity to make new homes more energy efficient, in exchange for windows that are unnecessary in these regions.

Products are Widely Available. Both exceptions were rejected by the *IECC* Committee in the 07/08 code cycle because they are unnecessary: The committee agreed with opponents that there were a sufficient amount of impact resistant products readily available that will meet fenestration U-factors for hurricane prone regions; therefore the exception for impact resistant windows is unnecessary.

There are many products already available on the market that meets both the prescriptive requirements and the wind-borne debris requirement. The exception simply wastes an opportunity to bring more energy efficiency to climate zones 1 through 3.

Weighted Average and Flexibility. Even if a builder installs windows that do not meet the prescriptive requirements, users may simply engage the Total UA Alternative or the Simulated Performance Alternative in Section 405 of the *IECC*, or the Department of Energy's free *RES*check software, and trade efficiency among all the envelope components. Because of the flexibility afforded by multiple compliance options, exceptions like these unnecessarily weaken the energy efficiency of the code.
(Lowinski) Fenestration thermal performance requirements should be independent of other performance criteria, such as providing protection from wind-borne debris or structural design pressure. This proposal seeks to undo a weakening of the energy code included in the 2009 IECC. There's plenty of windows and doors available in the market that can meet the thermal performance requirements as proposed, and meet the impact-resistant requirements of Section 1608.1.2.

Cost Impact: (Lowinski) The code change proposal will increase the cost of construction.

ICCFILENAME: PRINDLE-EC-16-Lowinski-EC-2-T. 402.1.1-T. N1102.1

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: The committee believes that availability of low E products with minimum required impact resistance is limited, and therefore this is still a necessary exception.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Submitted.

Commenter's Reason: *EC35 should be approved as submitted.*

It will make the IRC consistent with the IECC in this area and improve energy efficiency. As recognized by the IECC Committee in its approval of Part I, there is no need to create an exception to the energy efficiency requirements for impact-rated window products. Even more products are available today than during previous code cycles to meet the impact requirement while still meeting the prescriptive values and the market will only advance to provide more products with increased demand. Moreover, because this exception applies to counties well beyond the typical wind-borne debris regions covering coastal counties (and in fact would reach as far inland as Las Vegas, NV), a huge and unnecessary loophole is created in the fenestration requirements that results in a wasted opportunity to make these homes significantly more energy efficient.

Public Comment 2:

Jeff Inks, representing Window and Door Manufacturers Association, requests Approval as Submitted.

Commenter's Reason: Fundamentally, fenestration thermal performance requirements should be independent of other performance criteria, such as structural design pressure requirements or requirements for wind-borne debris protection as is the case here.

This exception was original included in the code based on concerns that there was limited availability of product that complies with both the impact resistance and energy performance requirements. However, while the IRC B&E committee based their decision for disapproval on this concern, limited availability is simply not the case and that concern can no longer be substantiated. The fenestration industry is fully capable of producing compliant product and Section R301.2.1.2 allows the use of alternative means for protection regardless. Allowing the exception needlessly compromises the energy efficiency of the code and is counter to the 30% increase in efficiency objective and we urge the approval of this modification.

There are no reasons for maintaining these exception and we urge the approval of this proposal as submitted.

Final Action: AS AM AMPC____ D

EC36-09/10-PART I
Table 402.1.1

Proposed Change as Submitted

Proponent: Julie Ruth, PE, JRuth Code Consulting, representing the American Architectural Manufacturers Association

PART I – IECC

Revise table as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	GLAZED FENESTRATION SHGC	SKYLIGHT[b] U-FACTOR	~~GLAZED FENESTRATION~~ SKYLIGHT[B] SHGC	Remainder of Table unchanged
1	1.20	0.30	0.75	~~0.30~~ 0.40[j]	
2	0.65[i]	0.30	0.75	~~0.30~~ 0.40[j]	
3	0.50[i]	0.30	0.65	~~0.30~~ 0.40[j]	
4 except Marine	0.35	N.R.	0.60	N.R.	
5 and Marine 4	0.35	N.R.	0.60	N.R.	
6	0.35	N.R.	0.60	N.R.	
7 and 8	0.35	N.R.	0.60	N.R.	

For SI: 1 foot = 304.8 mm.

b. The fenestration *U*-factor and glazed fenestration SGHC columns exclude~~s~~ skylights. ~~The SHGC column applies to all glazed fenestration.~~

j. The maximum SHGC for tubular daylighting devices (TDDs) that do not exceed 1.30 sq ft (0.12 m^2) in cross sectional area shall be 0.45.

(Portions of table and footnotes not shown remain unchanged)

Reason: Significant energy savings can be achieved in all types of buildings through the use of daylighting, which is free and therefore does not contribute to the energy cost of a building at all. Toplighting by skylights can be an important component of good daylighting design, but only if an adequate amount of light is transmitted through the skylight. The Visible Transmittance (VT) of light through a skylight is directly proportional to its SHGC. A review of the NFRC database on March 30, 2009 found that domed skylights with SHGC less than 0.35 had VT less than 0.50 and flat glass skylights with SHGC less than 0.35 had VT less than 0.56.

Increasing the SHGC for residential skylights brings domed skylights with VT between 0.60 and 0.70, and flat glass skylights with VT between 0.63 and 0.69 into the range of availability. This proposal provides that increase for skylights only, and also includes a footnote that establishes a maximum SHGC of 0.45 for tubular daylighting devices (TDDs). TDDs permit a lot of light to enter a space through a relatively small opening in the roof structure, but their SHGC will commonly be between 0.40 and 0.45.

Use of these skylights (flat glass, domed and TDDs) to provide daylighting into residences are a cost effective way to save energy, and should be not only permitted, but encouraged within both the IRC and IECC.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: RUTH-EC-4-T. 402.1.1-T. N1102.1

Public Hearing Results

PART I - IECC
Committee Action: Disapproved

Committee Reason: The proposal erodes the energy conservation level of the code. This would represent a rollback from the 2009 levels.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, request Approval as Submitted.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This proposal will keep skylight and tubular daylight device SHGC at a level that better allows skylights and tubular daylight devices to be used for daylighting.

Public Comment 2:

Jeff Inks, representing Window & Door Manufacturers Association, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	GLAZED FENESTRATION SHGC	SKYLIGHT[b] U-FACTOR	SKYLIGHT[B] SHGC	Remainder of Table unchanged
1	1.20	0.30	0.75	~~0.40~~ 0.35[j]	
2	0.65[i]	0.30	0.75	~~0.40~~ 0.35[j]	
3	0.50[i]	0.30	0.65	~~0.40~~ 0.35[j]	
4 except Marine	0.35	N.R.	0.60	N.R.	
5 and Marine 4	0.35	N.R.	0.60	N.R.	
6	0.35	N.R.	0.60	N.R.	
7 and 8	0.35	N.R.	0.60	N.R.	

For SI: 1 foot = 304.8 mm.

b. The fenestration *U*-factor and glazed fenestration SGHC columns exclude skylights.

j. The maximum SHGC for tubular daylighting devices (TDDs) that do not exceed 1.30 sq ft (0.12 m^2) in cross sectional area shall be 0.45.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: WDMA urges approval as modified by our public comment which maintains the original proposal but reduces the maximum SHGC from 0.40 to 0.35 to address concerns that allowing a maximum of 0.40 for skylights is not justified.

The remainder of the original proposal separating out SHGC requirements for skylights and tubular daylighting devices (TDD's) is maintained because at this point in the evolution of the IECC it is important that SHGC requirements for skylights and TDD's be distinguished from vertical fenestration in order to allow for more practical SHGC requirements to be established for each in relation to the different daylighting benefits each provides. Both are also now defined in the IBC & IRC.

Establishing the SHGC for skylights at 0.35 is a technically justified value that helps to maximize the daylighting benefits that are gained by skylights while still providing reasonable solar heat gain limits. As noted in the reason statement for the original proposal, "A review of the NFRC database on March 30, 2009 found that domed skylights with SHGC less than 0.35 had VT less than 0.50 and flat glass skylights with SHGC less than 0.35 had VT less than 0.56," ranges that diminish daylighting benefits. Increasing the SHGC for residential skylights to 0.35 will bring the VT's for both types of skylights into a more ideal VT range (above 50%) for offsetting the need for artificial light.

The new footnote permitting the use of TDD's with an SHGC of 0.45 is maintained because as also noted by the original proponent, "TDD's permit a lot of light to enter a space through a relatively small opening in the roof structure, but their SHGC will commonly be between 0.40 and 0.45." Because of the significant daylighting benefits these devices provide, the use of them should be permitted and encouraged by the IECC which is accomplished by this footnote.

Public Comment 3:

Jeff Inks, representing Window & Door Manufacturers Association, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

b. ~~The fenestration *U*-factor and glazed fenestration SGHC columns exclude skylights.~~ The maximum SHGC for tubular daylighting devices

CLIMATE ZONE	FENESTRATION				Remainder of table unchanged
	WINDOW AND DOOR		SKYLIGHT		
	U-FACTOR	SHGC	U-FACTOR	SHGC	
1	*no change*	0.30	*no change*	0.35[b]	
2	*no change*	0.30	*no change*	0.35[b]	
3	*no change*	0.30	*no change*	0.35[b]	
4 except Marine	*no change*	NR	*no change*	*no change*	
5 and Marine 4	*no change*	NR	*no change*	*no change*	
6	*no change*	NR	*no change*	*no change*	
7 and 8	*no change*	NR	*no change*	*no change*	

(TDDs) that do not exceed 1.30 sq ft (0.12m^2) in cross sectional area shall be 0.45)

TABLE 402.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENESTRATION		
	WINDOW AND DOOR *U*-FACTOR	SKYLIGHT *U*-FACTOR	
1	*no change*	*no change*	*Remainder of table unchanged*
2	*no change*	*no change*	
3	*no change*	*no change*	
4 except Marine	*no change*	*no change*	
5 and Marine 4	*no change*	*no change*	
6	*no change*	*no change*	
7 and 8	*no change*	*no change*	

(No change to footnotes)

Commenter's Reason: The intent of the original proposal and this public comment is to recognize different SHGC values for skylights and tubular daylighting devices (TDD's). The reformat and revised footnote provides this recognition without any changes to the remainder of the table.

Separating SHGC requirements for skylights and TDD's is needed at this point in the evolution of the IECC. Distinguishing them from vertical fenestration is necessary in order to allow for the most practical SHGC requirements to be established for each in relation to their design and different daylighting benefits each provides.

The reformatting is self-explanatory.

The SHGC for skylights at 0.35 is a technically justified value that helps to maximize the daylighting benefits that are gained by skylights while still providing reasonable solar heat gain limits. As noted in the reason statement for the original proposal, "A review of the NFRC database on March 30, 2009 found that domed skylights with SHGC less than 0.35 had VT less than 0.50 and flat glass skylights with SHGC less than 0.35 had VT less than 0.56," ranges that diminish daylighting benefits. Increasing the SHGC for residential skylights to 0.35 will bring the VT's for both types of skylights into a more ideal VT range (above 50%) for offsetting the need for artificial light.

The revision to footnote b. removes language that is no longer needed with the reformat and adds the provision permitting the use of TDD's with a SHGC of 0.45 or better without adding a new footnote. The basis for the 0.45 is also noted by the original proponent, "TDD's permit a lot of light to enter a space through a relatively small opening in the roof structure, but their SHGC will commonly be between 0.40 and 0.45." Because of the significant daylighting benefits these devices also provide, the use of them should be permitted and encouraged by the IECC which is accomplished by this footnote.

Final Action: AS AM AMPC____ D

EC36-09/10-PART II
IRC Table N1102.1

Proposed Change as Submitted

Proponent: Julie Ruth, PE, JRuth Code Consulting, representing the American Architectural Manufacturers Association

PART II – IRC BUILDING/ENERGY

Revise table as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[A]

CLIMATE ZONE	FENESTRATION U-FACTOR	GLAZED FENESTRATION SHGC	SKYLIGHT U-FACTOR	~~GLAZED FENESTRATION~~ SKYLIGHT SHGC	Remainder of Table unchanged
1	1.20	0.35[j]	0.75	~~0.35[j]~~ 0.40[l]	
2	0.65[i]	0.35[j]	0.75	~~0.35[j]~~ 0.40[l]	
3	0.50[i]	0.35[j]	0.65	~~0.35[j]~~ 0.40[l]	
4 except Marine	0.35	N.R.	0.60	N.R.	
5 and Marine 4	0.35	N.R.	0.60	N.R.	
6	0.35	N.R.	0.60	N.R.	
7 and 8	0.35	N.R.	0.60	N.R.	

b. The fenestration *U*-factor and glazed fenestration SHGC columns exclude~~s~~ skylights. ~~The SHGC column applies to all glazed fenestration.~~
l. The maximum SHGC for tubular daylighting devices (TDDs) that do not exceed 1.30 sq. ft. (0.12 m^2) in cross sectional area shall be 0.45.

(Portions of table and footnotes not shown remain unchanged)

Reason: Significant energy savings can be achieved in all types of buildings through the use of daylighting, which is free and therefore does not contribute to the energy cost of a building at all. Toplighting by skylights can be an important component of good daylighting design, but only if an adequate amount of light is transmitted through the skylight. The Visible Transmittance (VT) of light through a skylight is directly proportional to its SHGC. A review of the NFRC database on March 30, 2009 found that domed skylights with SHGC less than 0.35 had VT less than 0.50 and flat glass skylights with SHGC less than 0.35 had VT less than 0.56.

Increasing the SHGC for residential skylights brings domed skylights with VT between 0.60 and 0.70, and flat glass skylights with VT between 0.63 and 0.69 into the range of availability. This proposal provides that increase for skylights only, and also includes a footnote that establishes a maximum SHGC of 0.45 for tubular daylighting devices (TDDs). TDDs permit a lot of light to enter a space through a relatively small opening in the roof structure, but their SHGC will commonly be between 0.40 and 0.45.

Use of these skylights (flat glass, domed and TDDs) to provide daylighting into residences are a cost effective way to save energy, and should be not only permitted, but encouraged within both the IRC and IECC.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: RUTH-EC-4-T. 402.1.1-T. N1102.1

Public Hearing Results

PART II - IRC
Committee Action: **Approved as Submitted**

Committee Reason: This is a reasonable exception to allow skylights to function to supply natural light.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jeff Inks, representing Window & Door Manufacturers Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[A]

CLIMATE ZONE	FENESTRATION U-FACTOR	GLAZED FENESTRATION SHGC	SKYLIGHT U-FACTOR	SKYLIGHT SHGC	Remainder of Table unchanged
1	1.20	~~0.35~~ 0.30[j]	0.75	~~0.40~~ 0.35[l]	
2	0.65[i]	~~0.35~~ 0.30[j]	0.75	~~0.40~~ 0.35[l]	
3	0.50[i]	~~0.35~~ 0.30[j]	0.65	~~0.40~~ 0.35[l]	
4 except Marine	0.35	N.R.	0.60	N.R.	
5 and Marine 4	0.35	N.R.	0.60	N.R.	
6	0.35	N.R.	0.60	N.R.	
7 and 8	0.35	N.R.	0.60	N.R.	

b. The fenestration *U*-factor and glazed fenestration SHGC columns exclude~~s~~ skylights.
l. The maximum SHGC for tubular daylighting devices (TDDs) that do not exceed 1.30 sq. ft. (0.12 m^2) in cross sectional area shall be 0.45.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Approval of EC-36 Part II as submitted is a significant improvement in the energy provisions of the IRC for the reasons stated by the proponent. However, increasing the SHGC for skylights to 0.40 is not necessary. The existing SHGC of 0.35 for skylights is reasonably achievable without greatly compromising the daylighting benefits skylights provide and we are recommending it be maintained as proposed by this public comment.

The remainder of the original proposal separating out SHGC requirements for skylights and tubular daylighting devices (TDD's) is maintained because at this point in the evolution of the IECC it is important that SHGC requirements for skylights and TDD's be distinguished from vertical fenestration in order to allow for more practical SHGC requirements to be established for each in relation to the different daylighting benefits each provides. Both are also now defined in the IBC & IRC.

Public Comment 2:

Donald J. Vigneau, Northeast Energy Efficiency Partnerships, Inc, representing himself requests Disapproval.

Commenter's Reason: Public Comment is for Disapproval of Part II, since approval of this definition without a corresponding change to IECC Chapter 2 will create inconsistency between the two codes without valid reason or substantiation.

Part I was Disapproved (D) by the Energy Code Development Committee.
Part II was Approved as Submitted (AS) by the Residential Building & Energy Code Development Committee.

Final Action: AS AM AMPC____ D

EC38-09/10-PART I

Table 402.1.1, Table 402.1.3, 402.3.3(New)

Proposed Change as Submitted

Proponent: Thomas S.Zaremba, Roetzel & Andress, representing Pilkington North America

PART I – IECC

1. Revise tables as follows:

TABLE 402.1.1
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	CRAWL SPACE[c] WALL *R*-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30 ~~0.35~~	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.30 ~~0.35~~	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.30 ~~0.35~~	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE 402.1.3
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[d]	CRAWL SPACE WALL U-FACTOR[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	~~0.35~~ 0.30	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	~~0.35~~ 0.30	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	~~0.35~~ 0.30	0.60	0.026	0.057	0.057	0.028	0.050	0.065

(Footnotes remain unchanged)

2. Add new text as follows:

402.3.3 U-factor and SHGC alternative. Window assemblies having a U-factor of 0.31 and SHGC greater than or equal to 0.35 or a U-factor of 0.32 and SHGC greater than or equal to 0.40 shall be permitted to satisfy the requirements of Table 402.1.1 in Climate Zones 5, 6, 7 and 8. For compliance with this section, default SHGC values from Table 303.1.3(3) shall not be permitted.

Reason: After Lawrence Berkeley National Laboratories (LBNL) did an extensive study of energy equivalency of matching U-factors with various SHGCs in northern climate zones, the Department of Energy issued a new Energy Star Windows criteria (Energy Star) which will take effect on January 4, 2010. The DOE established the following alternate, equivalent energy performance criteria for Energy Star labeled windows for IECC climate zones 5-8:

U-factor	SHGC
≤ 0.30	Any or NR
= 0.31	≥ 0.35
= 0.32	≥ 0.40

In support of these alternate paths, DOE's Energy Star report issued on April 7, 2009 explains:

> The energy savings analysis … revealed that in the North, a 0.01 increase in U-factor produces equivalent energy performance to a 0.05 increase in SHGC. DOE used this relationship to establish the proposed revised tradeoff levels: setting the … 0.30 U-factor and 0.30 SHGC as the base case, the minimum required SHGC in the revised tradeoffs rise 0.05 to balance a 0.01 rise in U-factor. The two alternative criteria specify U-factors of 0.31 and 0.32, while allowing the minimum SHGC to rise to 0.35 and 0.40 respectively. Windows with those specific U-factors and the corresponding SHGCs or higher will qualify.

If adopted, this proposal would harmonize the 2012 IECC to the criteria specified for Energy Star windows in the north. It would be timely for the IECC to do this since, even before the new Energy Star criteria takes effect in January 2010, the DOE plans to begin researching a new, Phase 2 proposal for Energy Star Windows.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: ZAREMBA-EC-2-T. 402.1.1- RE-1-T. N1102.1

Public Hearing Results

PART I - IECC
Committee Action: **Disapproved**

Committee Reason: This could have the impact of lowering energy conservation in some circumstances. The committee was also concerned over the claims that Energy Star stated that this is not cost effective without a tax credit.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc. and AGC Flat Glass North America, Inc, requests Approval as Submitted.

Commenter's Reason: EC38-09/10 Parts I and II should be adopted as submitted. This code change proposal is identical to the Energy Star requirements for Windows that took effect on January 4, 2010. (The next changes to the Energy Star Windows criteria is not expected until 2012.)

This proposal increases U-factor stringency in prescriptive applications in climate zones 5-8 from 0.32 to 0.30. It then matches U-factor values of 0.31 and 0.32, respectively, with the windows that have an SHGC ≥ 0.35 or ≥ 0.40, respectively.

Currently, the code permits the use of ANY SHGC in climate zones 4-8. Based on the work done by Lawrence Berkley National Laboratories in developing the current Energy Star Windows criteria, this proposal simply matches windows with U-factors ranging from 0.30 to 0.32 with SHGCs that will yield equivalent energy performance.

Energy Star criteria exists to enable consumers to select the best replacement windows. The Code applies to replacement windows and in the current economy, most window installations are replacements. The use of Energy Star labeled windows will reduce heating costs and, to the extent there is an impact on cooling costs, the benefits of lower heating costs in these northern climate zones will far outweigh any effect on cooling.

Final Action voters are encouraged to vote against the standing motion to disapprove EC38 and to vote in favor of its adoption as submitted.

Public Comment 2:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.1
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	CRAWL SPACE[c] WALL *R*-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.30	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.30	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE 402.1.3
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[d]	CRAWL SPACE WALL U-FACTOR[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.30	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.30	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	0.30	0.60	0.026	0.057	0.057	0.028	0.050	0.065

(Footnotes remain unchanged)

~~**402.3.3 U-factor and SHGC alternative.** Window assemblies having a U-factor of 0.31 and SHGC greater than or equal to 0.35 or a U-factor of 0.32 and SHGC greater than or equal to 0.40 shall be permitted to satisfy the requirements of Table 402.1.1 in Climate Zones 5, 6, 7 and 8. For compliance with this section, default SHGC values from Table 303.1.3(3) shall not be permitted.~~

Commenter's Reason: *EC38 should be approved as modified by this public comment. If not modified, this proposal should be disapproved.*

This proposed modification corrects the major flaw in the original proposal by eliminating the proposed high SHGC exception while retaining the undisputed benefits of reduced heat loss from a lower window U-factor in climate zone Marine 4 through climate zone 8. The original proposal introduced a special limited exception for high solar gain window products in these northern climates – a concept that has been consistently rejected in a number of prior code cycles. These proposals have typically oversimplified the key differences between heating and cooling energy saved, and the proponents have not demonstrated that this tradeoff would actually save energy in homes with varying operational and design characteristics. Once again, neither the IECC nor IRC Code Development Committees were able to find that the benefits from a lower U-factor outweighed the negative impact of the trade-off. As originally written, the proposal cannot guarantee any energy savings, since it does not recognize the orientation of the fenestration and ignores other important issues like comfort and peak demand.

This modification cures this problem and secures the benefit of lower U-factors to save energy all-year-round by simply eliminating the trade-off exception while supporting the improvement in window insulating value (moving to a 0.30 U-factor) for colder climates.

Support for Proposal As Modified.

We support lowering the U-factor to 0.30 in climate zones Marine 4 through 8 without any exceptions because such a change would result in a guaranteed increase of almost 14% in window insulating value (with more than a 14% reduction in heat loss through these windows) in these colder climates and guaranteed energy savings year-round in every home over the 0.35 U-factor currently in the IECC. This 14% improvement compares favorably with the 8.5% improvement in insulating value from the move to a more modest 0.32 U-factor that was approved by the IECC Committee in EC13, EC27 and EC39.

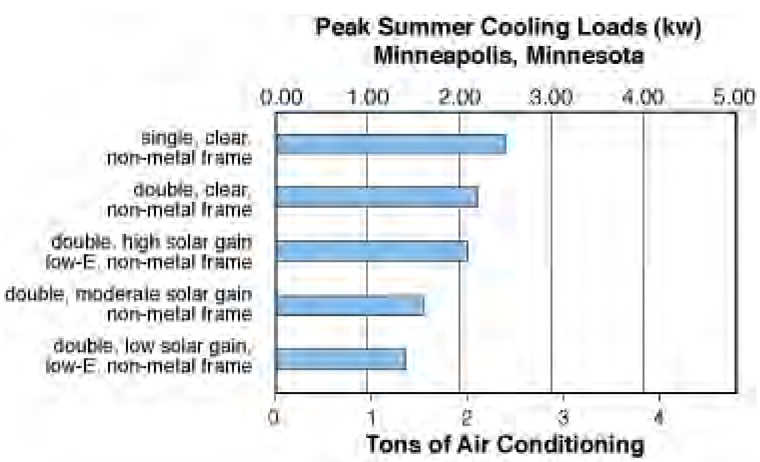
A lower glazing U-factor is a proven energy saver for heating and cooling energy, so this proposed lowering of the U-factor will result in savings on natural gas, heating oil and electric bills. Many windows sold in the northern U.S. that meet the current 0.35 U-factor (and the 0.32 U-factor that was approved by the IECC Committee in EC13, EC27 and EC39) also meet the 0.30 U-factor. Typically, the difference between a 0.35 and 0.30 window is argon-fill, a fairly low or no cost option, and possibly a slightly improved frame, spacer and/or glass package. While lowering the U-factor to this level may be viewed by some as aggressive, the area weighted average approach incorporated into the code will allow some windows to exceed this value, so long as the average U-factor of all of the windows in the home meets the 0.30 value, which makes the requirement easier to meet.

Opposition to the Original EC38 with High SHGC Special Product Exception.

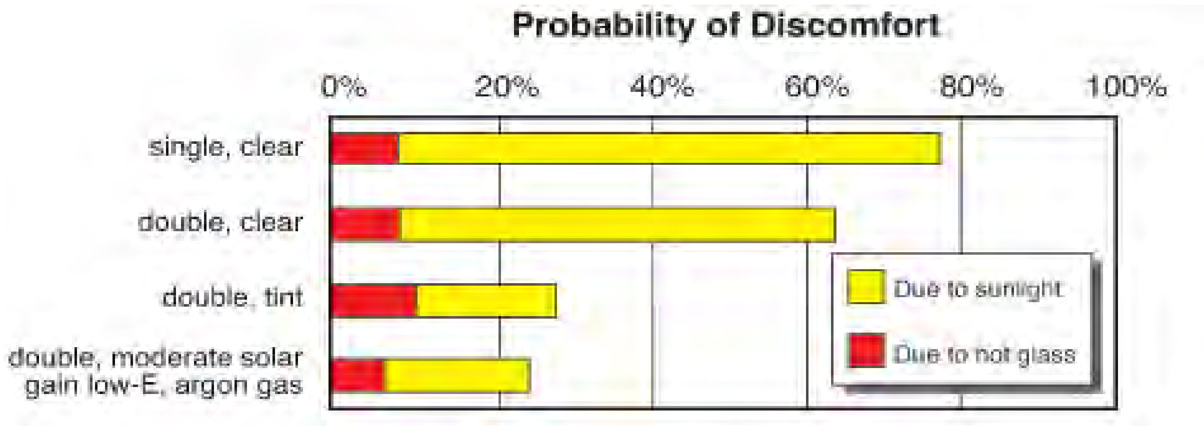
Regardless of the approach to the lower U-factor, we fundamentally disagree with the concept of creating a special exception that allows higher U-factors in windows with higher SHGC values. This is a very slippery slope that should be avoided. The proponents of this special exception contend that a window with a minimum SHGC of 0.35 and a maximum U-factor of 0.31, or a minimum SHGC of 0.40 and a maximum U-factor of 0.32, would use the same amount or less energy than a window with a 0.30 U-factor in all reasonably designed and operated houses, regardless of the window's orientation. There is no valid evidence to support this contention even for most cases, let alone all cases. Indeed, the risk is substantial that a higher SHGC would actually create occupant discomfort in the summer and consequently increase summer energy use (especially where windows face west and south with no or inadequate overhangs), as well as further increase peak demand during critical times of summer electric utility peak demand. Along the same lines, higher SHGCs would result in builders or homeowners needing to install larger air conditioning equipment by as much as an additional half-ton or more, which would increase peak summer electric load per home by as much as half a kilowatt or more (0.5 kW). Finally, we are concerned about weakening the IECC and IRC to make room for specific product exceptions such as this one.

In short, there is no reason to trade the certainty of the benefits of a window with a lower U-factor for a possibility of benefit from a higher SHGC, when those benefits are contingent upon the window being oriented correctly, the window's shades being open at the right times and adequate thermal mass and overhangs installed to properly capture the benefits and protect against the pitfalls associated with such windows. It is also important to note that the Energy Star analysis relied on to support this proposal only examined homes with equal square footage of windows on all four sides of the home and did not conduct any sensitivity to more realistic designs with most of the windows on two sides of the home. Moreover, that analysis showed widely varying results depending on location in the northern climate zones. The proper way to address this issue is through the performance compliance path, as it has been addressed for many years in the IECC, where these properties may be assessed on the basis of each individual home's characteristics. More details on the problems with this proposed exception are set forth below.

1. **Promotion of Higher SHGCs Would Negatively Impact Electric Peak Demand and HVAC Sizing.** Since electricity generally cannot be cost-effectively stored, one of the most serious challenges facing our nation's electric generation, transmission and distribution system is reliably meeting peak demand. Most utility systems in the US, including those across the northern part of the US, have peak demands that occur in the summer as a result of meeting residential and commercial air conditioning loads. Peak demand growth requires electric utilities (and indirectly consumers) to construct and pay for expensive additional generating units to supply power for only a few hours per year. Promoting higher SHGC windows would exacerbate this peak demand problem, and accordingly, this proposal to promote increased SHGCs should be rejected. The following chart based on data provided by Lawrence Berkeley National Laboratory (LBNL), which can be found on the Efficient Window Collaborative (EWC) website – http://www.efficientwindows.org/hvac.cfm – illustrates the peak demand and HVAC sizing issue by showing the potential peak demand impact from different window types. As is readily apparent, promoting a higher SHGC would have a negative impact on electrical peak demand and equipment sizing. The EWC website notes that using low-solar-gain low-e windows in Minneapolis may allow cooling equipment to be reduced in size up to a ton. Specifically looking at the difference between the third window (high solar gain low-e) and the fifth window (low solar gain low-e) in the graph demonstrates this impact and reinforces why a high solar gain trade-off is problematic.



2. **Promotion of Higher SHGCs Would Negatively Impact Summer Comfort.** As written, EC38 encourages the installation of high solar heat gain glazing, regardless of the orientation, by establishing an exception to the lower U-factor requirement applicable to lower SHGC windows. High solar gain will lead to significant occupant discomfort in the summer, even in colder winter climate zones (and may also impact winter comfort during the daytime). As explained by the EWC, as more direct sunlight passes through glazing, the probability of occupant discomfort increases enormously. The following chart provided by LBNL on the EWC website -- http://www.efficientwindows.org/comfort.cfm -- shows that use of a double pane clear window (with a higher SHGC) makes it almost three times more likely that the occupant will be uncomfortable, as compared to a sensible low SHGC low-e window. Higher solar gain also creates more volatility in the building's temperature fluctuations, and can create significant imbalances where more windows are located in specific rooms. When occupants are uncomfortable, they are likely to lower their thermostat set-points in the summer, consuming more energy, more than offsetting any of the savings claimed by the proponent of this proposal.



Source: Lawrence Berkeley National Laboratory (Lyons and Arasteh).

3. Special Product Exception is Inconsistent with Proper Passive Solar Design and Improperly Ignores Window Orientation. There is already room in the IECC and IRC for a passive-solar designed home. Builders have used the simulated performance alternative for years to take advantage of sophisticated designs that involve the correct windows for each orientation, thermal mass capable of absorbing heat gain, and overhangs to shield solar radiance when it is unneeded. With the performance path, builders can simulate the actual impact of specific window choices for specific orientations on a specific house. However, the oversimplified trade-off proposed by EC38 does not require any of the measures necessary for passive solar design, and as such, is not a reasonable addition to the simple prescriptive path. Recognizing that high SHGC windows are beneficial only for southern orientations with the proper design, the US Department of Energy recommends low SHGC windows (not high SHGC) for east and west oriented windows in northern cold climates for passive solar design. For more information, see the US DOE website -- http://www.eere.energy.gov/consumer. In addition, given the lack of solar gain on northern exposures during the winter in these climate zones, there is no basis for trading off the guaranteed benefits of a lower U-factor when there are no possible benefits from SHGC for north-facing glazing. As proposed, the EC38 high SHGC exception is not limited only to passive solar-designed homes, nor does it require proper orientation, but instead could apply to any home with any window orientation built in the northern portion of the country.

4. Special Product Exception is Confusing and Inconsistent with Simplified Prescriptive Path. This proposal, if adopted as written, will establish another confusing prescriptive alternative that runs counter to the simplified approach presently embodied in both the IECC and IRC. The changes adopted in the 2006 code cycle as developed by the U.S. Department of Energy established a single, simple prescriptive path to encourage ease of compliance and enforcement, as well as economies of scale and more effective competition, resulting in lower overall energy efficient building costs. Permitting such a specific prescriptive trade-off for one feature (high window SHGC) will encourage other interests to seek their own prescriptive trade-offs, ultimately resulting in over-complicating the code. This will only make the job of the code official more difficult without any offsetting benefits.

5. Similar High SHGC Proposals Have Been Consistently Rejected by the ICC. Similar proposals have been disapproved repeatedly by the IECC Committee in past code cycles for the same reasons (these proposals have also been rejected on public comment by the ICC membership for both the IECC and IRC). The IECC Development Committee stated in prior code cycles:

> EC21-07/08: "Given that the advantages for SHGC gains depends upon the direction of the wall in which the windows are installed, the committee believed that this provision was an oversimplification of the value of the trade-off. This would be better dealt with in the performance design."
>
> EC44 and EC45-06/07: "Regarding the new concept of introducing minimum SHGC values in northern climates, there are still too many unknown variables to justify this. For one, the orientation of the building will affect how much savings is realized. For another, the change in temperatures over the past few years in northern climates makes it unclear whether we can move to the concept of using windows to save on heating values."
>
> EC54-06/07: "The concept of heat gain windows in heating climates brings concerns as discussed in other code change proposals regarding the dependency on orientation or other factors that could limit solar access to truly gain the advantages from these windows. In addition, many of these climates now have longer cooling seasons due to change in human behavior as well as climate changes."
>
> Similarly, in this code cycle, as to the same proponent's proposal to require high SHGC glazing in EC43-09/10:
>
> > "The use of SHGC rating as a standard for glazing in the north is not appropriate, given that in summer, this could cause an increase in peak demand during cooling days. Also, the proposal makes no reference to orientation of the walls with glazing; therefore, the high SHGC glazing could cause a problem for rooms with south facing windows."

EC38, as written, suffers from the same fundamental flaws as these other proposals, and should be likewise rejected at the Final Action Hearing. EC38, as modified by this public comment, would eliminate these flaws while retaining an improvement in U-factor to save natural gas, heating oil, and electricity. It should be adopted only if it is modified as described above.

Final Action: AS AM AMPC____ D

EC38-09/10-PART II

IRC Table N1102.1, Table N1102.1.2, N1102.3.3

Proposed Change as Submitted

Proponent: Thomas S.Zaremba, Roetzel & Andress, representing Pilkington North America

PART II – IRC BUILDING/ENERGY

1. Revise tables as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35j	30	13	3/4	13	0	0	0
2	0.65i	0.75	0.35j	30	13	4/6	13	0	0	0
3	0.50i	0.65	0.35e, j	30	13	5/8	19	5/13f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	~~0.35~~ 0.30	0.60	NR	38	20 or 13 + 5h	13/17	30f	10/13	10, 2 ft	10/13
6	~~0.35~~ 0.30	0.60	NR	49	20 or 13 + 5h	15/19	30g	10/13	10, 4 ft	10/13
7 and 8	~~0.35~~ 0.30	0.60	NR	49	21	19/21	30g	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE N1102.1.2
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	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
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5 and Marine 4	~~0.35~~ 0.30	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	~~0.35~~ 0.30	0.60	0.026	0.060	0.060	0.033	0.059	0.065
7 and 8	~~0.35~~ 0.30	0.60	0.026	0.057	0.057	0.033	0.059	0.065

(Footnotes remain unchanged)

2. Add new text as follows:

N1102.3.3 U-factor and SHGC alternative. Window assemblies having a U-factor of 0.31 and SHGC greater than or equal to 0.35 or a U-factor of 0.32 and SHGC greater than or equal to 0.40 shall be permitted to satisfy the fenestration U-factor requirements of Table N1102.1 in Climate Zones 5, 6, 7 and 8. For compliance with this section, default SHGC values from Table N1101.5(3) shall not be permitted.

Reason: After Lawrence Berkeley National Laboratories (LBNL) did an extensive study of energy equivalency of matching U-factors with various SHGCs in northern climate zones, the Department of Energy issued a new Energy Star Windows criteria (Energy Star) which will take effect on January 4, 2010. The DOE established the following alternate, equivalent energy performance criteria for Energy Star labeled windows for IECC climate zones 5-8:

U-factor	SHGC
≤ 0.30	Any or NR

= 0.31 ≥ 0.35
= 0.32 ≥ 0.40

In support of these alternate paths, DOE's Energy Star report issued on April 7, 2009 explains:

> The ene rgy s avings anal ysis … r evealed that i n the Nor th, a 0.01 i ncrease i n U -factor p roduces equivalent energy performance to a 0.05 increase in SHGC. DOE used this relationship to establish the proposed revised tr adeoff l evels: s etting the … 0.30 U -factor and 0.30 S HGC a s the bas e c ase, the minimum r equired S HGC i n the r evised tr adeoffs r ise 0.05 to bal ance a 0.01 r ise i n U -factor. T he two alternative criteria specify U-factors of 0.31 and 0.32, while allowing the minimum SHGC to rise to 0.35 and 0.40 r espectively. W indows with thos e s pecific U -factors an d the c orresponding S HGCs or higher will qualify.

If adopted, this proposal would harmonize the 2012 IECC to the criteria specified for Energy Star windows in the north. It would be timely for the IECC to do this since, even before the new Energy Star criteria takes effect in January 2010, the DOE plans to begin researching a new, Phase 2 proposal for Energy Star Windows.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: ZAREMBA-EC-2-T. 402.1.1- RE-1-T. N1102.1

Public Hearing Results

PART II - IRC
Committee Action: Disapproved

Committee Reason: The committee was persuaded by the fact that Energy Star admits that this is not cost effective without tax credits. Therefore this has limited utility for energy conservation.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc and AGC Flat Glass North America Inc, requests Approval as Submitted.

Commenter's Reason: EC38-09/10 Parts I and II should be adopted as submitted. This code change proposal is identical to the Energy Star requirements for Windows that took effect on January 4, 2010. (The next changes to the Energy Star Windows criteria is not expected until 2012.)

This proposal increases U-factor stringency in prescriptive applications in climate zones 5-8 from 0.32 to 0.30. It then matches U-factor values of 0.31 and 0.32, respectively, with the windows that have an SHGC ≥ 0.35 or ≥ 0.40, respectively.

Currently, the code permits the use of ANY SHGC in climate zones 4-8. Based on the work done by Lawrence Berkley National Laboratories in developing the current Energy Star Windows criteria, this proposal simply matches windows with U-factors ranging from 0.30 to 0.32 with SHGCs that will yield equivalent energy performance.

Energy Star criteria exists to enable consumers to select the best replacement windows. The Code applies to replacement windows and in the current economy, most window installations are replacements. The use of Energy Star labeled windows will reduce heating costs and, to the extent there is an impact on cooling costs, the benefits of lower heating costs in these northern climate zones will far outweigh any effect on cooling.

Final Action voters are encouraged to vote against the standing motion to disapprove EC38 and to vote in favor of its adoption as submitted.

Public Comment 2:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
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2	0.65i	0.75	0.35j	30	13	4/6	13	0	0	0
3	0.50i	0.65	0.35e, j	30	13	5/8	19	5/13f	0	5/13

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
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5 and Marine 4	0.30	0.60	NR	38	20 or 13 + 5h	13/17	30f	10/13	10, 2 ft	10/13
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(Footnotes remain unchanged

TABLE N1102.1.2
EQUIVALENT U-FACTORS[a]

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(Footnotes remain unchanged)

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Commenter's Reason: *EC38 should be approved as modified by this public comment. If not modified, this proposal should be disapproved.*

This proposed modification corrects the major flaw in the original proposal by eliminating the proposed high SHGC exception while retaining the undisputed benefits of reduced heat loss from a lower window U-factor in climate zone Marine 4 through climate zone 8. The original proposal introduced a special limited exception for high solar gain window products in these northern climates – a concept that has been consistently rejected in a number of prior code cycles. These proposals have typically oversimplified the key differences between heating and cooling energy saved, and the proponents have not demonstrated that this tradeoff would actually save energy in homes with varying operational and design characteristics. Once again, neither the IECC nor IRC Code Development Committees were able to find that the benefits from a lower U-factor outweighed the negative impact of the trade-off. As originally written, the proposal cannot guarantee any energy savings, since it does not recognize the orientation of the fenestration and ignores other important issues like comfort and peak demand.

This modification cures this problem and secures the benefit of lower U-factors to save energy all-year-round by simply eliminating the trade-off exception while supporting the improvement in window insulating value (moving to a 0.30 U-factor) for colder climates.

Support for Proposal As Modified.

We support lowering the U-factor to 0.30 in climate zones Marine 4 through 8 without any exceptions because such a change would result in a guaranteed increase of almost 14% in window insulating value (with more than a 14% reduction in heat loss through these windows) in these colder climates and guaranteed energy savings year-round in every home over the 0.35 U-factor currently in the IECC. This 14% improvement compares favorably with the 8.5% improvement in insulating value from the move to a more modest 0.32 U-factor that was approved by the IECC Committee in EC13, EC27 and EC39.

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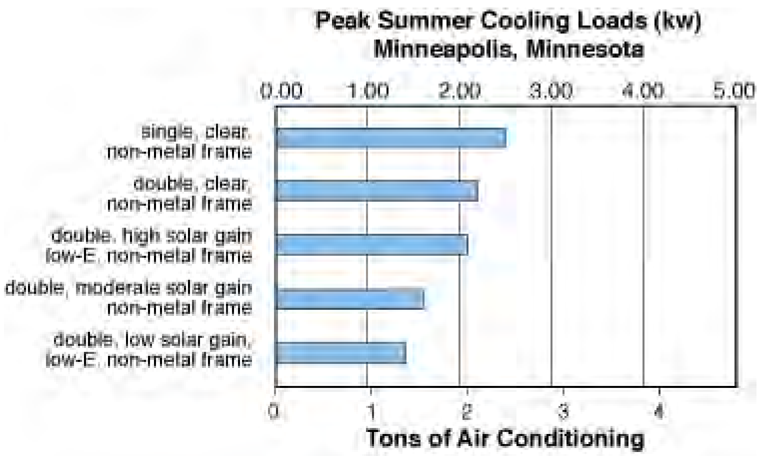
Opposition to the Original EC38 with High SHGC Special Product Exception.

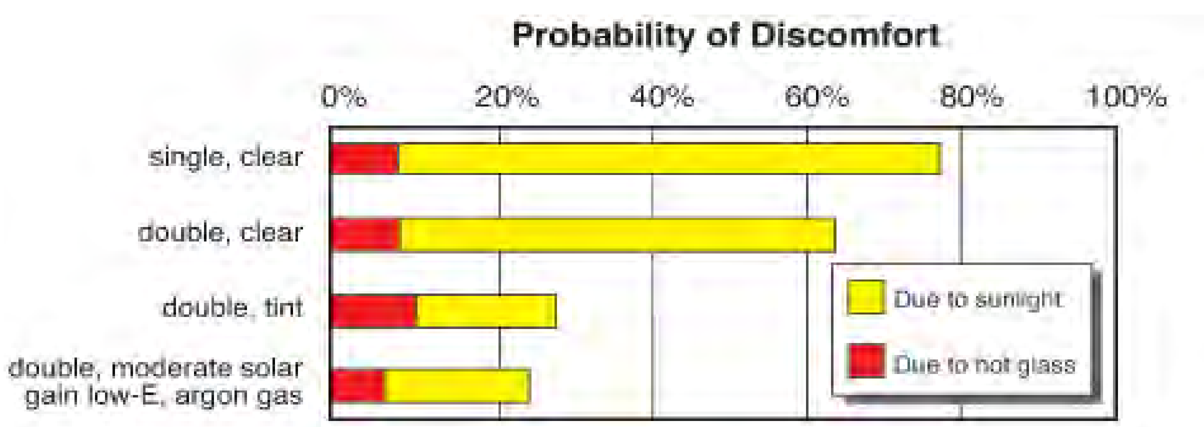
Regardless of the approach to the lower U-factor, we fundamentally disagree with the concept of creating a special exception that allows higher U-factors in windows with higher SHGC values. This is a very slippery slope that should be avoided. The proponents of this special exception contend that a window with a minimum SHGC of 0.35 and a maximum U-factor of 0.31, or a minimum SHGC of 0.40 and a maximum U-factor of 0.32, would use the same amount or less energy than a window with a 0.30 U-factor in all reasonably designed and operated houses, regardless of the window's orientation. There is no valid evidence to support this contention even for most cases, let alone all cases. Indeed, the risk is substantial that a higher SHGC would actually create occupant discomfort in the summer and consequently increase summer energy use (especially where windows face west and south with no or inadequate overhangs), as well as further increase peak demand during critical times of summer electric utility peak demand. Along the same lines, higher SHGCs would result in builders or homeowners needing to install larger air conditioning equipment by as much as an additional half-ton or more, which would increase peak summer electric load per home by as much as half a kilowatt or more (0.5 kW). Finally, we are concerned about weakening the IECC and IRC to make room for specific product exceptions such as this one.

In short, there is no reason to trade the certainty of the benefits of a window with a lower U-factor for a possibility of benefit from a higher SHGC, when those benefits are contingent upon the window being oriented correctly, the window's shades being open at the right times and adequate thermal mass and overhangs installed to properly capture the benefits and protect against the pitfalls associated with such windows. It is also important to note that the Energy Star analysis relied on to support this proposal only examined homes with equal square footage of windows on all four sides of the home and did not conduct any sensitivity to more realistic designs with most of the windows on two sides of the home. Moreover, that analysis showed widely varying results depending on location in the northern climate zones. The proper way to address this issue is through the performance compliance path, as it has been addressed for many years in the IECC, where these properties may be assessed on the basis of each individual home's characteristics. More details on the problems with this proposed exception are set forth below.

1. **Promotion of Higher SHGCs Would Negatively Impact Electric Peak Demand and HVAC Sizing.** Since electricity generally cannot be cost-effectively stored, one of the most serious challenges facing our nation's electric generation, transmission and distribution system is reliably meeting peak demand. Most utility systems in the US, including those across the northern part of the US, have peak demands that occur in the summer as a result of meeting residential and commercial air conditioning loads. Peak demand growth requires electric utilities (and indirectly consumers) to construct and pay for expensive additional generating units to supply power for only a few hours per year. Promoting higher SHGC windows would exacerbate this peak demand problem, and accordingly, this proposal to promote increased SHGCs should be rejected. The following chart based on data provided by Lawrence Berkeley National Laboratory (LBNL), which can be found on the Efficient Window Collaborative (EWC) website – http://www.efficientwindows.org/hvac.cfm – illustrates the peak demand and HVAC sizing issue by showing the potential peak demand impact from different window types. As is readily apparent, promoting a higher SHGC would have a negative impact on electrical peak demand and equipment sizing. The EWC website notes that using low-solar-gain low-e windows in Minneapolis may allow cooling equipment to be reduced in size up to a ton. Specifically looking at the difference between the third window (high solar gain low-e) and the fifth window (low solar gain low-e) in the graph demonstrates this impact and reinforces why a high solar gain trade-off is problematic.



2. **Promotion of Higher SHGCs Would Negatively Impact Summer Comfort.** As written, EC38 encourages the installation of high solar heat gain glazing, regardless of the orientation, by establishing an exception to the lower U-factor requirement applicable to lower SHGC windows. High solar gain will lead to significant occupant discomfort in the summer, even in colder winter climate zones (and may also impact winter comfort during the daytime). As explained by the EWC, as more direct sunlight passes through glazing, the probability of occupant discomfort increases enormously. The following chart provided by LBNL on the EWC website -- http://www.efficientwindows.org/comfort.cfm -- shows that use of a double pane clear window (with a higher SHGC) makes it almost three times more likely that the occupant will be uncomfortable, as compared to a sensible low SHGC low-e window. Higher solar gain also creates more volatility in the building's temperature fluctuations, and can create significant imbalances where more windows are located in specific rooms. When occupants are uncomfortable, they are likely to lower their thermostat set-points in the summer, consuming more energy, more than offsetting any of the savings claimed by the proponent of this proposal.



Source: Lawrence Berkeley National Laboratory (Lyons and Arasteh).

3. **Special Product Exception is Inconsistent with Proper Passive Solar Design and Improperly Ignores Window Orientation.** There is already room in the IECC and IRC for a passive-solar designed home. Builders have used the simulated performance alternative for years to take advantage of sophisticated designs that involve the correct windows for each orientation, thermal mass capable of absorbing heat gain, and overhangs to shield solar radiance when it is unneeded. With the performance path, builders can simulate the actual impact of specific window choices for specific orientations on a specific house. However, the oversimplified trade-off proposed by EC38 does not require any of the measures necessary for passive solar design, and as such, is not a reasonable addition to the simple prescriptive path. Recognizing that high SHGC windows are beneficial only for southern orientations with the proper design, the US Department of Energy recommends low SHGC windows (not high SHGC)

for east and west oriented windows in northern cold climates for passive solar design. For more information, see the US DOE website -- http://www.eere.energy.gov/consumer. In addition, given the lack of solar gain on northern exposures during the winter in these climate zones, there is no basis for trading off the guaranteed benefits of a lower U-factor when there are no possible benefits from SHGC for north-facing glazing. As proposed, the EC38 high SHGC exception is not limited only to passive solar-designed homes, nor does it require proper orientation, but instead could apply to any home with any window orientation built in the northern portion of the country.

4. Special Product Exception is Confusing and Inconsistent with Simplified Prescriptive Path. This proposal, if adopted as written, will establish another confusing prescriptive alternative that runs counter to the simplified approach presently embodied in both the IECC and IRC. The changes adopted in the 2006 code cycle as developed by the U.S. Department of Energy established a single, simple prescriptive path to encourage ease of compliance and enforcement, as well as economies of scale and more effective competition, resulting in lower overall energy efficient building costs. Permitting such a specific prescriptive trade-off for one feature (high window SHGC) will encourage other interests to seek their own prescriptive trade-offs, ultimately resulting in over-complicating the code. This will only make the job of the code official more difficult without any offsetting benefits.

5. Similar High SHGC Proposals Have Been Consistently Rejected by the ICC. Similar proposals have been disapproved repeatedly by the IECC Committee in past code cycles for the same reasons (these proposals have also been rejected on public comment by the ICC membership for both the IECC and IRC). The IECC Development Committee stated in prior code cycles:

EC21-07/08: "Given that the advantages for SHGC gains depends upon the direction of the wall in which the windows are installed, the committee believed that this provision was an oversimplification of the value of the trade-off. This would be better dealt with in the performance design."

EC44 and EC45-06/07: "Regarding the new concept of introducing minimum SHGC values in northern climates, there are still too many unknown variables to justify this. For one, the orientation of the building will affect how much savings is realized. For another, the change in temperatures over the past few years in northern climates makes it unclear whether we can move to the concept of using windows to save on heating values."

EC54-06/07: "The concept of heat gain windows in heating climates brings concerns as discussed in other code change proposals regarding the dependency on orientation or other factors that could limit solar access to truly gain the advantages from these windows. In addition, many of these climates now have longer cooling seasons due to change in human behavior as well as climate changes."

Similarly, in this code cycle, as to the same proponent's proposal to require high SHGC glazing in EC43-09/10:

> "The use of SHGC rating as a standard for glazing in the north is not appropriate, given that in summer, this could cause an increase in peak demand during cooling days. Also, the proposal makes no reference to orientation of the walls with glazing; therefore, the high SHGC glazing could cause a problem for rooms with south facing windows."

EC38, as written, suffers from the same fundamental flaws as these other proposals, and should be likewise rejected at the Final Action Hearing. EC38, as modified by this public comment, would eliminate these flaws while retaining an improvement in U-factor to save natural gas, heating oil, and electricity. It should be adopted only if it is modified as described above.

Final Action: AS AM AMPC____ D

EC39-09/10-PART II
IRC Table N1102.1, Table N1102.1.2

NOTE: PART I DID NOT RECEIVE A PUBLIC COMMENT AND IS ON THE CONSENT AGENDA, PART I IS REPRODUCED ONLY FOR INFORMATION PURPOSES FOLLOWING ALL OF PART II.

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise tables as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35j	30	13	3/4	13	0	0	0
2	0.65i	0.75	0.35j	30	13	4/6	13	0	0	0
3	0.50i	0.65	0.35e, j	30	13	5/8	19	5/13f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	~~0.35~~ 0.32	0.60	NR	38	20 or 13 + 5h	13/17	30f	10/13	10, 2 ft	10/13
6	~~0.35~~ 0.32	0.60	NR	49	20 or 13 + 5h	15/19	30g	10/13	10, 4 ft	10/13
7 and 8	~~0.35~~ 0.32	0.60	NR	49	21	19/21	30g	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE N1102.1.2
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	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	~~0.35~~ 0.32	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	~~0.35~~ 0.32	0.60	0.026	0.060	0.060	0.033	0.059	0.065
7 and 8	~~0.35~~ 0.32	0.60	0.026	0.057	0.057	0.033	0.059	0.065

(Footnotes remain unchanged)

Reason: This proposal specifies an improved fenestration U-factor requirement for colder climates. Lowering the U-factor to 0.32 in zones Marine 4, and 5-8 would result in a guaranteed increase of almost 10% in window insulating value (almost a 10% reduction in heat loss through these windows) in these cold climates and would guarantee energy savings year-round in every home. A lower glazing U-factor is a proven energy saver for heating and cooling energy, so there will be savings on natural gas, heating oil and electric bills.

While the window U-factor and SHGC requirements in other climate zones have improved substantially in recent code cycles, U-factors in these northern climate zones have not been improved.

Many windows sold in the northern U.S. that meet the 0.35 U-factor also meet the 0.32 U-factor. Typically, the difference between a 0.35 and 0.32 window is the level of argon-fill, a low or no-cost option. While lowering the U-factor from 0.35 to 0.32 may be aggressive for some frame types, the area weighted average approach incorporated into the code will allow some windows to exceed this value, so long as the windows selected for the home on average meet the 0.32 value.

This proposal increases energy efficiency in climate zones Marine 4 and 5-8. The table below illustrates the estimated energy cost savings from this measure in each climate zone. These savings are significant and when coupled with other proposed code modifications can lead to significant overall energy savings for homes.

	Climate Zone 4 Marine	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	2.3%	2.0%	2.0%	1.5%	1.7%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	1.8%	1.5%	1.6%	1.2%	1.4%

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

ICCFILENAME: PRINDLE-EC-15-T. 402.1.1-T. N1102.1

Public Hearing Results

PART II - IRC
Committee Action: Disapproved

Committee Reason: This proposal would be inconsistent with EC16.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Submitted.

Commenter's Reason: *EC39 should be approved as submitted.*

Although U-factor and SHGC requirements have been substantially improved for other climate zones in recent code cycles, the northern climate zones have not seen any improvement to their U-factor values. This proposal would address this situation and provide a significant increase in energy efficiency. Lowering the U-factor to 0.32 for these climate zones would reduce window heat loss by approximately 8.5% for these colder climates and would guarantee energy savings year-round. A lower glazing U-factor is a proven energy saver for both heating and cooling energy, thereby providing savings on natural gas, heating oil and electric bills. Lastly, many windows sold in these markets that meet the 0.35 U-factor will also meet the 0.32 U-factor, meaning that the energy savings will come at little or no cost. The likely savings from this proposal are significant and when combined with other code modifications will lead to considerable energy savings for all homes.

The IRC Committee provided no substantive reason for rejecting this proposal. The only reason given for not adopting this improvement is consistency with EC16. Adoption of this proposal would produce consistency with the IECC and save energy.

Public Comment 2:

Jeff Inks, representing Window & Door Manufacturers Association, requests Approval as Submitted.

Commenter's Reason: WDMA urges approval as submitted. The proposed increases are reasonably achievable and necessary to achieving the target improvements in the IRC energy provisions. This will also make the IRC provisions consistent with those approved for the IECC.

Public Comment 3:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, request Approval as Submitted.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This proposal allows for reasonable increases in northern window efficiency and these changes are consistent with what was done in EC13.

Final Action: AS AM AMPC____ D

NOTE: PART I REPRODUCED FOR INFORMATION PURPOSES ONLY – SEE ABOVE

PART I – IECC

Revise tables as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb, [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	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	~~0.35~~ 0.32	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	~~0.35~~ 0.32	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	~~0.35~~ 0.32	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE 402.1.3
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[d]	CRAWL SPACE WALL U-FACTOR[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	~~0.35~~ 0.32	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	~~0.35~~ 0.32	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	~~0.35~~ 0.32	0.60	0.026	0.057	0.057	0.028	0.050	0.065

(Footnotes remain unchanged)

PART I - IECC

Committee Action: **Approved as Submitted**

Committee Reason: This is compatible with EC13 and provides a reasonably achievable level of energy conservation.

Assembly Action: **None**

EC41-09/10-PART I
Table 402.1.1

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Revise table as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb,[b e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	~~0.30~~ 0.25	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	~~0.30~~ 0.25	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	~~0.30~~ 0.25[e]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

(Footnotes remain unchanged)

Reason: This proposal increases energy efficiency, reduces peak demand and sizing of cooling systems, and improves comfort in climate zones 1-3 by lowering the prescriptive SHGC values to 0.25. The need for and viability of lower SHGCs for these cooling climates is already recognized in the 2006 and 2009 *IECC* for commercial buildings, where the prescriptive value without an overhang is 0.25, establishing a precedent for a 0.25 SHGC. This proposal would establish the same value for residential buildings as well.

This proposal would reduce fenestration solar gain in hot climates (zones 1-3) in the *IECC* by almost 17% and in the *IRC* by almost 29%. Without even factoring in the increased cost of on-peak energy that this proposal would avoid, this proposal would provide an average of approximately 1% in additional heating and cooling purchased energy savings, in additional to reduced peak electrical demand, over the values set in the 2009 *IECC*. There should be no negative construction cost impact from this increase in energy code stringency since the existing SHGC requirements already effectively dictate a low solar gain low-e window and the new requirements will also require low solar gain low-e glass, but only with a lower SHGC. Such lower SHGC glass is readily available in the market. Moreover, the potential for smaller HVAC systems could generate construction cost savings. Finally, by maintaining the same SHGC requirements for all three zones, this proposal will promote lower costs of construction as a result of economies of scale, reduced inventory requirements and increased competition among suppliers of these fenestration products.

This proposal represents a reasonable and cost effective improvement that will provide states and local jurisdictions with an option to easily increase the efficiency of their code.

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

ICCFILENAME: PRINDLE-EC-12-T. 402.1.1-T. N1102.1

Public Hearing Results

PART I - IECC
Committee Action: **Disapproved**

Committee Reason: The proposal would cause an undesirable decrease in visual transmittance for skylights, thus would in all probability cause an increase in use of lighting.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb,[b e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.25	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.25	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.25[e]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1-3, where the SHGC for such skylights does not exceed 0.30.

(*Portions of code change proposal not shown remain unchanged*)

Commenter's Reason: *EC41 should be approved as modified by this public comment or as submitted.*

By establishing a lower fenestration SHGC, EC41 represents a significant opportunity for increased energy efficiency by saving energy (kWh), particularly high-priced on-peak energy, reducing electric utility system peak demand and sizing of cooling systems, as well as improving the overall occupant comfort levels in climate zones 1-3. This proposal would reduce fenestration solar gain in warmer climates (zones 1-3) in the IECC by almost 17%. Even without factoring in the increased cost of high-priced on-peak energy that this proposal would avoid, this change would provide an average of approximately 1% in additional purchased energy savings (for heating and cooling), in addition to reduced peak electrical demand, over the values set in the 2009 IECC.

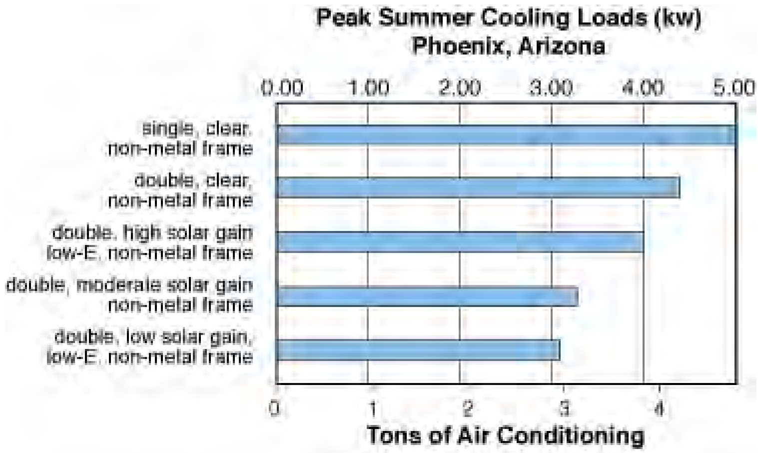
Existing SHGC requirements in the 2006 and 2009 IECC for commercial buildings (as well as ASHRAE 90.1) have already established a precedent for 0.25 SHGC – the IECC currently requires commercial windows to meet a 0.25 SHGC in zones 1-3. Furthermore, the current residential SHGC requirement – 0.30 SHGC – already effectively dictates a low solar gain low-e window and the proposed change simply requires a somewhat lower SHGC consistent with today's technology. Even NAHB included a 0.25 SHGC in its EC16 proposal for climate zones 1-2 (see EC16, proposed Table 403.1.3).

The IECC Development Committee narrowly voted to disapprove this proposal during the hearing by only 1 vote and a public assembly action to overturn the committee was unsuccessful by a very small margin; approximately 62% of the vote was favorable and wanted to overturn the Committee. This proposal offers a reasonable and cost effective improvement that will provide states and local jurisdictions that have substantial cooling requirements with an option to easily increase the efficiency of their code and should be approved.

The proposed modification is intended to address the IECC and IRC Committee's reasons for disapproval, which stated, "The proposal would cause an undesirable decrease in visual transmittance for skylights, thus would in all probability cause an increase in use of lighting." This modification would allow an exception for skylights that meet the current, 2009 IECC SHGC requirement of 0.30 SHGC, thereby resolving this single concern. While we do not agree with the Committee that possible small decreases in visual transmittance of light through skylights in homes offset the benefits of the lower SHGC, this exception would entirely remove this concern. As a result, we support the original proposal as submitted or as modified by this public comment.

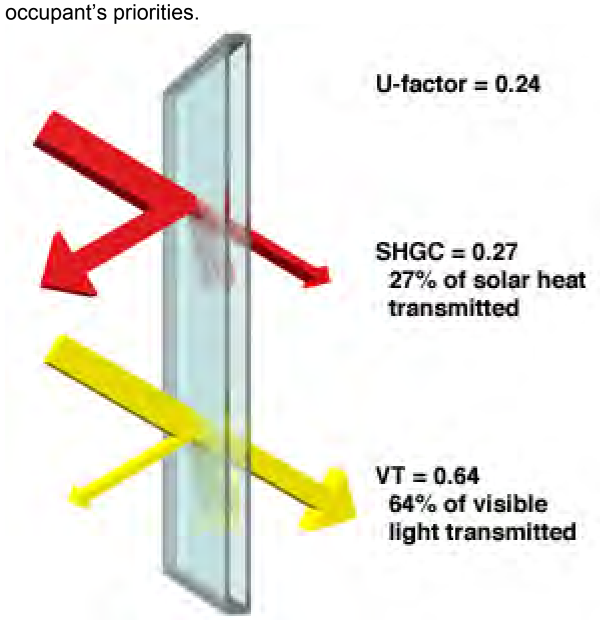
Product availability and technology to meet the proposed 0.25 SHGC is not an issue. According to the NFRC Certified Products Directory database, roughly half of the over 5 million window product types listed have an SHGC that will meet the 0.25 SHGC proposed in this code change. Given the number of window manufacturers who offer this product, it is not surprising that all but one of the major glass manufacturers for residential windows offer glass that would permit fenestration to meet the proposed requirement. Moreover, any additional cost for these products is minimal, since the current 0.30 SHGC requirement in the IECC often requires the same glass, and when it does not, the new glass package differs only in that it calls for a different low-e coating.

The graphs below from the website of the Efficient Windows Collaborative (See www.efficientwindows.org/hvac.cfm; www.efficientwindows.org/energycosts.cfm; and www.efficientwindows.org/lightview.cfm) illustrate the peak demand, HVAC sizing and energy savings benefits of low solar gain glass, as well as showing how such glass can provide substantial benefits in solar heat reduction while retaining substantial visible light, if so desired (the solar heat gain is blocked primarily in the non-visible part of the spectrum). The first graph displays the benefits of low solar gain low-e (SHGC equal to or below 0.25), compared with some other SHGC options from a peak demand/HVAC sizing point of view:



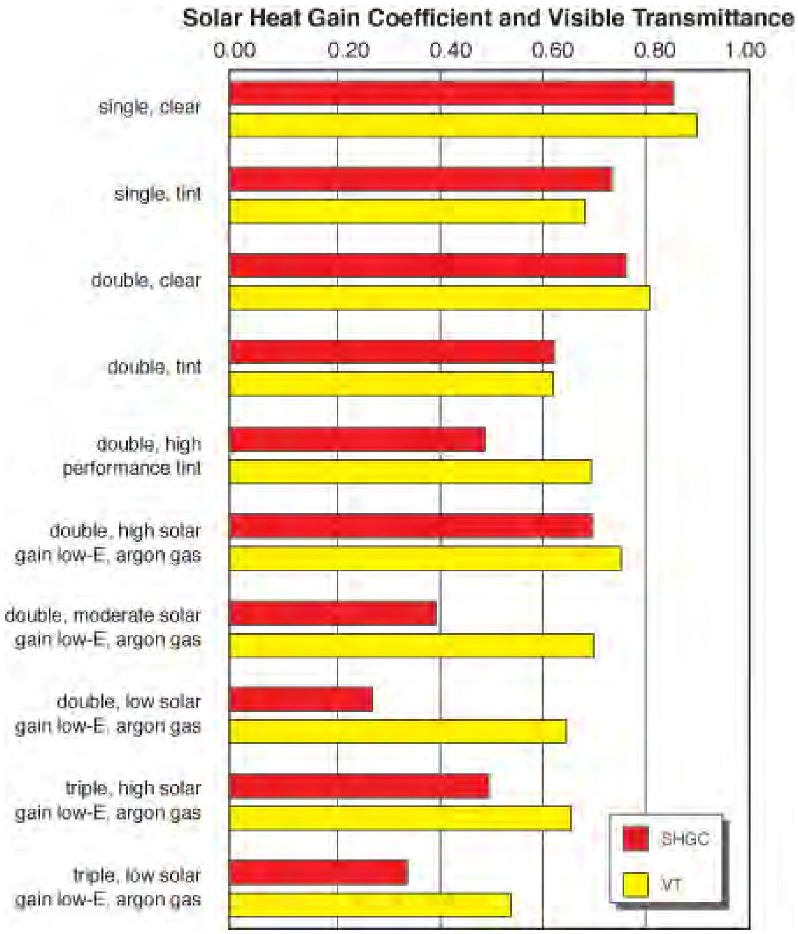
The second graph displays potential cooling cost savings for moving from a moderate solar gain low-e product to a low solar gain low-e product – 22% savings to 31% savings:

The third graph shows the effects of low solar gain glass (windows with an SHGC at or below 0.25) exclusive of frame (since windows are rated by NFRC with the frame, a 0.27 SHGC glass translates to a whole product SHGC below 0.25). Note that while glass can provide high visible light with low SHGCs, there are also alternatives that provide considerably lower visible light to reduce glare, along with a low SHGC, depending on the occupant's priorities.



Performance of Double-Glazed Low-Solar-Gain Low-E Glass (Spectrally Selective) and Argon Gas Fill

The fourth graph (again, just the glass and not the frame) shows how most of the visible light can be retained while reducing SHGC, if retaining visible light is a desired objective. A comparison of the third product in the graph with clear double pane glass against the three double pane products with low-e – the sixth (high solar low-e), seventh (moderate solar low-e) and eighth (low solar low-e) – shows that while visible light is reduced by a relatively small amount, SHGC is reduced drastically.



Note: All values are for glass only without frame. Source: Residential Windows by Carmody, Selkowitz, Arasteh and Heschong

In sum, this proposal is eminently reasonable and should be approved as submitted or as modified.

Public Comment 2:

Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc. and AGC Flat Glass North America, Inc., requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb,[b e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.25	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.25	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.25[e]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	~~0.35~~ 0.30	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	~~0.35~~ 0.30	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	~~0.35~~ 0.30	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

(*Portions of code change proposal not shown remain unchanged*)

402.3.3 U-factor and SHGC alternative. Window assemblies having a U-factor of 0.31 and SHGC greater than or equal to 0.35 or a U-factor of 0.32 and SHGC greater than or equal to 0.40 shall be permitted to satisfy the requirements of Table 402.1.1 in Climate Zones 5, 6, 7 and 8. For compliance with this section, default SHGC values from Table 303.1.3(3) shall not be permitted.

Commenter's Reason: EC41 proposes to reduce SHGC in Climate Zones 1, 2 and 3 to 0.25. Currently, there are no prescriptive limit on the use of SHGC in Climate Zones 4-8. Windows with a 0.25 SHGC not only block 75% of the sun's energy, they also reduce the amount of visible light that will pass through them. If EC41 is adopted, then it is likely that manufacturers of 0.25 SHGC glazing will not only market the use of 0.25 SHGC windows in Climate Zones 1-3, but they will also market it in the adjoining climate zones 4-8 where no prescriptive limit on SHGC exists. Such an inappropriate use of an ultra-low 0.25 SHGC glass in Climate Zones 4, 5, 6, 7 or 8 would increase winter heating loads by reason of the amount of solar gain they block and it would increase electric loads in those Climate Zones by reason of the amount of visible light such low SHGC glass will block from homes.

If EC 41 is adopted, the Energy Star criteria which mandates a lower, 0.30 U-factor but matches windows that have progressively higher U-factors of 0.31 and 0.32 with windows that have higher SHGCs of ≥ 0.35 and ≥ 0.40, respectively, should be allowed as an alternative to the ability of some window manufacturers to market an ultra-low 0.25 SHGC glass in these northern climate zones. Adopting this modification would promote the use of Energy Star labeled windows as an alternative in these northern climates.

Final Action: AS AM AMPC____ D

EC41-09/10-PART II
IRC Table N1102.1

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise table as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC [b]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	~~0.35[j]~~ 0.25	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	~~0.35[j]~~ 0.25	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	~~0.35[e,j]~~ 0.25[e,j]	30	13	5/8	19	5/13f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5[h]	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5[h]	15/19	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30[g]	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

Reason: This proposal increases energy efficiency, reduces peak demand and sizing of cooling systems, and improves comfort in climate zones 1-3 by lowering the prescriptive SHGC values to 0.25. The need for and viability of lower SHGCs for these cooling climates is already recognized in the 2006 and 2009 *IECC* for commercial buildings, where the prescriptive value without an overhang is 0.25, establishing a precedent for a 0.25 SHGC. This proposal would establish the same value for residential buildings as well.

This proposal would reduce fenestration solar gain in hot climates (zones 1-3) in the *IECC* by almost 17% and in the *IRC* by almost 29%. Without even factoring in the increased cost of on-peak energy that this proposal would avoid, this proposal would provide an average of approximately 1% in additional heating and cooling purchased energy savings, in additional to reduced peak electrical demand, over the values set in the 2009 *IECC*. There should be no negative construction cost impact from this increase in energy code stringency since the existing SHGC requirements already effectively dictate a low solar gain low-e window and the new requirements will also require low solar gain low-e glass, but only with a lower SHGC. Such lower SHGC glass is readily available in the market. Moreover, the potential for smaller HVAC systems could generate construction cost savings. Finally, by maintaining the same SHGC requirements for all three zones, this proposal will promote lower costs of construction as a result of economies of scale, reduced inventory requirements and increased competition among suppliers of these fenestration products.

This proposal represents a reasonable and cost effective improvement that will provide states and local jurisdictions with an option to easily increase the efficiency of their code.

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

ICCFILENAME: PRINDLE-EC-12-T. 402.1.1-T. N1102.1

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: The proposal would cause an undesirable decrease in visual transmittance for skylights, thus would in all probability cause an increase in use of lighting.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT [a]

CLIMATE ZONE	FENES-TRATION U-FACTOR	SKY-LIGHT [b] U-FACTOR	GLAZED FENEST-RATION SHGC[b]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT [c] WALL R-VALUE	SLAB [d] R-VALUE & DEPTH	CRAWL SPACE [c] WALL R-VALUE
1	1.2	0.75	0.25	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.25	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.25[e, j]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[f]	10/13	10, 2ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	10/13	10, 4ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30[g]	10/13	10, 4ft	10/13

b. The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1-3, where the SHGC for such skylights does not exceed 0.30.

(*Portions of code change proposal not shown remain unchanged*)

Commenter's Reason: *EC41 should be approved as modified by this public comment or as submitted.*

By establishing a lower fenestration SHGC, EC41 represents a significant opportunity for increased energy efficiency by saving energy (kWh), particularly high-priced on-peak energy, reducing electric utility system peak demand and sizing of cooling systems, as well as improving the overall occupant comfort levels in climate zones 1-3. This proposal would reduce fenestration solar gain in warmer climates (zones 1-3) in the IECC by almost 17%. Even without factoring in the increased cost of high-priced on-peak energy that this proposal would avoid, this change would provide an average of approximately 1% in additional purchased energy savings (for heating and cooling), in addition to reduced peak electrical demand, over the values set in the 2009 IECC.

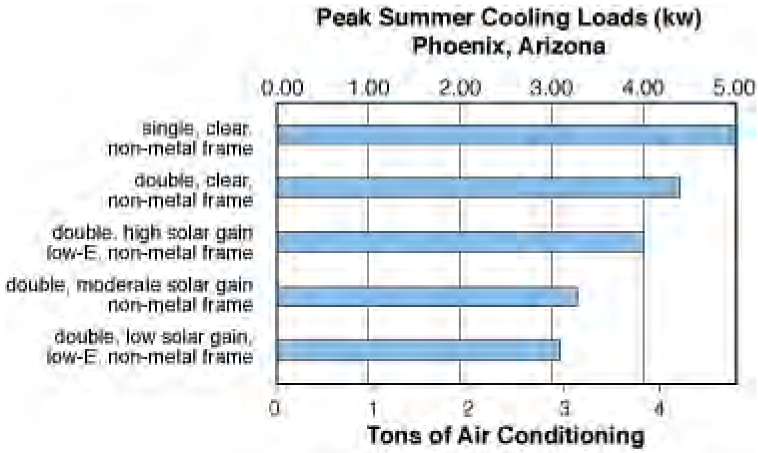
Existing SHGC requirements in the 2006 and 2009 IECC for commercial buildings (as well as ASHRAE 90.1) have already established a precedent for 0.25 SHGC – the IECC currently requires commercial windows to meet a 0.25 SHGC in zones 1-3. Furthermore, the current residential SHGC requirement – 0.30 SHGC – already effectively dictates a low solar gain low-e window and the proposed change simply requires a somewhat lower SHGC consistent with today's technology. Even NAHB included a 0.25 SHGC in its EC16 proposal for climate zones 1-2 (see EC16, proposed Table 403.1.3).

The IECC Development Committee narrowly voted to disapprove this proposal during the hearing by only 1 vote and a public assembly action to overturn the committee was unsuccessful by a very small margin; approximately 62% of the vote was favorable and wanted to overturn the Committee. This proposal offers a reasonable and cost effective improvement that will provide states and local jurisdictions that have substantial cooling requirements with an option to easily increase the efficiency of their code and should be approved.

The proposed modification is intended to address the IECC and IRC Committee's reasons for disapproval, which stated, "The proposal would cause an undesirable decrease in visual transmittance for skylights, thus would in all probability cause an increase in use of lighting." This modification would allow an exception for skylights that meet the current, 2009 IECC SHGC requirement of 0.30 SHGC, thereby resolving this single concern. While we do not agree with the Committee that possible small decreases in visual transmittance of light through skylights in homes offset the benefits of the lower SHGC, this exception would entirely remove this concern. As a result, we support the original proposal as submitted or as modified by this public comment.

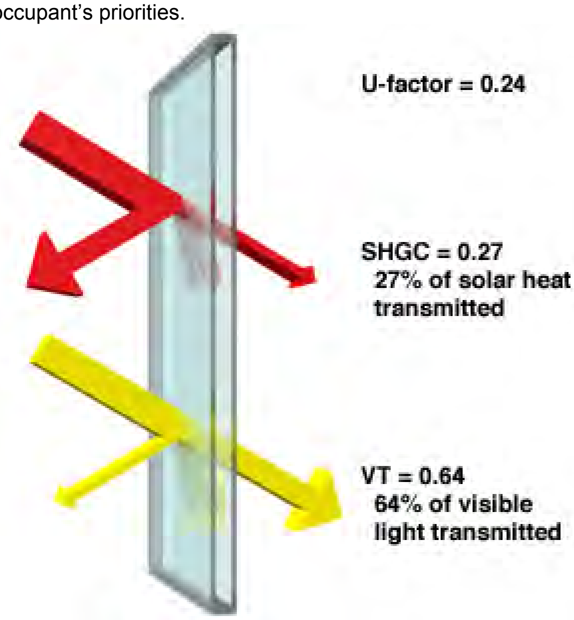
Product availability and technology to meet the proposed 0.25 SHGC is not an issue. According to the NFRC Certified Products Directory database, roughly half of the over 5 million window product types listed have an SHGC that will meet the 0.25 SHGC proposed in this code change. Given the number of window manufacturers who offer this product, it is not surprising that all but one of the major glass manufacturers for residential windows offer glass that would permit fenestration to meet the proposed requirement. Moreover, any additional cost for these products is minimal, since the current 0.30 SHGC requirement in the IECC often requires the same glass, and when it does not, the new glass package differs only in that it calls for a different low-e coating.

The graphs below from the website of the Efficient Windows Collaborative (See www.efficientwindows.org/hvac.cfm; www.efficientwindows.org/energycosts.cfm; and www.efficientwindows.org/lightview.cfm) illustrate the peak demand, HVAC sizing and energy savings benefits of low solar gain glass, as well as showing how such glass can provide substantial benefits in solar heat reduction while retaining substantial visible light, if so desired (the solar heat gain is blocked primarily in the non-visible part of the spectrum). The first graph displays the benefits of low solar gain low-e (SHGC equal to or below 0.25), compared with some other SHGC options from a peak demand/HVAC sizing point of view:



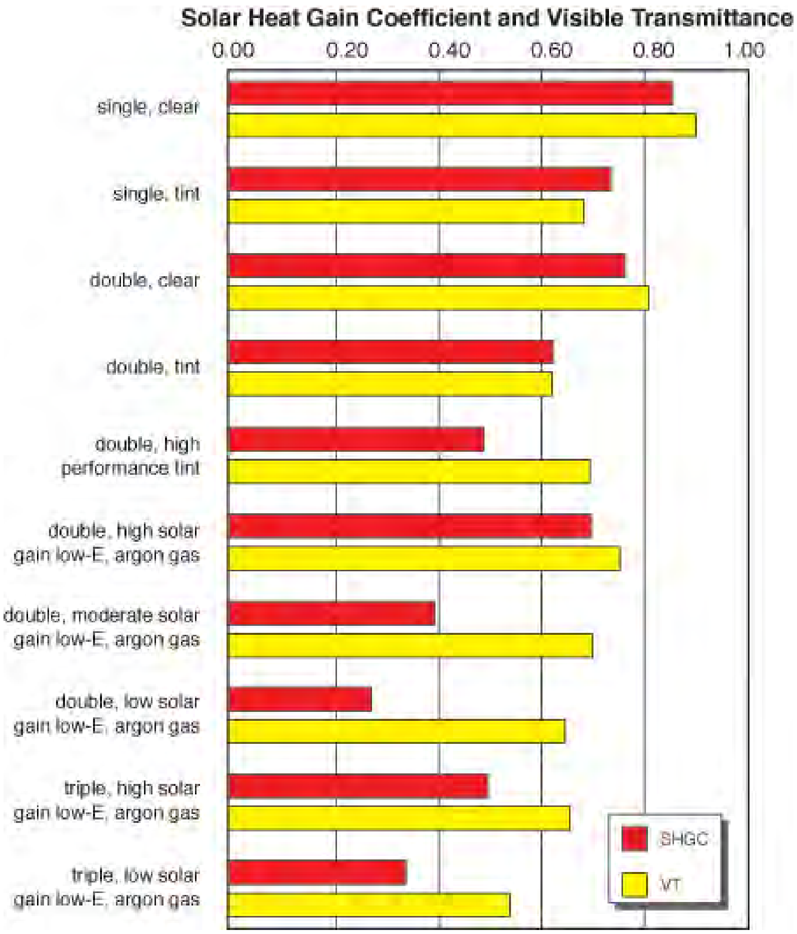
The second graph displays potential cooling cost savings for moving from a moderate solar gain low-e product to a low solar gain low-e product – 22% savings to 31% savings:

The third graph shows the effects of low solar gain glass (windows with an SHGC at or below 0.25) exclusive of frame (since windows are rated by NFRC with the frame, a 0.27 SHGC glass translates to a whole product SHGC below 0.25). Note that while glass can provide high visible light with low SHGCs, there are also alternatives that provide considerably lower visible light to reduce glare, along with a low SHGC, depending on the occupant's priorities.



Performance of Double-Glazed Low-Solar-Gain Low-E Glass (Spectrally Selective) and Argon Gas Fill

The fourth graph (again, just the glass and not the frame) shows how most of the visible light can be retained while reducing SHGC, if retaining visible light is a desired objective. A comparison of the third product in the graph with clear double pane glass against the three double pane products with low-e – the sixth (high solar low-e), seventh (moderate solar low-e) and eighth (low solar low-e) – shows that while visible light is reduced by a relatively small amount, SHGC is reduced drastically.



Note: All values are for glass only without frame. Source: Residential Windows by Carmody, Selkowitz, Arasteh and Heschong

In sum, this proposal is eminently reasonable and should be approved as submitted or as modified.

Public Comment 2:

Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc. and AGC Flat Glass North America, Inc., requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.25	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.25	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.25[ej]	30	13	5/8	19	5/13f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10,2 ft	10/13
5and Marine 4	~~0.35~~ 0.30	0.60	NR	38	20 or 13 + 5h	13/17	30[f]	10/13	10, 2 ft	10/13
6	~~0.35~~ 0.30	0.60	NR	49	20 or 13 + 5h	15/19	30[g]	10/13	10, 4 ft	10/13

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
7and8	~~0.35~~ <u>0.30</u>	0.60	NR	49	21	19/21	30[g]	10/13	10,4 ft	10/13

(*Portions of code change proposal not shown remain unchanged*)

<u>**N1102.3.3 U-factor and SHGC alternative.** Window assemblies having a U-factor of 0.31 and SHGC greater than or equal to 0.35 or a U-factor of 0.32 and SHGC greater than or equal to 0.40 shall be permitted to satisfy the requirements of Table 402.1.1 in Climate Zones 5, 6, 7 and 8. For compliance with this section, default SHGC values from Table 303.1.3(3) shall not be permitted.</u>

Commenter's Reason: EC41 proposes to reduce SHGC in Climate Zones 1, 2 and 3 to 0.25. Currently, there are no prescriptive limit on the use of SHGC in Climate Zones 4-8. Windows with a 0.25 SHGC not only block 75% of the sun's energy, they also reduce the amount of visible light that will pass through them. If EC41 is adopted, then it is likely that manufacturers of 0.25 SHGC glazing will not only market the use of 0.25 SHGC windows in Climate Zones 1-3, but they will also market it in the adjoining climate zones 4-8 where no prescriptive limit on SHGC exists. Such an inappropriate use of an ultra-low 0.25 SHGC glass in Climate Zones 4, 5, 6, 7 or 8 would increase winter heating loads by reason of the amount of solar gain they block and it would increase electric loads in those Climate Zones by reason of the amount of visible light such low SHGC glass will block from homes.

If EC 41 is adopted, the Energy Star criteria which mandates a lower, 0.30 U-factor but matches windows that have progressively higher U-factors of 0.31 and 0.32 with windows that have higher SHGCs of ≥ 0.35 and ≥ 0.40, respectively, should be allowed as an alternative to the ability of some window manufacturers to market an ultra-low 0.25 SHGC glass in these northern climate zones. Adopting this modification would promote the use of Energy Star labeled windows as an alternative in these northern climates.

Final Action: AS AM AMPC____ D

EC42-09/10-PART I
Table 402.1.1

<u>Proposed Change as Submitted</u>

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Revise table as follows:

TABLE 402.1.1
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	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	~~NR~~ 0.40	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

(Footnotes remain unchanged)

Reason: This proposal promotes "the effective use of energy" (see *IECC* section 101.3) by reducing the need for peak electricity by adopting a modest and conservative Solar Heat Gain Coefficient (SHGC) requirement in climate zone 4 except Marine.

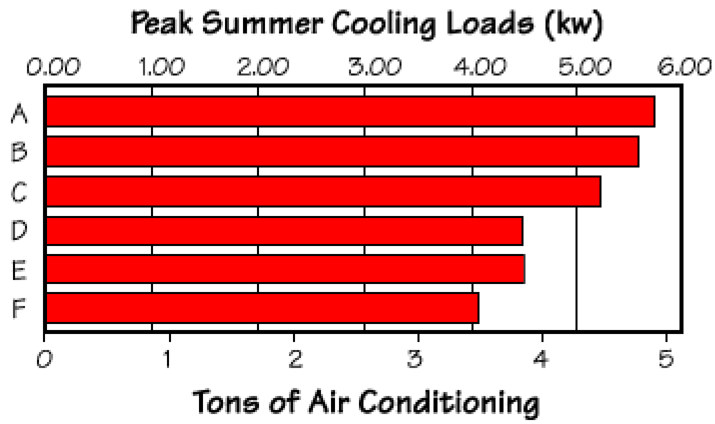
Precedent for a Maximum SHGC Requirement in Climate Zone 4.

DOE/EPA's ENERGY STAR for Windows program has included an SHGC maximum requirement in the North-Central zone (roughly *IECC* climate zone 4) for a number of years. The most recent Energy Star qualification criteria, released in April 2009, requires a maximum 0.40 SHGC in the North-Central zone. The 2009 American Recovery and Reinvestment Act (Stimulus Bill) goes even further, requiring a maximum 0.30 SHGC nationwide for the enhanced window tax credit. Chapter 5 of the *IECC* (Commercial Energy Efficiency) already requires a maximum SHGC of 0.40 in climate zones 4-6. ASHRAE 90.1-2007 also contains the same requirement in climate zones 4-6 for both high rise residential and commercial construction. See Table 5.5-4. It is time for the residential chapters of the *IECC* and *IRC* to move in the same direction.

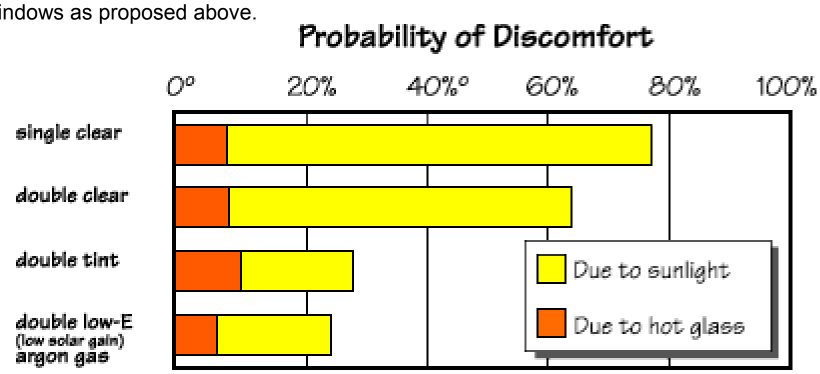
The proposed change would still allow a great deal of flexibility. The SHGC requirements in both ENERGY STAR and the Stimulus Bill apply to *each window*, as opposed to the area-weighted average flexibility allowed by the *IECC*. This proposal sets the *weighted average* at 0.40 SHGC, a level already achieved by most products on the market in climate zone 4.

Reduction of Peak Electricity Demand and Potential Energy Cost Savings.
Every state in climate zone 4 is "summer-peaking," meaning that demand for electricity is highest on the hottest summer days. Electricity during peaking times is scarce and exponentially more expensive on the open market. States have been forced to build and site new peaking power plants (or to revive retired, dirty plants) for the sake of keeping up with peak demand, due in large part to the increased use of air conditioners in new construction.

Windows with low SHGC are an obvious answer to this growing problem. The following chart, developed by the U.S. Department of Energy's Lawrence Berkley National Laboratory (LBNL), which is found on the Efficient Window Collaborative (EWC) website (www.efficientwindows.org), shows the potential for saving peak demand (and tons of HVAC) for different window types. Window E is a higher solar gain low-e double-pane window that meets the current U-factor requirement in climate zone 4. Window F is the low SHGC, low U-factor window that would meet the current U-factor requirement plus the SHGC maximum of this proposal. The reduction in peak cooling load is nearly half of a kW, reducing by almost a half ton the size of the air conditioning unit. As is readily apparent, improved windows will lead to smaller HVAC sizes (with lower costs to the homeowner) and lower peak cooling loads (saving the state from building additional peak capacity).



Similarly, the following chart shows the probability of discomfort during summer from sunlight and hot glass. The summertime probability of discomfort ranges from over 60% with double clear (which is currently allowed in climate zone 4 under the UA trade-off and performance paths) to almost 20% with low SHGC windows as proposed above.



Windows with low SHGC will reduce the volatility of temperatures in the home, which will reduce occupant discomfort and make it less likely that occupants will need to adjust the thermostat and use more energy.

Construction Costs/Benefits of a Low SHGC Requirement in Climate Zone 4.

There should be no increased construction cost for moving to a low SHGC requirement in climate zone 4. Climate zone 4 already requires a 0.35 U-factor window. Such a window, by definition, already incorporates low-e glass. Meeting a 0.40 SHGC merely requires that the low-e coating be designed to limit low solar gain, a feature that adds no additional cost.

On the other hand, use of lower SHGC windows will result in construction cost savings from properly downsizing the HVAC equipment.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: PRINDLE-EC-13-T. 402.1.1-T. N1102.1.DOC

Public Hearing Results

PART I - IECC
Committee Action: **Disapproved**

Committee Reason: The committee was concerned that this limitation is justified for Climate Zone 4 because of the possibility that this could increase the heating load in some parts of the zone. Therefore, it is not apparent whether this would really save energy.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

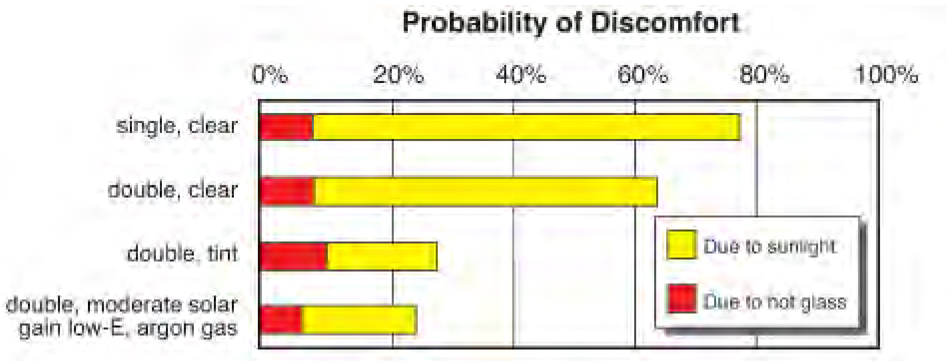
Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Submitted.

Commenter's Reason: *EC42 should be approved as submitted.*

The IECC Development Committee disapproved this proposal by a single vote based upon the reasoning that because heating load could be increased in certain parts of the zone, it was not apparent that this change would result in energy savings. A subsequent floor assembly action failed by a very narrow margin, with over 64% of the voters in favor of the proposal.

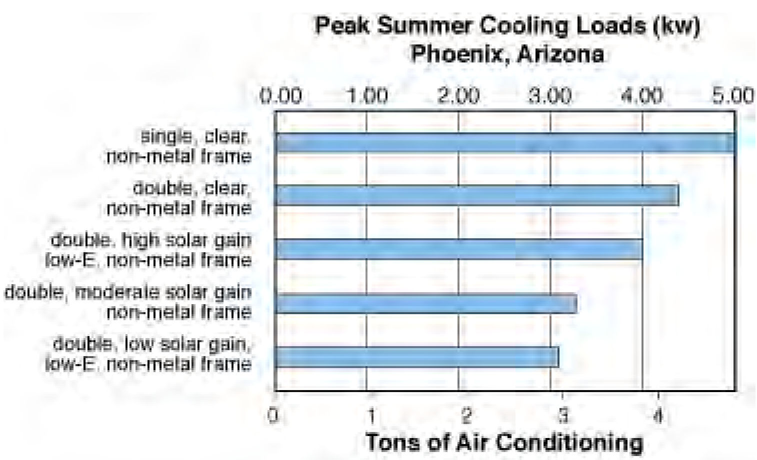
While it is possible that heating load could be increased in some cases, cooling loads will certainly be decreased by this proposal and the benefits of lower cooling load, lower peak demand and greater comfort outweigh this concern. The intent of the IECC, according to Section 101.3, is "the effective use of energy." Included in the effective use of energy is the impact of the energy use on comfort – after all, heating and cooling is primarily aimed at sustaining occupant comfort – as well as the time of use of energy, including the effects on peak demands, HVAC sizing and expensive peak energy costs. The committees failed to recognize the benefits of the proposed lower SHGC in this climate zone in this broader context.

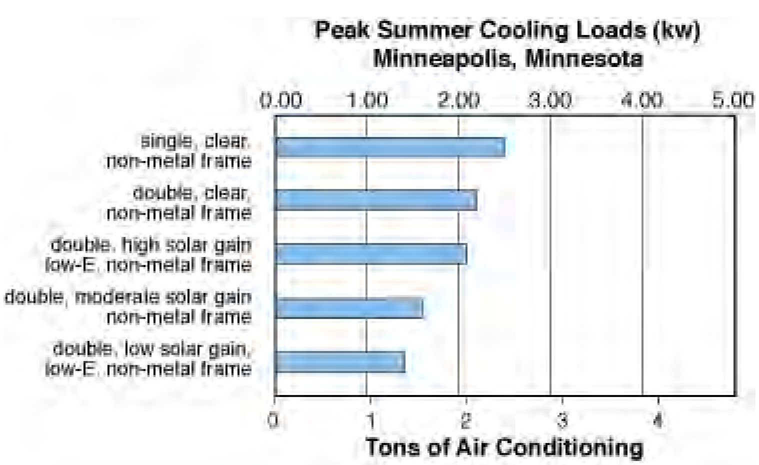
By contrast, the US Department of Energy has included a maximum SHGC requirement for years as part of its Energy Star program (the program's North-Central zone is roughly the same as IECC's zone 4). The current qualification criteria, released in April 2009, require this same maximum 0.40 SHGC. Such a maximum recognizes the reality that low SHGC windows increase comfort and reduce the likelihood of increased energy use from homeowners setting the thermostat lower to offset discomfort. Likewise, some states have already either adopted or are in the final stages of adopting an SHGC of 0.40 or lower in climate zone 4 because of the obvious benefits. The following graph from the Efficient Window Collaborative website (http://www.efficientwindows.org/comfort.cfm) demonstrates the discomfort issue:



This graph shows a reduction in the likelihood of discomfort from over 60% for a clear product down to almost 20% from a moderate solar gain (0.40 SHGC) product. As the EWC states on its website: "In summer, strong direct sunlight strikes people and interior surfaces, creating overheating and discomfort. Windows with low solar heat gain coefficients will reduce the solar radiation coming through the glass and associated discomfort. Low solar heat gain low-e glass (spectrally selective) reduces heat gain while still providing sufficient light and view."

The following graphs, also from the same website (see: http://www.efficientwindows.org/hvac.cfm), show the peak demand and HVAC savings potential from lower SHGCs in all climate zones. While the graphs demonstrate the benefits in Phoenix (climate zone 2) and Minneapolis (climate zone 6) – southern and northern climates – similar benefits would occur for climate zones in between like zone 4:





Most of the window products available would meet this standard. According to the NFRC Certified Products Directory database, 79% of the over 5 million product types listed would meet a 0.40 SHGC or lower.

This proposal should be approved as submitted based on the benefits outlined above.

Public Comment 2:

Jeff Inks, representing Window & Door Manufacturers Association, requests Approval as Submitted.

Commenter's Reason: WDMA urges approval of as submitted. Establishing a maximum SHGC for climate zone 4 is a needed improvement in the IECC for the reasons stated by the proponent in the original proposal. There is greater concern and substantiation that the absence of any SHGC requirement is resulting in increased cooling than potential increases in heating loads that could result by establishing max SHGC requirements. The proposed .40 SHGC for the climate in Zone 4 is reasonable and consistent with existing ENERGY STAR and commercial requirements.

Public Comment 3:

Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, & AGC Flat Glass North America, Inc., requests Disapproval.

Commenter's Reason: EC42 was disapproved by the IECC Committee. It was also disapproved by the IRC Committee. An attempt to overturn the IECC Committee through an Assembly Action also failed.

At the Final Action hearings, EC42 should be disapproved for the same reasons that it was rejected by both Committees that heard it in Baltimore. In that regard, EC42 proposes a change in SHGC in Climate Zone 4 from NR to 0.40. The IECC and the IRC Committees **both** concluded that this change could actually **increase** heating loads in Climate Zone 4 and, therefore, increase energy consumption, rather than reduce it. This reasoning is substantiated in a report entitled "An Evaluation of Alternative Qualifying Criteria for Energy Star Windows" prepared by Lawrence Berkeley National Laboratory ("LBNL") for the Department of Energy, dated May 8, 2002. In it, LBNL specifically examined how far north an SHGC limit like the one proposed in EC42, should go. It concluded that energy savings shifted away from the use of low SHGC windows to the use of high SHGC windows in the middle of Climate Zone 4. This means that adopting EC42 would actually **increase** heating loads throughout the northern half of Climate Zone 4 resulting in an increase, rather than a decrease, in energy usage.

EC42 should be disapproved for other reasons as well. Significantly, the proponents of EC42 do not attempt to establish that adopting EC42 would save any energy. Instead, in their supporting statement, the proponents of EC42 rely on a "peak load" argument, and include a red graph to prominently display "Peak Summer Cooling Loads" based on a variety of different window types. The proponents then argues that this graph is somehow relevant to their proposed SHGC change in Climate Zone 4. However, what the proponents **fail** to disclose anywhere in their supporting statement is that the "peak load" graph on which they attempt to justify their proposed change, is actually based on data taken from **Phoenix, Arizona**, in Climate Zone 2, not on data taken from anywhere in Climate Zone 4.

There is no technical or energy conservation justification for the change proposed in EC42. We urge Final Action Hearing voters to support their Committees and vote in favor of the standing motion to disapprove EC42.

Final Action: AS AM AMPC____ D

EC42-09/10-PART II
IRC Table N1102.1

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise table as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC [b]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	~~NR~~ 0.40[e]	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5[h]	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5[h]	15/19	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30[g]	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

Reason: This proposal promotes "the effective use of energy" (see *IECC* section 101.3) by reducing the need for peak electricity by adopting a modest and conservative Solar Heat Gain Coefficient (SHGC) requirement in climate zone 4 except Marine.

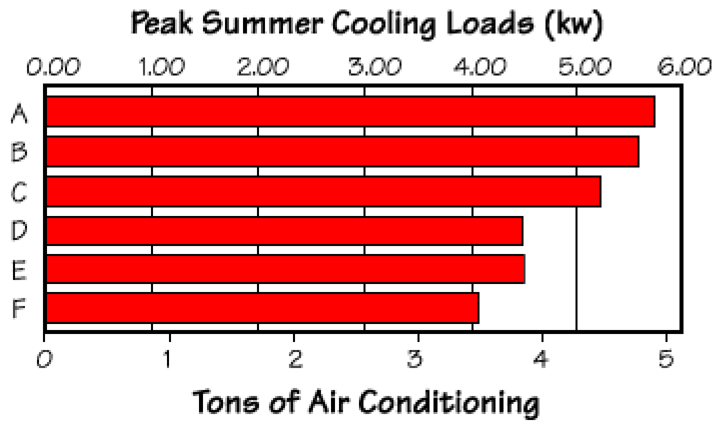
Precedent for a Maximum SHGC Requirement in Climate Zone 4.

DOE/EPA's ENERGY STAR for Windows program has included an SHGC maximum requirement in the North-Central zone (roughly *IECC* climate zone 4) for a number of years. The most recent Energy Star qualification criteria, released in April 2009, requires a maximum 0.40 SHGC in the North-Central zone. The 2009 American Recovery and Reinvestment Act (Stimulus Bill) goes even further, requiring a maximum 0.30 SHGC nationwide for the enhanced window tax credit. Chapter 5 of the *IECC* (Commercial Energy Efficiency) already requires a maximum SHGC of 0.40 in climate zones 4-6. ASHRAE 90.1-2007 also contains the same requirement in climate zones 4-6 for both high rise residential and commercial construction. See Table 5.5-4. It is time for the residential chapters of the *IECC* and *IRC* to move in the same direction.

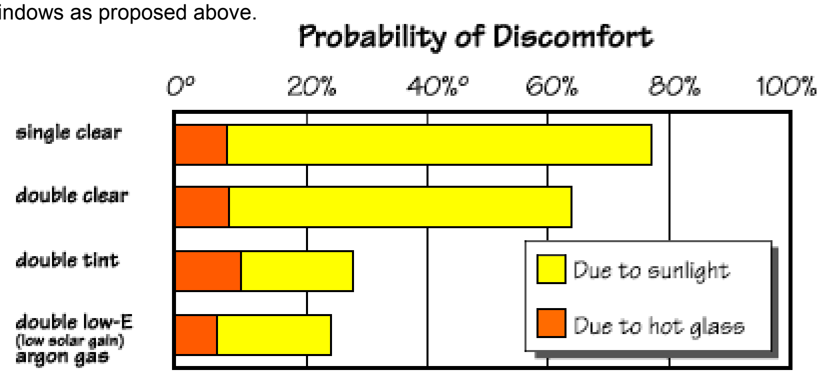
The proposed change would still allow a great deal of flexibility. The SHGC requirements in both ENERGY STAR and the Stimulus Bill apply to *each window*, as opposed to the area-weighted average flexibility allowed by the *IECC*. This proposal sets the *weighted average* at 0.40 SHGC, a level already achieved by most products on the market in climate zone 4.

Reduction of Peak Electricity Demand and Potential Energy Cost Savings.
Every state in climate zone 4 is "summer-peaking," meaning that demand for electricity is highest on the hottest summer days. Electricity during peaking times is scarce and exponentially more expensive on the open market. States have been forced to build and site new peaking power plants (or to revive retired, dirty plants) for the sake of keeping up with peak demand, due in large part to the increased use of air conditioners in new construction.

Windows with low SHGC are an obvious answer to this growing problem. The following chart, developed by the U.S. Department of Energy's Lawrence Berkley National Laboratory (LBNL), which is found on the Efficient Window Collaborative (EWC) website (www.efficientwindows.org), shows the potential for saving peak demand (and tons of HVAC) for different window types. Window E is a higher solar gain low-e double-pane window that meets the current U-factor requirement in climate zone 4. Window F is the low SHGC, low U-factor window that would meet the current U-factor requirement plus the SHGC maximum of this proposal. The reduction in peak cooling load is nearly half of a kW, reducing by almost a half ton the size of the air conditioning unit. As is readily apparent, improved windows will lead to smaller HVAC sizes (with lower costs to the homeowner) and lower peak cooling loads (saving the state from building additional peak capacity).



Similarly, the following chart shows the probability of discomfort during summer from sunlight and hot glass. The summertime probability of discomfort ranges from over 60% with double clear (which is currently allowed in climate zone 4 under the UA trade-off and performance paths) to almost 20% with low SHGC windows as proposed above.



Windows with low SHGC will reduce the volatility of temperatures in the home, which will reduce occupant discomfort and make it less likely that occupants will need to adjust the thermostat and use more energy.

Construction Costs/Benefits of a Low SHGC Requirement in Climate Zone 4.

There should be no increased construction cost for moving to a low SHGC requirement in climate zone 4. Climate zone 4 already requires a 0.35 U-factor window. Such a window, by definition, already incorporates low-e glass. Meeting a 0.40 SHGC merely requires that the low-e coating be designed to limit low solar gain, a feature that adds no additional cost.

On the other hand, use of lower SHGC windows will result in construction cost savings from properly downsizing the HVAC equipment.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: PRINDLE-EC-13-T. 402.1.1-T. N1102.1.DOC

Public Hearing Results

PART II - IRC
Committee Action: Disapproved

Committee Reason: The committee was concerned that this limitation is justified for Climate Zone 4 because of the possibility that this could increase the heating load in some parts of the zone. Therefore, it is not apparent whether this would really save energy.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

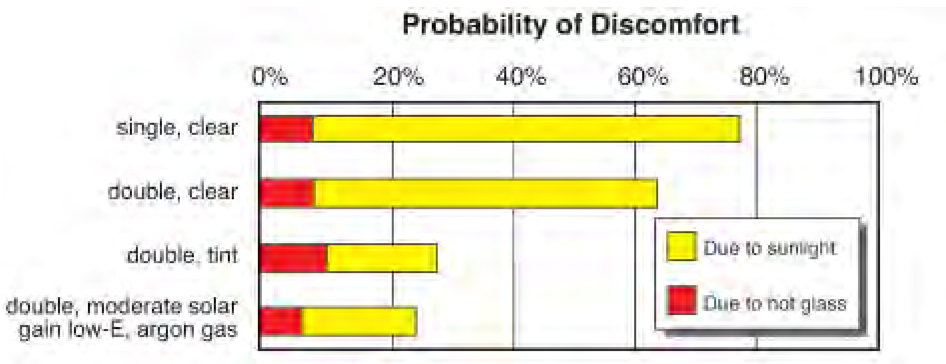
Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Submitted.

Commenter's Reason: *EC42 should be approved as submitted.*

The IECC Development Committee disapproved this proposal by a single vote based upon the reasoning that because heating load could be increased in certain parts of the zone, it was not apparent that this change would result in energy savings. A subsequent floor assembly action failed by a very narrow margin, with over 64% of the voters in favor of the proposal.

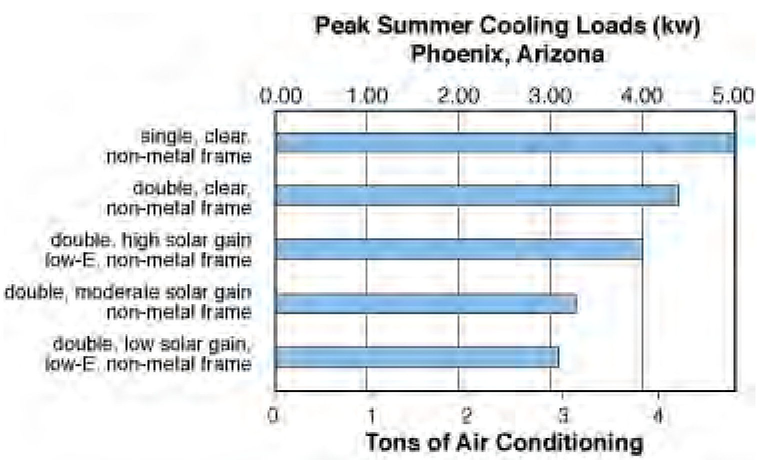
While it is possible that heating load could be increased in some cases, cooling loads will certainly be decreased by this proposal and the benefits of lower cooling load, lower peak demand and greater comfort outweigh this concern. The intent of the IECC, according to Section 101.3, is "the effective use of energy." Included in the effective use of energy is the impact of the energy use on comfort – after all, heating and cooling is primarily aimed at sustaining occupant comfort – as well as the time of use of energy, including the effects on peak demands, HVAC sizing and expensive peak energy costs. The committees failed to recognize the benefits of the proposed lower SHGC in this climate zone in this broader context.

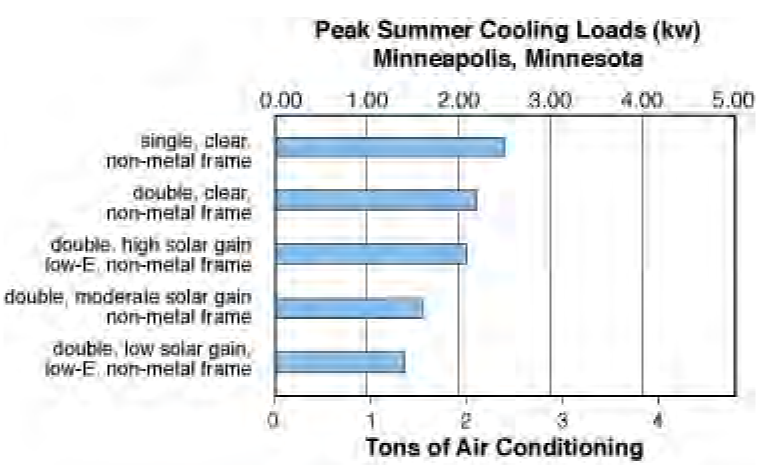
By contrast, the US Department of Energy has included a maximum SHGC requirement for years as part of its Energy Star program (the program's North-Central zone is roughly the same as IECC's zone 4). The current qualification criteria, released in April 2009, require this same maximum 0.40 SHGC. Such a maximum recognizes the reality that low SHGC windows increase comfort and reduce the likelihood of increased energy use from homeowners setting the thermostat lower to offset discomfort. Likewise, some states have already either adopted or are in the final stages of adopting an SHGC of 0.40 or lower in climate zone 4 because of the obvious benefits. The following graph from the Efficient Window Collaborative website (http://www.efficientwindows.org/comfort.cfm) demonstrates the discomfort issue:



This graph shows a reduction in the likelihood of discomfort from over 60% for a clear product down to almost 20% from a moderate solar gain (0.40 SHGC) product. As the EWC states on its website: "In summer, strong direct sunlight strikes people and interior surfaces, creating overheating and discomfort. Windows with low solar heat gain coefficients will reduce the solar radiation coming through the glass and associated discomfort. Low solar heat gain low-e glass (spectrally selective) reduces heat gain while still providing sufficient light and view."

The following graphs, also from the same website (see: http://www.efficientwindows.org/hvac.cfm), show the peak demand and HVAC savings potential from lower SHGCs in all climate zones. While the graphs demonstrate the benefits in Phoenix (climate zone 2) and Minneapolis (climate zone 6) – southern and northern climates – similar benefits would occur for climate zones in between like zone 4:





Most of the window products available would meet this standard. According to the NFRC Certified Products Directory database, 79% of the over 5 million product types listed would meet a 0.40 SHGC or lower.

This proposal should be approved as submitted based on the benefits outlined above.

Public Comment 2:

Jeff Inks, representing Window & Door Manufacturers Association, requests Approval as Submitted.

Commenter's Reason: WDMA urges approval of as submitted. Establishing a maximum SHGC for climate zone 4 is a needed improvement in the energy provisions of the IRC for the reasons stated by the proponent in the original proposal. There is greater concern and substantiation that the absence of any SHGC requirement is resulting in increased cooling than potential increases in heating loads that could result by establishing max SHGC requirements. The proposed .40 SHGC for the climate in Zone 4 is reasonable and consistent with existing ENERGY STAR and commercial requirements.

Public Comment 3:

Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc. & AGC Flat Glass North America Inc., requests Disapproval.

Commenter's Reason: EC42 was disapproved by the IECC Committee. It was also disapproved by the IRC Committee. An attempt to overturn the IECC Committee through an Assembly Action also failed.

At the Final Action hearings, EC42 should be disapproved for the same reasons that it was rejected by both Committees that heard it in Baltimore. In that regard, EC42 proposes a change in SHGC in Climate Zone 4 from NR to 0.40. The IECC and the IRC Committees **both** concluded that this change could actually **increase** heating loads in Climate Zone 4 and, therefore, increase energy consumption, rather than reduce it. This reasoning is substantiated in a report entitled "An Evaluation of Alternative Qualifying Criteria for Energy Star Windows" prepared by Lawrence Berkeley National Laboratory ("LBNL") for the Department of Energy, dated May 8, 2002. In it, LBNL specifically examined how far north an SHGC limit like the one proposed in EC42, should go. It concluded that energy savings shifted away from the use of low SHGC windows to the use of high SHGC windows in the middle of Climate Zone 4. This means that adopting EC42 would actually **increase** heating loads throughout the northern half of Climate Zone 4 resulting in an increase, rather than a decrease, in energy usage.

EC42 should be disapproved for other reasons as well. Significantly, the proponents of EC42 do not attempt to establish that adopting EC42 would save any energy. Instead, in their supporting statement, the proponents of EC42 rely on a "peak load" argument, and include a red graph to prominently display "Peak Summer Cooling Loads" based on a variety of different window types. The proponents then argues that this graph is somehow relevant to their proposed SHGC change in Climate Zone 4. However, what the proponents **fail** to disclose anywhere in their supporting statement is that the "peak load" graph on which they attempt to justify their proposed change, is actually based on data taken from **Phoenix, Arizona**, in Climate Zone 2, not on data taken from anywhere in Climate Zone 4.

There is no technical or energy conservation justification for the change proposed in EC42. We urge Final Action Hearing voters to support their Committees and vote in favor of the standing motion to disapprove EC42

Final Action: AS AM AMPC____ D

EC45-09/10-PART I

Tables 402.1.1 and 402.1.3

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Revise tables as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHTb U-FACTOR	GLAZED FENESTRATION SHGCb, [e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENTc WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65j	0.75	0.30	~~30~~ 38	13	4/6	13	0	0	0
3	0.50j	0.65	0.30	~~30~~ 38	13	5/8	19	5/13f	0	5/13
4 except Marine	0.35	0.60	NR	~~38~~ 49	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	~~38~~ 49	20 or 13+5h	13/17	30g	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5h	15/19	30g	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38g	15/19	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE 402.1.3
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[d]	CRAWL SPACE WALL U-FACTOR[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	~~0.035~~ 0.030	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	~~0.035~~ 0.030	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	~~0.030~~ 0.026	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	~~0.030~~ 0.026	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.028	0.050	0.065

(Footnotes remain unchanged)

Reason: This code proposal is intended to improve thermal envelope efficiency through improved insulation in ceilings in climate zones 2-5. These proposed improvements are reasonable, producing savings in total heating, cooling and hot water energy ranging from 0.8% to 1.4% in these climate zones. These savings are significant and when coupled with other proposed code modifications can lead to significant overall energy savings for homes. Moreover, unlike many building components, ceiling insulation can last for the life of the building, delivering consistent energy savings far longer than most energy savings measures. The following table portrays estimated savings from these measures:

	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4M	Climate Zone 5
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	0.8%	1.0%	1.2%	1.4%	1.4%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	0.6%	0.8%	0.9%	1.1%	1.0%

The U.S. Department of Energy issued new recommendations for cost-effective insulation levels in new homes in early 2008. The R-values in this proposal are consistent with the recommendations for new construction as shown in the table below from the DOE.

Zone	Gas	Heat Pump	Fuel Oil	Electric Furnace	Attic	Cathedral Ceiling	Wall		Floor
							Cavity	Insulation Sheathing	
1	✓	✓	✓	✓	R30 to R49	R22 to R38	R13 to R15	None	R13
2	✓	✓	✓		R30 to R60	R22 to R38	R13 to R15	None	R13
2				✓	R30 to R60	R22 to R38	R13 to R15	None	R19 - R25
3	✓	✓	✓		R30 to R60	R22 to R38	R13 to R15	None	R25
3				✓	R30 to R60	R22 to R38	R13 to R15	R2.5 to R5	R25
4	✓	✓	✓		R38 to R60	R30 to R38	R13 to R15	R2.5 to R6	R25 - R30
4				✓	R38 to R60	R30 to R38	R13 to R15	R5 to R6	R25 - R30
5	✓	✓	✓		R38 to R60	R30 to R38	R13 to R15	R2.5 to R6	R25 - R30
5				✓	R38 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
6	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
7	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
8	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30

Source: http://www1.eere.energy.gov/consumer/tips/insulation.html

These modest, cost-effective savings are part of a larger package of proposals that together will get the IECC to the 30% improvement that national policymakers are seeking. Achieving this goal requires several modest improvements, in multiple components of the building. Recent energy price increases, despite softening effects of the current economic downturn, signal a new era of sharply higher energy costs. In addition, climate change policy is likely to be enacted before the 2012 IECC is published, and its effects will likely include further energy price increases This proposal represents one of a set of reasonable and cost effective improvements that give states new options to increase the efficiency of their energy codes.

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

ICCFILENAME: PRINDLE-EC-6-T. 402.1.1-T. N1102.1

Public Hearing Results

PART I - IECC
Committee Action: Disapproved

Committee Reason: This is not a cost effective change to insulation values. Opponents provided specific data that the return on investment would be 40 to 50 years.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Submitted.

Commenter's Reason: *EC45, Parts I & II should be approved as submitted.*
The IECC Committee recommended approval of the same improvements in ceiling insulation as proposed in EC45 for climate zones 3, Marine 4, and 5 in EC13 and EC27. If EC45 is approved as submitted, additional energy savings would be gained in climate zone 2 (by moving it to R-38 like climate zone 3) and climate zone 4 except Marine (by moving it to R-49 like climate zone Marine 4).

As documented in the original reason statement, these insulation levels were shown to be cost-effective by the U.S. Department of Energy. Analysis shows that the homeowner will see positive cashflow from the energy savings in each of the climates compared to the increased cost of insulation. In climate zone 2, there is a modest increase of insulation from R-30 to R-38, which is important for homes in locations where documented attic temperatures range from 110 to 140 degrees -- a 40 to 70 degree temperature differential from the top floor of a home. The extra insulation is important to reduce occupant discomfort in the top floor of a home and to reduce energy usage.

The improvement from R-38 to R-49 in climate zone 4 will also reduce the extreme temperature swings in both winter and summer, reducing the need for both heating and cooling. In the case of zone 4, if R-49 is appropriate for climate zone Marine 4, then it is also appropriate for the rest of climate zone 4. These improvements are permanent, efficient measures that will benefit homeowners for the lifetime of the home.

Final Action: AS AM AMPC____ D

EC45-09/10-PART II
IRC Tables N1102.1 and N1102.1.2

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise tables as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35j	30	13	3/4	13	0	0	0
2	0.65i	0.75	0.35j	~~30~~ 38	13	4/6	13	0	0	0
3	0.50i	0.65	0.35e, j	~~30~~ 38	13	5/8	19	5/13f	0	5/13
4 except Marine	0.35	0.60	NR	~~38~~ 49	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	~~38~~ 49	20 or 13 + 5h	13/17	30f	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5h	15/19	30g	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30g	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE N1102.1.2
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	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	~~0.035~~ 0.030	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	~~0.035~~ 0.030	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	~~0.030~~ 0.026	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	~~0.030~~ 0.026	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.060	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.059	0.065

(Footnotes remain unchanged)

Reason: This code proposal is intended to improve thermal envelope efficiency through improved insulation in ceilings in climate zones 2-5. These proposed improvements are reasonable, producing savings in total heating, cooling and hot water energy ranging from 0.8% to 1.4% in these climate zones. These savings are significant and when coupled with other proposed code modifications can lead to significant overall energy savings for homes. Moreover, unlike many building components, ceiling insulation can last for the life of the building, delivering consistent energy savings far longer than most energy savings measures. The following table portrays estimated savings from these measures:

	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4M	Climate Zone 5
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	0.8%	1.0%	1.2%	1.4%	1.4%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	0.6%	0.8%	0.9%	1.1%	1.0%

The U.S. Department of Energy issued new recommendations for cost-effective insulation levels in new homes in early 2008. The R-values in this proposal are consistent with the recommendations for new construction as shown in the table below from the DOE.

Zone	Gas	Heat Pump	Fuel Oil	Electric Furnace	Attic	Cathedral Ceiling	Wall		Floor
							Cavity	Insulation Sheathing	
1	✓	✓	✓	✓	R30 to R49	R22 to R38	R13 to R15	None	R13
2	✓	✓	✓		R30 to R60	R22 to R38	R13 to R15	None	R13
2				✓	R30 to R60	R22 to R38	R13 to R15	None	R19 - R25
3	✓	✓	✓		R30 to R60	R22 to R38	R13 to R15	None	R25
3				✓	R30 to R60	R22 to R38	R13 to R15	R2.5 to R5	R25
4	✓	✓	✓		R38 to R60	R30 to R38	R13 to R15	R2.5 to R6	R25 - R30
4				✓	R38 to R60	R30 to R38	R13 to R15	R5 to R6	R25 - R30
5	✓	✓	✓		R38 to R60	R30 to R38	R13 to R15	R2.5 to R6	R25 - R30
5				✓	R38 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
6	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
7	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
8	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30

Source: http://www1.eere.energy.gov/consumer/tips/insulation.html

These modest, cost-effective savings are part of a larger package of proposals that together will get the IECC to the 30% improvement that national policymakers are seeking. Achieving this goal requires several modest improvements, in multiple components of the building. Recent energy price increases, despite softening effects of the current economic downturn, signal a new era of sharply higher energy costs. In addition, climate change policy is likely to be enacted before the 2012 IECC is published, and its effects will likely include further energy price increases This proposal represents one of a set of reasonable and cost effective improvements that give states new options to increase the efficiency of their energy codes.

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

ICCFILENAME: PRINDLE-EC-6-T. 402.1.1-T. N1102.1

Public Hearing Results

PART II - IRC
Committee Action: Disapproved

Committee Reason: The proposal does not provide a cost effective change to insulation values. In addition, this would be inconsistent with EC16.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Submitted.

Commenter's Reason: *EC45, Parts I & II should be approved as submitted.*

The IECC Committee recommended approval of the same improvements in ceiling insulation as proposed in EC45 for climate zones 3, Marine 4, and 5 in EC13 and EC27. If EC45 is approved as submitted, additional energy savings would be gained in climate zone 2 (by moving it to R-38 like climate zone 3) and climate zone 4 except Marine (by moving it to R-49 like climate zone Marine 4).

As documented in the original reason statement, these insulation levels were shown to be cost-effective by the U.S. Department of Energy. Analysis shows that the homeowner will see positive cashflow from the energy savings in each of the climates compared to the increased cost of insulation. In climate zone 2, there is a modest increase of insulation from R-30 to R-38, which is important for homes in locations where documented attic temperatures range from 110 to 140 degrees -- a 40 to 70 degree temperature differential from the top floor of a home. The extra insulation is important to reduce occupant discomfort in the top floor of a home and to reduce energy usage.

The improvement from R-38 to R-49 in climate zone 4 will also reduce the extreme temperature swings in both winter and summer, reducing the need for both heating and cooling. In the case of zone 4, if R-49 is appropriate for climate zone Marine 4, then it is also appropriate for the rest of climate zone 4. These improvements are permanent, efficient measures that will benefit homeowners for the lifetime of the home

Final Action: AS AM AMPC____ D

EC46-09/10-PART I

Table 402.1.1, Table 402.1.3, 402.2.1

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Revise as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHTb U-FACTOR	GLAZED FENESTRATION SHGCb, [e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENTc WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65j	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50j	0.65	0.30	30	13	5/8	19	5/13f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5h	13/17	30g	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5h	15/19	30g	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	~~49~~ 60	21	19/21	38g	15/19	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE 402.1.3
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[d]	CRAWL SPACE WALL U-FACTOR[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	~~0.026~~ 0.024	0.057	0.057	0.028	0.050	0.065

(Footnotes remain unchanged)

402.2.1 Ceilings with attic spaces. When Section 402.1.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly R-38 shall be deemed to satisfy the requirements for R-49 or higher wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the U-factor alternative approach in Section 402.1.3 and the total UA alternative in Section 402.1.4.

Reason: This code proposal is intended to improve thermal envelope efficiency through improved insulation in ceilings in climate zones 7 and 8. By increasing the ceiling insulation from R-49 to R-60 in climate zones 7 & 8 residential buildings can achieve approximately 0.6 to 0.7% purchased energy cost savings. These savings, especially coupled with other proposed code modifications can lead to significant overall energy savings for homes. Moreover, unlike many building components, ceiling insulation can last for the life of the building, delivering consistent energy savings far longer than many energy savings measures. Given that these climates are extremely cold, insulation measures are especially cost-effective.

	Climate Zone 7	Climate Zone 8
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	1.0%	0.9%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	0.7%	0.6%

The U.S. Department of Energy issued new recommendations for cost-effective insulation levels in new homes in early 2008. The R-values proposed in here are consistent with those recommendations as shown in the table below from the DOE.

Zone	Gas	Heat Pump	Fuel Oil	Electric Furnace	Attic	Cathedral Ceiling	Wall: Cavity	Wall: Insulation Sheathing	Floor
1	✓	✓	✓	✓	R30 to R49	R22 to R38	R13 to R15	None	R13
2	✓	✓	✓		R30 to R60	R22 to R38	R13 to R15	None	R13
2				✓	R30 to R60	R22 to R38	R13 to R15	None	R19 - R25
3	✓	✓	✓		R30 to R60	R22 to R38	R13 to R15	None	R25
3				✓	R30 to R60	R22 to R38	R13 to R15	R2.5 to R5	R25
4	✓	✓	✓		R38 to R60	R30 to R38	R13 to R15	R2.5 to R6	R25 - R30
4				✓	R38 to R60	R30 to R38	R13 to R15	R5 to R6	R25 - R30
5	✓	✓	✓		R38 to R60	R30 to R38	R13 to R15	R2.5 to R6	R25 - R30
5				✓	R38 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
6	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
7	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
8	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30

Source: http://www1.eere.energy.gov/consumer/tips/insulation.html

These modest, cost-effective savings are part of a larger package of proposals that together will get the IECC to the 30% improvement that national policymakers are seeking. Achieving this goal requires several modest improvements, in multiple components of the building. Recent energy price increases, despite softening effects of the current economic downturn, signal a new era of sharply higher energy costs. In addition, climate change policy is likely to be enacted before the 2012 IECC is published, and its effects will likely include further energy price increases This proposal represents one of a set of reasonable and cost effective improvements that give states new options to increase the efficiency of their energy codes.

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

ICCFILENAME: PRINDLE-EC-7-T. 402.1.1-T. N1102.1

Public Hearing Results

PART I - IECC
Committee Action: Disapproved

Committee Reason: The committee believes that there might be unintended consequences related to this proposal that were not considered. First, extra protection will need to be provided for the insulation to allow storage in the attics. Second, this could result in a greater amount of snow accumulation on roofs.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Submitted.

Commenter's Reason: *EC46, Parts I & II should be approved as submitted.*

Simply put, this proposal will require more insulation in ceilings in the coldest locations of the US. The IECC Code Development Committee cited only two reasons for disapproval, and neither reason was related to energy efficiency. We believe that the reasons cited do not justify disapproving EC46, and we recommend approving as submitted.

First, the Committee cited the need for "extra protection" for attic insulation to allow attic storage. The current ceiling insulation requirement for these climate zones in the 2009 IECC is R-49, which would already require a raised platform to ensure that insulation is not compacted. Although attic storage is not covered in the energy code, we believe that whenever attic storage is incorporated into building designs, the designer should allow some measure of protection, such as wooden platforms that ensure that the insulation is not compressed or compromised. This is a common sense building practice that should be used regardless of the level of attic insulation.

Second, we do not believe that the answer to snow accumulation is to encourage less-efficient ceilings. Snow accumulation on the roof is not dependent only on the insulation levels in the attic (i.e. heat loss from the conditioned home), but is also highly dependent on the design of the home, such as the slope of the roof, color of the roof and roof material. If the home is designed and built according to the code, the homeowner will have a more comfortable home with less money going to pay to heat and cool the house. Snow accumulation is not directly addressed in the energy code, and we do not believe that the level of ceiling insulation required is an accurate or appropriate means of controlling snow loads.

EC46 will save energy over the building lifetime at a relatively low cost. We recommend approval as submitted.

Final Action: AS AM AMPC____ D

EC46-09/10-PART II
IRC Table N1102.1, Table N1102.1.2, N1102.2.1

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35j	30	13	3/4	13	0	0	0
2	0.65i	0.75	0.35j	30	13	4/6	13	0	0	0
3	0.50i	0.65	0.35e, j	30	13	5/8	19	5/13f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5h	13/17	30f	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5h	15/19	30g	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	~~49~~ 60	21	19/21	30g	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE N1102.1.2
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	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.060	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	~~0.026~~ 0.024	0.057	0.057	0.033	0.059	0.065

(Footnotes remain unchanged)

N1102.2.1 Ceilings with attic spaces. When Section N1102.1.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly R-38 shall be deemed to satisfy the requirements for R-49 or higher wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the U-factor alternative approach in Section N1102.1.2 and the total UA alternative in Section N1102.1.3.

Reason: This code proposal is intended to improve thermal envelope efficiency through improved insulation in ceilings in climate zones 7 and 8. By increasing the ceiling insulation from R-49 to R-60 in climate zones 7 & 8 residential buildings can achieve approximately 0.6 to 0.7% purchased energy cost savings. These savings, especially coupled with other proposed code modifications can lead to significant overall energy savings for homes. Moreover, unlike many building components, ceiling insulation can last for the life of the building, delivering consistent energy savings far longer than many energy savings measures. Given that these climates are extremely cold, insulation measures are especially cost-effective.

	Climate Zone 7	Climate Zone 8
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	1.0%	0.9%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	0.7%	0.6%

The U.S. Department of Energy issued new recommendations for cost-effective insulation levels in new homes in early 2008. The R-values proposed in here are consistent with those recommendations as shown in the table below from the DOE.

							Wall		
Zone	Gas	Heat Pump	Fuel Oil	Electric Furnace	Attic	Cathedral Ceiling	Cavity	Insulation Sheathing	Floor
1	✓	✓	✓	✓	R30 to R49	R22 to R38	R13 to R15	None	R13
2	✓	✓	✓		R30 to R60	R22 to R38	R13 to R15	None	R13
2				✓	R30 to R60	R22 to R38	R13 to R15	None	R19 - R25
3	✓	✓	✓		R30 to R60	R22 to R38	R13 to R15	None	R25
3				✓	R30 to R60	R22 to R38	R13 to R15	R2.5 to R5	R25
4	✓	✓	✓		R38 to R60	R30 to R38	R13 to R15	R2.5 to R6	R25 - R30
4				✓	R38 to R60	R30 to R38	R13 to R15	R5 to R6	R25 - R30
5	✓	✓	✓		R38 to R60	R30 to R38	R13 to R15	R2.5 to R6	R25 - R30
5				✓	R38 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
6	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
7	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30
8	✓	✓	✓	✓	R49 to R60	R30 to R60	R13 to R21	R5 to R6	R25 - R30

Source: http://www1.eere.energy.gov/consumer/tips/insulation.html

These modest, cost-effective savings are part of a larger package of proposals that together will get the IECC to the 30% improvement that national policymakers are seeking. Achieving this goal requires several modest improvements, in multiple components of the building. Recent energy price increases, despite softening effects of the current economic downturn, signal a new era of sharply higher energy costs. In addition, climate change policy is likely to be enacted before the 2012 IECC is published, and its effects will likely include further energy price increases This proposal represents one of a set of reasonable and cost effective improvements that give states new options to increase the efficiency of their energy codes.

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

ICCFILENAME: PRINDLE-EC-7-T. 402.1.1-T. N1102.1

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: The values would be inconsistent with the approach taken in EC16.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Submitted.

Commenter's Reason: *EC46, Parts I & II should be approved as submitted.*

Simply put, this proposal will require more insulation in ceilings in the coldest locations of the US. The IECC Code Development Committee cited only two reasons for disapproval, and neither reason was related to energy efficiency. We believe that the reasons cited do not justify disapproving EC46, and we recommend approving as submitted.

First, the Committee cited the need for "extra protection" for attic insulation to allow attic storage. The current ceiling insulation requirement for these climate zones in the 2009 IECC is R-49, which would already require a raised platform to ensure that insulation is not compacted. Although attic storage is not covered in the energy code, we believe that whenever attic storage is incorporated into building designs, the designer should allow some measure of protection, such as wooden platforms that ensure that the insulation is not compressed or compromised. This is a common sense building practice that should be used regardless of the level of attic insulation.

Second, we do not believe that the answer to snow accumulation is to encourage less-efficient ceilings. Snow accumulation on the roof is not dependent only on the insulation levels in the attic (i.e. heat loss from the conditioned home), but is also highly dependent on the design of the home, such as the slope of the roof, color of the roof and roof material. If the home is designed and built according to the code, the homeowner will have a more comfortable home with less money going to pay to heat and cool the house. Snow accumulation is not directly addressed in the energy code, and we do not believe that the level of ceiling insulation required is an accurate or appropriate means of controlling snow loads.

EC46 will save energy over the building lifetime at a relatively low cost. We recommend approval as submitted.

Final Action: AS AM AMPC____ D

EC47-09/10-PART I
Table 402.1.1, Table 402.1.3, Table 402.2.5

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Revise tables as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb, [e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	~~13~~ 20 or 13 + 5	~~5/8~~ 8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	~~13~~ 20 or 13+5	~~5/10~~ 8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[h]	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE 402.1.3
EQUIVALENT U-FACTORS[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	WOOD FRAME WALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR[d]	CRAWL SPACE WALL U-FACTOR[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	~~0.082~~ 0.057	~~0.141~~ 0.098	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	~~0.082~~ 0.057	~~0.141~~ 0.098	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.028	0.050	0.065

(Footnotes remain unchanged)

TABLE 402.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL 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	
R-13	R-13 + 5 or R-15 + 4 or R-21 + 3 or R-0 + 10
R-19	R-13 + 9 or R-19 + 8 or R-25 + 7
R-20	R-13+10 or R-19+8 or R-25+7
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
Steel Joist Floor	
R-13	R-19 in 2 x 6 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

(Footnotes remain unchanged)

Reason: This code proposal is intended to improve the thermal envelope efficiency through improved insulation in walls in climate zones 3 and 4. The table below illustrates the estimated energy cost savings from this measure in each climate zone. These savings in these zones are substantial and when coupled with other proposed code modifications can lead to significant overall energy savings for homes. Moreover, unlike many building components, wall insulation can last for the life of the building, delivering consistent energy savings far longer than many energy savings measures. In addition, it is difficult to add additional wall insulation after the home is constructed. As a result, the failure to adequately insulate the walls would impose needlessly higher energy costs on homeowners for decades to come.

	Climate Zone 3	Climate Zone 4
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	5.5%	6.9%
Total Purchased Energy Cost Percent Savings (including appliances and lighting)	4.0%	5.2%

For wood frame walls, the specific values proposed for climate zones 3 and 4 match exactly current requirements for the Marine 4 climate zone and climate zones 5 and 6. As we work to increase the energy efficiency of the code, it is reasonable to extend these prescriptive requirements that are already being met in these colder climate zones to climate zones 3 and 4.

It is important to remember that the builder need not install the specific wall insulation that is designated by the prescriptive path. Compliance with thermal envelope criteria can be achieved through several paths:

1. Any combination of cavity and sheathing—Builders can easily combine various types of batt and blown cavity insulation with continuous sheathing to achieve any of these nominal R-values. .
2. UA tradeoffs—Builders can calculate an average U-factor for the envelope, and adjust any component—walls, windows, ceilings, or floors—to adjust wall R-values to desired levels. Small changes in window specifications, for example, can easily allow builders to use a wide range of insulation solutions
3. Performance path—Builders can trade off wall insulation against a wide range of other measures.

Because of this built-in flexibility in the compliance options, as well as the fact that these requirements currently exist in three climate zones, there is no basis to claim that the insulation levels in this code change proposal are impractical or prevent competition. They are simply modest improvements in wall performance that are needed to achieve a larger overall performance improvement in American homes.

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

ICCFILENAME: PRINDLE-EC-10-T. 402.1.1-T. N1102.1

Public Hearing Results

PART I - IECC
Committee Action: **Approved as Modified**

Modify proposal as follows:

h. First value is cavity insulation, second is continuous insulation, so “13+5” means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.

Committee Reason: This represents a reasonable level of energy conservation. The modification is to provide correct terminology in the footnote.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jay Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

CONTINUOUS INSULATION. Insulation installed continuously across all structural members on the interior, exterior, or integral to any opaque surface of the building envelope, without intervening vented air spaces or thermal bridges other than fasteners and service openings.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This proposal and various other proposals and modifications from the code development hearings use or introduce the term, "continuous insulation", but the term is not defined. This public comment corrects that problem and provides needed clarification of the meaning of continuous insulation to ensure proper application in compliance with the intent of the energy code.

ASHRAE 90.1 defines continuous insulation as "insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope." This definition is adopted in this PC for sake of consistency and is further improved to clarify an important concern with the proper and consistent characterization of continuous insulation. The ASHRAE definition addresses a concern with thermal bridging but does not address the similar concern with intervening vented air spaces which can create a disconnect of continuous insulation thermal resistance such that its contribution to a layered wall assembly R-value cannot be simply summed. Thus, wording is included in the definition to address this concern. Air exchange rates for vented airspaces behind claddings can exceed 90 air-changes per hour (see references 1 and 2) which significantly impacts the R-value of the air-space or disconnects the R-value of material on the exterior side of the airspace. A robust definition for continuous insulation is needed in the IECC.

References:

1. Straube, J. and Finch, G. (2009). Ventilated Wall Claddings: Review, Field Performance, and Hygrothermal Modeling, Research Report – 0907, Building Science Press, www.buildingscience.com.
2. Salonvarra, M., Karagiozis, A.N., Pazera, M., Miller W. (2007). "Air Cavities Behind Claddings – What Have We Learned?", Buildings X, ASHRAE

Public Comment 2:

Jay Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb, [e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	20 or 13+ 5	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation ~~or insulating sheathing~~. If structural sheathing covers ~~25~~ 40 percent or less of the exterior, continuous insulation ~~or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2~~ R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This public comment achieves two things:

1. corrects a severe problem with footnote 'h' that erodes the energy code, regardless of which version of the energy code is approved; and,
2. provides a rational and flexible application of footnote 'h' in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote 'h' is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote 'h', the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote 'h' allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Public Comment 3:

Mark Halverson, representing APA, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb, [e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	20 or 13 + 5	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation or insulated sheathing, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing; "20+5" means R-20 cavity insulation in addition to a layer or R-5 continuous or insulating sheathing; and "13+10" means R-13 cavity insulation in addition to a layer of R-10 continuous or insulating sheathing. ~~If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If~~ In locations where structural sheathing ~~covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2~~ is used, continuous insulation or insulating sheathing shall be permitted to be reduced by no more than R-2.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This modification simplifies and clarifies footnote h. of Table 402.1.1 when both R-5 and R-10 continuous sheathing or insulating sheathing is required regardless of the amount of structural sheathing that is used. The amount of structural sheathing needed to adequately brace the walls is not limited, so the structural capacity of the wall is not impacted. This modification also assures that all opaque wall areas are covered by continuous insulation or insulating sheathing while maintaining the same combined sheathing thickness in all the wall envelope areas.

Instead of a fixed minimum requirement of R-2 continuous sheathing as before, a reduction of R-2 sheathing from the specified amount works for both R-5 or R10 continuous sheathing requirements. A R-5 requirement reduced by R-2 yields a R-3 continuous insulation applied over the structural sheathing and a R-10 reduced by R-2 yields a R-8 continuous insulation over the structural sheathing.

We ask that the code body support the Committee's recommendation for approval as modified by this Public Comment.

Public Comment 4:

Martha G. VanGeem, CTLGroup, representing Masonry Alliance for Codes and Standards, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb, [e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	20 or 13 + 5	~~8/13~~ <u>5/8</u>	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5	15/19	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.

TABLE 402.1.3
EQUIVALENT U-FACTORS[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	WOOD FRAME WALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR[d]	CRAWL SPACE WALL U-FACTOR[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.057	~~0.098~~ <u>0.141</u>	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.057	0.098	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.057	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.028	0.050	0.065

(Footnotes remain unchanged)

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This restores the insulation values for mass walls in climate zone 3 back to what it is in DOE's code change proposal EC-13. EC-13 was developed by a broad base coalition of stakeholders and represents a reasonable, cost-effective increase in insulation values. EC13 is one part of an effort by DOE and other stakeholders to improve the energy efficiency of the IECC by 30% compared to the 2006 edition of the code.

The values in this public comment represent reasonable values considering the effect of thermal mass in the relatively moderate climate zone 3. In this region of the country, heat flow reversals within the wall are common on the many days when the outdoor air temperature fluctuates above and below the balance point of the building, resulting in significant thermal mass effects and little or no heat flow through the wall at these times. Note that DOE2 simulations show mass effects for a 2400 sq foot homes in all climates. The U-factor for mass walls in Table 402.1.3 should correspond to the R-value for mass walls in Table 402.1.1

Public Comment 5:

Don Surrena, representing National Association of Home Builders (NAHB), requests Disapproval.

Commenter's Reason: Increasing the wall R-value to R-20 in climate zone 3 is a significant cost increase with a relatively small energy savings. The cost to increase the R-value from R-13 to R-20 is expected to be around $1,900 for a 2,000 square foot 2-story house with an associated energy savings of around $22/yr. This is nearly a 100 year payback, well beyond any cost effective criteria.

Final Action: AS AM AMPC____ D

EC47-09/10-PART II
IRC Table N1102.1, Table N1102.1.2, Table N1102.2.5

<u>Proposed Change as Submitted</u>

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise tables as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE <u>h</u>	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	~~13~~ <u>20 or 13+5</u>	~~5/8~~ <u>8/13</u>	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	~~13~~ <u>20 or 13+5</u>	~~5/10~~ <u>8/13</u>	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5[~~h~~]	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5[~~h~~]	15/19	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30[g]	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE N1102.1.2
EQUIVALENT U-FACTORS[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	<u>WOOD</u> FRAME WALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	~~0.082~~ <u>0.057</u>	~~0.141~~ <u>0.098</u>	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	~~0.082~~ <u>0.057</u>	~~0.141~~ <u>0.098</u>	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.060	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.059	0.065

(Footnotes remain unchanged)

TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL 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	
R-13	R-13 + 5 or R-15 + 4 or R-21 + 3 or R-0 + 10
R-19	R-13 + 9 or R-19 + 8 or R-25 + 7
R-20	R-13+10 or R-19+8 or R-25+7
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
Steel Joist Floor	
R-13	R-19 in 2 x 6 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

(Footnotes remain unchanged)

Reason: This code proposal is intended to improve the thermal envelope efficiency through improved insulation in walls in climate zones 3 and 4. The table below illustrates the estimated energy cost savings from this measure in each climate zone. These savings in these zones are substantial and when coupled with other proposed code modifications can lead to significant overall energy savings for homes. Moreover, unlike many building components, wall insulation can last for the life of the building, delivering consistent energy savings far longer than many energy savings measures. In addition, it is difficult to add additional wall insulation after the home is constructed. As a result, the failure to adequately insulate the walls would impose needlessly higher energy costs on homeowners for decades to come.

	Climate Zone 3	Climate Zone 4
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	5.5%	6.9%
Total Purchased Energy Cost Percent Savings (including appliances and lighting)	4.0%	5.2%

For wood frame walls, the specific values proposed for climate zones 3 and 4 match exactly current requirements for the Marine 4 climate zone and climate zones 5 and 6. As we work to increase the energy efficiency of the code, it is reasonable to extend these prescriptive requirements that are already being met in these colder climate zones to climate zones 3 and 4.

It is important to remember that the builder need not install the specific wall insulation that is designated by the prescriptive path. Compliance with thermal envelope criteria can be achieved through several paths:

1. Any combination of cavity and sheathing—Builders can easily combine various types of batt and blown cavity insulation with continuous sheathing to achieve any of these nominal R-values. .
2. UA tradeoffs—Builders can calculate an average U-factor for the envelope, and adjust any component—walls, windows, ceilings, or floors—to adjust wall R-values to desired levels. Small changes in window specifications, for example, can easily allow builders to use a wide range of insulation solutions
3. Performance path—Builders can trade off wall insulation against a wide range of other measures.

Because of this built-in flexibility in the compliance options, as well as the fact that these requirements currently exist in three climate zones, there is no basis to claim that the insulation levels in this code change proposal are impractical or prevent competition. They are simply modest improvements in wall performance that are needed to achieve a larger overall performance improvement in American homes.

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

ICCFILENAME: PRINDLE-EC-10-T. 402.1.1-T. N1102.1

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: This is not a cost effective requirement for other than electrically heated homes. Also, the provisions would be inconsistent with EC16.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE [h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	20 or 13+5	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5	15/19	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30[g]	10/13	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.

TABLE N1102.1.2
EQUIVALENT U-FACTORS [a]

Climate Zone	Wood Frame Wall U-Factor	Mass Wall U-Factor [b]
1	0.082	0.197
2	0.082	0.165
3	0.057	0.098
4 except Marine	0.057	0.098
5 and Marine 4	0.060	0.082
6	0.060	0.060
7 and 8	0.057	0.057

TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

Wood Frame R-Value Requirement	Cold-Formed Steel Equivalent R-Value [a]
Steel-Framed Wall	
R-13	R-13+5 or R-15+4 or R-21+3 or R-0+10
R-19	R-13+9 or R-19+8 or R-25+7
R-20	R-13+10 or R-19+8 or R-25+7
R-21	R-13+10 or R-19+9 or R-25+8

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: *EC47, Part II should be approved as modified by this public comment.*

The proposed modification reflects the modification approved by the IECC Committee. The IRC Committee reasons for disapproval are unfounded, as energy savings will be significant for all fuel types. Additionally, where builders desire to retain 2x4 construction, builders can meet these requirements through the use of insulating sheathing and proper framing design. This proposal should be approved to create consistency with the IECC and save energy.

Public Comment 2:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

CONTINUOUS INSULATION. Insulation installed continuously across all structural members on the interior, exterior, or integral to any opaque surface of the building envelope, without intervening vented air spaces or thermal bridges other than fasteners and service openings.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This proposal and various other proposals and modifications from the code development hearings use or introduce the term, "continuous insulation", but the term is not defined. This public comment corrects that problem and provides needed clarification of the meaning of continuous insulation to ensure proper application in compliance with the intent of the energy code.

ASHRAE 90.1 defines continuous insulation as "insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope." This definition is adopted in th
is PC for sake of consistency and is further improved to clarify an important concern with the proper and consistent characterization of continuous insulation. The ASHRAE definition addresses a concern with thermal bridging but does not address the similar concern with intervening vented air spaces which can create a disconnect of continuous insulation thermal resistance such that its contribution to a layered wall assembly R-value cannot be simply summed. Thus, wording is included in the definition to address this concern. Air exchange rates for vented airspaces behind claddings can exceed 90 air-changes per hour (see references 1 and 2) which significantly impacts the R-value of the air-space or disconnects the R-value of material on the exterior side of the airspace. A robust definition for continuous insulation is needed in the IECC.

References:

1. Straube, J. and Finch, G. (2009). Ventilated Wall Claddings: Review, Field Performance, and Hygrothermal Modeling, Research Report – 0907, Building Science Press, www.buildingscience.com.
2. Salonvarra, M., Karagiozis, A.N., Pazera, M., Miller W. (2007). "Air Cavities Behind Claddings – What Have We Learned?", Buildings X, ASHRAE.

Public Comment 3:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE [h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	20 or 13+5	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5	15/19	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30[g]	10/13	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 ~~insulated sheathing~~ continuous insulation. If structural sheathing covers ~~25~~ 40 percent or less of the exterior, ~~insulated sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior structural sheathing shall be supplemented with insulated sheathing of at least R-2~~ continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This public comment achieves two things:

1. corrects a severe problem with footnote 'h' that erodes the energy code, regardless of which version of the energy code is approved; and,
2. provides a rational and flexible application of footnote 'h' in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote 'h' is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote 'h', the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote 'h' allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Public Comment 4:

Mark Halverson, representing APA, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE [h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	20 or 13+5	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5	15/19	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30[g]	10/13	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation or insulated sheathing, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated sheathing; "20+5" means R-20 cavity insulation in addition to a layer of R-5 continuous or insulating sheathing; and "13+10" means R-13 cavity insulation in addition to a layer of R-10 continuous or insulating sheathing~~. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If~~ In locations where structural sheathing is used, continuous insulation or insulating sheathing shall be permitted to be reduced by no more than R-2~~covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2~~.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This modification simplifies and clarifies footnote h. of Table 402.1.1 when both R-5 and R-10 continuous sheathing or insulating sheathing is required regardless of the amount of structural sheathing that is used. The amount of structural sheathing needed to adequately brace the walls is not limited, so the structural capacity of the wall is not impacted. This modification also assures that all opaque wall areas are covered by continuous insulation or insulating sheathing while maintaining the same combined sheathing thickness in all the wall envelope areas.

Instead of a fixed minimum requirement of R-2 continuous sheathing as before, a reduction of R-2 sheathing from the specified amount works for both R-5 or R10 continuous sheathing requirements. A R-5 requirement reduced by R-2 yields a R-3 continuous insulation applied over the structural sheathing and a R-10 reduced by R-2 yields a R-8 continuous insulation over the structural sheathing.

We ask that the code body support the Committee's recommendation for approval as modified by this Public Comment.

Public Comment 5:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC, and Craig Conner, Building Quality, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE [h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	20 or 13+5	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5	15/19	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30[g]	10/13	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation or insulated sheathing, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or ~~insulated~~ insulating sheathing. ~~If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building c ode. T his c hange i s one of a s eries of c hanges i ntended to c orrect a l arge nu mber of i nconsistencies i n the r esidential ener gy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

The modification takes away the misunderstood and misinterpreted part of the footnote that very few code officials were enforcing and creates a more stringent and simple footnote in alignment with EC27.

Public Comment 6:

Theresa A. Weston, representing DuPont Building Innovations, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE [h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	20 or 13+5	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	20 or 13+5	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13 + 5	15/19	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	30[g]	10/13	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or ~~insulated~~ insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating ~~insulated~~ sheathing of at least R-2.

Commenter's Reason:
This modification changes this proposal to be consistent with committee action on EC47 Part I which was modified and approved during the technical hearings. It generalizes the requirement for continuous insulation and does not require the insulation to be a sheathing thus allowing more options for meeting this requirement.

Final Action: AS AM AMPC____ D

EC48-09/10-PART I
Table 402.1.1, Table 402.1.3, Table 402.2.5

<u>Proposed Change as Submitted</u>

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Revise tables as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb, [e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[<u>h</u>]	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[~~h~~]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20<u>+5</u> or 13+<u>10</u>~~5~~[~~h~~]	15/~~19~~ <u>20</u>	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	<u>20+5 or 13+10</u> ~~21~~	19/21	38[g]	15/19	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE 402.1.3
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[d]	CRAWL SPACE WALL U-FACTOR[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.0<u>48</u> ~~57~~	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	0.026	0.04~~8~~ <u>57</u>	0.057	0.028	0.050	0.065

(Footnotes remain unchanged)

TABLE 402.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL 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

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE[a]
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	
R-13	R-13 + 5 or R-15 + 4 or R-21 + 3 or R-0 + 10
R-19	R-13 + 9 or R-19 + 8 or R-25 + 7
R-20	R-13+10 or R-19+8 or R-25+7
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
R-20+5	R-13+15 or R-19+14 or R-25+13
Steel Joist Floor	
R-13	R-19 in 2 x 6 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

(Footnotes remain unchanged)

Reason: This code proposal is intended to improve the thermal envelope efficiency through improved insulation in walls in climate zones 6, 7 and 8. The table below illustrates the estimated energy cost savings from this measure in each climate zone. These savings are significant and when coupled with other proposed code modifications can lead to significant overall energy savings for homes. Moreover, unlike many building components, wall insulation can last for the life of the building, delivering consistent energy savings far longer than many energy savings measures. In addition, it is difficult to add additional wall insulation after the home is constructed. As a result, the failure to adequately insulate the walls would impose needlessly higher energy costs on homeowners for decades to come.

	Climate Zone 6	Climate Zone 7	Climate Zone 8
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	3.5%	3.6%	3.8%
Total Purchased Energy Cost Percent Savings (including appliances and lighting)	2.7%	2.7%	3.0%

As we work to increase the energy efficiency of the code, it is reasonable to raise the bar and increase current prescriptive requirements for these coldest climate zones.

It is important to remember that the builder need not install the specific wall insulation that is designated by the prescriptive path. Compliance with thermal criteria can be achieved through several paths:

1. Any combination of cavity and sheathing—Builders can easily combine various types of batt and blown cavity insulation with continuous sheathing to achieve any of these nominal R-values. .
2. UA tradeoffs—Builders can calculate an average U-factor for the envelope, and adjust any component—walls, windows, ceilings, or floors—to adjust wall R-values to desired levels. Small changes in window specifications, for example, can easily allow builders to use a wide range of insulation solutions
3. Performance path—Builders can trade off wall insulation against a wide range of other measures.

Because of this built-in flexibility in compliance options, there is no basis to claim that the insulation levels in this public comment are impractical, not cost-effective, or prevent competition. They are simply modest improvements in wall performance that are needed to achieve a larger overall performance improvement in American homes.

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

ICCFILENAME: PRINDLE-EC-11-T. 402.1.1-T. N1102.1

Public Hearing Results

PART I - IECC
Committee Action: Approved as Modified

Modify proposal as follows:

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.

Committee Reason: This will provide for energy conservation levels consistent with EC13. The modification is intended to provide corrections to terminology in the footnote.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

James D. Bowman, representing American Wood Council, request Approval as Modified by this Public Comment.

Further modify the proposal as follows:

TABLE 402.1.1
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[h]	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20+5 or 13+10 or R-24	15/20	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	20+5 or 13+10 or R-24	19/21	38[g]	15/19	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.

TABLE 402.1.3
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[d]	CRAWL SPACE WALL U-FACTOR[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	~~0.048~~ 0.051	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	0.026	~~0.057~~ 0.051	0.057	0.028	0.050	0.065

(Footnotes remain unchanged)

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This proposal adds a requirement to Table 402.1.1 for continuous insulation as the only prescriptive solution for meeting the required Frame Wall U-value. In cases where high structural requirements are demanded, this may not be the most viable and cost effective construction. This proposal should maintain at least one cavity insulation wall construction R-value for each climate zone, which is desirable from a design perspective.

There is growing concern that the exclusive use of continuous insulation in the wall insulation requirements for Climate Zones 6, 7 and 8 will preclude the use of structural sheathing where it is needed in lateral force resisting systems. This proposal should not require the exclusive use of continuous insulation in the three referenced zones when the objective is simply to ensure energy efficiency. It should only specify efficiency levels and let designers comply with the values.

Specifying insulation levels are simple R-values allows the designer to combine all types of insulation materials and it strikes a balance between the desired objective for energy efficiency in the building envelope and workable options for building designers.

The R-24 batts are an existing product in the market place that facilitates compliance at a reasonable, buildable level while maintaining a level of efficiency that is not significantly different from slightly greater insulation levels that achieve little incremental improvement. Continuous insulation options cost significantly more when labor and fastening materials are included. These costs are greater than the simple cost of the insulation materials and are not included in the cost effectiveness studies that underlie the current justification for insulation board/batt combinations, currently listed in the referenced climate zones.

The U-051 value is recommended because it is consistent with the commercial values currently deemed compliant for these Climate Zones in Chapter 5.

Public Comment 2:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

CONTINUOUS INSULATION. Insulation installed continuously across all structural members on the interior, exterior, or integral to any opaque surface of the building envelope, without intervening vented air spaces or thermal bridges other than fasteners and service openings.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This proposal and various other proposals and modifications from the code development hearings use or introduce the term, "continuous insulation", but the term is not defined. This public comment corrects that problem and provides needed clarification of the meaning of continuous insulation to ensure proper application in compliance with the intent of the energy code.

ASHRAE 90.1 defines continuous insulation as "insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope." This definition is adopted in this PC for sake of consistency and is further improved to clarify an important concern with the proper and consistent characterization of continuous insulation. The ASHRAE definition addresses a concern with thermal bridging but does not address the similar concern with intervening vented air spaces which can create a disconnect of continuous insulation thermal resistance such that its contribution to a layered wall assembly R-value cannot be simply summed. Thus, wording is included in the definition to address this concern. Air exchange rates for vented airspaces behind claddings can exceed 90 air-changes per hour (see references 1 and 2) which significantly impacts the R-value of the air-space or disconnects the R-value of material on the exterior side of the airspace. A robust definition for continuous insulation is needed in the IECC.

References:

1. Straube, J. and Finch, G. (2009). Ventilated Wall Claddings: Review, Field Performance, and Hygrothermal Modeling, Research Report – 0907, Building Science Press, www.buildingscience.com.
2. Salonvarra, M., Karagiozis, A.N., Pazera, M., Miller W. (2007). "Air Cavities Behind Claddings – What Have We Learned?", Buildings X, ASHRAE

Public Comment 3:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb, [e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20+5 or 13+10 or R-24	15/20	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	20+5 or 13+10 or R-24	19/21	38[g]	15/19	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or ~~insulating sheathing~~. If structural sheathing covers ~~25~~ 40 percent or less of the exterior, continuous insulation ~~or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing~~

~~shall be supplemented with continuous insulation or insulating sheathing of at least R-2~~ R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This public comment achieves two things:

1. corrects a severe problem with footnote 'h' that erodes the energy code, regardless of which version of the energy code is approved; and,
2. provides a rational and flexible application of footnote 'h' in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote 'h' is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote 'h', the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote 'h' allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Public Comment 4:

Mark Halverson, representing APA, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGCb, [e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20+5 or 13+10	15/20	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	20+5 or 13+10	19/21	38[g]	15/19	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation or insulating sheathing, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulating sheathing; "20+5" means R-20 cavity insulation in addition to a layer of R-5 continuous or insulating sheathing; and "13+10" means R-13 cavity insulation in addition to a layer of R-10 continuous or insulating sheathing. ~~If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If~~ In locations where structural sheathing is used, continuous insulation or insulating sheathing shall be permitted to be reduced by no more than R-2.~~covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating sheathing of at least R-2.~~

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This modification simplifies and clarifies footnote h. of Table 402.1.1 when both R-5 and R-10 continuous sheathing or insulating sheathing is required regardless of the amount of structural sheathing that is used. The amount of structural sheathing needed to adequately brace the walls is not limited, so the structural capacity of the wall is not impacted. This modification also assures that all opaque wall areas are covered by continuous insulation or insulating sheathing while maintaining the same combined sheathing thickness in all the wall envelope areas.

Instead of a fixed minimum requirement of R-2 continuous sheathing as before, a reduction of R-2 sheathing from the specified amount works for both R-5 or R10 continuous sheathing requirements. A R-5 requirement reduced by R-2 yields a R-3 continuous insulation applied over the structural sheathing and a R-10 reduced by R-2 yields a R-8 continuous insulation over the structural sheathing.

We ask that the code body support the Committee's recommendation for approval as modified by this Public Comment.

Public Comment 5:

Don Surrena, representing National Association of Home Builders (NAHB) requests Disapproval.

Commenter's Reason: This proposal virtually mandates the use of rigid foam on the exterior of a home in climate zones 6, 7 and 8. Although possible to build, these systems have an increased susceptibility to bulk moisture problems. If the insulative sheathing is placed directly over structural sheathing a double vapor barrier can retain water and increase the moisture level in structural sheathing potentially resulting in mold, rot and/or compromised structural performance.

Final Action: AS AM AMPC____ D

EC48-09/10-PART II

IRC Table N1102.1, Table N1102.1.2, Table N1102.2.5

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise tables as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5h	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20+5 or 13+10~~5[h]~~	15/~~19~~ 20	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	20+5 or 13+10 ~~21~~	19/21	30[g]	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE N1102.1.2
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	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.048 ~~60~~	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.048 ~~57~~	0.057	0.033	0.059	0.065

(Footnotes remain unchanged)

TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL 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

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE[a]
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	
R-13	R-13 + 5 or R-15 + 4 or R-21 + 3 or R-0 + 10
R-19	R-13 + 9 or R-19 + 8 or R-25 + 7
R-20	R-13+10 or R-19+8 or R-25+7
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
R-20+5	R-13+15 or R-19+14 or R-25+13
Steel Joist Floor	
R-13	R-19 in 2 x 6 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

(Footnotes remain unchanged)

Reason: This code proposal is intended to improve the thermal envelope efficiency through improved insulation in walls in climate zones 6, 7 and 8. The table below illustrates the estimated energy cost savings from this measure in each climate zone. These savings are significant and when coupled with other proposed code modifications can lead to significant overall energy savings for homes. Moreover, unlike many building components, wall insulation can last for the life of the building, delivering consistent energy savings far longer than many energy savings measures. In addition, it is difficult to add additional wall insulation after the home is constructed. As a result, the failure to adequately insulate the walls would impose needlessly higher energy costs on homeowners for decades to come.

	Climate Zone 6	Climate Zone 7	Climate Zone 8
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	3.5%	3.6%	3.8%
Total Purchased Energy Cost Percent Savings (including appliances and lighting)	2.7%	2.7%	3.0%

As we work to increase the energy efficiency of the code, it is reasonable to raise the bar and increase current prescriptive requirements for these coldest climate zones.

It is important to remember that the builder need not install the specific wall insulation that is designated by the prescriptive path. Compliance with thermal criteria can be achieved through several paths:

1. Any combination of cavity and sheathing—Builders can easily combine various types of batt and blown cavity insulation with continuous sheathing to achieve any of these nominal R-values. .
2. UA tradeoffs—Builders can calculate an average U-factor for the envelope, and adjust any component—walls, windows, ceilings, or floors—to adjust wall R-values to desired levels. Small changes in window specifications, for example, can easily allow builders to use a wide range of insulation solutions
3. Performance path—Builders can trade off wall insulation against a wide range of other measures.

Because of this built-in flexibility in compliance options, there is no basis to claim that the insulation levels in this public comment are impractical, not cost-effective, or prevent competition. They are simply modest improvements in wall performance that are needed to achieve a larger overall performance improvement in American homes.

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

ICCFILENAME: PRINDLE-EC-11-T. 402.1.1-T. N1102.1

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: This would be inconsistent with the approach taken in EC16.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Name: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5h	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20+5 or 13+10~~5~~~~[h]~~	15/~~19~~ 20	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	20+5 or 13+10 ~~21~~	19/21	30[g]	10/13	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulating ~~insulated~~ sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or ~~insulating~~ insulated sheathing of at least R-2.

TABLE N1102.1.2
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	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.048 ~~60~~	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.048 ~~57~~	0.057	0.033	0.059	0.065

(Footnotes remain unchanged)

TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL 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]	

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE[a]
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	
R-13	R-13 + 5 or R-15 + 4 or R-21 + 3 or R-0 + 10
R-19	R-13 + 9 or R-19 + 8 or R-25 + 7
R-20	R-13+10 or R-19+8 or R-25+7
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
R-20+5	R-13+15 or R-19+14 or R-25+13
Steel Joist Floor	
R-13	R-19 in 2 x 6 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

(Footnotes remain unchanged)

Commenter's Reason: *EC48, Part II should be approved as modified by this public comment.* This public comment reflects the modification approved by the IECC Committee. Adopting this proposal as modified will create consistency with the IECC as to these requirements, provide the correct terminology in footnote h, and require increased energy efficiency for the coldest locations in the US

Public Comment 2:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

CONTINUOUS INSULATION. Insulation installed continuously across all structural members on the interior, exterior, or integral to any opaque surface of the building envelope, without intervening vented air spaces or thermal bridges other than fasteners and service openings.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This proposal and various other proposals and modifications from the code development hearings use or introduce the term, "continuous insulation", but the term is not defined. This public comment corrects that problem and provides needed clarification of the meaning of continuous insulation to ensure proper application in compliance with the intent of the energy code.

ASHRAE 90.1 defines continuous insulation as "insulation that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior, exterior, or is integral to any opaque surface of the building envelope." This definition is adopted in this PC for sake of consistency and is further improved to clarify an important concern with the proper and consistent characterization of continuous insulation. The ASHRAE definition addresses a concern with thermal bridging but does not address the similar concern with intervening vented air spaces which can create a disconnect of continuous insulation thermal resistance such that its contribution to a layered wall assembly R-value cannot be simply summed. Thus, wording is included in the definition to address this concern. Air exchange rates for vented airspaces behind claddings can exceed 90 air-changes per hour (see references 1 and 2) which significantly impacts the R-value of the air-space or disconnects the R-value of material on the exterior side of the airspace. A robust definition for continuous insulation is needed in the IECC.

References:

1. Straube, J. and Finch, G. (2009). Ventilated Wall Claddings: Review, Field Performance, and Hygrothermal Modeling, Research Report – 0907, Building Science Press, www.buildingscience.com.
2. Salonvarra, M., Karagiozis, A.N., Pazera, M., Miller W. (2007). "Air Cavities Behind Claddings – What Have We Learned?", Buildings X, ASHRAE.

Public Comment 3:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5h	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20+5 or 13+10	15/20	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	20+5 or 13+10	19/21	30[g]	10/13	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation. If structural sheathing covers 40 percent or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason:
This public comment achieves two things:

1. corrects a severe problem with footnote 'h' that erodes the energy code, regardless of which version of the energy code is approved; and,
2. provides a rational and flexible application of footnote 'h' in coordination with recent changes to IRC wall bracing provisions.

First, the last sentence of the current footnote 'h' is excluded from this public comment because it creates a significant unintended consequence whereby use of continuous structural sheathing wall bracing (i.e. OSB, etc.) per the IRC would allow 100% of the wall net area to be insulated with only R2 continuous insulation over the structural sheathing when R5 or R10 is actually intended by the energy code. Thus, as little as 20% to 40% of the required continuous insulation amount (omission of 60 to 80 percent of required R-value) is inadvertently permitted by this last sentence in footnote 'h'. Thus, where R5 or R10 continuous insulation is required, the unintended loophole of footnote 'h' is being exploited to allow use of R2 continuous insulation on the entire net wall area. This was not the intended purpose of footnote h and correction is needed.

Second and in coordination with the above correction of footnote 'h', the allowance for reduction in continuous insulation value is capped at a maximum R-3 reduction and the percentage of net wall area to which this reduction applies is changed from 25 percent to 40 percent. For typical residential buildings and continuous insulation products, this will result in at least 80% of the tabulated continuous insulation R-value being achieved on average for the net wall area (area without window and door openings). This allowance is consistent with the performance implications of the current/original footnote 'h' allowance to use R0 (no continuous insulation) over structural sheathing for a maximum of 25% of the net wall area. The 40 percent allowance will cover most single story homes and many two-story homes (particularly typical affordable homes) in typical 90 mph / Exposure B wind conditions for which structural sheathing (bracing) is provided per recently updated IRC wall bracing provisions.

Public Comment 4:

Mark Halverson, representing APA, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5h	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20+5 or 13+10	15/20	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	20+5 or 13+10	19/21	30[g]	10/13	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation or insulating sheathing, so “13+5” means R-13 cavity insulation plus R-5 continuous insulation or insulated sheathing; “20+5” means R-20 cavity insulation in addition to a layer of R-5 continuous or insulating sheathing; and “13+10” means R-13 cavity insulation in addition to a layer of R-10 continuous or insulating sheathing~~. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If~~ In locations where structural sheathing is used, continuous insulation or insulating sheathing shall be permitted to be reduced by no more than R-2~~covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2~~.

(Portions of code change proposal not shown remain unchanged).

Commenter’s Reason: This modification simplifies and clarifies footnote h. of Table 402.1.1 when both R-5 and R-10 continuous sheathing or insulating sheathing is required regardless of the amount of structural sheathing that is used. The amount of structural sheathing needed to adequately brace the walls is not limited, so the structural capacity of the wall is not impacted. This modification also assures that all opaque wall areas are covered by continuous insulation or insulating sheathing while maintaining the same combined sheathing thickness in all the wall envelope areas.

Instead of a fixed minimum requirement of R-2 continuous sheathing as before, a reduction of R-2 sheathing from the specified amount works for both R-5 or R10 continuous sheathing requirements. A R-5 requirement reduced by R-2 yields a R-3 continuous insulation applied over the structural sheathing and a R-10 reduced by R-2 yields a R-8 continuous insulation over the structural sheathing.

We ask that the code body support the Committee’s recommendation for approval as modified by this Public Comment.

Public Comment 5:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC, and Craig Conner, Building Quality request Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5h	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20+5 or 13+10	15/20	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	20+5 or 13+10	19/21	30[g]	10/13	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation, so “13+5” means R-13 cavity insulation plus R-5 ~~insulated~~ insulation. ~~sheathing. If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than25%of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~

(Portions of code change proposal not shown remain unchanged).

Commenter’s Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

The proposal is consistent with the changes created in EC13 and subsequent public comments that eliminate the confusion in the existing footnote h..

Public Comment 6:

Theresa A. Weston, representing DuPont Building Innovations, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[h]	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.35[e, j]	30	13	5/8	19	5/13[f]	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5h	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20+5 or 13+10	15/20	30[g]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	20+5 or 13+10	19/21	30[g]	10/13	10, 4 ft	10/13

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or ~~insulated~~ insulating sheathing. If structural sheathing covers 25 percent or less of the exterior, continuous insulation or insulating sheathing is not required in the locations where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with continuous insulation or insulating ~~insulated~~ sheathing of at least R-2.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: This modification changes this proposal to be consistent with committee action on EC48 P1 which was modified and approved during the technical hearings. It generalizes the requirement for continuous insulation and does not require the insulation to be a sheathing thus allowing more options for meeting this requirement.

Final Action: AS AM AMPC____ D

EC50-09/10-PART I
Table 402.1.1, Table 402.1.3

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Revise as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHTb U-FACTOR	GLAZED FENESTRATION SHGCb, [e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENTc WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30	30	13	3/4	13	0	0	0
2	0.65j	0.75	0.30	30	13	4/6	13	0	0	0
3	0.50j	0.65	0.30	30	13	5/8	19	5/13f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5h	13/17	30g	~~10/13~~ 15/19	10, 2 ft	~~10/13~~ 15/19
6	0.35	0.60	NR	49	20 or 13+5h	15/19	30g	15/19	10, 4 ft	~~10/13~~ 15/19
7 and 8	0.35	0.60	NR	49	21	19/21	38g	15/19	10, 4 ft	~~10/13~~ 15/19

(Footnotes remain unchanged)

TABLE 402.1.3
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[d]	CRAWL SPACE WALL U-FACTOR[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	~~0.059~~ 0.050	~~0.065~~ 0.055
6	0.35	0.60	0.026	0.057	0.060	0.033	0.050	~~0.065~~ 0.055
7 and 8	0.35	0.60	0.026	0.057	0.057	0.028	0.050	~~0.065~~ 0.055

(Footnotes remain unchanged)

Reason: This code proposal is intended to improve thermal envelope efficiency through improved insulation in foundations, including both basements and crawlspaces, in the colder climates. The savings from this proposal, especially when coupled with other proposed code modifications can lead to significant overall energy savings for homes. Moreover, unlike many building components, foundation insulation can last for the life of the building, and is harder to install after new construction is complete than other building components. This helps in delivering consistent energy savings far longer than most energy savings measures. The following table portrays estimated savings from these measures:

	Basement Climate Zone 5	Basement Climate Zone 6	Basement Climate Zone 7	Basement Climate Zone8	Crawlspace Climate Zone 5	Crawlspace Climate Zone 6	Crawlspace Climate Zone 7	Crawlspace Climate Zone 8
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	0.9%	0.9%	1.1%	0.9%	0.3%	0.3%	0.3%	0.3%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	0.7%	0.7%	0.8%	0.7%	0.2%	0.2%	0.3%	0.2%

These modest, cost-effective savings are part of a larger package of proposals that together will get the IECC to the 30% improvement that national policymakers are seeking. Achieving this goal requires several modest improvements, in multiple components of the building. Recent energy price increases, despite softening effects of the current economic downturn, signal a new era of sharply higher energy costs. In addition, climate change policy is likely to be enacted before the 2012 IECC is published, and its effects will likely include further energy price increases This proposal represents one of a set of reasonable and cost effective improvements that give states new options to increase the efficiency of their energy codes.

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

ICCFILENAME: PRINDLE-EC-8-T. 402.1.1-T. N1102.1.DOC

Public Hearing Results

PART I - IECC
Committee Action: **Approved as Submitted**

Committee Reason: This is an achievable increase in stringency that will provide significant energy savings in northern climates.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Don Surrena, representing National Association of Home Builders (NAHB), requests Disapproval.

Commenter's Reason: This proposal in climate zone 5 increases the basement wall R-value (R-15 continuous) higher than that of above grade mass walls (R-13).

Although touted as a "modest increase" by the proponent, this increases the insulation (if exterior foam is used) by one inch which begins to cause problems with flashing and attachment. If R-19 insulation is used in an interior framed wall, the framing increases by 2 inches to a 2x6 which has a considerable cost premium.

Final Action: AS AM AMPC____ D

EC50-09/10-PART II
IRC Table N1102.1, Table N1102.1.2

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[k]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE AND DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.35j	30	13	3/4	13	0	0	0
2	0.65i	0.75	0.35j	30	13	4/6	13	0	0	0
3	0.50i	0.65	0.35e, j	30	13	5/8	19	5/13f	0	5/13
4 except Marine	0.35	0.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13 + 5h	13/17	30f	~~10/13~~ 15/19	10, 2 ft	~~10/13~~ 15/19
6	0.35	0.60	NR	49	20 or 13 + 5h	15/19	30g	~~10/13~~ 15/19	10, 4 ft	~~10/13~~ 15/19
7 and 8	0.35	0.60	NR	49	21	19/21	30g	~~10/13~~ 15/19	10, 4 ft	~~10/13~~ 15/19

(Footnotes remain unchanged)

TABLE N1102.1.2
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	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091c	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.033	~~0.059~~ 0.050	~~0.065~~ 0.055
6	0.35	0.60	0.026	0.060	0.060	0.033	~~0.059~~ 0.050	~~0.065~~ 0.055
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	~~0.059~~ 0.050	~~0.065~~ 0.055

(Footnotes remain unchanged)

Reason: This code proposal is intended to improve thermal envelope efficiency through improved insulation in foundations, including both basements and crawlspaces, in the colder climates. The savings from this proposal, especially when coupled with other proposed code modifications can lead to significant overall energy savings for homes. Moreover, unlike many building components, foundation insulation can last for the life of the building, and is harder to install after new construction is complete than other building components. This helps in delivering consistent energy savings far longer than most energy savings measures. The following table portrays estimated savings from these measures:

	Basement Climate Zone 5	Basement Climate Zone 6	Basement Climate Zone 7	Basement Climate Zone8	Crawlspace Climate Zone 5	Crawlspace Climate Zone 6	Crawlspace Climate Zone 7	Crawlspace Climate Zone 8
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	0.9%	0.9%	1.1%	0.9%	0.3%	0.3%	0.3%	0.3%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	0.7%	0.7%	0.8%	0.7%	0.2%	0.2%	0.3%	0.2%

These modest, cost-effective savings are part of a larger package of proposals that together will get the IECC to the 30% improvement that national policymakers are seeking. Achieving this goal requires several modest improvements, in multiple components of the building. Recent energy price increases, despite softening effects of the current economic downturn, signal a new era of sharply higher energy costs. In addition, climate change policy is likely to be enacted before the 2012 IECC is published, and its effects will likely include further energy price increases This proposal represents one of a set of reasonable and cost effective improvements that give states new options to increase the efficiency of their energy codes.

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

ICCFILENAME: PRINDLE-EC-8-T. 402.1.1-T. N1102.1.DOC

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: The proposal would not be cost effective for all types of fuel sources.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International , representing Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute, request Approval as Submitted.

Commenter's Reason: *EC50, Part II should be approved as submitted.*

This action will create consistency with the IECC for these values and save energy. As the IECC Committee stated: "This is an achievable increase in stringency that will provide significant energy savings in northern climates."

Public Comment 2:

Shaunna Mozingo, City of Westminster, Co, representing Colorado Chapter of ICC, and Craig Conner, Building Quality request Approval as Submitted.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This proposal makes worthwhile increases in the crawlspace wall insulation in zones 5-8 as well as increased basement wall insulation in zone 5 therefore we would recommend approval as submitted for the IRC to match the action taken in the IECC.

Final Action: AS AM AMPC____ D

EC54-09/10-PART I
Table 402.1.1, 402.1.2

Proposed Change as Submitted

Proponent: Matthew Dobson, representing Vinyl Siding Institute

PART I – IECC

Revise as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

h. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing or insulated siding. If structural sheathing covers less 25 percent or less of the exterior, insulated sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing or insulated siding of at least R-2.

(Portions of table and footnotes not shown remain unchanged)

402.1.2 *R*-value computation. Insulation material used in layers, such as framing cavity insulation ~~and~~ insulating sheathing and insulated siding, shall be summed to compute the component *R*-value. The manufacturer's settled *R*-value shall be used for blown insulation. Computed *R*-values shall not include an *R*-value for other building materials or air films.

Reason: Forms of insulated siding have been commercially available for at least twelve years. Current versions of insulated vinyl siding as well as other types of insulated claddings are now being tested to show actual field R-values. Many of these tests are being conducted using the appropriate testing methodology using the "hot box" test or ASTM C1363. This building component presents a viable option. A minimal performance value of R-value is consistent with the minimal R-value requirements to establish the product as a home insulation or insulation.

In addition to the thermal resistance characteristics, insulated siding's components and other non-related energy performance characteristics are covered by the code and specific product standards. For example the foam plastic used with insulated siding is addressed in the foam plastic sections of the IBC and IRC as well as through AC12. In addition ASTM C578 is the standard for foam plastics. Over the past few years both an acceptance criteria and product standard have been developed to address the non-thermal characteristics of what is termed as "backed siding". These material standards (ASTM D7445-09 and AC 37 (both vinyl and backed vinyl siding)) provide performance criteria for the siding including areas required by the building codes for example warp, shrinkage, impact strength, expansion, appearance, and wind load resistance.

Testing relative to moisture and water management issues indicated that use of insulated siding has no negative effect on the performance of the wall panels in relationship to moisture absorption. In field studies where the product had been installed for nearly ten years there were no indications of any problems of moisture entrapment related issues. Further the industry knows of no claims or complaints relating to moisture issues and the performance insulated vinyl siding.

Included with the insulated siding definition proposal is an example of testing that has been completed using the ASTM C1363 test method as well as recent research co-funded by VSI through the New York State Energy Research and Development Authority's High Performance Residential Development Challenge program. Both testing and research support insulated siding as a viable option to help increase the energy efficiency of buildings.

As a part of this proposal please visit the link provided of an example of testing that has been completed using the ASTM C1363 test method as well as a link to recent research co-funded by VSI through the New York State Energy Research and Development Authority's High Performance Residential Development Challenge program. Both testing and research support insulated siding as a viable option to help increase the energy efficiency of buildings.

Here is the link to the example ASTM C1363 testing results
http://www.vinylsiding.org/aboutsiding/insulatedvinylsiding/ASTM%5FC1363%5Ftest%5Fresults%2Epdf.

Here is a link to the New York State Energy Research and Development Authority report
http://www.vinylsiding.org/aboutsiding/newsroom/insulatedvs/090702_Building_Green_with_Insualted_Vinyl_Siding_Case_Study.pdf.

Cost Impact: The code change proposal will not increase the cost of construction as it will give specifiers another affordable option for achieving energy code compliance.

ICCFILENAME: DOBSON-EC-2 AND 3 MERGED-402.1.2-RE-1-N1102.1.1.DOC

Public Hearing Results

PART I – IECC

Committee Action: **Approved as Submitted**

Committee Reason: This provides builders with additional options to achieve the insulation values required by the code.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC, and Craig Conner, Building Quality, request Disapproval.

Commenter's Reason: EC17, which defines "insulated siding", and EC54, which adds "insulated siding" as a type of insulation, are primarily designed to accommodate insulated vinyl siding within the code. EC17 and EC54 share two problems, they expand the R-value to include more than the insulation and they add a product that the code requires be "loosely" attached to the exterior with a small air space to allow its expansion and contraction with temperature changes.

The code-specified R-value in Section 402.1.2 is intended to include only the insulation product's nominal R-value. Using the nominal R-value makes the energy code simpler to use by eliminating the need to fix an R-value for the various others materials, air spaces, and air films (gyp board, interior and exterior air films, framing, air spaces …). The existing Section 402.1.2 states that computed R-values used to meet the code requirement shall not include an R-value for the other (non-insulation) building materials or air films. Insulated siding as specified in EC17 and EC54 might allow a test that includes the insulation plus the non-insulation portions of the siding, including coverings and imbedded air spaces. We have no problem with giving any product an R-Value for the insulation as long as they test only the R-value of the insulation itself. It is important to treat all insulation products in the same way.

The U-factor alternative, the existing Section 402.1.3, specifies a U-factor for an assembly. The U-factor alternative can be used to account for elements of a whole assembly's design, such as framing spacing and thermal breaks. Section 402.1.3 also allows tested assembly U-factors and calculations (table note "a"). The existing U-factor alternative can be used for any type of insulation or assembly, including assemblies that might include insulation as a part of the siding.

The code-required method of attachment is an additional issue for vinyl siding. Section 1405.15 of the IBC requires that vinyl siding conform to the requirements of ASTM D3679. The ASTM D3679 states that vinyl siding *"… shall be installed in accordance with Practice D4756*" (Section 1.4 of ASTM D3679).

The full name for "Practice D4756" is "*ASTM D4756 – 06*", the "*Standard Practice for Installation of Rigid Poly (Vinyl Chloride) (PVC) Siding and Soffit*" whose scope states: "*This practice covers the minimum requirements for and the methods of installation of rigid vinyl siding, soffits, and accessories on the exterior wall and soffit areas of buildings…."* (Section 1.1). Because "*Vinyl siding and accessories will expand when heated and contract when cooled*" the standard requires:

> "*When applied, vinyl siding products must be attached "loosely" leaving approximately a 1⁄32-in. (0.8-mm) space between the vinyl and the fastener head or crown to permit thermal movement."* (Section 9.1.1, ASTM D4756-06).

Some makers of vinyl siding suggest larger spaces.

Materials required to be installed loosely and include air spaces on wall exteriors may not perform as well as insulators. Therefore EC17 and EC54 should be disapproved.

Also, we strongly prefer that the IECC and IRC be made identical, possibly based on RE4. This is only a backup, in case RE4 is not approved.

The incorporation of very different formats and sets of requirements for energy in the IECC and the IRC would greatly complicate code enforcement. Many jurisdictions would probably refuse to adopt two very different forms of the residential energy requirements. NAHB deserves great credit for stepping up to participating constructively in the code development process, including both offering its own solution (EC16) and offering many constructive comments on EC13, which prevailed in the IECC. However, only one of these very different code formats can be approved. EC13 is the more useable format for code requirements.

The following table lists the differences between IECC and IRC energy requirements as they stand after the first hearing, each with a suggested resolution. Because so many proposals are affected, to keep our public comments brief in the monograph, this table will only be published with a few public comments. The remainder of our reason statements will refer back to this table and associated reasoning.

The International Codes (I-codes) need to be internally consistent. The I-codes provide the foundation for the building codes adopted by most jurisdictions. Although adopting entities can, and do, amend the I-codes, the adopting jurisdictions expect a set of model codes that are internally consistent. The 2009 IECC and IRC energy requirements are identical in most areas. However, this development cycle introduced many potential inconsistencies. These inconsistencies are substantial enough to affect code usability. To be effective and enforceable, the IECC and IRC need to be consistent.

The table below shows the public comments designed to realign the IECC and IRC residential energy requirements to ensure internal consistency. The code development process deals with each code change separately, so realignment requires multiple comments. The method suggested for aligning the IECC and IRC falls into one these categories:

• A code change was submitted to the IECC without a parallel comment on the same text in the IRC. At this stage, the code development process does not allow a change unless there was an initial public comment, so realigning the codes means rejecting any comment that would create an inconsistency.

• The code change was approved in one code and disapproved in the other. The best option is usually to disapprove the change in both codes or approve the same version in both codes. In a few instances some details of the change also need to be corrected.

• The code changes were treated the same way in both codes—either approved or disapproved. In this case there is consistency, and no change is needed to align the IECC and IRC. Those code changes are not listed in the table.

Inconsistencies in the IRC & IECC Requirements
Key: AS=Approved as Submitted AM=Approved as Modified
AMPC=Approved as Modified by Public Comment D=Disapproved

EC#	Description	Initial Result	**Suggested Action**
EC2	Add insulated sheathing R-value label	IECC – D IRC – AS	**No action.** Withdrawn by proponent.
EC13	Comprehensive revision- insulation, windows, air tightness, ducts, water systems, equipment, …	IECC – AS IRC – D	IECC – AS, **IRC – AS** Majority of residential energy savings. Important to maintain and to make IRC consistent. EC13 had broad agreement from many parties.
EC16	Comprehensive revision- insulation, windows, air tightness, ducts, water systems, equipment, etc. Creates 4 options for each climate zone.	IECC – D IRC – AS	IECC – D, **IRC – D** As written this change creates big differences between IECC & IRC. While it is a good attempt we would suggest EC13 instead.
EC17	Defines "Insulated Siding"	IECC – AM IRC - AS	**IECC – D**, **IRC – D** There are problems in this definition that will be addressed in public comment.
EC24	Eliminate home owner energy certificate	IECC – AS IRC – no submission	**IECC- D** No IRC version submitted. Energy certificate modified by EC22 in IECC and IRC should be retained.
EC27	Increase window, skylight, insulation requirements	IECC – AM IRC – D	**IECC – AMPC**, **IRC AMPC** As further amended by DOE public comment to fix footnote "h".
EC29	Set maximum SHGC for skylights and sunrooms to .40 instead of .30	IECC – D IRC - AS	**No Action Required** Withdrawn by Proponent
EC30	Compressed cavity insulation	IECC – AS IRC – D	**IECC – D**, IRC – D Makes footnote worse. Could be misread as a ban on cavity insulation below R-value in table.
EC31	Limit window size in prescriptive approach	IECC – AS IRC – D	**IECC – D**, IRC D Window calculation too much work. Only affects a few homes. Includes doors and skylights in limit. Better option- approved changes already requiring much better windows for all homes.
EC34	Lower southern U-factor	IECC –AS IRC –D	IECC – AS, **IRC – AS** Windows required are common.
EC35	Apply same U-factor and SHGC to impact glass	IECC –AS, IRC –D	**IECC – D**, IRC –D Appling lowered U-factors from EC34 is too much for impact glass
EC36	Increase max SHGC for skylights	IECC –D, IRC –AS	**IECC – AS**, IRC AS Lower SHGC for skylights makes it harder to use skylights for day-lighting.
EC39	Lower northern window U-factor	IECC– AS, IRC –D	IECC – AS, **IRC – AS** Already accomplished in EC13. Reasonable increases in northern window efficiency.
EC47	Increase middle US wall insulation	IECC AM, IRC D	IECC – AM, **IRC AM** Likely to suggest AMPC to fix footnote
EC48	Increase northern wall insulation	IECC –AM, IRC– D	IECC – AM, **IRC AM** Already accomplished in EC13.
EC50	Increase crawl space wall insulation	IECC –AS, IRC –D	IECC –AS, **IRC –AS**
EC54	Add insulated siding as type of insulation	IECC AS, IRC AM	**IECC –D, IRC –D** Vinyl siding R-value imparred by code requirement to attach "loosely" and leave space for expansion/contraction
EC55	mass wall U-factor	IECC D, IRC AS	**IECC –AS**, IRC –AS Aligns codes and fixes table
EC60	IECC/IRC realignment	IECC – D IRC - D	**IECC – AMPC, IRC – AMPC** Use IRC definition of conditioned space and use IRC limits on reduced R-value in ceilings with limited space.
EC63	attic wind baffle	IECC –AS, IRC –AM	**IECC –AM**, IRC –AM Based on preferences of affected industry
EC68	Sun roof requirement clarification	IECC –AM, IRC– D	**IECC – AMPC, IRC – AMPC** Correct language per EECC comment.
EC70	Skylight definition	IECC –AS, No IRC version	**IECC – D** Creates inconsistency with existing I-code skylight definitions IBC (202) and IRC 308.6.1
EC74	Allow window projection factor instead of SHGC	IECC –D, IRC –AS	**IECC –AMPC, IRC – AMPC** Allow projection factor as alternative based on public comment. Simplified change is proposed.
EC79	Revise air sealing requirements	IECC – AS, IRC – D	IECC – AS, **IRC – AS**. Not needed if EC13 passes. Not completely consistent with EC13. Follow DOE's lead.
EC91	Remove "listing", leaving "labeled" for fenestration	IECC –D, IRC –AS	**IECC – AS**, IRC – AS Fenestration is labeled, not listed.
EC99	Ventilation fan efficiency, define whole house ventilation	IECC –AM, IRC– D	**IECC –AMPC, IRC –AMPC** Increases fan efficiency. Remove need to know "intent" of fan.
		IECC –D/ASF,	**IECC – D**, IRC – D

EC#	Description	Initial Result	**Suggested Action**
EC101	Programmable thermostats- set points, schedules, heat pumps,	IRC D	Set points hard to inspect. Research shows thermostats do not save energy.
EC102	Ground conductance calculation	IECC –AS, IRC –D	IECC –AS, **IRC –AS** Improved calculation per DOE.
EC107	Decrease duct leakage	IECC –AS, IRC –D	IECC –AS, **IRC –AS** Not needed if EC13 passes. DOE might modify. Follow DOE's lead.
EC109	Eliminate framing cavities as return ducts	IECC –AS, IRC –D	IECC –AS, **IRC –AS** Framing cavities make leaky ducts.
EC112	more efficient water heating pipe layout & insulation	IECC –AS, IRC –D	IECC –AS, **IRC –AS** Already in EC13.
EC115	increases circulating water heating pipe insulation	IECC – D, IRC –AS	**IECC – D**, IRC – D Pipe layout and insulation handled better in EC13
EC123	Prohibit electric resistance heating, with exceptions	IECC – AM IRC – D	**IECC – D**, IRC – D Way too broad. Electric heat is OK is some situations. Examples- very low energy buildings or as backup.
EC125	Prohibit standing pilots on fireplaces	IECC – AS IRC – D	IECC – AS, **IRC – AS** Standing pilot lights waste energy

Final Action: AS AM AMPC____ D

EC54-09/10-PART II
Table N1102.1, N1102.1.1

Proposed Change as Submitted

Proponent: Matthew Dobson, representing Vinyl Siding Institute

PART II – IRC BUILDING/ENERGY

Revise as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

h. “13+5” means R-13 cavity insulation plus R-5 insulated sheathing or insulated siding. If structural sheathing covers less 25 percent or less of the exterior, insulated sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing or insulated siding of at least R-2.

(Portions of table and footnotes not shown remain unchanged)

N1102.1.1 *R*-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing and insulated siding, shall be summed to compute the component *R*-value. The manufacturer’s settled *R*-value shall be used for blown insulation. Computed *R*-values shall not include an *R*-value for other building materials or air films.

Reason: Forms of insulated siding have been commercially available for at least twelve years. Current versions of insulated vinyl siding as well as other types of insulated claddings are now being tested to show actual field R-values. Many of these tests are being conducted using the appropriate testing methodology using the “hot box” test or ASTM C1363. This building component presents a viable option. A minimal performance value of R-value is consistent with the minimal R-value requirements to establish the product as a home insulation or insulation.

In addition to the thermal resistance characteristics, insulated siding’s components and other non-related energy performance characteristics are covered by the code and specific product standards. For example the foam plastic used with insulated siding is addressed in the foam plastic sections of the IBC and IRC as well as through AC12. In addition ASTM C578 is the standard for foam plastics. Over the past few years both an acceptance criteria and product standard have been developed to address the non-thermal characteristics of what is termed as “backed siding”. These material standards (ASTM D7445-09 and AC 37 (both vinyl and backed vinyl siding)) provide performance criteria for the siding including areas required by the building codes for example warp, shrinkage, impact strength, expansion, appearance, and wind load resistance.

Testing relative to moisture and water management issues indicated that use of insulated siding has no negative effect on the performance of the wall panels in relationship to moisture absorption. In field studies where the product had been installed for nearly ten years there were no indications of any problems of moisture entrapment related issues. Further the industry knows of no claims or complaints relating to moisture issues and the performance insulated vinyl siding.

Included with the insulated siding definition proposal is an example of testing that has been completed using the ASTM C1363 test method as well as recent research co-funded by VSI through the New York State Energy Research and Development Authority’s High Performance Residential Development Challenge program. Both testing and research support insulated siding as a viable option to help increase the energy efficiency of buildings.

As a part of this proposal please visit the link provided of an example of testing that has been completed using the ASTM C1363 test method as well as a link to recent research co-funded by VSI through the New York State Energy Research and Development Authority’s High Performance Residential Development Challenge program. Both testing and research support insulated siding as a viable option to help increase the energy efficiency of buildings.

Here is the link to the example ASTM C1363 testing results
http://www.vinylsiding.org/aboutsiding/insulatedvinylsiding/ASTM%5FC1363%5Ftest%5Fresults%2Epdf.

Here is a link to the New York State Energy Research and Development Authority report
http://www.vinylsiding.org/aboutsiding/newsroom/insulatedvs/090702_Building_Green_with_Insualted_Vinyl_Siding_Case_Study.pdf.

Cost Impact: The code change proposal will not increase the cost of construction as it will give specifiers another affordable option for achieving energy code compliance.

ICCFILENAME: DOBSON-EC-2 AND 3 MERGED-402.1.2-RE-1-N1102.1.1.DOC

Public Hearing Results

PART II - IRC

Committee Action: **Approved as Modified**

Modify proposal as follows:

h. First value is cavity insulation, second is continuous insulation, so "13+5" means R-13 cavity insulation plus R-5 insulating sheathing, or insulated siding, or other continuous insulation. If structural sheathing covers less 25 percent or less of the exterior, insulated sheathing continuous insulation is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulating sheathing, or insulated siding, or other continuous insulation of at least R-2.

Committee Reason: This provides builders with additional options to achieve the insulation values required by the code. The modification simply clarifies the footnote by succinctly stating the meaning of "13 + 5."

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, request Disapproval.

Commenter's Reason: EC17, which defines "insulated siding", and EC54, which adds "insulated siding" as a type of insulation, are primarily designed to accommodate insulated vinyl siding within the code. EC17 and EC54 share two problems, they expand the R-value to include more than the insulation and they add a product that the code requires be "loosely" attached to the exterior with a small air space to allow its expansion and contraction with temperature changes.

The code-specified R-value in Section 402.1.2 is intended to include only the insulation product's nominal R-value. Using the nominal R-value makes the energy code simpler to use by eliminating the need to fix an R-value for the various others materials, air spaces, and air films (gyp board, interior and exterior air films, framing, air spaces …). The existing Section 402.1.2 states that computed R-values used to meet the code requirement shall not include an R-value for the other (non-insulation) building materials or air films. Insulated siding as specified in EC17 and EC54 might allow a test that includes the insulation plus the non-insulation portions of the siding, including coverings and imbedded air spaces. We have no problem with giving any product an R-Value for the insulation as long as they test only the R-value of the insulation itself. It is important to treat all insulation products in the same way.

The U-factor alternative, the existing Section 402.1.3, specifies a U-factor for an assembly. The U-factor alternative can be used to account for elements of a whole assembly's design, such as framing spacing and thermal breaks. Section 402.1.3 also allows tested assembly U-factors and calculations (table note "a"). The existing U-factor alternative can be used for any type of insulation or assembly, including assemblies that might include insulation as a part of the siding.

The code-required method of attachment is an additional issue for vinyl siding. Section 1405.15 of the IBC requires that vinyl siding conform to the requirements of ASTM D3679. The ASTM D3679 states that vinyl siding *"… shall be installed in accordance with Practice D4756*" (Section 1.4 of ASTM D3679).

The full name for "Practice D4756" is "*ASTM D4756 – 06*", the "*Standard Practice for Installation of Rigid Poly (Vinyl Chloride) (PVC) Siding and Soffit*" whose scope states: "*This practice covers the minimum requirements for and the methods of installation of rigid vinyl siding, soffits, and accessories on the exterior wall and soffit areas of buildings…."* (Section 1.1). Because "*Vinyl siding and accessories will expand when heated and contract when cooled*" the standard requires:

> "*When applied, vinyl siding products must be attached "loosely" leaving approximately a 1⁄32-in. (0.8-mm) space between the vinyl and the fastener head or crown to permit thermal movement."* (Section 9.1.1, ASTM D4756-06).

Some makers of vinyl siding suggest larger spaces.

Materials required to be installed loosely and include air spaces on wall exteriors may not perform as well as insulators. Therefore EC17 and EC54 should be disapproved.

Also, we strongly prefer that the IECC and IRC be made identical, possibly based on RE4. This is only a backup, in case RE4 is not approved.

The incorporation of very different formats and sets of requirements for energy in the IECC and the IRC would greatly complicate code enforcement. Many jurisdictions would probably refuse to adopt two very different forms of the residential energy requirements. NAHB deserves great credit for stepping up to participating constructively in the code development process, including both offering its own solution (EC16) and offering many constructive comments on EC13, which prevailed in the IECC. However, only one of these very different code formats can be approved. EC13 is the more useable format for code requirements.

The following table lists the differences between IECC and IRC energy requirements as they stand after the first hearing, each with a suggested resolution. Because so many proposals are affected, to keep our public comments brief in the monograph, this table will only be published with a few public comments. The remainder of our reason statements will refer back to this table and associated reasoning.

The International Codes (I-codes) need to be internally consistent. The I-codes provide the foundation for the building codes adopted by most jurisdictions. Although adopting entities can, and do, amend the I-codes, the adopting jurisdictions expect a set of model codes that are internally consistent. The 2009 IECC and IRC energy requirements are identical in most areas. However, this development cycle introduced many potential inconsistencies. These inconsistencies are substantial enough to affect code usability. To be effective and enforceable, the IECC and IRC need to be consistent.

The table below shows the public comments designed to realign the IECC and IRC residential energy requirements to ensure internal consistency. The code development process deals with each code change separately, so realignment requires multiple comments. The method suggested for aligning the IECC and IRC falls into one these categories:

- A code change was submitted to the IECC without a parallel comment on the same text in the IRC. At this stage, the code development process does not allow a change unless there was an initial public comment, so realigning the codes means rejecting any comment that would create an inconsistency.
- The code change was approved in one code and disapproved in the other. The best option is usually to disapprove the change in both codes or approve the same version in both codes. In a few instances some details of the change also need to be corrected.
- The code changes were treated the same way in both codes—either approved or disapproved. In this case there is consistency, and no change is needed to align the IECC and IRC. Those code changes are not listed in the table.

Inconsistencies in the IRC & IECC Requirements
Key: AS=Approved as Submitted AM=Approved as Modified
AMPC=Approved as Modified by Public Comment D=Disapproved

EC#	Description	Initial Result	**Suggested Action**
EC2	Add insulated sheathing R-value label	IECC – D IRC – AS	**No action.** Withdrawn by proponent.
EC13	Comprehensive revision- insulation, windows, air tightness, ducts, water systems, equipment, …	IECC – AS IRC – D	IECC – AS, **IRC – AS** Majority of residential energy savings. Important to maintain and to make IRC consistent. EC13 had broad agreement from many parties.
EC16	Comprehensive revision- insulation, windows, air tightness, ducts, water systems, equipment, etc. Creates 4 options for each climate zone.	IECC – D IRC – AS	IECC – D, **IRC – D** As written this change creates big differences between IECC & IRC. While it is a good attempt we would suggest EC13 instead.
EC17	Defines “Insulated Siding”	IECC – AM IRC - AS	**IECC – D**, **IRC – D** There are problems in this definition that will be addressed in public comment.
EC24	Eliminate home owner energy certificate	IECC – AS IRC – no submission	**IECC- D** No IRC version submitted. Energy certificate modified by EC22 in IECC and IRC should be retained.
EC27	Increase window, skylight, insulation requirements	IECC – AM IRC – D	**IECC – AMPC**, **IRC AMPC** As further amended by DOE public comment to fix footnote “h”.
EC29	Set maximum SHGC for skylights and sunrooms to .40 instead of .30	IECC – D IRC - AS	**No Action Required** Withdrawn by Proponent
EC30	Compressed cavity insulation	IECC – AS IRC – D	**IECC – D**, IRC – D Makes footnote worse. Could be misread as a ban on cavity insulation below R-value in table.
EC31	Limit window size in prescriptive approach	IECC – AS IRC – D	**IECC – D**, IRC D Window calculation too much work. Only affects a few homes. Includes doors and skylights in limit. Better option- approved changes already requiring much better windows for all homes.
EC34	Lower southern U-factor	IECC –AS IRC –D	IECC – AS, **IRC – AS** Windows required are common.
EC35	Apply same U-factor and SHGC to impact glass	IECC –AS, IRC –D	**IECC – D**, IRC –D Appling lowered U-factors from EC34 is too much for impact glass
EC36	Increase max SHGC for skylights	IECC –D, IRC –AS	**IECC – AS**, IRC AS Lower SHGC for skylights makes it harder to use skylights for day-lighting.
EC39	Lower northern window U-factor	IECC– AS, IRC –D	IECC – AS, **IRC – AS** Already accomplished in EC13. Reasonable increases in northern window efficiency.
EC47	Increase middle US wall insulation	IECC AM, IRC D	IECC – AM, **IRC AM** Likely to suggest AMPC to fix footnote
EC48	Increase northern wall insulation	IECC –AM, IRC– D	IECC – AM, **IRC AM** Already accomplished in EC13.
EC50	Increase crawl space wall insulation	IECC –AS, IRC –D	IECC –AS, **IRC –AS**
EC54	Add insulated siding as type of insulation	IECC AS, IRC AM	**IECC –D, IRC –D** Vinyl siding R-value imparred by code requirement to attach “loosely” and leave space for expansion/contraction
EC55	mass wall U-factor	IECC D, IRC AS	**IECC –AS**, IRC –AS Aligns codes and fixes table
EC60	IECC/IRC realignment	IECC – D IRC - D	**IECC – AMPC, IRC – AMPC** Use IRC definition of conditioned space and use IRC limits on reduced R-value in ceilings with limited space.
EC63	attic wind baffle	IECC –AS, IRC –AM	**IECC –AM**, IRC –AM Based on preferences of affected industry
EC68	Sun roof requirement clarification	IECC –AM, IRC– D	**IECC – AMPC, IRC – AMPC** Correct language per EECC comment.
EC70	Skylight definition	IECC –AS, No IRC version	**IECC – D** Creates inconsistency with existing I-code skylight definitions IBC (202) and IRC 308.6.1

EC#	Description	Initial Result	**Suggested Action**
EC74	Allow window projection factor instead of SHGC	IECC –D, IRC –AS	**IECC –AMPC, IRC – AMPC** Allow projection factor as alternative based on public comment. Simplified change is proposed.
EC79	Revise air sealing requirements	IECC – AS, IRC – D	IECC – AS, **IRC – AS**. Not needed if EC13 passes. Not completely consistent with EC13. Follow DOE's lead.
EC91	Remove "listing", leaving "labeled" for fenestration	IECC –D, IRC –AS	**IECC – AS**, IRC – AS Fenestration is labeled, not listed.
EC99	Ventilation fan efficiency, define whole house ventilation	IECC –AM, IRC– D	**IECC –AMPC, IRC –AMPC** Increases fan efficiency. Remove need to know "intent" of fan.
EC101	Programmable thermostats- set points, schedules, heat pumps,	IECC –D/ASF, IRC D	**IECC – D**, IRC – D Set points hard to inspect. Research shows thermostats do not save energy.
EC102	Ground conductance calculation	IECC –AS, IRC –D	IECC –AS, **IRC –AS** Improved calculation per DOE.
EC107	Decrease duct leakage	IECC –AS, IRC –D	IECC –AS, **IRC –AS** Not needed if EC13 passes. DOE might modify. Follow DOE's lead.
EC109	Eliminate framing cavities as return ducts	IECC –AS, IRC –D	IECC –AS, **IRC –AS** Framing cavities make leaky ducts.
EC112	more efficient water heating pipe layout & insulation	IECC –AS, IRC –D	IECC –AS, **IRC –AS** Already in EC13.
EC115	increases circulating water heating pipe insulation	IECC – D, IRC –AS	**IECC – D**, IRC – D Pipe layout and insulation handled better in EC13
EC123	Prohibit electric resistance heating, with exceptions	IECC – AM IRC – D	**IECC – D**, IRC – D Way too broad. Electric heat is OK is some situations. Examples- very low energy buildings or as backup.
EC125	Prohibit standing pilots on fireplaces	IECC – AS IRC – D	IECC – AS, **IRC – AS** Standing pilot lights waste energy

Final Action: AS AM AMPC____ D

EC55-09/10-PART I
Table 402.1.3

Proposed Change as Submitted

Proponent: Martha VanGeem, CTL Group, representing Masonry Alliance for Codes and Standards

PART I – IECC

Revise as follows:

TABLE 402.1.3
EQUIVALENT U-FACTORS

b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.10 in Zone 4 except Marine, 0.065 in Zone 5 and Marine 4, and 0.060 in Zone 6, and 0.057 in Zones 7 and 8. ~~and the same as the frame wall *U*-factor in Marine Zone 4 and Zones 5 through 8~~.

(Portions of table and footnotes not shown remain unchanged)

ICCFILENAME: VANGEEM-EC-1-T. 402.1.3-T. N1102.1.2

Public Hearing Results

PART I – IECC

Committee Action: **Disapproved**

Committee Reason: This has the effect of reducing the stringency of the code.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Martha G VanGeem, CTL Group, representing Masonry Alliance for Codes and Standards, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Table 402.1.3
EQUIVALENT U-FACTORS

b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, ~~0.10~~ 0.087 in Zone 4 except Marine, 0.065 in Zone 5 and Marine 4, ~~and 0.060 in Zone 6,~~ and 0.057 in Zones 6, 7, and 8.

(Portions of table and footnotes not shown remain unchanged)

Commenter's Reason: This public comment decreases the U-factors, making them more stringent, to align them with approved increases in R-values approved in EC-13.

EC-55 corrects and clarifies U-factors for mass walls with interior insulation to correspond with the R-values in Table 402.1.1.

For Zone 4 except Marine: The U-factor that corresponds to R-13 insulation on the interior of a mass wall from Table 402.1.1 is 0.087. This is for a cast-in-place concrete wall with R-13 insulation between 2x4 wood framing and gypsum wallboard insulation.

For Zone 5 and Marine 4: The U-factor that corresponds to R-17 insulation on the interior of a mass wall from Table 402.1.1 is 0.065. This is for a cast-in-place concrete wall with R-17 insulation between 2x6 wood framing and gypsum wallboard insulation.

EC 55 does not result in a decrease in stringency in the code. Section 402.1.2 is the R-value criteria. Section 402.1.2 is a U-factor alternative; the criteria is set by the R-value and the U-factor is an alternate path. These changes make the U-factors equivalent to the R-value criteria.

Public Comment 2:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC, and Craig Conner, Building Quality, request Disapproval.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This proposal modifies U-factor for mass walls with most of the insulation to the interior of the mass to match the values in the IRC. These are reasonable values and we recommend approval as submitted for both codes.

Final Action: AS AM AMPC____ D

EC55-09/10-PART II
Table N1102.1.2

Proposed Change as Submitted

PART II – IRC BUILDING/ENERGY

Revise as follows:

TABLE N1102.1.2
EQUIVALENT U-FACTORS

b. When more than half the insulation is on the interior, the mass wall *U*-factors shall be a maximum of 0.17 in Zone 1, 0.14 in Zone 2, 0.12 in Zone 3, 0.10 in Zone 4 except Marine, 0.065 in Zone 5 and Marine 4, 0.060 in Zone 6, and 0.057 in Zones 7 and 8. ~~and the same as the frame wall *U*-factor in Marine Zone 4 and Zones 5 through 8~~.

(Portions of table and footnotes not shown remain unchanged)

Reason: This proposal corrects and clarifies U-factors for mass walls with interior insulation to correspond with the R-values in Table N1102.1.

For Zone 5 and Marine 4: The U-factor that corresponds to R-17 insulation on the interior of a mass wall in Table N1102.1 is 0.065. This is for a cast-in-place concrete wall with R-17 insulation between 2x6 wood framing and gypsum wallboard insulation.

For Zone 6: The U-factor that corresponds with R-19 insulation on the interior of a mass wall is approximately 0.060. This proposal does not change the value, and leaves it at 0.060. However, as the frame wall U-factors are revised, it is more clear to print the actual U-factor that corresponds with the R-value for mass walls. This is 0.060 as in the 2009 IRC.

For Zones 7 and 8: The U-factor that corresponds with R-21 insulation on the interior of a mass wall is approximately 0.057. This proposal does not change the value. However, as the frame wall U-factors are revised, it is more clear to print the actual U-factor that corresponds with the R-value for mass walls. This is 0.057 as in the 2009 IRC.

Note that DOE2 simulations show mass effects for a 2400 sq foot homes in all climates. The U-factor for mass walls in Table N1102.1.2 should correspond to the R-value for mass walls in Table N1102.1 and not refer to the U-factor for frame walls.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: VANGEEM-EC-1-T. 402.1.3-T. N1102.1.2

Public Hearing Results

PART II – IRC

Committee Action: **Approved as Submitted**

Committee Reason: This is an appropriate correlation for mass wall values with R-Values in Table N1102.1.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Disapproval.

Commenter's Reason: *EC55, Part II should be disapproved.*

The IECC Committee recommended that this proposal should be disapproved, concluding that it would have the effect of reducing the stringency of the code. We agree. One of EECC's guiding principles is specifically to oppose backsliding – proposals that weaken energy efficiency or overturn gains and improvements achieved in the 2006 and 2009 IEECs and IRCs.

This proposal increases U-factors for mass walls at a time when wall U-factors are otherwise being reduced and where substantial increases in efficiency are sought in the code. Moreover, this proposal would make the IRC, which is already less efficient than the IECC, even weaker and more inconsistent.

Public Comment 2:

Donald J. Vigneau, Northeast Energy Efficiency Partnerships, Inc. representing self requests Disapproval.

Commenter's Reason: Public Comment is for Disapproval of Part II, since this change to the IRC will create inconsistency between the two codes and reduce energy savings.

Part I was Disapproved (D) by the Energy Code Development Committee.

Part II was Approved as Submitted (AS) by the Residential Building & Energy Code Development Committee.

IECC Committee Reason: This has the effect of reducing the stringency of the code.

Cost Impact: The code change proposal will not increase the cost of construction.

Final Action: AS AM AMPC____ D

EC57-09/10-PART I
402.1.5 (New), Table 402.1.5 (New)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Add new text and table as follows:

402.1.5 Calculating opaque envelope component U-factors. When determining the U-factor of an opaque assembly as part of Sections 402.1.3, 402.1.4, or 404.5.2, Table 402.1.5 shall be used to calculate the U-factor by using a series-parallel calculation. Where actual insulation and framing fractions have been calculated for the proposed design, they shall be used; otherwise the default insulation and framing fractions in Table 402.1.5 shall be used. The *code official* may require: (1) actual insulation and framing fractions to be calculated and documented and (2) the calculated and documented values to be inspected and reviewed by an independent party *approved* by the *code official.*

TABLE 402.1.5
COMPONENT R-VALUE AND INSULATION AND FRAMING FRACTIONS BY ASSEMBLY TYPE

	Interior Air Film	Interior Layer	Cavity Insulation Layer	Insulation Fraction	Cavity Framing Layer	Framing Fraction	Insulating Sheathing Layer[c]	Structural Sheathing Layer[c]	Siding Layer	Exterior Air Film
	R-Value	R-Value	R-Values	Percent	R-Values	Percent	R-Value	R-Value	R-Value	R-Value
Wood Frame Ceiling	0.61	0.45	As Specified[a]	93%	R-1.25 per inch[b]	7%	-	-	-	0.61
Wood Frame Wall	0.68	0.45	As Specified	77%	R-1.25 per inch[b]	23%	0 or as specified	0.62	0.61	0.25
Steel Frame Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Mass Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Wood Frame Floor	0.92	1.23 + 0.94	As Specified	90%	R-1.25 per inch[b]	10%	-	-	-	0.92
Basement Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25
Crawlspace Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25

a. In the standard reference design, the depth of the insulation shall be calculated to account for limited depth at the edge of the ceiling based on a standard truss with available depth of 3.86 inches at the edge of the ceiling and a roof slope of 1 foot for every 3 feet across. In the proposed design, the ceiling insulation u-value shall be calculated with the actual insulation depths in the proposed design.

b. The depth of the wood framing shall be based on the actual depth of the wood framing. In the standard reference design, it shall be calculated as the cavity insulation R-Value divided by 4 and then rounded up to the following depths in inches: 3.5 for a 2x4 frame, 5.5 for a 2x6 frame, 7.5 for a 2x8 frame or 9.5 for a 2x10 frame.

c. If insulating sheathing is used in the standard reference design, only 80% of the net wall is assumed to be covered by the insulating sheathing. The other 20% is assumed to be covered with plywood. The proposed design shall be calculated with the actual percentage of insulating sheathing and structural sheathing.

Reason: The calculations between the R-Values and U-Values for envelope components have not been available in the IECC or IRC. This proposal is intended to make the calculations within the code and the use of code consistent and transparent. The proposal does not change the insulation R-value or U-Value requirements, but rather is intended to be the means for future calculations to be consistent and for software tools to be consistent. This proposal makes the standard reference design and proposed design framing fractions explicit, along with all of the layers of the envelope components that are used in energy calculations.

Without explicit values that indicate how energy modeling tools are to model exact building envelope components, software tools have the discretion to select "appropriate" but inconsistent envelope layers. This inconsistency between modeling tools can create inconsistent results for what proposed designs comply with code. By adopting explicit component default value tables, the industry tools can increase consistency in how buildings are modeled.

This proposal offers an easy way to understand the true energy efficiency of the homes that are being constructed, by defining the home default construction values, the home building industry is encouraged to meet the standard construction techniques and improve to advanced framing construction techniques.

This proposal uses the values that are based on ASHRAE where possible and further supplemented with Rescheck, HERS and Washington State Energy code information.

This proposal also allows the code to be transparent where it is currently silent. Currently energy software and code officials do not have any official guidance from the code on the actual translation between R-Value and U-Value. This leads to confusion and lack of consistency in the implementation of code across the country.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: PRINDLE-EC-17-402.1.5-N1102.1.4

Public Hearing Results

PART I - IECC
Committee Action: Disapproved

Committee Reason: This information does not need to be included in the code. It could be provided in commentary, some type of design guide, or in an informational appendix.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.1.5 Calculating opaque envelope component U-factors. When determining the U-factor of an opaque assembly as part of Sections 402.1.3, 402.1.4, or ~~404.5.2~~ 405.5.2, Table 402.1.5 shall be used to calculate the U-factor by using a series-parallel path calculation. Where actual insulation and framing fractions have been calculated for the proposed design, they shall be used; otherwise the default insulation and framing fractions in Table 402.1.5 shall be used. The *code official* may require: (1) actual insulation and framing fractions to be calculated and documented and (2) the calculated and documented values to be inspected and reviewed by an ~~independent~~ party *approved* by the *code official.*

TABLE 402.1.5
COMPONENT R-VALUE AND INSULATION AND FRAMING FRACTIONS BY ASSEMBLY TYPE

	Interior Air Film	Interior Layer	Cavity Insulation Layer	Insulation Fraction	Cavity Framing Layer	Framing Fraction	~~Insulating Sheathing~~ Continuous Insulation Layer[c]	Structural Sheathing Layer[c]	Siding Layer	Exterior Air Film
	R-Value	R-Value	R-Values	Percent	R-Values	Percent	R-Value	R-Value	R-Value	R-Value
Wood Frame Ceiling	0.61	0.45	As Specified[a]	93%	R-1.25 per inch[b]	7%	-	-	-	0.61
Wood Frame Wall	0.68	0.45	As Specified	~~77~~ 75%	R-1.25 per inch[b]	~~23~~ 25%	0 or as specified	0.62	0.61	0.25
Steel Frame Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Mass Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Wood Frame Floor	0.92	1.23 + 0.94	As Specified	90%	R-1.25 per inch[b]	10%	-	-	-	0.92
Basement Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25
Crawlspace Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25

a. ~~In~~ When calculating the equivalent u-factor for the standard reference design, the depth of the insulation shall be calculated to account for limited depth at the edge of the ceiling based on a standard truss with available depth of 3.86 inches at the edge of the ceiling and a roof slope of 1 foot for every 3 feet across. In the proposed design, the ceiling insulation u-value shall be calculated with the actual insulation depths in the proposed design.

b. The depth of the wood framing shall be based on the actual depth of the wood framing. ~~In~~ When calculating the equivalent u-factor for the standard reference design, ~~it~~ the depth of the wood framing shall be calculated as the cavity insulation R-Value divided by 4 and then rounded up to the following depths in inches: 3.5 for a 2x4 frame, 5.5 for a 2x6 frame, 7.5 for a 2x8 frame or 9.5 for a 2x10 frame.

c. ~~If insulating sheathing is used in~~ When calculating the equivalent u-factor for the standard reference design, using continuous insulation, ~~only 80%~~ 100% of the net wall is assumed to be covered by continuous insulation ~~the insulating sheathing. The other 20% is assumed to be covered with plywood.~~ The proposed design shall be calculated with the actual percentage of continuous insulation ~~of insulating sheathing~~ and structural sheathing.

d. When determining the U-factor of a steel framed assembly using Table 402.1.5, a series path calculation shall be used. The R-value of the cavity/framing layer for steel framed assemblies shall be calculated by multiplying the specified cavity insulation R-value by the corresponding correction factor located in Table 402.1.6. If there is no specified cavity insulation, the R-value of the cavity/framing layer shall be taken as R-0.8 for 16 inch on center assemblies and R-0.9 for 24 inch on center assemblies.

TABLE 402.1.6 STEEL FRAMED ASSEMBLIES CAVITY INSULATION CORRECTION FACTORS

Nominal Stud Size[a]	Cavity Insulation R-Value	Nominal Framing Spacing	
		16 in. on center	24 in. on center
2x4	11	0.50	0.60
2x4	13	0.46	0.55
2x4	15	0.43	0.52
2x6	19	0.37	0.45
2x6	20	0.36	0.44
2x6	21	0.35	0.43
2x8	25	0.31	0.38

Commenter's Reason: *EC57*, parts I and II, *should be approved as modified by this public comment.*

This public comment incorporates the additional changes that were recommended by the Steel Framing Alliance and the RESNET technical committee chair. In addition, this public comment addresses the "footnote h" issue by modifying footnote c to be consistent with public comments that are being submitted to modify note h from Table 402.1.1. The result is a uniform set of assumptions to be used in compliance worksheets and software applications that will ensure more accurate and consistent results whenever the Total UA Alternative or the Simulated Performance Alternative is used.

This proposal was disapproved by a tiebreaker vote from the chair of the IECC committee, due to a split vote among the voting members of the IECC committee. It should be noted that the Committee did not conclude that this proposal was technically flawed or otherwise problematic, only that it was not necessary to include this information directly in the code. We disagree with the Committee conclusion that these provisions need not be in the code. It is important to include these provisions in the code to ensure consistent modeling for code compliance. These provisions are not intended for design guidance, but instead set code requirements that otherwise can currently be changed by any energy modeling tool or code compliance calculator. There are dozens of compliance software packages in use today, and each one necessarily incorporates a number of assumptions that are not set in the IECC. Currently there is inconsistency among the energy modeling tools and therefore inconsistency in the results, depending on the tools used. As long as the IECC allows a Total UA Alternative and/or the Simulated Performance Alternative, we believe the fundamental underlying assumptions for the software should be established in the code, and not in an informational appendix.

Public Comment 2:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.1.5
COMPONENT R-VALUE AND INSULATION AND FRAMING FRACTIONS BY ASSEMBLY TYPE

	Interior Air Film	Interior Layer	Cavity Insulation Layer	Insulation Fraction	Cavity Framing Layer	Framing Fraction	Insulating Sheathing Layer[c]	Structural Sheathing Layer[c]	Siding Layer	Exterior Air Film
	R-Value	R-Value	R-Values	Percent	R-Values	Percent	R-Value	R-Value	R-Value	R-Value
Wood Frame Ceiling	0.61	0.45	As Specified[a]	93%	R-1.25 per inch[b]	7%	-	-	-	0.61
Wood Frame Wall	0.68	0.45	As Specified	77%	R-1.25 per inch[b]	23%	0 or as specified	0.62	0.61	0.25
Steel Frame Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Mass Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Wood Frame Floor	0.92	1.23 + 0.94	As Specified	90%	R-1.25 per inch[b]	10%	-	-	-	0.92
Basement Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25
Crawlspace Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25

a. In the standard reference design, the depth of the insulation shall be calculated to account for limited depth at the edge of the ceiling based on a standard truss with available depth of 3.86 inches at the edge of the ceiling and a roof slope of 1 foot for every 3 feet across. In the proposed design, the ceiling insulation u-value shall be calculated with the actual insulation depths in the proposed design.

b. The depth of the wood framing shall be based on the actual depth of the wood framing. In the standard reference design, it shall be calculated as the cavity insulation R-Value divided by 4 and then rounded up to the following depths in inches: 3.5 for a 2x4 frame, 5.5 for a 2x6 frame, 7.5 for a 2x8 frame or 9.5 for a 2x10 frame.

c. ~~If insulating sheathing is used in the standard reference design, only 80% of the net wall is assumed to be covered by the insulating sheathing. The other 20% is assumed to be covered with plywood. The proposed design shall be calculated with the actual percentage of insulating sheathing and structural sheathing.~~

c. If calculating the equivalent u-factor for the standard reference design using continuous insulation, only 80% of the net wall is assumed to be covered by the continuous insulation. The other 20% is assumed to be covered with 7/16-inch-thick oriented strand board. The proposed design shall be calculated with the actual percentage of continuous insulation and structural sheathing.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: The original EC57 proposal with this public comment is needed for a variety of reasons. First, with the baseline conditions for energy analysis explicitly recognized in the code, unfair or inconsistent practices are avoided when evaluating various alternatives for compliance. This proposal will encourage fair and open competition in the market. Second, footnote 'c' is modified in this PC to coordinate with the use of "continuous insulation" in other IECC proposals and modifications at the code development hearings. Finally, this PC intends to retain the 80% baseline conditions for continuous insulation coverage to correspond with footnote h as used with prescriptive R-value requirements for continuous insulation on walls. The "performance" or trade-off requirements of the code addressed in this proposal should be consistent with the minimum baseline established in the prescriptive code such that performance exceeding the minimum baseline permitted in the prescriptive code for continuous insulation is properly rewarded in analyses of trade-offs and properly modeled in the use of RESCheck.

Final Action: AS AM AMPC____ D

EC57-09/10-PART II
IRC N1102.1.4 (New), Table N1102.1.4 (New)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1102.1.4 Calculating opaque envelope component U-factors. When determining the U-factor of an opaque assembly as part of Section N1102.1.2 or N1102.1.3, Table N1102.1.4 shall be used to calculate the U-factor by using a series-parallel calculation. Where actual insulation and framing fractions have been calculated for the proposed design, they shall be used; otherwise the default insulation and framing fractions in Table N1102.1.4 shall be used. The *building official* may require: (1) actual insulation and framing fractions to be calculated and documented and (2) the calculated and documented values to be inspected and reviewed by an independent party *approved* by the *building official.*

TABLE N1102.1.4
COMPONENT R-VALUE AND INSULATION AND FRAMING FRACTIONS BY ASSEMBLY TYPE

	Interior Air Film	Interior Layer	Cavity Insulation Layer	Insulation Fraction	Cavity Framing Layer	Framing Fraction	Insulating Sheathing Layer[c]	Structural Sheathing Layer[c]	Siding Layer	Exterior Air Film
	R-Value	R-Value	R-Values	Percent	R-Values	Percent	R-Value	R-Value	R-Value	R-Value
Wood Frame Ceiling	0.61	0.45	As Specified[a]	93%	R-1.25 per inch[b]	7%	-	-	-	0.61
Wood Frame Wall	0.68	0.45	As Specified	77%	R-1.25 per inch[b]	23%	0 or as specified	0.62	0.61	0.25
Steel Frame Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Mass Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Wood Frame Floor	0.92	1.23 + 0.94	As Specified	90%	R-1.25 per inch[b]	10%	-	-	-	0.92
Basement Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25
Crawlspace Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25

a. In the standard reference design, the depth of the insulation shall be calculated to account for limited depth at the edge of the ceiling based on a standard truss with available depth of 3.86 inches at the edge of the ceiling and a roof slope of 1 foot for every 3 feet across. In the proposed design, the ceiling insulation u-value shall be calculated with the actual insulation depths in the proposed design.
b. The depth of the wood framing shall be based on the actual depth of the wood framing. In the standard reference design, it shall be calculated as the cavity insulation R-Value divided by 4 and then rounded up to the following depths in inches: 3.5 for a 2x4 frame, 5.5 for a 2x6 frame, 7.5 for a 2x8 frame or 9.5 for a 2x10 frame.
c. If insulating sheathing is used in the standard reference design, only 80% of the net wall is assumed to be covered by the insulating sheathing. The other 20% is assumed to be covered with plywood. The proposed design shall be calculated with the actual percentage of insulating sheathing and structural sheathing.

Reason: The calculations between the R-Values and U-Values for envelope components have not been available in the IECC or IRC. This proposal is intended to make the calculations within the code and the use of code consistent and transparent. The proposal does not change the insulation R-value or U-Value requirements, but rather is intended to be the means for future calculations to be consistent and for software tools to be consistent. This proposal makes the standard reference design and proposed design framing fractions explicit, along with all of the layers of the envelope components that are used in energy calculations.

Without explicit values that indicate how energy modeling tools are to model exact building envelope components, software tools have the discretion to select "appropriate" but inconsistent envelope layers. This inconsistency between modeling tools can create inconsistent results for what proposed designs comply with code. By adopting explicit component default value tables, the industry tools can increase consistency in how buildings are modeled.

This proposal offers an easy way to understand the true energy efficiency of the homes that are being constructed, by defining the home default construction values, the home building industry is encouraged to meet the standard construction techniques and improve to advanced framing construction techniques.

This proposal uses the values that are based on ASHRAE where possible and further supplemented with Rescheck, HERS and Washington State Energy code information.

This proposal also allows the code to be transparent where it is currently silent. Currently energy software and code officials do not have any official guidance from the code on the actual translation between R-Value and U-Value. This leads to confusion and lack of consistency in the implementation of code across the country.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: PRINDLE-EC-17-402.1.5-N1102.1.4

Public Hearing Results

PART II - IRC
Committee Action: Disapproved

Committee Reason: This information does not need to be included in the code. The proper application is not clear. It could be provided in commentary, some type of design guide, or in an informational appendix.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.1.4 Calculating opaque envelope component U-factors. When determining the U-factor of an opaque assembly as part of Section N1102.1.2 or N1102.1.3, Table N1102.1.4 shall be used to calculate the U-factor by using a series-parallel <u>path</u> calculation. Where actual insulation and framing fractions have been calculated for the proposed design, they shall be used; otherwise the default insulation and framing fractions in Table N1102.1.4 shall be used. The *building official* may require: (1) actual insulation and framing fractions to be calculated and documented and (2) the calculated and documented values to be inspected and reviewed by ~~an independent~~ party *approved* by the *building official.*

TABLE N1102.1.4
COMPONENT R-VALUE AND INSULATION AND FRAMING FRACTIONS BY ASSEMBLY TYPE

	Interior Air Film	Interior Layer	Cavity Insulation Layer	Insulation Fraction	Cavity Framing Layer	Framing Fraction	Insulating Sheathing Layer[c]	Structural Sheathing Layer[c]	Siding Layer	Exterior Air Film
	R-Value	R-Value	R-Values	Percent	R-Values	Percent	R-Value	R-Value	R-Value	R-Value
Wood Frame Ceiling	0.61	0.45	As Specified[a]	93%	R-1.25 per inch[b]	7%	-	-	-	0.61
Wood Frame Wall	0.68	0.45	As Specified	~~77~~ <u>75</u>%	R-1.25 per inch[b]	~~23~~ <u>25</u>%	0 or as specified	0.62	0.61	0.25
Steel Frame Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Mass Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Wood Frame Floor	0.92	1.23 + 0.94	As Specified	90%	R-1.25 per inch[b]	10%	-	-	-	0.92
Basement Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25
Crawlspace Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25

a. ~~In~~ <u>When calculating the equivalent u-factor for</u> the standard reference design, the depth of the insulation shall be calculated to account for limited depth at the edge of the ceiling based on a standard truss with available depth of 3.86 inches at the edge of the ceiling and a roof slope of 1 foot for every 3 feet across. In the proposed design, the ceiling insulation u-value shall be calculated with the actual insulation depths in the proposed design.

b. The depth of the wood framing shall be based on the actual depth of the wood framing. ~~In~~ When calculating the equivalent u-factor for the standard reference design, ~~it~~ the depth of the wood framing shall be calculated as the cavity insulation R-Value divided by 4 and then rounded up to the following depths in inches: 3.5 for a 2x4 frame, 5.5 for a 2x6 frame, 7.5 for a 2x8 frame or 9.5 for a 2x10 frame.

c. When calculating the equivalent u-factor for ~~If insulating sheathing is used in~~ the standard reference design using continuous insulation, ~~only 80%~~ 100% of the net wall is assumed to be covered by continuous insulation ~~the insulating sheathing. The other 20% is assumed to be covered with plywood~~. The proposed design shall be calculated with the actual percentage of ~~insulating sheathing~~ continuous insulation and structural sheathing.

d. When determining the U-factor of a steel framed assembly using Table N1102.1.5, a series path calculation shall be used. The R-value of the cavity/framing layer for steel framed assemblies shall be calculated by multiplying the specified cavity insulation R-value by the corresponding correction factor located in Table N1102.1.6. If there is no specified cavity insulation, the R-value of the cavity/framing layer shall be taken as R-0.8 for 16 inch on center assemblies and R-0.9 for 24 inch on center assemblies.

TABLE N1102.1.5
STEEL FRAMED ASSEMBLIES CAVITY INSULATION CORRECTION FACTORS

Nominal Stud Size[a]	Cavity Insulation R-Value	Nominal Framing Spacing	
		16 in. on center	24 in. on center
2x4	11	0.50	0.60
2x4	13	0.46	0.55
2x4	15	0.43	0.52
2x6	19	0.37	0.45
2x6	20	0.36	0.44
2x6	21	0.35	0.43
2x8	25	0.31	0.38

Commenter's Reason:*EC57*, parts I and II, *should be approved as modified by this public comment.*

This public comment incorporates the additional changes that were recommended by the Steel Framing Alliance and the RESNET technical committee chair. In addition, this public comment addresses the "footnote h" issue by modifying footnote c to be consistent with public comments that are being submitted to modify note h from Table 402.1.1. The result is a uniform set of assumptions to be used in compliance worksheets and software applications that will ensure more accurate and consistent results whenever the Total UA Alternative or the Simulated Performance Alternative is used.

This proposal was disapproved by a tiebreaker vote from the chair of the IECC committee, due to a split vote among the voting members of the IECC committee. It should be noted that the Committee did not conclude that this proposal was technically flawed or otherwise problematic, only that it was not necessary to include this information directly in the code. We disagree with the Committee conclusion that these provisions need not be in the code. It is important to include these provisions in the code to ensure consistent modeling for code compliance. These provisions are not intended for design guidance, but instead set code requirements that otherwise can currently be changed by any energy modeling tool or code compliance calculator. There are dozens of compliance software packages in use today, and each one necessarily incorporates a number of assumptions that are not set in the IECC. Currently there is inconsistency among the energy modeling tools and therefore inconsistency in the results, depending on the tools used. As long as the IECC allows a Total UA Alternative and/or the Simulated Performance Alternative, we believe the fundamental underlying assumptions for the software should be established in the code, and not in an informational appendix.

Public Comment 2:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1.4
COMPONENT R-VALUE AND INSULATION AND FRAMING FRACTIONS BY ASSEMBLY TYPE

	Interior Air Film	Interior Layer	Cavity Insulation Layer	Insulation Fraction	Cavity Framing Layer	Framing Fraction	Insulating Sheathing Layer[c]	Structural Sheathing Layer[c]	Siding Layer	Exterior Air Film
	R-Value	R-Value	R-Values	Percent	R-Values	Percent	R-Value	R-Value	R-Value	R-Value
Wood Frame Ceiling	0.61	0.45	As Specified[a]	93%	R-1.25 per inch[b]	7%	-	-	-	0.61
Wood Frame Wall	0.68	0.45	As Specified	77%	R-1.25 per inch[b]	23%	0 or as specified	0.62	0.61	0.25
Steel Frame Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Mass Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	0.62	0.61	0.25
Wood Frame Floor	0.92	1.23 + 0.94	As Specified	90%	R-1.25 per inch[b]	10%	-	-	-	0.92
Basement Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25
Crawlspace Wall	0.68	0.45	As Specified	-	-	-	0 or as specified	-	-	0.25

a. In the standard reference design, the depth of the insulation shall be calculated to account for limited depth at the edge of the ceiling based on a standard truss with available depth of 3.86 inches at the edge of the ceiling and a roof slope of 1 foot for every 3 feet across. In the proposed design, the ceiling insulation u-value shall be calculated with the actual insulation depths in the proposed design.

b. The depth of the wood framing shall be based on the actual depth of the wood framing. In the standard reference design, it shall be calculated as the cavity insulation R-Value divided by 4 and then rounded up to the following depths in inches: 3.5 for a 2x4 frame, 5.5 for a 2x6 frame, 7.5 for a 2x8 frame or 9.5 for a 2x10 frame.

~~c. If insulating sheathing is used in the standard reference design, only 80% of the net wall is assumed to be covered by the insulating sheathing. The other 20% is assumed to be covered with plywood. The proposed design shall be calculated with the actual percentage of insulating sheathing and structural sheathing.~~

c. If calculating the equivalent u-factor for the standard reference design using continuous insulation, only 80% of the net wall is assumed to be covered by the continuous insulation. The other 20% is assumed to be covered with 7/16-inch-thick oriented strand board. The proposed design shall be calculated with the actual percentage of continuous insulation and structural sheathing.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: The original EC 57 proposal with this public comment is needed for a variety of reasons. First, with the baseline conditions for energy analysis explicitly recognized in the code, unfair or inconsistent practices are avoided when evaluating various alternatives for compliance. This proposal will encourage fair and open competition in the market. Second, footnote 'c' is modified in this PC to coordinate with the use of "continuous insulation" in other IECC proposals and modifications at the code development hearings. Finally, this PC intends to retain the 80% baseline conditions for continuous insulation coverage to correspond with footnote h as used with prescriptive R-value requirements for continuous insulation on walls. The "performance " or trade-off requirements of the code addressed in this proposal should be consistent with the minimum baseline established in the prescriptive code such that performance exceeding the minimum baseline permitted in the prescriptive code for continuous insulation is a properly rewarded in analyses of trade-offs and properly modeled in the use of RESCheck.

Final Action: AS AM AMPC____ D

EC60-09/10-PART I
202, 402.2.2

Proposed Change as Submitted

Proponent: Craig Conner, Building Quality, representing self; Shaunna Mozinga, City of Westminster, representing Colorado Chapter of ICC

PART I – IECC

Revise definition as follows:

CONDITIONED SPACE. ~~An area or room within a building being heated or cooled, containing annulated ducts, or with a fixed opening directly into an adjacent conditioned space.~~ For energy purposes, space within a building that is provided with equipment or systems capable of maintaining, through design or heat loss/gain, 50°F (10°C) and 85°F (29°C) during the cooling season, or communicates directly with a conditioned space. For mechanical purposes, an area, room or space being heated or cooled by any equipment or appliance.

402.2.2 Ceilings without attic spaces. Where Section 402.1.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section 402.1.1 shall be limited to 500 square feet (46 m^2) ~~or 20%~~ of ~~the total insulated~~ ceiling area~~, whichever is less.~~ This reduction shall not apply to the U-factor alternative approach in Section 402.1.3 and the Total UA alternative in Section 402.1.4.

Reason: This set of six changes is designed to align the IECC and IRC. Code users expect their family of I-codes to be consistent. This change corrects six inconsistencies left over from the major changes made in the energy requirements in the last code change cycle.

This change makes the IECC **definition of conditioned space** consistent with the existing IRC definition. The primary reason for preferring the IRC definition is that it is more useable.

The IECC now has **two separate limits on the ceiling area eligible for reduced R-value** due to the limited space for installing insulation (cathedral ceilings, EC46). The IRC has only one limit. The second limit could be added to the IRC or removed from the IECC. Both codes already have the simple area limit (500 ft^2). It would seem that having the simple limit of 500 ft^2 is enough; we don't need to have a "percentage of area" calculation too.

Three differences between the IECC and IRC are in R-value and U-factor tables. In each case the suggestion is to align the IRC and IECC by making in IRC consistent with what is in the IECC.

Lower southern SHGC requirements were approved in the IECC, but not the IRC. The lower SHGC from the IECC contributes significantly to limiting the cooling energy in the southern zones. This change modifies the IRC by duplicating the lower IECC SHGCs from zones 1 to 3. (Change is included in Table N1102.1.)

Basement insulation R-values in the IECC were increased in the northern zones 6 to 8. This change inserts the IECC basement insulation R-value and U-factors into the IRC. (Change is included in Tables N1102.1 and N1102.1.2.)

Floor insulation R-values in the IECC were increased to R-38 in zones 7 and 8. This change inserts the IECC floor insulation R-value and U-factors into the IRC. (Change is included in Tables N1102.1 and N1102.1.2.)

The **new "Air Barrier and Insulation Inspection Table"** was added to both the IECC and IRC. **One line was left out of the IRC** table. This adds back the missing line.

Cost Impact: The cost impact varies with the six changes.

ICCFILENAME: CONNER-MOZINGO-EC-1-402.2.2-T. N1102.1.DOC

Public Hearing Results

PART I - IECC
Committee Action: **Disapproved**

Committee Reason: The proponent requested disapproval.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

CONDITIONED SPACE. For energy purposes, space within a building that is provided with equipment or systems capable of maintaining, through design or heat loss/gain, 50°F (10°C) and ~~85~~ 75°F (~~29~~ 24°C) during the cooling season, or communicates directly with a conditioned space. For mechanical purposes, an area, room or space being heated or cooled by any equipment or appliance.

(*Portions of code change proposal not shown remain unchanged*)

Commenter's Reason: We strongly prefer that the IECC and IRC be made identical, possibly based on RE4. Part of this change is a backup, in case RE4 is not approved.

Even if RE4 is approved the conditioned space definition changed here is still needed to align the IRC and IECC. This makes the IECC definition for conditioned space consistent with the existing IRC definition for conditioned space. It also changes the 85ºF temperature to 75ºF to be consistent with ACCA manuals J and N, as well as making the temperatures consistent with IECC Section 302.1.

Should the IRC and IECC be aligned with RE4, this change is not intended to resurrect the any part of the IRC that was eliminated or changed by RE4.

Final Action: AS AM AMPC____ D

EC60-09/10-PART II

IRC Tables N1102.1, N1102.1.2, N1102.4.2

Proposed Change as Submitted

Proponent: Craig Conner, Building Quality, representing self; Shaunna Mozingo, City of Westminster, representing Colorado Chapter of ICC

PART II – IRC ENERGY

Revise tables as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE	FLOOR *R*-VALUE	BASEMENT WALL *R*-VALUE	SLAB *R*-VALUE & DEPTH	CRAWL SPACE WALL *R*-VALUE
1	1.20	0.75	~~0.40~~ 0.30	30	13	3 / 4	13	0	0	0
2	0.65	0.65	~~0.40~~ 0.30	30	13	4 / 6	13	0	0	0
3	0.50	0.65	~~0.40~~ 0.30	30	13	5 / 8	19	5/13[i]	0	5 / 13
4 except Marine	0.35	0.60	NR	38	13	5 / 10	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5	13/17	30[f]	10/13	10,2ft	10/13
6	0.35	0.60	NR	49	20 or 13+5	15/19	30[f]	~~10/13~~ 15/19	10,4ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	~~30~~ 38[f]	~~10/13~~ 15/19	10,4ft	10/13

TABLE N1102.1.2
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENES-TRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTORb	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.50	0.65	0.035	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.057	0.057	0.033	~~0.059~~ 0.050	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	~~0.033~~ 0.028	~~0.059~~ 0.050	0.065

TABLE N1102.4.2
AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material. Air permeable insulation is inside of an air barrier.

(Portions of table not shown remain unchanged)

Reason: This set of six changes is designed to align the IECC and IRC. Code users expect their family of I-codes to be consistent. This change corrects six inconsistencies left over from the major changes made in the energy requirements in the last code change cycle.

This change makes the IECC **definition of conditioned space** consistent with the existing IRC definition. The primary reason for preferring the IRC definition is that it is more useable.

The IECC now has **two separate limits on the ceiling area eligible for reduced R-value** due to the limited space for installing insulation (cathedral ceilings, EC46). The IRC has only one limit. The second limit could be added to the IRC or removed from the IECC. Both codes already have the simple area limit (500 ft^2). It would seem that having the simple limit of 500 ft^2 is enough; we don't need to have a "percentage of area" calculation too.

Three differences between the IECC and IRC are in R-value and U-factor tables. In each case the suggestion is to align the IRC and IECC by making in IRC consistent with what is in the IECC.

Lower southern SHGC requirements were approved in the IECC, but not the IRC. The lower SHGC from the IECC contributes significantly to limiting the cooling energy in the southern zones. This change modifies the IRC by duplicating the lower IECC SHGCs from zones 1 to 3. (Change is included in Table N1102.1.)

Basement insulation R-values in the IECC were increased in the northern zones 6 to 8. This change inserts the IECC basement insulation R-value and U-factors into the IRC. (Change is included in Tables N1102.1 and N1102.1.2.)

Floor insulation R-values in the IECC were increased to R-38 in zones 7 and 8. This change inserts the IECC floor insulation R-value and U-factors into the IRC. (Change is included in Tables N1102.1 and N1102.1.2.)

The **new "Air Barrier and Insulation Inspection Table"** was added to both the IECC and IRC. **One line was left out of the IRC** table. This adds back the missing line.

Cost Impact: The cost impact varies with the six changes.

ICCFILENAME: CONNER-MOZINGO-EC-1-402.2.2-T. N1102.1.DOC

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: These proposed changes in R-Values and U-Factors are not cost effective.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

CONDITIONED SPACE. For energy purposes, space within a building that is provided with equipment or systems capable of maintaining, through design or heat loss/gain, 50°F (10°C) and ~~85~~ 75°F (~~29~~ 24°C) during the cooling season, or communicates directly with a conditioned space. For mechanical purposes, an area, room or space being heated or cooled by any equipment or appliance.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: We strongly prefer that the IECC and IRC be made identical, possibly based on RE4. Part of this change is a backup, in case RE4 is not approved.

Even if RE4 is approved the conditioned space definition changed here is still needed to align the IRC and IECC. This makes the IECC definition for conditioned space consistent with the existing IRC definition for conditioned space. It also changes the 85ºF temperature to 75ºF to be consistent with ACCA manuals J and N, as well as making the temperatures consistent with IECC Section 302.1.

Should the IRC and IECC be aligned with RE4, this change is not intended to resurrect the any part of the IRC that was eliminated or changed by RE4.

Final Action: AS AM AMPC____ D

EC63-09/10-PART I
402.2.3(NEW)

NOTE: PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS ON THE CONSENT AGENDA, PART II IS REPRODUCED ONLY FOR INFORMATION PURPOSES FOLLOWING ALL OF PART I

Proposed Change as Submitted

Proponent: Craig Conner, Building Quality, representing self

PART I – IECC

Add new text as follows:

<u>**402.2.3 Wind wash baffle.** For air permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain an opening equal or greater than the size of the vent. The baffle shall extend over the top of the attic insulation inward until it is at least 4 inches vertically above the insulation at full height. The baffle shall be permitted to be any solid material such as cardboard or thin rigid insulating sheathing.</u>

Reason: Inexpensive wind wash baffles prevent the wind from blowing through air permeable insulation. Wind blowing through insulation lowers the insulation's effectiveness.

The baffle also keeps the wind from blowing insulation off parts of the ceiling directly next to the vents. Areas lacking insulation can create moisture problems.

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

ICCFILENAME: CONNER-EC-4-402.2.3-N1102.2.3.DOC

Public Hearing Results

PART I - IECC
Committee Action: Approved as Submitted

Committee Reason: Baffles serve to keep vents open, insulation in place, and keep wind from blowing through the insulation and reducing the effectiveness.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.2.3 ~~Wind wash~~ <u>Eave</u> baffle. For air permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain an opening equal or greater than the size of the vent. The baffle shall extend over the top of the attic ~~insulation inward until it is at least 4 inches vertically above the insulation at full height~~. The baffle shall be permitted to be any solid material ~~such as cardboard or thin rigid insulating sheathing~~.

Commenter's Reason: Very similar versions of this change were approved in the IECC (AS) and IRC (AM). Both versions help prevent wind from degrading attic insulation performance. The affected industry preferred the IRC version, which why AMPC for the IECC is suggested here. (As an alternative, IRC Approval as Submitted would also align the two codes.)

This change is one of a series intended to correct inconsistencies in the requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC16 and EC17. The best way to align the codes would be to approve RE4. Changes to the IRC are not needed if RE4 aligns the codes.

Public Comment 2:

Charles C. Cottrell, representing North America Insulation Manufacturers Association (NAIMA), requests, Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.2.3 ~~Wind wash~~ Eave baffle. For air permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain an opening equal or greater than the size of the vent. The baffle shall extend over the top of the attic insulation ~~inward until it is at least 4 inches vertically above the insulation at full height~~. The baffle shall be permitted to be any solid material ~~such as cardboard or thin rigid insulating sheathing~~.

Commenter's Reason: The proposed modification reflects the modification approved by the IRC committee, removes unclear requirements in the original proposal, and makes the IECC and IRC requirements identical.

Final Action: AS AM AMPC____ D

NOTE: PART II REPRODUCED FOR INFORMATION PURPOSES ONLY – SEE ABOVE

PART II – IRC ENERGY

N1102.2.3 Wind wash baffle. For air permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain an opening equal or greater than the size of the vent. The baffle shall extend over the top of the attic insulation inward until it is at least 4 inches vertically above the insulation at full height. The baffle shall be permitted to be any solid material such as cardboard or thin rigid insulating sheathing.

Reason: Inexpensive wind wash baffles prevent the wind from blowing through air permeable insulation. Wind blowing through insulation lowers the insulation's effectiveness.

The baffle also keeps the wind from blowing insulation off parts of the ceiling directly next to the vents. Areas lacking insulation can create moisture problems.

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

PART II - IRC
Committee Action: **Approved as Modified**

Modify the proposal as follows:

N1102.2.3 ~~Wind wash~~ Eave baffle. For air permeable insulations in vented attics, a baffle shall be installed adjacent to soffit and eave vents. Baffles shall maintain an opening equal or greater than the size of the vent. The baffle shall extend over the top of the attic insulation ~~inward until it is at least 4 inches vertically above the insulation at full height.~~ The baffle shall be permitted to be any solid material ~~such as cardboard or thin rigid insulating sheathing~~.

Committee Reason: Baffles serve to keep vents open, insulation in place, and keep wind from blowing through the insulation and reducing the effectiveness. The modification removes unnecessary and technically unsupported restrictions on dimensional characteristics.

Assembly Action: **None**

EC66-09/1-PART I
Table 402.2.5

Proposed Change as Submitted

Proponent: Mark Nowak, representing Steel Framing Alliance

PART I – IECC

Revise table as follows:

TABLE 402.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL 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	
R-13	R-13 + ~~5~~ 3.2 or ~~R-15 + 4~~ R-19 + 2.1 or R-21 + ~~3~~ 2.0 or R-0 + ~~10~~ 8.4
~~R-19~~	~~R-13 + 9 or R-19 + 8 or R-25 + 7~~
R-20	R-0 + 12.5 or R-13 + 7.3 or R-19 + 6.2 or R-21 + 5.9
R-21	R-0 + 13.0 or R-13 + ~~10~~ 7.7 or R-19 + ~~9~~ 6.6 or R-21 + 6.4 or R-25 + 8
Steel Joist Floor	
R-13	R-19 in 2 x 6 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.

Reason: Currently, there are inconsistencies between ASHRAE 90.1, the IECC, and the IRC regarding determination of U-factors for steel framed walls. This proposal and its companion to the IECC serve to ensure that U-factors for steel framed walls are determined in accordance with ASHRAE 90.1 methodology across all codes. This change will remove confusion and simplify the code compliance process as well as permit greater transparency, consistency, and collaboration across codes.

ASHRAE 90.1 values should be used in this table and across the IECC and IRC for three reasons: first, because ASHRAE 90.1 is the only source of U-factors that were determined through the ANSI consensus process; second, because ASHRAE 90.1 clearly delineates their assumptions and methodology in calculating the U-factors (this is not done within the IRC or IECC); and third, because in some areas the IECC already uses the ASHRAE methodology for determining U-factors of steel framed walls (See IECC Table 502.2.1 and 502.2(1), which are sourced directly from ASHRAE 90.1-2007).

To ensure consistency with ASHRAE 90.1 and with the U-factors used in Table 502.1.2, U-factors for wood framed walls and their thermally equivalent steel framed wall counterparts were calculated based on ASHRAE 90.1 methodology as follows:

1. U-factors for wood framed walls were sourced from ASHRAE 90.1-2007, Table A 3.4 as follows: R-13 (0.089), R-20 (0.065, interpolated), R-21 (0.063). Note that IECC Table 502.1.2 uses identical U-factors where values overlap (e.g. 0.089 for R-13 wood framed wall).
2. The required cavity and continuous R-values for steel framed walls to match the U-factors for wood framed walls were then calculated based on guidance provided by ASHRAE 90.1-2007 Section A3.3.1, “Steel-Framed Walls, General”, and Section A9.4, “Calculation Procedures and Assumptions.” This methodology is the same calculation procedure that was used to derive Table A3.3 of ASHRAE 90.1, which provides a matrix of metal framed wall U-factors based on specified cavity and/or continuous insulation.
3. To be consistent with the formatting of prescriptive steel frame wall requirements in IECC Table 502.2(1), requirements for steel framed wall continuous insulation R-values were then rounded to the nearest 0.1.

Submitted below are ASHRAE 90.1-2007 Table A3.4 and Table A3.3, with mark-ups showing how wood framed wall U-factors were sourced and how steel framed wall equivalent R-values were sourced. Table A3.3 contains mark-ups that highlight steel framed wall insulation R-values that would result in thermal equivalence to an R-13 wood framed wall.

TABLE A3.4 Assembly U-Factors for Wood-Frame Walls

Framing Type and Spacing Width (Actual Depth)	Cavity Insulation R-Value: Rated (Effective Installed [see Table A9.4C])	Overall U-Factor for Entire Base Wall Assembly	Overall U-Factor for Assembly of Base Wall Plus Continuous Insulation — Rated R-Value of Continuous Insulation: R-1.00	R-2.00	R-3.00	R-4.00	R-5.00	R-6.00	R-7.00	R-8.00	R-9.00	R-10.00	R-11.00	R-12.00	R-13.00
Wood Studs at 16 in. on center															
3.5 in. depth	None (0.0)	**0.292**	0.223	0.181	0.152	0.132	0.116	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060
	R-11 (11.0)	**0.096**	0.087	0.079	0.073	0.068	0.063	0.059	0.056	0.053	0.050	0.048	0.046	0.044	0.042
	R-13 (13.0)	**0.089**	0.080	0.074	0.068	0.063	0.059	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.040
	R-15 (15.0)	**0.083**	0.075	0.069	0.064	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038
5.5 in. depth	R-19 (18.0)	**0.067**	0.062	0.058	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034
	R-21 (21.0)	**0.063**	0.058	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.032

Targeted U-Factor for Thermal Equivalence with wood framed R-13 wall (0.089)

Graphic A: ASHRAE 90.1-2007 Table A3.4. Provides the U-factor for an R-13 wood framed wall.

Targeted U-factor for thermal equivalence with R-13 wood framed wall = 0.089.

TABLE A3.3 Assembly U-Factors for Steel-Frame Walls

Framing Type and Spacing Width (Actual Depth)	Cavity Insulation R-Value: Rated (Effective Installed [see Table A9.2B])	Overall U-Factor for Entire Base Wall Assembly	Overall U-Factor for Assembly of Base Wall Plus Continuous Insulation — Rated R-Value of Continuous Insulation: R-1.00	R-2.00	R-3.00	R-4.00	R-5.00	R-6.00	R-7.00	R-8.00	R-9.00	R-10.00	R-11.00	R-12.00	R-13.00
Steel Framing at 16 in. on center															
3.5 in. depth	None (0.0)	**0.352**	0.260	0.207	0.171	0.146	0.128	0.113	0.102	0.092	0.084	0.078	0.072	0.067	0.063
	R-11 (5.5)	**0.132**	0.117	0.105	0.095	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.051	0.049
	R-13 (6.0)	**0.124**	0.111	0.100	0.091	0.083	0.077	0.071	0.066	0.062	0.059	0.055	0.052	0.050	0.048
	R-15 (6.4)	**0.118**	0.106	0.096	0.087	0.080	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047
6.0 in. depth	R-19 (7.1)	**0.109**	0.099	0.090	0.082	0.076	0.071	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045
	R-21 (7.4)	**0.106**	0.096	0.087	0.080	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047	0.045

R-13 + 3.2

R-0 + 8.4

R-19 + 2.1

R-21 + 2.0

Graphic B: ASHRAE 90.1-2007 Table A3.3.

Additionally, this proposal removes the reference to R-19 since there is no longer a wood frame wall R-value prescription with this value that would require a steel framed thermal equivalent. An R-20 equivalent is added to provide an equivalent path to the R-20 wood framed wall prescription that was introduced in the 2009 code.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: NOWAK-EC-4-T. 402.2.5-RE-1-T. N1102.2.5

Public Hearing Results

PART I - IECC
Committee Action: Disapproved

Committee Reason: The committee was concerned that the proposal would actually resolve conflicts with ASHRAE 90.1 as it appears that there would still be conflicts.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jonathan Humble, representing American Iron and Steel Institute, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.2.5 Steel-frame ceilings, walls, and floors. Steel frame ceilings, walls and floors shall meet the insulation requirements of Table 402.2.5 or shall meet the *U*-factor requirements in Table 402.1.3. The calculation of the *U*-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

> ~~**Exception:** In Climate Zones 1 and 2, the continuous insulation requirements in Table 402.2.4 shall be permitted to be reduced to R-3 for steel frame wall assemblies with studs spaced at 24 inches (610 mm) on center.~~

TABLE 402.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL 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" O.C.	
R-13	R-13 + ~~3.2~~ 4.2 or R-19 + 2.1 or R-21 + ~~2.0~~ 2.8 or R-0 + ~~8.4~~ 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-20	R-0 + ~~12.5~~ 14.0 or R-13 + ~~7.3~~ 8.9 or R-15+8.5 or-19+7.8 or R-19 + 6.2 or R-21 + ~~5.9~~ 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 + ~~13.0~~ 14.6 or R-13 + ~~7.7~~ 9.5 or R-15+9.1 or R-19 + ~~6.6~~ 8.4 or R-21 + ~~6.4~~ 8.1 or R-25 + ~~8~~ 7.7
Steel Framed Wall, 24" O.C	
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-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 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.

Commenter's Reason: We are proposing to modify Section 402.2.5 and Table 402.2.5 by:

- Deleting the exception to Section 402.2.5, and
- Adding additional cold-formed steel wall framing equivalent R-values, and
- Expanding the table from just 16 inch o/c spacing options to both 16 and 24 inch o/c options.

History:
During the public hearings, the proponent to this proposal asked the committee to disapprove EC66-09/10 because it was incomplete. Based on feedback received during and following the public hearings, the American Iron and Steel Institute is proposing the following changes as improvements to the original proposal within this comment. The intent is to make complete the original intent of the proposal, that of listing a greater number of options, thus permitting the user of the code to avoid having to execute a calculation to demonstrate equivalency for those simple design assemblies which were not listed. In this case, two new wood-framed R-value requirements have been added (R-13+3 and R-20+5) to ensure that this table provides equivalent R-values for each wood-framed wall assembly that was approved during the 2009 public hearings or was present in the 2009 IECC.
Section 402.2.5:

We propose to delete the exception under Section 402.2.5. The exception is no longer necessary as a result of the proposal to add new 24 inch on center cold-formed steel assemblies to the conversion Table 405.2.5.

New Values for Table:

The initial proposal used ASHRAE values to develop thermal equivalence, while this comment uses the Department of Energy's REScheck software to develop thermal equivalence. RESCheck was selected 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 adoption of the 2004 IECC, and has more conservative values for steel framed assemblies (i.e. requires more insulation).

Details of Calculations and Assumptions:

RESCheck's U-factors for wood framed walls were determined to be the following. Where there is overlap with IECC requirements in Table 402.1.3, these values are in agreement with the IECC as well.

Framing	R-value	U-factor
Wood	R-13	0.082
Wood	R-13+3ci	0.071
Wood	R-20	0.059
Wood	R-20+5ci	0.048
Wood	R-21	0.057

Steel framed walls at 16" o.c. and 24" o.c. were then modeled in RESCheck, and cavity and exterior insulation were added until equivalent U-factors were obtained for steel assemblies which resulted in R-values and U-factors that can be considered equivalent to wood wall assemblies. The results are proposed within the table. Notice that the R-value requirements for 16" o.c. steel framed walls vary only slightly from the 2009 IECC values, in that they are simply calculated to the nearest tenth, instead of rounded up to the nearest whole number. Calculating continuous insulation requirements to the nearest tenth is consistent with how continuous insulation requirements are addressed in Chapter 5 of the IECC, and is also consistent with how this product is labeled by various manufacturers. See the image below for an example of product labeling.

Conclusion:

Adopting the proposed modifications is intended to provide more prescriptive options, and to clear up confusion within the current table when users of the code choose to submit under the section on alternative materials, design and methods of construction when determining thermal equivalency.

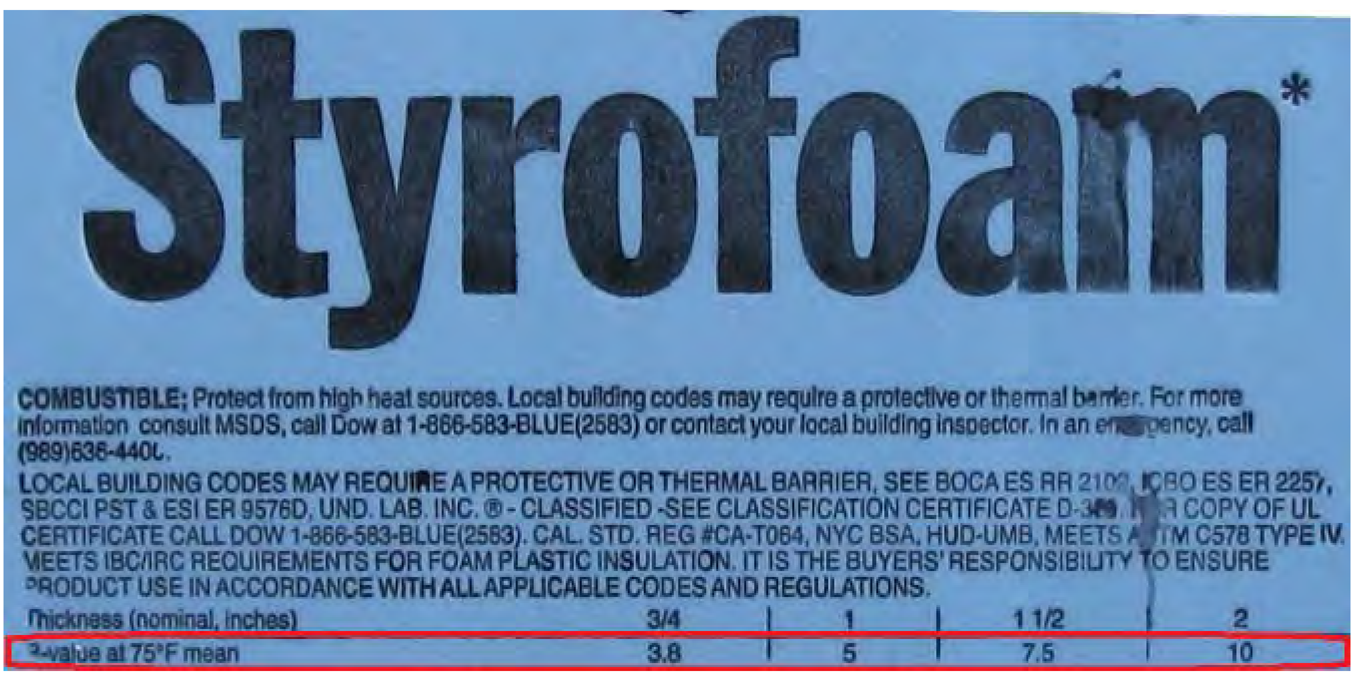
The change will encourage conservation of materials and energy by recognizing efficiency gains that can be realized by increasing the spacing of framing to 24" o.c. These efficiencies are realized without compromising the ability of the framing to withstand its structural load requirements.

This change would establish agreement among the methodology used to establish IECC U-factors, federally-sponsored code compliance software (RESCheck), and the steel equivalence table within the code.

The change illustrates continuous insulation values to the nearest tenth to reflect how this insulation is labeled by the manufacturer (See image below for example).

Coordination:

We also understand that because of the unpredictability of the code development process that if either R-13+3 or R-20+5 is not referenced within the "wood frame wall R-value" column of the 2012 IECC Table 402.1.1, we would request that ICC correlate that action into this proposal for the 2012 IECC.



Public Comment 2:

Joe Nebbia and Mike Moore, Newport Ventures, representing Steel Framing Alliance, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.2.5 Steel-frame ceilings, walls, and floors. Steel frame ceilings, walls and floors shall meet the insulation requirements of Table 402.2.5 or shall meet the *U*-factor requirements in Table 402.1.3. The calculation of the *U*-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

> ~~**Exception:** In Climate Zones 1 and 2, the continuous insulation requirements in Table 402.2.4 shall be permitted to be reduced to R-3 for steel frame wall assemblies with studs spaced at 24 inches (610 mm) on center.~~

TABLE 402.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL 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" O.C.
R-13	R-13 + 3.2 or R-19 + 2.1 or R-21 + ~~3~~ 2.0 or R-0 + 8.4
R-20	R-0 + 12.5 or R-13 + 7.3 or R-19 + 6.2 or R-21 + 5.9
R-21	R-0 + 13.0 or R-13 + 7.7 or R-19 + 6.6 or R-21 + 6.4 or R-25 + 8
	Steel Framed Wall, 24" O.C.
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-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 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.

Commenter's Reason: During the public hearings, we asked the committee to disapprove EC66 because it was incomplete. Based on feedback received during and following the public hearings, the following changes have been made to improve the original proposal:

1. This comment simply extends the intent of the exception to Section 402.2.5 of the 2009 IECC (achieving thermal equivalency between steel walls at 24" o.c. and wood frame walls at 16" o.c.) to each wood frame wall assembly listed in Table 402.1.1. For example, the 2009 IECC is limited in that it only draws one thermal equivalency comparison between wood frame walls at 16" o.c. and steel frame walls at 24" o.c., stating that R-13+3 in the 24" o.c. steel frame wall is equivalent to R-13 in the wood frame wall. While this one point of comparison can be verified to have equivalent thermal performance using DOE's REScheck software, the exception stops short in that it fails to capture options for achieving thermal equivalency when wood walls are insulated to values other than R-13.
2. REScheck was selected in developing the values for this comment 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 adoption of the 2004 IECC, and because it has more conservative values for steel framed assemblies (i.e. requires more insulation). Also, note that REScheck values result in a 24" o.c. steel frame R-13+3 wall being thermally equivalent to an R-13 wood framed. This is in exact agreement with the 2009 IECC exception to 402.2.5, which is being replaced by introducing a 24" o.c. equivalency path to Table 402.2.5.
3. The comment clearly distinguishes between equivalent R-values for steel framing at 16" o.c. and at 24" o.c. so that code officials are provided with better guidance as to which insulation values to require under different scenarios. All of the assemblies listed are supported within and verified by REScheck code compliance software.
4. Also included with this comment is a note to the ICC staff which requests staff to remove any new references within this table to wood wall assemblies that are not ultimately listed within Table 402.1.1 of the 2012 IECC. This will ensure that the steel equivalent assemblies listed within this table remain relevant, regardless of what other changes occur at the final action hearings.

Details of Calculations and Assumptions

REScheck's U-factors for wood framed walls were determined to be the following. Where there is overlap with IECC requirements in Table 402.1.3, these values are in exact agreement with the IECC as well:

Wood R-13: 0.082
Wood R-13+3: 0.071
Wood R-20: 0.059
Wood R-20+5: 0.048
Wood R-21: 0.057

Steel framed walls at 24" o.c. were then modeled in REScheck, and cavity and exterior insulation were added until equivalent U-factors were obtained for steel assemblies (resulting in thermal equivalence for wood and steel assemblies). Continuous insulation requirements were calculated to the nearest tenth of an R-value. Providing continuous insulation requirements to the nearest tenth is consistent with how continuous insulation requirements are addressed in Chapter 5 of the IECC, and is also in-step with how this product is labeled by the manufacturer. The results are proposed within the table.

Why this Change is Needed

Adopting the proposed changes will clear up confusion within the current table as to the framing spacing assumed when determining thermal equivalency. Also, the change will encourage conservation of materials and energy by recognizing efficiency gains that can be realized by increasing the spacing of framing to 24" o.c. These efficiencies are realized without compromising the ability of the framing to withstand its structural load requirements. Further, this change would establish agreement among the methodology used to establish IECC U-factors, federally-sponsored code compliance software (RESCheck), and the steel equivalence table within the code. Finally, the change provides continuous insulation values to the nearest tenth to reflect how this insulation is labeled by the manufacturer.

Note to ICC Staff: Submitted with this comment is a request to the ICC staff to remove references to wall assemblies introduced within this comment that are not listed within Table 402.1.1 of the 2012 IECC. For example, if either R-13+3 or R-20+5 is not referenced within the "wood frame wall R-value" column of the 2012 IECC Table 402.1.1, then we request that the corresponding reference also be omitted from Table 402.2.5 of the 2012 IECC.

Final Action: AS AM AMPC____ D

EC66-09/10-PART II
IRC Table N1102.2.5

Proposed Change as Submitted

Proponent: Mark Nowak, representing Steel Framing Alliance

PART II – IRC Energy

Revise table as follows:

TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL 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	
R-13	R-13 + ~~5~~ 3.2 or ~~R-15 + 4~~ R-19 + 2.1 or R-21 + ~~3~~ 2.0 or R-0 + ~~10~~ 8.4
~~R-19~~	~~R-13 + 9 or R-19 + 8 or R-25 + 7~~
R-20	R-0 + 12.5 or R-13 + 7.3 or R-19 + 6.2 or R-21 + 5.9
R-21	R-0 + 13.0 or R-13 + ~~10~~ 7.7 or R-19 + ~~9~~ 6.6 or R-21 + 6.4 or R-25 + 8
Steel Joist Floor	
R-13	R-19 in 2 x 6 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.

Reason: Currently, there are inconsistencies between ASHRAE 90.1, the IECC, and the IRC regarding determination of U-factors for steel framed walls. This proposal and its companion to the IECC serve to ensure that U-factors for steel framed walls are determined in accordance with ASHRAE 90.1 methodology across all codes. This change will remove confusion and simplify the code compliance process as well as permit greater transparency, consistency, and collaboration across codes.

ASHRAE 90.1 values should be used in this table and across the IECC and IRC for three reasons: first, because ASHRAE 90.1 is the only source of U-factors that were determined through the ANSI consensus process; second, because ASHRAE 90.1 clearly delineates their assumptions and methodology in calculating the U-factors (this is not done within the IRC or IECC); and third, because in some areas the IECC already uses the ASHRAE methodology for determining U-factors of steel framed walls (See IECC Table 502.2.1 and 502.2(1), which are sourced directly from ASHRAE 90.1-2007).

To ensure consistency with ASHRAE 90.1 and with the U-factors used in Table 502.1.2, U-factors for wood framed walls and their thermally equivalent steel framed wall counterparts were calculated based on ASHRAE 90.1 methodology as follows:

1. U-factors for wood framed walls were sourced from ASHRAE 90.1-2007, Table A 3.4 as follows: R-13 (0.089), R-20 (0.065, interpolated), R-21 (0.063). Note that IECC Table 502.1.2 uses identical U-factors where values overlap (e.g. 0.089 for R-13 wood framed wall).
2. The required cavity and continuous R-values for steel framed walls to match the U-factors for wood framed walls were then calculated based on guidance provided by ASHRAE 90.1-2007 Section A3.3.1, “Steel-Framed Walls, General”, and Section A9.4, “Calculation Procedures and Assumptions.” This methodology is the same calculation procedure that was used to derive Table A3.3 of ASHRAE 90.1, which provides a matrix of metal framed wall U-factors based on specified cavity and/or continuous insulation.
3. To be consistent with the formatting of prescriptive steel frame wall requirements in IECC Table 502.2(1), requirements for steel framed wall continuous insulation R-values were then rounded to the nearest 0.1.

Submitted below are ASHRAE 90.1-2007 Table A3.4 and Table A3.3, with mark-ups showing how wood framed wall U-factors were sourced and how steel framed wall equivalent R-values were sourced. Table A3.3 contains mark-ups that highlight steel framed wall insulation R-values that would result in thermal equivalence to an R-13 wood framed wall.

TABLE A3.4 Assembly U-Factors for Wood-Frame Walls

Targeted U-Factor for Thermal Equivalence with wood framed R-13 wall

Framing Type and Spacing Width (Actual Depth)	Cavity Insulation R-Value: Rated (Effective Installed [see Table A9.4C])	Overall U-Factor for Entire Base Wall Assembly	Overall U-Factor for Assembly of Base Wall Plus Continuous Insulation — Rated R-Value of Continuous Insulation: R-1.00	R-2.00	R-3.00	R-4.00	R-5.00	R-6.00	R-7.00	R-8.00	R-9.00	R-10.00	R-11.00	R-12.00	R-13.00
Wood Studs at 16 in. on center															
3.5 in. depth	None (0.0)	**0.292**	0.223	0.181	0.152	0.132	0.116	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060
	R-11 (11.0)	**0.096**	0.087	0.079	0.073	0.068	0.063	0.059	0.056	0.053	0.050	0.048	0.046	0.044	0.042
	R-13 (13.0)	**0.089**	0.080	0.074	0.068	0.063	0.059	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.040
	R-15 (15.0)	**0.083**	0.075	0.069	0.064	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038
5.5 in. depth	R-19 (18.0)	**0.067**	0.062	0.058	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034
	R-21 (21.0)	**0.063**	0.058	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.032

Graphic A: ASHRAE 90.1-2007 Table A3.4. Provides the U-factor for an R-13 wood framed wall.

Targeted U-factor for thermal equivalence with R-13 wood framed wall = 0.089.

TABLE A3.3 Assembly U-Factors for Steel-Frame Walls

R-13 + 3.2

R-0 + 8.4

R-19 + 2.1

R-21 + 2.0

Framing Type and Spacing Width (Actual Depth)	Cavity Insulation R-Value: Rated (Effective Installed [see Table A9.2B])	Overall U-Factor for Entire Base Wall Assembly	Overall U-Factor for Assembly of Base Wall Plus Continuous Insulation — Rated R-Value of Continuous Insulation: R-1.00	R-2.00	R-3.00	R-4.00	R-5.00	R-6.00	R-7.00	R-8.00	R-9.00	R-10.00	R-11.00	R-12.00	R-13.00
Steel Framing at 16 in. on center															
3.5 in. depth	None (0.0)	**0.352**	0.260	0.207	0.171	0.146	0.128	0.113	0.102	0.092	0.084	0.078	0.072	0.067	0.063
	R-11 (5.5)	**0.132**	0.117	0.105	0.095	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.051	0.049
	R-13 (6.0)	**0.124**	0.111	0.100	0.091	0.083	0.077	0.071	0.066	0.062	0.059	0.055	0.052	0.050	0.048
	R-15 (6.4)	**0.118**	0.106	0.096	0.087	0.080	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047
6.0 in. depth	R-19 (7.1)	**0.109**	0.099	0.090	0.082	0.076	0.071	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045
	R-21 (7.4)	**0.106**	0.096	0.087	0.080	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047	0.045

Graphic B: ASHRAE 90.1-2007 Table A3.3.

Additionally, this proposal removes the reference to R-19 since there is no longer a wood frame wall R-value prescription with this value that would require a steel framed thermal equivalent. An R-20 equivalent is added to provide an equivalent path to the R-20 wood framed wall prescription that was introduced in the 2009 code.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: NOWAK-EC-4-T. 402.2.5-RE-1-T. N1102.2.5

Public Hearing Results

PART II - IRC

Committee Action: Disapproved

Committee Reason: The committee was concerned that the proposal would actually resolve conflicts with ASHRAE 90.1 as it appears that there would still be conflicts.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jonathan Humble, representing American Iron and Steel Institute, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.2.5 Steel-frame ceilings, walls, and floors. Steel frame ceilings, walls and floors shall meet the insulation requirements of Table N1102.2.5 or shall meet the *U*-factor requirements in Table N1102.1.2. The calculation of the *U*-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

> ~~**Exception:** In Climate Zones 1 and 2, the continuous insulation requirements in Table N1102.2.5 shall be permitted to be reduced to R-3 for steel frame wall assemblies with studs spaced at 24 inches (610 mm) on center.~~

TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL 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" O.C.	
R-13	R-13 + ~~3.2~~ 4.2 or R-15+3.8 or R-19 + 2.1 or R-19+3.1 or R-21 + ~~2.0~~ 2.8 or R-0 + ~~8.4~~ 9.3
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-20	R-0 + ~~12.5~~ 14.0 or R-13 + ~~7.3~~ 8.9 or R-15+8.5 or R-19 + 6.2 or R-19+7.8 or R-21 + ~~5.9~~ 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 + ~~13.0~~ 14.6 or R-13 + ~~7.7~~ 9.5 or R15+9.1 or R-19 + ~~6.6~~ 8.4 or R-21 + ~~6.4~~ 8.1 or R-25 + ~~8~~ 7.7
Steel Framed Wall, 24" O.C.	
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-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 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.

Commenter's Reason: We are proposing to modify Table N1102.2.5 by:

- Deleting the exception to Section N1102.2.5, and
- Adding additional cold-formed steel wall framing equivalent R-values, and
- Expanding the table from 16 inch o/c spacing options to both 16 and 24 inch o/c options.

History:
During the public hearings, the proponent to this proposal asked the committee to disapprove EC66-09/10 because it was incomplete. Based on feedback received during and following the public hearings, the American Iron and Steel Institute is proposing the following changes as improvements to the original proposal within this comment. The intent is to make complete the original intent of the proposal, that of listing a greater number of options, thus permitting the user of the code to avoid having to execute a calculation to demonstrate equivalency for those simple design assemblies which were not listed. In this case, two new wood-framed R-value requirements have been added (R-13+3 and R-20+5) to ensure that this table provides equivalent R-values for each wood-framed wall assembly that was approved during the 2009 public hearings or was present in the 2009 IRC.

Section N1102.2.5:
We propose to delete the exception under Section N1102.2.5. The exception is no longer necessary as a result of the proposal to add new 24 inch on center cold-formed steel assemblies to the conversion Table N1102.2.5.
New Values for Table:
The initial proposal used ASHRAE values to develop thermal equivalence, while this comment uses the Department of Energy's REScheck software to develop thermal equivalence. REScheck was selected 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 adoption of the 2004 IECC, and has more conservative values for steel framed assemblies (i.e. requires more insulation).
Details of Calculations and Assumptions:
RESCheck's U-factors for wood framed walls were determined to be the following. Where there is overlap with IRC requirements in Table N1102.1.2, these values are in agreement with the IRC as well.

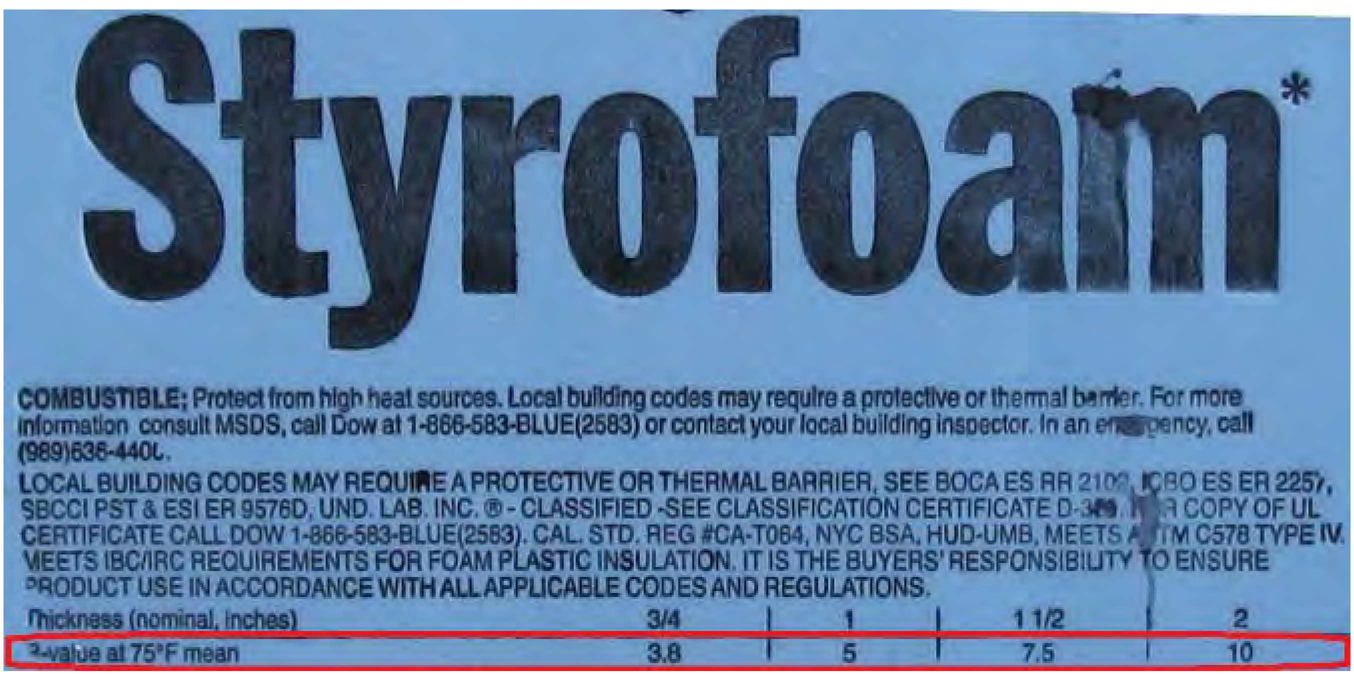
Framing	R-value	U-factor
Wood	R-13	0.082
Wood	R-13+3ci	0.071
Wood	R-20	0.059
Wood	R-20+5ci	0.048
Wood	R-21	0.057

Steel framed walls at 16" o.c. and 24" o.c. were then modeled in RESCheck, and cavity and exterior insulation were added until equivalent U-factors were obtained for steel assemblies which resulted in R-values and U-factors that can be considered equivalent to wood wall assemblies. The results are proposed within the table. Notice that the R-value requirements for 16" o.c. steel framed walls vary only slightly from the 2009 IECC and IRC values, in that they are simply calculated to the nearest tenth, instead of rounded up to the nearest whole number. Calculating continuous insulation requirements to the nearest tenth is consistent with how continuous insulation requirements are addressed in Chapter 5 of the IECC, and is also consistent with how this product is labeled by various manufacturers. See the image below for an example of product labeling.
Conclusion:
Adopting the proposed modifications is intended to provide more prescriptive options, and to clear up confusion within the current table when users of the code choose to submit under the section on alternative materials, design and methods of construction when determining thermal equivalency.

The change will encourage conservation of materials and energy by recognizing efficiency gains that can be realized by increasing the spacing of framing to 24" o.c. These efficiencies are realized without compromising the ability of the framing to withstand its structural load requirements.

This change would establish agreement among the methodology used to establish IECC and IRC-Energy U-factors, federally-sponsored code compliance software (RESCheck), and the steel equivalence table within the code.

The change illustrates continuous insulation values to the nearest tenth to reflect how this insulation is labeled by the manufacturer (See image below for example).
Coordination:
We also understand that because of the unpredictability of the code development process that if either R-13+3 or R-20+5 is not referenced within the "wood frame wall R-value" column of the 2012 IRC, we would request that ICC correlate that action into this proposal for the 2012 IRC.



Public Comment 2:

Joe Nebbia and Mike Moore, Newport Ventures, representing Steel Framing Alliance, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.2.5 Steel-frame ceilings, walls, and floors. Steel frame ceilings, walls and floors shall meet the insulation requirements of Table N1102.2.5 or shall meet the *U*-factor requirements in Table N1102.1.2. The calculation of the *U*-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

> ~~**Exception:** In Climate Zones 1 and 2, the continuous insulation requirements in Table N1102.2.5 shall be permitted to be reduced to R-3 for steel frame wall assemblies with studs spaced at 24 inches (610 mm) on center.~~

TABLE N1102.2.5
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION (R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL 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"O.C.	
R-13	R-13 + 3.2 or R-19 + 2.1 or R-21 + ~~3~~ 2.0 or R-0 + ~~10~~ 8.4
R-20	R-0 + 12.5 or R-13 + 7.3 or R-19 + 6.2 or R-21 + 5.9
R-21	R-0 + 13.0 or R-13 + 7.7 or R-19 + 6.6 or R-21 + 6.4 or R-25 + 8
Steel Framed Wall, 24" O.C.	
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-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
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R-13	R-19 in 2 x 6 R-19 + 6 in 2 x 8 or 2 x 10
R-19	R-19 + 6 in 2 x 6 R-19 + 12 in 2 x 8 or 2 x 10

a. Cavity insulation *R*-value is listed first, followed by continuous insulation *R*-value.
b. Insulation exceeding the height of the framing shall cover the framing.

Commenter's Reason: During the public hearings, we asked the committee to disapprove EC66 because it was incomplete. Based on feedback received during and following the public hearings, the following changes have been made to improve the original proposal:

1. This comment simply extends the intent of the exception to Section N1102.2.5 of the 2009 IRC (achieving thermal equivalency between steel walls at 24" o.c. and wood frame walls at 16" o.c.) to each wood frame wall assembly listed in Table N1102.2.5. For example, the 2009 IRC is limited in that it only draws one thermal equivalency comparison between wood frame walls at 16" o.c. and steel frame walls at 24" o.c., stating that R-13+3 in the 24" o.c. steel frame wall is equivalent to R-13 in the wood frame wall. While this one point of comparison can be verified to have equivalent thermal performance using DOE's REScheck software, the exception stops short in that it fails to capture options for achieving thermal equivalency when wood walls are insulated to values other than R-13.
2. REScheck was selected in developing the values for this comment 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 adoption of the 2004 IECC, and because it has more conservative values for steel framed assemblies (i.e. requires more insulation). Also, note that REScheck values result in a 24" o.c. steel frame R-13+3 wall being thermally equivalent to an R-13 wood framed. This is in exact agreement with the 2009 IRC exception to N1102.2.5, which is being replaced by introducing a 24" o.c. equivalency path to Table N1102.2.5.
3. The comment clearly distinguishes between equivalent R-values for steel framing at 16" o.c. and at 24" o.c. so that code officials are provided with better guidance as to which insulation values to require under different scenarios. All of the assemblies listed are supported within and verified by REScheck code compliance software.
4. Also included with this comment is a note to the ICC staff which requests staff to remove any new references within this table to wood wall assemblies that are not ultimately listed within Table N1102.1 of the 2012 IRC. This will ensure that the steel equivalent assemblies listed within this table remain relevant, regardless of what other changes occur at the final action hearings.

Details of Calculations and Assumptions

REScheck's U-factors for wood framed walls were determined to be the following. Where there is overlap with IRC requirements in Table N1102.1.2, these values are in exact agreement with the IRC as well:

Wood R-13: 0.082
Wood R-13+3: 0.071
Wood R-20: 0.059
Wood R-20+5: 0.048
Wood R-21: 0.057

Steel framed walls at 24" o.c. were then modeled in REScheck, and cavity and exterior insulation were added until equivalent U-factors were obtained for steel assemblies (resulting in thermal equivalence for wood and steel assemblies). Continuous insulation requirements were calculated to the nearest tenth of an R-value. Providing continuous insulation requirements to the nearest tenth is consistent with how continuous insulation requirements are addressed in Chapter 5 of the IECC, and is also in-step with how this product is labeled by the manufacturer. The results are proposed within the table.

Why this Change is Needed

Adopting the proposed changes will clear up confusion within the current table as to the framing spacing assumed when determining thermal equivalency. Also, the change will encourage conservation of materials and energy by recognizing efficiency gains that can be realized by increasing the spacing of framing to 24" o.c. These efficiencies are realized without compromising the ability of the framing to withstand its structural load requirements. Further, this change would establish agreement among the methodology used to establish IRC/IECC U-factors, federally-sponsored code compliance software (REScheck), and the steel equivalence table within the code. Finally, the change provides continuous insulation values to the nearest tenth to reflect how this insulation is labeled by the manufacturer.

Note to ICC Staff: Submitted with this comment is a request to the ICC staff to remove references to wall assemblies introduced within this comment that are not listed within Table N1102.1 of the 2012 IRC. For example, if either R-13+3 or R-20+5 is not referenced within the "wood frame wall R-value" column of the 2012 IRC Table N1102.1, then we request that the corresponding reference also be omitted from Table N1102.2.5 of the 2012 IRC.

Final Action: AS AM AMPC____ D

EC68-09/10-PART I
402.2.11, 402.3.5

<u>Proposed Change as Submitted</u>

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Revise as follows:

402.2.11 Thermally isolated sunroom insulation. <u>All *sunrooms* shall meet the insulation requirements of this code.</u>

> **<u>Exception:</u>** <u>For *sunrooms* with *thermal isolation*, the following exceptions to the insulation *requirements* of this code shall apply: (1) </u>The minimum ceiling insulation R-values shall be R-~~19~~<u>24</u> in Zones 1 through 4 and R-~~24~~<u>30</u> in Zones 5 through 8~~.~~<u>; and (2) </u>The minimum wall R-value shall be R-13 in all zones. New wall(s) separating a *sunroom* <u>with *thermal isolation*</u> from *conditioned space* shall meet the *building thermal envelope* requirements <u>of this code</u>.

402.3.5 Thermally isolated sunroom U-factor. <u>All *sunrooms* shall meet the fenestration requirements of this code.</u>

> **<u>Exception:</u>** For <u>*sunrooms* with *thermal isolation* in </u>Zones 4 through 8, the <u>following exceptions to the fenestration requirements of this code shall apply: (1) the </u>maximum fenestration U-factor shall be ~~0.50~~ <u>0.45;</u> and <u>(2)</u> the maximum skylight U-factor shall be 0.7<u>0</u>~~5~~. New ~~windows and doors~~ <u>fenestration</u> separating the *sunroom* <u>with *thermal isolation*</u> from *conditioned space* shall meet the *building thermal envelope* requirements<u> of this code</u>.

Reason: This proposal editorially clarifies that the requirements for thermally isolated *sunrooms* in these sections are exceptions and only apply to *sunrooms* that have *thermal isolation* and that all other sunrooms must comply with all of the requirements of the code. The proposal also tightens the requirements in the exceptions. It is reasonable to require some improvement in *sunrooms* with *thermal isolation*, particularly given the amount of glass and the relatively minimal current requirements.

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

ICCFILENAME: PRINDLE-EC-18-402.2.11-N1102.2.11

<u>Public Hearing Results</u>

PART I - IECC
Committee Action: **Approved as Modified**

Modify proposal as follows:

402.2.11 ~~Thermally isolated~~ Sunroom insulation. All *sunrooms* shall meet the insulation requirements of this code.

Exception: For *sunrooms* with *thermal isolation*, the following exceptions to the insulation *requirements* of this code shall apply: (1) The minimum ceiling insulation R-values shall be <u>R-19</u>~~24~~ in Zones 1 through 4 and <u>R-24</u>~~30~~ in Zones 5 through 8.; and (2) The minimum wall R-value shall be R-13 in all zones. New wall(s) separating a *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

402.3.5 ~~Thermally isolated~~ Sunroom U-factor. All *sunrooms* shall meet the fenestration requirements of this code.

Exception: For *sunrooms* with *thermal isolation* in Zones 4 through 8, the following exceptions to the fenestration requirements of this code shall apply: (1) the maximum fenestration U-factor shall be 0.50 0.45; and (2) the maximum skylight U-factor shall be 0.705. New fenestration separating the *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

Committee Reason: The code change revises the language to accurately reflect the code requirements and therefore eliminate confusion. The modification revises the R values in the exception back to the present code values.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment 1:

Bill Prindle, ICF International , representing Energy Efficient Codes Coalition, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

402.2.11 Sunroom insulation. All *sunrooms* enclosing conditioned space shall meet the insulation requirements of this code.

> **Exception:** For *sunrooms* with *thermal isolation*, and enclosing conditioned space, the following exceptions to the insulation *requirements* of this code shall apply: (1) The minimum ceiling insulation R-values shall be R-19 in Zones 1 through 4 and R-24 in Zones 5 through 8; and (2) The minimum wall R-value shall be R-13 in all zones. New wall(s) separating a *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

402.3.5 ~~Thermally isolated~~ Sunroom U-factor. All *sunrooms* and enclosing conditioned space, shall meet the fenestration requirements of this code.

> **Exception:** For *sunrooms* with *thermal isolation* and enclosing conditioned space, in Zones 4 through 8, the following exceptions to the fenestration requirements of this code shall apply: (1) the maximum fenestration U-factor shall be 0.50 0.45; and (2) the maximum skylight U-factor shall be 0.705. New fenestration separating the *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code

Commenter's Reason: *EC68 should be approved as modified by this public comment.*

The proposed modifications are intended to reflect the modification approved by the IECC Committee, as well as clarify that these requirements apply only to sunrooms enclosing conditioned space. While this final clarification may already be apparent from current code language, this clarification will help to ensure consistent and correct application of the requirements.

This proposal should be approved to clarify the application of the energy code only to sunrooms that enclose conditioned space and to increase the energy efficiency of such sunrooms as described in the original reason statement.

Public Comment 2:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, request Approval as Modified by this Public Comment.

Further modify the proposal as follows:

402.2.11 Sunroom insulation. All *sunrooms* enclosing conditioned space shall meet the insulation requirements of this code.

Exception: For *sunrooms* with *thermal isolation*, enclosing conditioned space, the following exceptions to the insulation *requirements* of this code shall apply: (1) The minimum ceiling insulation R-values shall be R-19 in Zones 1 through 4 and R-24 in Zones 5 through 8.; and (2) The minimum wall R-value shall be R-13 in all zones. New wall(s) separating a *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

402.3.5 Sunroom U-factor. All *sunrooms* enclosing conditioned space shall meet the fenestration requirements of this code.

> **Exception:** For *sunrooms* with *thermal isolation* enclosing conditioned space, in Zones 4 through 8, the following exceptions to the fenestration requirements of this code shall apply: (1) the maximum fenestration U-factor shall be 0.50 0.45; and (2) the maximum skylight U-factor shall be 0.705. New fenestration separating the *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

Commenter's Reason: Because we were involved in an elaborate collaboration process prior to submitting public comments we are aware, and agree with, the public comment (as listed above) that will be submitted by the proponent (EECC) to clarify this code section by including conditioned space and propose the same comment**.**

We agree that the code as currently written for sunrooms is unclear, especially for thermally isolated sunrooms. However, the original EC68 proposal did not seem to add clarity. We worked with the proponents to gain some clarity for the Code Official who has to interpret this section. We recommend approval as modified by the proponent's public comment.

The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.
Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

Final Action: AS AM AMPC____ D

EC68-09/10-PART II
IRC N1102.2.11, N1102.3.5

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1102.2.11 Thermally isolated sunroom insulation. All *sunrooms* shall meet the insulation requirements of this code.

> **Exception:** For *sunrooms* with *thermal isolation*, the following exceptions to the insulation *requirements* of this code shall apply: (1) The minimum ceiling insulation R-values shall be R-~~19~~24 in Zones 1 through 4 and R-~~24~~30 in Zones 5 through 8~~.~~; and (2). The minimum wall R-value shall be R-13 in all zones. New wall(s) separating a *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

N1102.3.5 Thermally isolated sunroom U-factor. All *sunrooms* shall meet the fenestration requirements of this code.

> **Exception:** For *sunrooms* with *thermal isolation* in Zones 4 through 8, the following exceptions to the fenestration requirements of this code shall apply: (1) the maximum fenestration U-factor shall be ~~0.50~~ 0.45; and (2) the maximum skylight U-factor shall be 0.70~~5~~. New ~~windows and doors~~ fenestration separating the *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

Reason: This proposal editorially clarifies that the requirements for thermally isolated *sunrooms* in these sections are exceptions and only apply to *sunrooms* that have *thermal isolation* and that all other sunrooms must comply with all of the requirements of the code. The proposal also tightens the requirements in the exceptions. It is reasonable to require some improvement in *sunrooms* with *thermal isolation*, particularly given the amount of glass and the relatively minimal current requirements.

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

ICCFILENAME: PRINDLE-EC-18-402.2.11-N1102.2.11

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: The proposal raises the R values for thermally isolated sunrooms without any cost justification, or technical justification. For thermally isolated sunrooms the committee questions whether raising R-values would have a significant impact on energy usage.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.2.11 ~~Thermally isolated sunroom~~ Sunroom insulation. All *sunrooms* enclosing conditioned space shall meet the insulation requirements of this code.

Exception: For *sunrooms* with *thermal isolation* and enclosing conditioned space, the following exceptions to the insulation *requirements* of this code shall apply: (1) The minimum ceiling insulation R-values shall be R-~~24~~ 19 in Zones 1 through 4 and R-~~30~~ 24 in Zones 5 through 8~~.~~; and (2). The minimum wall R-value shall be R-13 in all zones. New wall(s) separating a *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

N1102.3.5 ~~Thermally isolated sunroom~~ Sunroom U-factor. All *sunrooms* enclosing conditioned space shall meet the fenestration requirements of this code.

Exception: For *sunrooms* with *thermal isolation* and enclosing conditioned space in Zones 4 through 8, the following exceptions to the fenestration requirements of this code shall apply: (1) the maximum fenestration U-factor shall be 0.45; and (2) the maximum skylight U-factor shall be 0.70. New fenestration separating the *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

Commenter's Reason: *EC68 should be approved as modified by this public comment.*

The proposed modifications are intended to reflect the modification approved by the IECC Committee, as well as clarify that these requirements apply only to sunrooms enclosing conditioned space. While this final clarification may already be apparent from current code language, this clarification will help to ensure consistent and correct application of the requirements.

This proposal should be approved to clarify the application of the energy code only to sunrooms that enclose conditioned space and to increase the energy efficiency of such sunrooms as described in the original reason statement.

Public Comment 2:

Ellen Eggerton, Fairfax County, VA, representing Virginia Building and Code Officials Association (VBCOA), requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.2.11 ~~Thermally isolated sunroom~~ Sunroom insulation. All *sunrooms* shall meet the insulation requirements of this code.

Exception: For *sunrooms* with *thermal isolation*, the following exceptions to the insulation *requirements* of this code shall apply: (1) The minimum ceiling insulation R-values shall be R-~~24~~ 19 in Zones 1 through 4 and R-~~30~~ 24 in Zones 5 through 8; and (2). The minimum wall R-value shall be R-13 in all zones. New wall(s) separating a *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

N1102.3.5 ~~Thermally isolated sunroom~~ Sunroom U-factor. All *sunrooms* shall meet the fenestration requirements of this code.

Exception: For *sunrooms* with *thermal isolation* in Zones 4 through 8, the following exceptions to the fenestration requirements of this code shall apply: (1) the maximum fenestration U-factor shall be 0.~~45~~ 50; and (2) the maximum skylight U-factor shall be 0.~~70~~ 75. New fenestration separating the *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

Commenter's Reason: The purpose of this public comment is to change IRC chapter 11 sections to match the IECC changes and wording approved by the IECC committee in Baltimore. This change improves the enforceability and language of the code to improve understanding by the builder and code official to clarify when an exception applies. This corrects the concerns the IRC committee had in the original code change by putting the insulation values back to the current code yet improves the language for the exception. **Code officials have issues trying to enforce conflicting code language between the IRC and the IECC.**

Therefore I recommend to Approve as Modified for Part II – IRC sections **N1102.2.11, N1102.3.5** to be the same as Approved as Modified by the committee for Part I – IECC sections **402.2.11, 402.3.5**. The proposal was modified in the IECC hearings to return the R-values to current code but only change the language for clarity. This revised language will more "accurately reflect the code requirements and therefore eliminates confusion" as published in the IECC committee reason statement.

Public Comment 3:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.2.11 ~~Thermally isolated sunroom~~ Sunroom insulation. All *sunrooms* enclosing conditioned space shall meet the insulation requirements of this code.

Exception: For *sunrooms* with *thermal isolation* enclosing conditioned space, the following exceptions to the insulation *requirements* of this code shall apply: (1) The minimum ceiling insulation R-values shall be R-~~24~~ 19 in Zones 1 through 4 and R-~~30~~ 24 in Zones 5 through 8; and (2). The minimum wall R-value shall be R-13 in all zones. New wall(s) separating a *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

N1102.3.5 Thermally isolated sunroom U-factor. All *sunrooms* enclosing conditioned space shall meet the fenestration requirements of this code.

Exception: For *sunrooms* with *thermal isolation* enclosing conditioned space in Zones 4 through 8, the following exceptions to the fenestration requirements of this code shall apply: (1) the maximum fenestration U-factor shall be 0.45; and (2) the maximum skylight U-factor shall be 0.70. New fenestration separating the *sunroom* with *thermal isolation* from *conditioned space* shall meet the *building thermal envelope* requirements of this code.

Commenter's Reason: Because we were involved in an elaborate collaboration process prior to submitting public comments we are aware, and agree with, the public comment (as listed above) that will be submitted by the proponent (EECC) to clarify this code section by including conditioned space and propose the same comment**.**

We agree that the code as currently written for sunrooms is unclear, especially for thermally isolated sunrooms. However, the original EC68 proposal did not seem to add clarity. We worked with the proponents to gain some clarity for the Code Official who has to interpret this section. We recommend approval as modified by the proponent's public comment.

The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.
Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

Final Action: AS AM AMPC____ D

EC70-09/10
202

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

Revise definition as follows:

SKYLIGHT. Glass or other transparent or translucent glazing material installed at a slope of ~~15~~ less than 60 degrees (0.26 rad) ~~or more from vertical~~ from horizontal. Glazing material in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls is included in this definition.

Reason: For consistency with ASHRAE Standard 90.1. Currently ASHRAE 90.1-07 defines skylights as having a slope of less than 60 degrees from the horizontal plane. Other fenestration, even if mounted on the roof of a building, is considered *vertical fenestration*.

Cost Impact: The code change could increase or decrease the cost of construction to the degree that the current IECC would consider some glazing vertical fenestration while ASHRAE 90.1-07 would consider the same glazing a skylight. There are different thermal requirements for skylights and vertical fenestration.

Analysis: This will create a different definition than is currently in the IBC and IRC.

ICCFILENAME: MAJETTE-EC-37-202

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: This proposal would provide consistency in terminology with ASHRAE 90.1. In this context, for the application of the energy code, consistency with ASHRAE is useful.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jeff Inks, representing Window & Door Manufacturers Association, requests Disapproval.

Commenter's Reason: WDMA is strongly urging disapproval of EC-70 because there is no technical substantiation of any kind to justify the revision. The current IECC definition is consistent with skylight definitions in the IBC, IRC, AAMA/WDMA/CSA 101/I.S.2/A440 (NAFS) and NFRC 600. The approved revision creates an unjustified conflict in the IECC with its ICC companion documents and reference standards simply for the sake of making the IECC consistent with ASHRAE 90.1 If there is concern that the definition in ASHRAE 90.1 which results in a definition that revised definition approved by the committee is in conflict with skylight should be disapproved.

Public Comment 2:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, request Disapproval.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This code change creates I-code inconsistency. The proposed skylight definition conflicts with existing skylight definitions in the IBC (202) and the IRC 308.6.1. Also, there was no part II to align the IRC. We recommend disapproval of EC70.

Final Action: AS AM AMPC____ D

EC71-09/10-PART I
202 (New), 402.3 (New), 402.3.1 (New), Table 402.3(1) (New), Chapter 6 (New)

Proposed Change as Submitted

Proponent: Ronald Majette, US Department of Energy

PART I – IECC

1. Add new definitions as follows:

REFLECTANCE, SOLAR. The ratio of reflected solar flux to incident solar flux.

ABSORPTANCE, SOLAR. The difference 1.0 minus the *solar reflectance*.

2. Add new text and table as follows:

402.3 Solar properties of opaque surfaces (Prescriptive).

402.3.1 Solar absorptance of roofs. Roofs in climate zones 1, 2, and 3 having a ratio of rise to run less than or equal to 2:12 (9.5 degrees from horizontal) shall be provided with roofing materials having a solar absorptance not exceeding 0.75, as tested in accordance with ASTM E1918 or C1549. For unrated roofing materials, solar absorptance values shall be taken from Table 402.3(1).

TABLE 402.3(1)
DEFAULT ROOF SOLAR ABSORPTANCE VALUES

ROOF MATERIAL	SOLAR ABSORPTANCE
White Composition Shingles	0.80
White Tile (including concrete)	0.60
White Metal	0.50
All Others	0.92

3. Add new standards to Chapter 6 as follows:

ASTM
E1918-06 Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
C1549-04 Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field

Reason: The U.S. Department of Energy has estimated that reducing the solar absorptivity of all buildings and roads could affect the equivalent carbon reduction of removing all automobiles in the world from the road for 11 years. This proposal extends the solar absorptance currently used in the standard reference design of the Simulated Performance Alternative to the prescriptive compliance path. Provisions for solar reflectance ratings and default values for unrated materials are consistent with the 2006 Mortgage Industry National Home Energy Rating Systems Standards (RESNET 2006).

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

Analysis: A review of the standard(s) proposed for inclusion in the code, ASTM E1918-06 and ASTM C1549-04, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: MAJETTE-EC-66-202-CH 4-IRC R202-CH 11-REDONE

Public Hearing Results

PART I - IECC
Committee Action: **Disapproved**

Committee Reason: The logical construct of the language to allow determination of solar absorptance is confusing. The proposed language is not consistent and not enforceable.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, US Department of Energy, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

REFLECTANCE, SOLAR. The ratio of reflected solar flux to incident solar flux.

ABSORPTANCE, SOLAR. The difference 1.0 minus the *solar reflectance*.

402.3 Solar properties of opaque surfaces (Prescriptive).

402.3.1 Solar absorptance of roofs. Roof Solar Reflectance and Thermal Roofs in climate zones 1, 2, and 3 having a ratio of rise to run less than or equal to 2:12 (9.5 degrees from horizontal) shall be provided with roofing materials having a solar absorptance not exceeding 0.75, as tested in accordance with ASTM E1918 or C1549. For unrated roofing materials, solar absorptance values shall be taken from Table 402.3(1). **Emittance.** Low-sloped roofs, with a slope < 2:12, directly above cooled *conditioned spaces* in climate zones 1, 2, and 3 shall comply with at least one option in Table 402.3(1).

Exceptions: The following are exempt from the requirements in Table 402.3(1):

1. Portions of roofs that include or are covered by:
   a. Photovoltaic systems or components
   b. Solar air or water heating systems or components
   c. Roof gardens or landscaped roofs
   d. Above-roof decks or walkways
   e. Skylights
   f. HVAC systems, components, and other opaque objects mounted above the roof
2. Portions of roofs shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings
3. Ballasted roofs with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or 23 lbs/ft2 pavers (117 kg/m2)
4. Roofs where a minimum of 75% of the roof area meets a minimum of one of the exceptions above.

TABLE 402.3(1)
DEFAULT ROOF SOLAR ABSORPTANCE VALUES

ROOF MATERIAL	SOLAR ABSORPTANCE
White Composition Shingles	0.80
White Tile (including concrete)	0.60
White Metal	0.50
All Others	0.92

TABLE 402.3(1)
Minimum Roof Reflectance and Emittance Options[a]

Three-year aged solar reflectance[b] of 0.55 and three-year aged thermal emittance[b] of 0.75
Initial solar reflectance[b] of 0.70 and initial thermal emittance[b] of 0.75
Three-year-aged solar reflectance index[c] of 64
Initial solar reflectance index[c] of 82

a. The use of area-weighted averages to meet these requirements shall be permitted. Materials lacking initial tested values for either *solar reflectance* or *thermal reflectance*, shall be assigned both an initial *solar reflectance* of 0.10 and an initial *thermal emittance* of 0.90. Materials lacking three-year aged tested values for either *solar reflectance* or *thermal reflectance*, shall be assigned both a three-year aged *solar reflectance* of 0.10 and a three-year aged *thermal emittance* of 0.90.
b. Tested solar reflectance and thermal emittance shall be in accordance with CRRC-1 Standard.
c. Solar reflectance index (SRI) determined in accordance with ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft^2-F (12W/m^2.K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance. Calculation of initial SRI shall be based on initial tested values of solar reflectance and *thermal emittance*.

Add new standards to Chapter 6 as follows:

ASTM International

E1980-2001 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low Sloped Opaque Surfaces Table 402.3(1), Table 502.2.1.1

Cool Roof Rating Council (CRRC) 1610 Harrison St, Oakland, CA 94612

ANSI/CRRC-1 Standard (2010) Cool Roof Rating Council CRRC-1 Standard Table 402.3(1), Table 502.2.1.1

Commenter's Reason: This public comment modifies the original proposal in response to input from numerous stakeholders. DOE's original proposal was formatted to match the terminology in RESNET's home energy rating system procedures. This modification recasts the proposal into terms more familiar to the building industry.

Studies illustrating the savings from cool roofs are available on the Cool Roof Ratings Council website. http://www.coolroofs.org/article.html#energy For example, the Florida Solar Energy Center tested seven retail shops in a strip mall in Cocoa, Florida over a two-year period, which allowed surface degradation over a year period to be accounted for. The roof was resurfaced to alter the surface reflectivity from approximately 29% to 75%. There was a 25.3% average reduction in summer space cooling energy in the seven shops.

Parker, D., J. Sonne, J. Sherwin. 1997. Demonstration of Cooling Savings of Light Colored Roof Surfacing in Florida Commercial Buildings: Retail Strip Mall. Florida Solar Energy Center. Cocoa, Florida.

Public Comment 2:

Craig Conner, Building Quality, representing himself requests Approval as Modified by this Public Comment.

Replace proposal as follows:

402.3 Roof solar reflectance and thermal emittance. Low-sloped roofs, with a slope <2:12, directly above cooled *conditioned spaces* in climate zones 1, 2, and 3 shall comply with a minimum of one option in Table 402.3.

Exceptions: The following are exempt from the requirements in Table 402.3:

1. Portions of roofs that include or are covered by:
   a. Photovoltaic systems or components
   b. Solar air or water heating systems or components
   c. Roof gardens or landscaped roofs
   d. Above-roof decks or walkways
   e. Skylights
   f. HVAC systems, components, and other opaque objects mounted above the roof
2. Portions of roofs shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings
3. Ballasted roofs with a minimum stone ballast of 17 lbs/ft^2 (74 kg/m^2) or 23 lbs/ft^2 pavers (117 kg/m^2)
4. Roofs where a minimum of 75% of the roof area meets a minimum of one of the exceptions above.

Table 402.3 Minimum Roof Reflectance and Emittance Options[a]

Three-year aged solar reflectance[b] of 0.55 and three-year aged thermal emittance[c] of 0.75
Initial solar reflectance[b] of 0.70 and initial thermal emittance[c] of 0.75
Three-year-aged solar reflectance index[d] of 64
Initial solar reflectance index[d] of 82

a. The use of area-weighted averages to meet these requirements shall be permitted. Materials lacking initial tested values for either *solar reflectance* or *thermal emittance*, shall be assigned both an initial *solar reflectance* of 0.10 and an initial *thermal emittance* of 0.90. Materials lacking three-year aged tested values for either *solar reflectance* or *thermal emittance* shall be assigned both a three-year aged *solar reflectance* of 0.10 and a three-year aged *thermal emittance* of 0.90.
b. Solar reflectance tested in accordance with ASTM C1549, ASTM E903, or ASTM E1918.
c. Thermal emittance tested in accordance with ASTM C1371 or ASTM E408.
d. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft^2-F (12W/m^2.K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance. Calculation of initial SRI shall be based on initial tested values of solar reflectance and thermal emittance.

Add new standards to Chapter 6 as follows:

ASTM International

E1980-2001 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low Sloped Opaque Surfaces Table 502.2.1.1

Commenter's Reason: This public comment is a backup to the preferred DOE comment. It is identical to the preferred comment except for the table notes "b", "c", and "d"; and lack of reference to the CRRC-1 Standard.

The proposed change requires a "cool roof" in southern climates. So what is a Cool Roof?

"A cool roof reflects and emits the sun's heat back to the sky instead of transferring it to the building below. "Coolness" is measured by two properties, solar reflectance and thermal emittance. Both properties are measured from 0 to 1 and the higher the value, the "cooler" the roof." from http://www.coolroofs.org/

The proponents of EC71 and this comment listened to comments at the hearings and consulted with industry experts, designers and advocates of cool roofs; thereby determining that the cool roof text in the original EC71 was difficult to understand or use. After iterations with a number of interested parties, this text was developed to be a clearer statement of both the requirement for the use of cool roofs and a practical set of exceptions to the requirement.

Cool roofs save energy by lowering cooling loads. The energy savings are greatest in areas with the greatest cooling loads; hence the change applies to the southernmost climate zones 1 through 3.

The variety of roof coverings for cool roofs has been greatly expanded in the last decade. Concurrently, methods for testing and comparing the "coolness" of the roofs have been perfected. It turns out that the eye is not a good judge of what is cool, so a tested value is needed to make this an enforceable code change. This requirement is consistent with work done by the Cool Roof Rating Council and the EPA Energy Star Program to promote cool roofs.

Two versions of this change were submitted. The only difference between the versions is in the use of the CRRC-1 Standard. If the Cool Roof Rating Council standard CRRC-1 Standard has received ANSI approval and meets ICC guidelines as a referenced standard, this is the preferred option. The CRRC-1 Standard best defines the testing process for rating cool roofs and incorporates the lessons learned in over a decade of rating roofs. If not available, an alternative presents rating requirements that incorporate the test standards in CRRC-1 standard.

The terms used in these changes were selected to be consistent with the terms in the I-codes. "*Low sloped roofs*" are already in code (IBC 1504.4, 1504.6, 1504.7, 1507.12.3), as well as the terms "*roof gardens*" and "*landscape roofs*" (IBC 1507.16, 1607.11.2.2, 1607.11.3).

There are a number of exceptions for roofs covered by active photovoltaics (PV), solar thermal water or air heating, gardens, decks, and the elements of HVAC systems. Roofs that are shaded are not required to comply. Ballasted roofs (exception #3) have been shown to be another way to save energy and are an important alternative to parts of the roofing industry.
http://www.spri.org/pdf/Thermal%20Performance%20of%20Ballast%20Study%20Final%20Report%2005%2008%20.pdf

There are three options for demonstrating that a material will produce a cool roof. An option for 3-year aged requirements that are less stringent, as most cool roofs lose some reflectivity over time. A more stringent requirement is set for the initial reflectivity for new materials. Allowing testing for initial characteristics allows new products into the market. An alternative SRI combines both solar reflectance and thermal remittance (re-radiating the heat back into the sky).

The summer solstice is longest day of the year and is June 21st in the northern hemisphere. If the code was applied in the southern hemisphere the summer solstice would be December 21st.

There is an existing body of tested materials, such as that in Cool Roof Rating Council database. Those tests would be valid with either version of the code change.

There are a number of secondary benefits of cools roofs, beyond energy savings. Limiting the heat gain on the roof lowers the temperature extremes that roofing products experience and helps increase roof lifetime. Cool roofs help mitigate the "urban heat island effect" that makes cities warmer. Cool roofs lower peak cooling loads and cooling equipment sizes.

Further information on cool roofs, including energy savings and costs can be found in "*Potential Benefits of Cool Roofs on Commercial Buildings: Conserving Energy, Saving Money, and Reducing Emission of Greenhouse Gases and Air Pollutants"*
http://www.springerlink.com/content/9r48k34558240825

Public Comment 3:

Mike Ennis, representing Single Ply Roofing Industry (SPRI) requests Approval as Modified by this Public Comment.

Replace proposal as follows:

402.3 Roof coverings. Buildings located in climate zones 1 through 3 which have roofs with a slope 2:12 or less, and where the roofs are located over conditioned space(s) which are cooled, a minimum of 75 percent of the roof surfaces shall be in compliance with Section 402.3.1 or 402.3.2. Roofs surfaces not in compliance with Sections 402.3.1 or 402.3.2 shall comply with Section 402.3.3.

Exceptions:

a. Ballasted *roofs* with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or a minimum paver ballast of 23 lbs/ft2 (117 kg/m2).
b. Roofs where a minimum of 75 percent of the roof if shaded by permanent shading devices or features of the building during the peak sun angle on the summer solstice.
c. Roofs where a minimum of 75 percent of the roof is covered by off-set photovoltaic arrays, building integrated photovoltaics, or solar or hot-air or water collectors.
d. *Extensive or intensive vegetated roofs where a minimum of 75% of the roof is covered by a minimum of 15 lbs/ft2 of growth media or a miniumum 9 lbs/ft2 tray system.*
e. Roofs located over:
   1. Ventilated attics
   2. Spaces which are not conditioned spaces that are cooled
   3. Semi-heated spaces

402.3.1 Roof solar reflectance and thermal emittance. Roof products shall be tested for a minimum three-year aged *solar reflectance* of 0.55 and *thermal emittance* 0.75 in accordance with CRRC-1 Standard. The values for *solar reflectance* and *thermal emittance* shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be *labeled* and certified by the manufacturer demonstrating compliance.

402.3.2 Solar reflectance index. Roof products shall be permitted to use a Solar Reflectance Index (SRI) where the calculated value shall not be less than 64 in order to demonstrate compliance. The SRI value shall be determined using ASTM E1980 with a convection coefficient of 2.1 Btu/h-ft^2 (12 W/m^2*k) based on three-year aged roof samples tested in accordance with CRRC-1 Standard. The values for *solar reflectance* and *thermal emittance* shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be *labeled* and certified by the manufacturer demonstrating compliance.

402.3.3 Other roof products. Roof products not in compliance with Sections 402.3.1 or 402.3.2 shall use equation X-X to demonstrate compliance.

U_{fcom} = U-factor – 0.010 (Equation X-X)

Where:
U_{fcom} = Maximum assembly U-factor required to demonstrate compliance.
U-factor = Maximum Ceiling U-factor value from Table 402.1.3.

(renumber remaining sections)

Add new standard to Chapter 6 as follows:
Cool Roof Rating Council (CRRC) 1610 Harrison St, Oakland, CA 94612

ANSI/CRRC-1 Standard (2010) Cool Roof Rating Council CRRC-1 Standard 402.3.1, 402.3.2

VEGETATIVE ROOF:

Extensive vegetative roof. A low profile roof with a growing medium less than 8 inches in depth, composed of plants that can thrive in a rooftop environment with limited water, shallow roots and sparse nutrients.

Intensive vegetative roof. A high profile roof with a growing medium 8 inches or more in depth that can support a wide range of vegetables, shrubs and small trees.

Commenter's Reason: We propose to further modify code change EC71-09/10 with the above proposal.
The benefits of the proposal are:

- Format that is logical in organization and compatible with ICC codes
- Focus on correct terminology
- Use of the new CRRC-1 Standard
- Expansive text to address vague inferences
- Requires labeling of roof products

Format:
The format of this proposal completely revises the original proposal. The charging statement focuses only on the basic components of the requirements, the exceptions are expressed immediately below the charging section paragraph, and the requirements for the two types of compliance are self contained.
Terminology:
Terminology has been changed to reflect what is currently used in the market and with other standards development organizations. Solar absorptance has been changed to solar reflectance, cooled spaces has been changed for a format consistent with the IECC by referring to "conditioned spaces" which are cooled. Additional terminology is proposed to address the definitions of vegetated roofs. The source for these definitions, and the text discussing vegetated roofs, was the International Green Construction Code – Version 1.0. This additional language is proposed in order to overcome the potential issues that can arise when only generically referencing landscaped or vegetated roofs.
Exceptions:
The exceptions have been both modified and enhanced. Additional text was added to the originally proposed exceptions for clarity. In this case exceptions "a", "b", and "c" contain language which clearly identifies the intent of the exception. Additional exemptions have been included to address roofs that are shaded by permanent architectural features, solar devices, and vegetated roofs.
CRRC-1 Standard:
The introduction of the CRRC-1 Standard is recommended as the document contains far more information than does the reference to the ASTM standards. It was developed by the Cool Roof Rating Council, a not-for-profit organization. The ASTM standards are a good source, but because the verification of a roofing product requires more than just the test method we are recommending the use of the standard instead.
The Standard

- Contains definitions which focus on roof product testing,
- Identifies what constitutes a testing laboratory,
- Contains available tests methods for roof products that can not be tested under the ASTM standards due to their configuration or make-up,
- Identifies how samples are to be selected,
- Requires 9 test samples for testing, and allows only the average of those tested samples to be considered for the certified report,
- Identified what constitutes aged testing of samples, and what regions aged testing is to take place, and
- Addresses the minimum content of a roof product report of results.

The document was produced under the ANSI process, and does not include the proprietary requirements that are used by the Cool Roof Rating Council for their roof product program.
Expansive text:
We have expended some text in order to be more complete, and therefore more clear on intent. Much of this work is in the exceptions where solar devices and vegetated roofs are concerned. Further, the provisions for compliance are self contained where they describe the minimum requirements, type of roof testing, the independence of the testing agency, and the requirements for labeling.
Labeling:
The original proposal did not require labeling of products. This proposal recommends language which will overcome this issue by requiring labeling and certification by the manufacturer with use of test results from an independent testing agency.
Additional Insulation:
For those buildings where a roof product is chosen which is not in compliance with an alternative that is being proposed to address energy, additional insulation is required to demonstrate compliance. The values chosen are U-factors as this will allow the designer or homeowner the opportunity to choose from many options. The U-factor decrease was derived from the Oak Ridge National Laboratory Cool Roof Calculator. This calculator is based on data obtained during a three-year study to evaluate the impact of roof membrane reflectivity on energy use. As part of this work a model was developed that determines the amount of additional insulation required for a black membrane roof to provide equivalent energy performance to a highly reflective roof membrane. The value provided represents a single correction factor for Climate Zones 1, 2 and 3. This approach is consistent with ASHRAE standard 90.1 2004 and 2007 editions where a deduction in insulation was employed for reflective roofs.

Public Comment 4:

Jonathan Humble, representing American Iron & Steel Institute, requests Approval as Modified by this Public Comment.

Replace proposal as follows:

402.3 Roof coverings. Buildings located in climate zones 1 through 3 which have roofs with a slope 2:12 or less, and where the roofs are located over conditioned space(s) which are cooled, a minimum of 75 percent of the roof surfaces shall be in compliance with Section 402.3.1 or 402.3.2.

Exceptions:

a. Ballasted *roofs* with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or a minimum paver ballast of 23 lbs/ft2 (117 kg/m2).
b. Roofs where a minimum of 75 percent of the roof if shaded by permanent shading devices or features of the building during the peak sun angle on the summer solstice.
c. Roofs where a minimum of 75 percent of the roof is covered by off-set photovoltaic arrays, building integrated photovoltaics, or solar or hot-air or water collectors.

b. *Extensive or intensive vegetated roofs.* All plantings shall be selected according their hardiness zone classifications and shall be capable of withstanding the climate conditions of the *jurisdiction* and the micro climate conditions of the *building site* including, but not limited to, wind, precipitation and temperature. *Invasive plant* species shall not be planted. Selected plants shall not add to the potential for fire hazard in the event of severe drought. The engineered soil medium shall be designed for the physical conditions and local climate to support the plants and shall consist of non-synthetic materials. The planting design shall provide a wind erosion blanket that protects the engineered soil medium until the plants are established. The engineered soil medium that shall be not less than 3 inches in depth in all areas.
d. Low sloped metal building *roofs* in climate zones 2 and 3.
e. Asphaltic membranes in climate zones 2 and 3.
f. Roofs located over:
1. Ventilated attics
2. Spaces which are not conditioned spaces that are cooled
3. Semi-heated spaces

402.3.1 Roof solar reflectance and thermal emittance. Roof products shall be tested for a minimum three-year aged *solar reflectance* of 0.55 and *thermal emittance* 0.75 in accordance with CRRC-1 Standard. The values for *solar reflectance* and *thermal emittance* shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be *labeled* and certified by the manufacturer demonstrating compliance.

402.3.2 Solar reflectance index. Roof products shall be permitted to use a Solar Reflectance Index (SRI) where the calculated value shall not be less than 64 in order to demonstrate compliance. The SRI value shall be determined using ASTM E1980 with a convection coefficient of 2.1 Btu/h-ft^2 (12 W/m^2*k) based on three-year aged roof samples tested in accordance with CRRC-1 Standard. The values for *solar reflectance* and *thermal emittance* shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be *labeled* and certified by the manufacturer demonstrating compliance.

Add new standard to Chapter 6 as follows:

Cool Roof Rating Council (CRRC) 1610 Harrison St, Oakland, CA 94612

ANSI/CRRC-1 Standard (2010) Cool Roof Rating Council CRRC-1 Standard 402.3.1, 402.3.2

VEGETATIVE ROOF:

Extensive vegetative roof. A low profile roof with a growing medium less than 8 inches in depth, composed of plants that can thrive in a rooftop environment with limited water, shallow roots and sparse nutrients.

Intensive vegetative roof. A high profile roof with a growing medium 8 inches or more in depth that can support a wide range of vegetables, shrubs and small trees.

Commenter's Reason: We propose to further modify code change EC71-09/10 with the above proposal.

The benefits of the proposal are:
- Format that is logical in organization and compatible with ICC codes
- Focus on correct terminology
- Use of the new CRRC-1 Standard
- Expansive text to address vague inferences
- Requires labeling of roof products

Format:
The format of this proposal completely revises the original proposal. The charging statement focuses only on the basic components of the requirements, the exceptions are expressed immediately below the charging section paragraph, and the requirements for the two types of compliance are self contained.
Terminology:
Terminology has been changed to reflect what is currently used in the market and with other standards development organizations. Solar absorptance has been changed to solar reflectance, cooled spaces has been changed for a format consistent with the IECC by referring to "conditioned spaces" which are cooled. Additional terminology is proposed to address the definitions of vegetated roofs. The source for these definitions, and the text discussing vegetated roofs, was the International Green Construction Code – Version 1.0. This additional language is proposed in order to overcome the potential issues that can arise when only generically referencing landscaped or vegetated roofs.
Exceptions:
The exceptions have been both modified and enhanced. Additional text was added to the originally proposed exceptions for clarity. In this case exceptions "a", "b", and "c" contain language which clearly identifies the intent of the exception. Additional exemptions have been included to address roofs that are shaded by solar devices, to recognize vegetated roofs, and to recognize that through a first cost benefit assessment that specific roof products are not cost effective versus the benefits from cool roofs.
CRRC-1 Standard:
The introduction of the CRRC-1 Standard is recommended as the document contains far more information than does the reference to the ASTM standards. It was developed by the Cool Roof Rating Council, a not-for-profit organization. The ASTM standards are a good source, but because the verification of a roofing product requires more than just the test method we are recommending the use of the standard instead.

The Standard

- Contains definitions which focus on roof product testing,
- Identifies what constitutes a testing laboratory,
- Contains available tests methods for roof products that can not be tested under the ASTM standards due to their configuration or make-up,
- Identifies how samples are to be selected,
- Requires 9 test samples for testing, and allows only the average of those tested samples to be considered for the certified report,
- Identified what constitutes aged testing of samples, and what regions aged testing is to take place, and
- Addresses the minimum content of a roof product report of results.

The document was produced under the ANSI process, and does not include the proprietary requirements that are used by the Cool Roof Rating Council for their roof product program.

Expansive text:

We have expended some text in order to be more complete, and therefore more clear on intent. Much of this work is in the exceptions where solar devices and vegetated roofs are concerned. Further, the provisions for compliance are self contained where they describe the minimum requirements, type of roof testing, the independence of the testing agency, and the requirements for labeling.

Labeling:

The original proposal did not require labeling of products. This proposal recommends language which will overcome this issue by requiring labeling and certification by the manufacturer with the use of test results from an independent testing agency.

Final Action: AS AM AMPC____ D

EC71-09/10-PART II
R202 (New), N1102.3 (New), N1102.3.1 (New), Table N1102.3(1) (New), Chapter 44

Proposed Change as Submitted

Proponent: Ronald Majette, US Department of Energy

PART II – IRC BUILDING/ENERGY

1. Add new definitions as follows:

REFLECTANCE, SOLAR. The ratio of reflected solar flux to incident solar flux.

ABSORPTANCE, SOLAR. The difference 1.0 minus the *solar reflectance*.
2. Add new text and table as follows:

N1102.3 Solar properties of opaque surfaces (Prescriptive).

N1102.3.1 Solar absorptance of roofs. Roofs in climate zones 1, 2, and 3 having a ratio of rise to run less than or equal to 2:12 (9.5 degrees from horizontal) shall be provided with roofing materials having a solar absorptance not exceeding 0.75, as tested in accordance with ASTM E1918 or C1549. For unrated roofing materials, solar absorptance values shall be taken from Table 402.3(1).

TABLE N1102.3(1)
DEFAULT ROOF SOLAR ABSORPTANCE VALUES

ROOF MATERIAL	SOLAR ABSORPTANCE
White Composition Shingles	0.80
White Tile (including concrete)	0.60
White Metal	0.50
All Others	0.92

3. Add new standards to Chapter 44 as follows:

ASTM
E1918-06 Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
C1549-04 Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field

Reason: The U.S. Department of Energy has estimated that reducing the solar absorptivity of all buildings and roads could affect the equivalent carbon reduction of removing all automobiles in the world from the road for 11 years. This proposal extends the solar absorptance currently used in the standard reference design of the Simulated Performance Alternative to the prescriptive compliance path. Provisions for solar reflectance ratings and default values for unrated materials are consistent with the 2006 Mortgage Industry National Home Energy Rating Systems Standards (RESNET 2006).

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

Analysis: A review of the standard(s) proposed for inclusion in the code, ASTM E1918-06 and ASTM C1549-04, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009

ICCFILENAME: MAJETTE-EC-66-202-CH 4-IRC R202-CH 11-REDONE

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: The definition of “white” in the default table is unknown. The default tables should contain more options.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, US Department of Energy, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**REFLECTANCE, SOLAR.** The ratio of reflected solar flux to incident solar flux.~~

~~**ABSORPTANCE, SOLAR.** The difference 1.0 minus the *solar reflectance*.~~

Add new sections as follows, renumber following sections:

N1102.3 Solar Properties of Opaque Surfaces.

N1102.3.1 ~~**Solar Absorptance of Roofs.**~~ **Roof Solar Reflectance and Thermal Emittance.** ~~Roofs in climate zones 1, 2, and 3 having a ratio of rise to run less than or equal to 2:12 (9.5 degrees from horizontal) shall be provided with roofing materials having a solar absorptance not exceeding 0.75, as tested in accordance with ASTM E1918 or C1549. For unrated roofing materials, solar absorptance values shall be taken from Table N1102.3(1).~~ Low-sloped roofs, with a slope < 2:12, directly above cooled *conditioned spaces* in climate zones 1, 2, and 3 shall comply with at least one option in Table N1102.3(1).

Exceptions: The following are exempt from the requirements in Table N1102.3(1):

1. Portions of roofs that include or are covered by:
   a. Photovoltaic systems or components
   b. Solar air or water heating systems or components
   c. Roof gardens or landscaped roofs
   d. Above-roof decks or walkways
   e. Skylights
   f. HVAC systems, components, and other opaque objects mounted above the roof
2. Portions of roofs shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings
3. Ballasted roofs with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or 23 lbs/ft2 pavers (117 kg/m2)
4. Roofs where a minimum of 75% of the roof area meets a minimum of one of the exceptions above.

~~**TABLE N1102.3(1)**~~
~~**DEFAULT ROOF SOLAR ABSORPTANCE VALUES**~~

~~ROOF MATERIAL~~	~~SOLAR ABSORPTANCE~~
~~White Composition Shingles~~	~~0.80~~
~~White Tile (including concrete)~~	~~0.60~~
~~White Metal~~	~~0.50~~
~~All Others~~	~~0.92~~

TABLE N1102.3(1)
Minimum Roof Reflectance and Emittance Options[a]

Three-year aged solar reflectance[b] of 0.55 and three-year aged thermal emittance[b] of 0.75
Initial solar reflectance[b] of 0.70 and initial thermal emittance[b] of 0.75
Three-year-aged solar reflectance index[c] of 64
Initial solar reflectance index[c] of 82

a. The use of area-weighted averages to meet these requirements shall be permitted. Materials lacking initial tested values for either *solar reflectance* or *thermal reflectance*, shall be assigned both an initial *solar reflectance* of 0.10 and an initial *thermal emittance* of 0.90. Materials lacking three-year aged tested values for either *solar reflectance* or *thermal reflectance*, shall be assigned both a three-year aged *solar reflectance* of 0.10 and a three-year aged *thermal emittance* of 0.90.
b. Tested solar reflectance and thermal emittance shall be in accordance with CRRC-1 Standard.
c. Solar reflectance index (SRI) determined in accordance with ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft^2-F (12W/m^2.K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance. Calculation of initial SRI shall be based on initial tested values of solar reflectance and thermal emittance.

~~**ASTM**~~
~~**E1918-06 Standard Test Method for Measuring Solar Reflectance of Horizontal Table 402.3(1) and Low-Sloped Surfaces in the Field**~~

~~**C1549-04 Standard Test Method for Measuring Solar Reflectance of Horizontal Table 402.3(1) and Low-Sloped Surfaces in the Field**~~

ASTM International

E1980-2001 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low Sloped Opaque Surfaces Table N1102.3(1)
Cool Roof Rating Council (CRRC) 1610 Harrison St, Oakland, CA 94612

ANSI/CRRC-1 Standard (2010) Cool Roof Rating Council CRRC-1 Standard Table N1102.3(1)

Commenter's Reason: This public comment modifies the original proposal in response to input from numerous stakeholders. DOE's original proposal was formatted to match the terminology in RESNET's home energy rating system procedures. This modification recasts the proposal into terms more familiar to the building industry.

Studies illustrating the savings from cool roofs are available on the Cool Roof Ratings Council website. http://www.coolroofs.org/article.html#energy For example, the Florida Solar Energy Center tested seven retail shops in a strip mall in Cocoa, Florida over a two-year period, which allowed surface degradation over a year period to be accounted for. The roof was resurfaced to alter the surface reflectivity from approximately 29% to 75%. There was a 25.3% average reduction in summer space cooling energy in the seven shops.

Parker, D., J. Sonne, J. Sherwin. 1997. Demonstration of Cooling Savings of Light Colored Roof Surfacing in Florida Commercial Buildings: Retail Strip Mall. Florida Solar Energy Center. Cocoa, Florida.

Public Comment 2:

Craig Conner, Building Quality, representing himself requests Approval as Modified by this Public Comment.

Modify proposal as follows:

N1102.3 Roof solar reflectance and thermal emittance. Low-sloped roofs, with a slope <2:12, directly above cooled *conditioned spaces* in climate zones 1, 2, and 3 shall comply with a minimum of one option in Table N1102.3.

Exceptions: The following are exempt from the requirements in Table N1102.3:

1. Portions of roofs that include or are covered by:
   a. Photovoltaic systems or components
   b. Solar air or water heating systems or components
   c. Roof gardens or landscaped roofs
   d. Above-roof decks or walkways
   e. Skylights
   f. HVAC systems, components, and other opaque objects mounted above the roof
2. Portions of roofs shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings
3. Ballasted roofs with a minimum stone ballast of 17 lbs/ft^2 (74 kg/m^2) or 23 lbs/ft^2 pavers (117 kg/m^2)
4. Roofs where a minimum of 75% of the roof area meets a minimum of one of the exceptions above.

Table N1102.3 Minimum Roof Reflectance and Emittance Options[a]

Three-year aged solar reflectance[b] of 0.55 and three-year aged thermal emittance[c] of 0.75
Initial solar reflectance[b] of 0.70 and initial thermal emittance[c] of 0.75
Three-year-aged solar reflectance index[d] of 64
Initial solar reflectance index[d] of 82

a. The use of area-weighted averages to meet these requirements shall be permitted. Materials lacking initial tested values for either *solar reflectance* or *thermal emittance*, shall be assigned both an initial *solar reflectance* of 0.10 and an initial *thermal emittance* of 0.90. Materials lacking three-year aged tested values for either *solar reflectance* or *thermal emittance* shall be assigned both a three-year aged *solar reflectance* of 0.10 and a three-year aged *thermal emittance* of 0.90.
b. Solar reflectance tested in accordance with ASTM C1549, ASTM E903, or ASTM E1918.
c. Thermal emittance tested in accordance with ASTM C1371 or ASTM E408.
d. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft^2-F (12W/m^2.K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance. Calculation of initial SRI shall be based on initial tested values of solar reflectance and thermal emittance.

ASTM International

E1980-2001 Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low Sloped Opaque Surfaces Table 502.2.1.1

Commenter's Reason: This public comment is a backup to the preferred DOE comment. It is identical to the preferred comment except for the table notes "b", "c", and "d"; and lack of reference to the CRRC-1 Standard.

The proposed change requires a "cool roof" in southern climates. So what is a Cool Roof?

"A cool roof reflects and emits the sun's heat back to the sky instead of transferring it to the building below. "Coolness" is measured by two properties, solar reflectance and thermal emittance. Both properties are measured from 0 to 1 and the higher the value, the "cooler" the roof." from http://www.coolroofs.org/

The proponents of EC71 and this comment listened to comments at the hearings and consulted with industry experts, designers and advocates of cool roofs; thereby determining that the cool roof text in the original EC71 was difficult to understand or use. After iterations with a number of interested parties, this text was developed to be a clearer statement of both the requirement for the use of cool roofs and a practical set of exceptions to the requirement.

Cool roofs save energy by lowering cooling loads. The energy savings are greatest in areas with the greatest cooling loads; hence the change applies to the southernmost climate zones 1 through 3.

The variety of roof coverings for cool roofs has been greatly expanded in the last decade. Concurrently, methods for testing and comparing the "coolness" of the roofs have been perfected. It turns out that the eye is not a good judge of what is cool, so a tested value is needed to make this an enforceable code change. This requirement is consistent with work done by the Cool Roof Rating Council and the EPA Energy Star Program to promote cool roofs.

Two versions of this change were submitted. The only difference between the versions is in the use of the CRRC-1 Standard. If the Cool Roof Rating Council standard CRRC-1 Standard has received ANSI approval and meets ICC guidelines as a referenced standard, this is the preferred option. The CRRC-1 Standard best defines the testing process for rating cool roofs and incorporates the lessons learned in over a decade of rating roofs. If not available, an alternative presents rating requirements that incorporate the test standards in CRRC-1 standard.

The terms used in these changes were selected to be consistent with the terms in the I-codes. "*Low sloped roofs"* are already in code (IBC 1504.4, 1504.6, 1504.7, 1507.12.3), as well as the terms "*roof gardens*" and "*landscape roofs"* (IBC 1507.16, 1607.11.2.2, 1607.11.3).

There are a number of exceptions for roofs covered by active photovoltaics (PV), solar thermal water or air heating, gardens, decks, and the elements of HVAC systems. Roofs that are shaded are not required to comply. Ballasted roofs (exception #3) have been shown to be another way to save energy and are an important alternative to parts of the roofing industry.
http://www.spri.org/pdf/Thermal%20Performance%20of%20Ballast%20Study%20Final%20Report%2005%2008%20.pdf

There are three options for demonstrating that a material will produce a cool roof. An option for 3-year aged requirements that are less stringent, as most cool roofs lose some reflectivity over time. A more stringent requirement is set for the initial reflectivity for new materials. Allowing testing for initial characteristics allows new products into the market. An alternative SRI combines both solar reflectance and thermal remittance (re-radiating the heat back into the sky).

The summer solstice is longest day of the year and is June 21st in the northern hemisphere. If the code was applied in the southern hemisphere the summer solstice would be December 21st.

There is an existing body of tested materials, such as that in Cool Roof Rating Council database. Those tests would be valid with either version of the code change.

There are a number of secondary benefits of cools roofs, beyond energy savings. Limiting the heat gain on the roof lowers the temperature extremes that roofing products experience and helps increase roof lifetime. Cool roofs help mitigate the "urban heat island effect" that makes cities warmer. Cool roofs lower peak cooling loads and cooling equipment sizes.

Further information on cool roofs, including energy savings and costs can be found in "*Potential Benefits of Cool Roofs on Commercial Buildings: Conserving Energy, Saving Money, and Reducing Emission of Greenhouse Gases and Air Pollutants"*
http://www.springerlink.com/content/9r48k34558240825

Public Comment 3:

Mike Ennis, representing Single Ply Roofing Industry (SPRI), requests Approval as Modified by this Public Comment.

Modify proposal as follows:

N1102.3 Roof coverings. Buildings located in climate zones 1 through 3 which have roofs with a slope 2:12 or less, and where the roofs are located over conditioned space(s) which are cooled, a minimum of 75 percent of the roof surfaces shall be in compliance with Section N1102.3.1 or N1102.3.2. Roofs surfaces not in compliance with Sections N1102.3.1 or N1102.3.2 shall comply with Section N1102.3.3.

Exceptions:

a. Ballasted *roofs* with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or a minimum paver ballast of 23 lbs/ft2 (117 kg/m2).
b. Roofs where a minimum of 75 percent of the roof if shaded by permanent shading devices or features of the building during the peak sun angle on the summer solstice.
c. Roofs where a minimum of 75 percent of the roof is covered by off-set photovoltaic arrays, building integrated photovoltaics, or solar or hot-air or water collectors.
d. *Extensive or intensive vegetated roofs where a minimum of 75% of the roof is covered by a minimum of 15 lbs/ft2 of growth media or a miniumum 9 lbs/ft2 tray system.*
e. Roofs located over:
    1. Ventilated attics
    2. Spaces which are not conditioned spaces that are cooled
    3. Semi-heated spaces

N1102.3.1Roof solar reflectance and thermal emittance. Roof products shall be tested for a minimum three-year aged *solar reflectance* of 0.55 and *thermal emittance* 0.75 in accordance with CRRC-1 Standard. The values for *solar reflectance* and *thermal emittance* shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be *labeled* and certified by the manufacturer demonstrating compliance.

N1102.3.2 Solar reflectance index. Roof products shall be permitted to use a Solar Reflectance Index (SRI) where the calculated value shall not be less than 64 in order to demonstrate compliance. The SRI value shall be determined using ASTM E1980 with a convection coefficient of 2.1 Btu/h-ft^2 (12 W/m^2*k) based on three-year aged roof samples tested in accordance with CRRC-1 Standard. The values for *solar reflectance* and *thermal emittance* shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be *labeled* and certified by the manufacturer demonstrating compliance.

N1102.3.3 Other roof products. Roof products not in compliance with Sections N1102.3.1 or N1102.3.2 shall use equation X-X to demonstrate compliance.

U_{fcom} = U-factor – 0.010 (Equation X-X)

Where:
U_{fcom} = Maximum assembly U-factor required to demonstrate compliance.
U-factor = Maximum Ceiling U-factor value from Table N1102.1.2.
(renumber remaining sections)

ASTM International

Cool Roof Rating Council (CRRC) 1610 Harrison St, Oakland, CA 94612

ANSI/CRRC-1 Standard (2010) Cool Roof Rating Council CRRC-1 Standard 402.3.1, 402.3.2

VEGETATIVE ROOF:

Extensive vegetative roof. A low profile roof with a growing medium less than 8 inches in depth, composed of plants that can thrive in a rooftop environment with limited water, shallow roots and sparse nutrients.

Intensive vegetative roof. A high profile roof with a growing medium 8 inches or more in depth that can support a wide range of vegetables, shrubs and small trees.

Commenter's Reason: We propose to further modify code change EC71-09/10 with the above proposal.
The benefits of the proposal are:

- Format that is logical in organization and compatible with ICC codes
- Focus on correct terminology
- Use of the new CRRC-1 Standard
- Expansive text to address vague inferences
- Requires labeling of roof products

Format:
The format of this proposal completely revises the original proposal. The charging statement focuses only on the basic components of the requirements, the exceptions are expressed immediately below the charging section paragraph, and the requirements for the two types of compliance are self contained.

Terminology:
Terminology has been changed to reflect what is currently used in the market and with other standards development organizations. Solar absorptance has been changed to solar reflectance, cooled spaces has been changed for a format consistent with the IECC by referring to "conditioned spaces" which are cooled. Additional terminology is proposed to address the definitions of vegetated roofs. The source for these definitions, and the text discussing vegetated roofs, was the International Green Construction Code – Version 1.0. This additional language is proposed in order to overcome the potential issues that can arise when only generically referencing landscaped or vegetated roofs.

Exceptions:
The exceptions have been both modified and enhanced. Additional text was added to the originally proposed exceptions for clarity. In this case exceptions "a", "b", and "c" contain language which clearly identifies the intent of the exception. Additional exemptions have been included to address roofs that are shaded by permanent architectural features, solar devices, and vegetated roofs.

CRRC-1 Standard:
The introduction of the CRRC-1 Standard is recommended as the document contains far more information than does the reference to the ASTM standards. It was developed by the Cool Roof Rating Council, a not-for-profit organization. The ASTM standards are a good source, but because the verification of a roofing product requires more than just the test method we are recommending the use of the standard instead.

The Standard

- Contains definitions which focus on roof product testing,
- Identifies what constitutes a testing laboratory,
- Contains available tests methods for roof products that can not be tested under the ASTM standards due to their configuration or make-up,
- Identifies how samples are to be selected,
- Requires 9 test samples for testing, and allows only the average of those tested samples to be considered for the certified report,
- Identified what constitutes aged testing of samples, and what regions aged testing is to take place, and
- Addresses the minimum content of a roof product report of results.

The document was produced under the ANSI process, and does not include the proprietary requirements that are used by the Cool Roof Rating Council for their roof product program.

Expansive text:
We have expended some text in order to be more complete, and therefore more clear on intent. Much of this work is in the exceptions where solar devices and vegetated roofs are concerned. Further, the provisions for compliance are self contained where they describe the minimum requirements, type of roof testing, the independence of the testing agency, and the requirements for labeling.

Labeling:
The original proposal did not require labeling of products. This proposal recommends language which will overcome this issue by requiring labeling and certification by the manufacturer with use of test results from an independent testing agency.

Additional Insulation:
For those buildings where a roof product is chosen which is not in compliance with an alternative that is being proposed to address energy, additional insulation is required to demonstrate compliance. The values chosen are U-factors as this will allow the designer or homeowner the opportunity to choose from many options. The U-factor decrease was derived from the Oak Ridge National Laboratory Cool Roof Calculator. This calculator is based on data obtained during a three-year study to evaluate the impact of roof membrane reflectivity on energy use. As part of this work a model was developed that determines the amount of additional insulation required for a black membrane roof to provide equivalent energy performance to a highly reflective roof membrane. The value provided represents a single correction factor for Climate Zones 1, 2 and 3. This approach is consistent with ASHRAE standard 90.1 2004 and 2007 editions where a deduction in insulation was employed for reflective roofs.

Public Comment 4:

Jonathan Humble, representing American Iron & Steel Institute, requests Approval as Modified by this Public Comment.

Replace proposal as follows:

N1102.3 Roof coverings. Buildings located in climate zones 1 through 3 which have roofs with a slope 2:12 or less, and where the roofs are located over conditioned space(s) which are cooled, a minimum of 75 percent of the roof surfaces shall be in compliance with Section N1102.3.1 or N1102.3.2.

Exceptions:

a. Ballasted *roofs* with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or a minimum paver ballast of 23 lbs/ft2 (117 kg/m2).
b. Roofs where a minimum of 75 percent of the roof if shaded by permanent shading devices or features of the building during the peak sun angle on the summer solstice.
c. Roofs where a minimum of 75 percent of the roof is covered by off-set photovoltaic arrays, building integrated photovoltaics, or solar or hot-air or water collectors.
d. *Extensive or intensive vegetated roofs.* All plantings shall be selected according their hardiness zone classifications and shall be capable of withstanding the climate conditions of the *jurisdiction* and the micro climate conditions of the *building site* including, but not limited to, wind, precipitation and temperature. *Invasive plant* species shall not be planted. Selected plants shall not add to the potential for fire hazard in the event of severe drought. The engineered soil medium shall be designed for the physical conditions and local climate to support the plants and shall consist of non-synthetic materials. The planting design shall provide a wind erosion blanket that protects the engineered soil medium until the plants are established. The engineered soil medium that shall be not less than 3 inches in depth in all areas.
e. Low sloped metal building *roofs* in climate zones 2 and 3.
f. Asphaltic membranes in climate zones 2 and 3.
g. Roofs located over:
   1. Ventilated attics
   2. Spaces which are not conditioned spaces that are cooled
   3. Semi-heated spaces

N1102.3.1Roof solar reflectance and thermal emittance. Roof products shall be tested for a minimum three-year aged *solar reflectance* of 0.55 and *thermal emittance* 0.75 in accordance with CRRC-1 Standard. The values for *solar reflectance* and *thermal emittance* shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be *labeled* and certified by the manufacturer demonstrating compliance.

N1102.3.2 Solar reflectance index. Roof products shall be permitted to use a Solar Reflectance Index (SRI) where the calculated value shall not be less than 64 in order to demonstrate compliance. The SRI value shall be determined using ASTM E1980 with a convection coefficient of 2.1 Btu/h-ft^2 (12 W/m^2*k) based on three-year aged roof samples tested in accordance with CRRC-1 Standard. The values for *solar reflectance* and *thermal emittance* shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be *labeled* and certified by the manufacturer demonstrating compliance.

Cool Roof Rating Council (CRRC) 1610 Harrison St, Oakland, CA 94612

ANSI/CRRC-1 Standard (2010) Cool Roof Rating Council CRRC-1 Standard N1102.3.1, N1102.3.2

VEGETATIVE ROOF:

Extensive vegetative roof. A low profile roof with a growing medium less than 8 inches in depth, composed of plants that can thrive in a rooftop environment with limited water, shallow roots and sparse nutrients.

Intensive vegetative roof. A high profile roof with a growing medium 8 inches or more in depth that can support a wide range of vegetables, shrubs and small trees.

Commenter's Reason: We propose to further modify code change EC71-09/10 with the above proposal.

The benefits of the proposal are:

- Format that is logical in organization and compatible with ICC codes
- Focus on correct terminology
- Use of the new CRRC-1 Standard
- Expansive text to address vague inferences
- Requires labeling of roof products

Format:
The format of this proposal completely revises the original proposal. The charging statement focuses only on the basic components of the requirements, the exceptions are expressed immediately below the charging section paragraph, and the requirements for the two types of compliance are self contained.
Terminology:
Terminology has been changed to reflect what is currently used in the market and with other standards development organizations. Solar absorptance has been changed to solar reflectance, cooled spaces has been changed for a format consistent with the IECC by referring to "conditioned spaces" which are cooled. Additional terminology is proposed to address the definitions of vegetated roofs. The source for these definitions, and the text discussing vegetated roofs, was the International Green Construction Code – Version 1.0. This additional language is proposed in order to overcome the potential issues that can arise when only generically referencing landscaped or vegetated roofs.

Exceptions:
The exceptions have been both modified and enhanced. Additional text was added to the originally proposed exceptions for clarity. In this case exceptions “a”, “b”, and “c” contain language which clearly identifies the intent of the exception. Additional exemptions have been included to address roofs that are shaded by solar devices, to recognize vegetated roofs, and to recognize that through a first cost benefit assessment that specific roof products are not cost effective versus the benefits from cool roofs.
CRRC-1 Standard:
The introduction of the CRRC-1 Standard is recommended as the document contains far more information than does the reference to the ASTM standards. It was developed by the Cool Roof Rating Council, a not-for-profit organization. The ASTM standards are a good source, but because the verification of a roofing product requires more than just the test method we are recommending the use of the standard instead.

The Standard
- Contains definitions which focus on roof product testing,
- Identifies what constitutes a testing laboratory,
- Contains available tests methods for roof products that can not be tested under the ASTM standards due to their configuration or make-up,
- Identifies how samples are to be selected,
- Requires 9 test samples for testing, and allows only the average of those tested samples to be considered for the certified report,
- Identified what constitutes aged testing of samples, and what regions aged testing is to take place, and
- Addresses the minimum content of a roof product report of results.

The document was produced under the ANSI process, and does not include the proprietary requirements that are used by the Cool Roof Rating Council for their roof product program.
Expansive text:
We have expended some text in order to be more complete, and therefore more clear on intent. Much of this work is in the exceptions where solar devices and vegetated roofs are concerned. Further, the provisions for compliance are self contained where they describe the minimum requirements, type of roof testing, the independence of the testing agency, and the requirements for labeling.
Labeling:
The original proposal did not require labeling of products. This proposal recommends language which will overcome this issue by requiring labeling and certification by the manufacturer with the use of test results from an independent testing agency.

Final Action: AS AM AMPC____ D

EC74-09/10-PART I
402.3.3 (New), 402.3.3.1 (New), 402.3.3.2 (New), Table 402.3.3 (New)

Proposed Change as Submitted

Proponent: Thomas S. Zaremba, representing Roetzel & Andress

PART I – IECC

Add new text and table as follows:

402.3.3 External shading. As an alternative to the SHGC requirements of Table 402.1.1, vertical glazed fenestration shall be permitted to meet the SHGC requirements of Table 402.3.3 based upon the calculated projection factor of any overhang, eave, or permanently attached shading device that covers the full width of the glazing and extends a minimum of 12 inches (0.3 m) beyond each side of thereof.

402.3.3.1 Projection factor. The projection factor shall be determined in accordance with Equation 4-1.

PF = *A/B* **(Equation 4-1)**

where:

PF = Projection factor (decimal).
A = Distance measured horizontally from the furthest 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.

402.3.3.2 Differing PF values. Where different windows or glass doors have different *PF* values, they shall each be evaluated separately, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

TABLE 402.3.3
EQUIVALENT SHGC REQUIREMENTS FOR VERTICAL GLAZED FENESTRATION WITH EXTERNAL SHADING

CLIMATE ZONE	1	2	3[a]
SHGC: *PF* < 0.25	0.30	0.30	0.30
SHGC: 0.25 ≤ *PF* < 0.50	0.36	0.36	0.36
SHGC: *PF* ≥ 0.50	0.45	0.45	0.45

a. There are no SHGC requirements in the Marine zone.

Reason: Long before window makers began marketing low-SHGC windows, shading was an accepted and effective architectural method for achieving solar control. It still is. Chapter 5 recognizes the benefits of controlling solar gain through the use of shading or projection factors for commercial buildings. A similar credit should be provided for residential occupancies.

The language starting with 403.3.3.1 and N1102.3 is similar to the language in the Chapter 5. The SHGC multipliers are based on multipliers given in ASHRAE 90.1 for different projection factors. For PF = 0.25 and 0.50, the multipliers were calculated as the weighted average from the ASHRAE 90.1 multiplier for west/south/east orientation (75%) and the multiplier for northern orientation (25%). In comparison, the commercial chapter is effectively using SHGC multipliers of 0.76 and 0.62 for these PF ranges, so this proposal is more conservative.

Cost Impact: The code change proposal will not increase the cost of construction and may reduce the cost of construction by offering an alternative compliance method.

ICCFILENAME: ZAREMBA-EC-1-402.3.3-N1102.3.3

Public Hearing Results

PART I - IECC
Committee Action: **Disapproved**

Committee Reason: The use of projection factors are not as reliable as SHGC values given variables in the local climate. In addition, the technical support for projection factors ignore the impact of reflectance of light from the ground.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc and AGC Flat Glass North America, Inc, requests Approval as Submitted.

Commenter's Reason: EC74-09/10 Part I should be approved as submitted. Since its inception in 2000, Chapter 5 of the IECC has provided the designers of commercial buildings with a credit when SHGC is controlled by shading windows using projections from the vertical building design. The shading credit (projection factor) of Chapter 5 has worked extremely well over the last decade in providing designers with flexibility in using the building design itself to shade windows. EC74 is modeled closely after the shading credit provisions of Chapter 5 of the IECC and there is no real justification for not carrying the flexibility of Chapter 5's shading credits over to residential design and construction.

In Baltimore, the IECC Committee voted to disapprove EC74 by a narrow margin of 6 to 5. The IRC Committee voted unanimously to approve it as submitted. It is clear that the IECC Committee had to stretch to justify its marginal disapproval vote.

In its supporting statement, the Committee first says that: "The use of projection factors are not as reliable as SHGC values given variables in the local climate." The Committee gives no explanation as to what local climates it may be talking about and it offers no corroboration, direction or advice as to how one might go about finding any corroboration or substantiation for its statement. Further, in chosing to make this statement, the Committee also chose not to explain how or why the projection factor provisions offered in this proposal are any different from those that have been in use for at least the last ten (10) years in Chapter 5.

The Committee then says: "[T]he technical support for the projection factor ignores the impact of the reflectance of light from the ground." The Committee fails to provide any substantiation whatsoever for this statement, undoubtedly, because the Committee is, simply, technically, wrong. The SHGC multipliers used in EC74 were taken directly from the SHGC multipliers used in ASHRAE 90.1 and do, in fact, take reflectance of light from the ground into account.

The Committee failed to provide any real justification for its marginal disapproval vote. The Committee's decision is all the more inexplicable when one realizes that this same committee has repeatedly refused over at least the last two development cycles to eliminate the projection factor provisions from the commercial code, even though a producer of low SHGC glass has repeatedly attempted to eliminate them.

From the many times that we have all stood in the cool shade, out of direct sunlight on a warm summer day, common sense tells us that shading is a natural and cost effective way to eliminate or control solar gain in a dwelling unit and should be approved for use in the residential provisions of the energy code.

Shading design has been used effectively to keep buildings cool, literally, for centuries. We strongly urge Final Action voters to vote against the standing motion to disapprove EC74 and to vote to approve EC74 As Submitted.

Public Comment 2:

Amanda Hickman, InterCode Incorporated, representing The Air Movement and Control Association, requests Approval as Submitted.

Commenter's Reason: For 12 years, the commercial chapter of the IECC has recognized the energy and cost benefits of external shading. This proposal provides the same simple approach for residential buildings as found in Chapter 5. This proposal is easy to understand, apply and enforce. In Baltimore the IECC committee disapproved this proposal by a slim margin of just one vote. It is time to bring consistency between the chapters and recognize the significant benefits of external shading in the residential chapter.

Public Comment 3:

Thomas D. Culp, Birch Point Consulting LLC, representing The Glazing Industry Code Committee, requests Approval as Submtted.

Commenter's Reason: We ask for your approval of EC74 part I as-submitted, consistent with the unanimous recommendation of the IRC B/E code development committee for part II. This proposal correctly recognizes the value of external shading, using the same simple approach as that already used in chapter 5 for commercial construction since the 1998 IECC. As the IRC B/E committee noted, "there is no reason why this should not be able to be applied for residential construction."

The IECC committee only disapproved this proposal by a very close 6-5 vote, stating concern about "reflectance of light from the ground." While that may have been a potential concern for proposal EC72 which gave a complete exception to the SHGC requirement with a big enough overhang, EC74 still requires a maximum SHGC in all cases of either 0.36 or 0.45 depending on the amount of external shading. This is clearly conservative. Furthermore, both committees expressed concern about the enforcement issues of including orientation in EC72. EC74 does not suffer from this complication, and follows the established approach of chapter 5.

This proposal will increase the usability of the code, ensure the use of energy efficient fenestration, and encourage integrated design. Shading has been part of good building design for millennia. The code should recognize and encourage this practice as we strive for ever increasing levels of energy efficiency.

We ask that you vote against the initial motion for disapproval, followed by a vote to approve EC74 part I, consistent with the unanimous vote by the IRC B/E committee for Part II.

Public Comment 4:

Shaunna Mozingo, City of Westminster, Co, representing Colorado Chapter of ICC and Craig Conner, Building Quality, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.3.3 External shading. As an alternative to the SHGC requirements of Table 402.1.1, vertical glazed fenestration in climate zones 1 through 3 shall be permitted to meet the SHGC requirements of Table 402.3.3 based upon the calculated projection factor of any overhang, eave, or permanently attached shading device that covers the full width of the glazing and extends a minimum of 12 inches (0.3 m) beyond each side of thereof.

402.3.3.1 Projection factor. The projection factor shall be determined in accordance with Equation 4-1.

$$PF = A/B \qquad \textbf{(Equation 4-1)}$$

where:

PF = Projection factor (decimal).
A = Distance measured horizontally from the furthest 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.

402.3.3.2 Differing PF values. Where different windows or glass doors have different *PF* values, they shall each be evaluated separately, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

TABLE 402.3.3
EQUIVALENT SHGC ~~REQUIREMENTS~~ FOR VERTICAL GLAZED FENESTRATION WITH EXTERNAL SHADING

~~CLIMATE ZONE~~	~~1~~	~~2~~	~~3[a]~~
SHGC: *PF* < 0.25	0.30	~~0.30~~	~~0.30~~
SHGC: 0.25 ≤ *PF* < 0.50	0.36	~~0.36~~	~~0.36~~
SHGC: *PF* ≥ *0.50*	0.45	~~0.45~~	~~0.45~~

~~a. There are no SHGC requirements in the Marine zone.~~

Commenter's Reason: We strongly prefer that the IECC and IRC be made identical, possibly based on RE4. This is a backup, in case RE4 is not approved.

This change offers a simple, traditional southern alternative to the SHGC, an overhang. It is based on the existing description of a projection factor in Chapter 5.

EC74 is modified to simplify the table by combining the identical columns. The footnote is not needed since there is no requirement

Final Action: AS AM AMPC____ D

EC74-09/10-PART II

IRC N1102.3.3 (New), N1102.3.3.1 (New), N1102.3.3.2 (New), Table N1102.3 (New)

Proposed Change as Submitted

Proponent: Thomas S. Zaremba, representing Roetzel & Andress

PART II – IRC BUILDING/ENERGY

Add new text and table as follows:

N1102.3.3 External shading. As an alternative to the SHGC requirements of Table N1102.1, vertical glazed fenestration shall be permitted to meet the SHGC requirements of Table N1102.3 based upon the calculated projection factor of any overhang, eave, or permanently attached shading device that covers the full width of the glazing and extends a minimum of 12 inches (0.3 m) beyond each side thereof.

N1102.3.3.1 Projection factor. The projection factor shall be determined in accordance with Equation N1102-1.

$PF = A/B$ **(Equation N1102-1)**

where:

PF = Projection factor (decimal).
A = Distance measured horizontally from the furthest 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.

N1102.3.3.2 Differing PF values. Where different windows or glass doors have different *PF* values, they shall each be evaluated separately, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

TABLE N1102.3
EQUIVALENT SHGC REQUIREMENTS FOR VERTICAL GLAZED FENESTRATION WITH EXTERNAL SHADING

CLIMATE ZONE	1	2	3[a]
SHGC: $PF = 0.25$	0.30	0.30	0.30
SHGC: $0.25 \le PF < 0.50$	0.36	0.36	0.36
SHGC: $PF \ge 0.50$	0.45	0.45	0.45

a. There are no SHGC requirements in the Marine zone.

Reason: Long before window makers began marketing low-SHGC windows, shading was an accepted and effective architectural method for achieving solar control. It still is. Chapter 5 recognizes the benefits of controlling solar gain through the use of shading or projection factors for commercial buildings. A similar credit should be provided for residential occupancies.

The language starting with 403.3.3.1 and N1102.3 is similar to the language in the Chapter 5. The SHGC multipliers are based on multipliers given in ASHRAE 90.1 for different projection factors. For PF = 0.25 and 0.50, the multipliers were calculated as the weighted average from the ASHRAE 90.1 multiplier for west/south/east orientation (75%) and the multiplier for northern orientation (25%). In comparison, the commercial chapter is effectively using SHGC multipliers of 0.76 and 0.62 for these PF ranges, so this proposal is more conservative.

Cost Impact: The code change proposal will not increase the cost of construction and may reduce the cost of construction by offering an alternative compliance method.

ICCFILENAME: ZAREMBA-EC-1-402.3.3-N1102.3.3

Public Hearing Results

PART II - IRC
Committee Action: Approved as Submitted

Committee Reason: This is similar to the approach taken in Chapter 5. The committee felt that there is no reason why this should not be able to be applied for residential construction.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Amanda Hickman, InterCode Incorporated, representing The Air Movement and Control Association, requests Approval as Submitted.

Commenter's Reason: For 12 years, the commercial chapter of the IECC has recognized the energy and cost benefits of external shading. This proposal provides the same simple approach for residential buildings as found in Chapter 5. This proposal is easy to understand, apply and enforce. In Baltimore the IECC committee disapproved this proposal by a slim margin of just one vote. It is time to bring consistency between the chapters and recognize the significant benefits of external shading in the residential chapter.

Public Comment 2:

Shaunna Mozingo, City of Westminster, Co, representing Colorado Chapter of ICC and Craig Conner, Building Quality, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.3.3 External shading. As an alternative to the SHGC requirements of Table N1102.1, vertical glazed fenestration in climate zones 1 through 3 shall be permitted to meet the SHGC requirements of Table N1102.3 based upon the calculated projection factor of any overhang, eave, or permanently attached shading device that covers the full width of the glazing and extends a minimum of 12 inches (0.3 m) beyond each side thereof.

N1102.3.3.1 Projection factor. The projection factor shall be determined in accordance with Equation N1102-1.

$PF = A/B$ **(Equation N1102-1)**

where:

PF = Projection factor (decimal).
A = Distance measured horizontally from the furthest 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.

N1102.3.3.2 Differing PF values. Where different windows or glass doors have different *PF* values, they shall each be evaluated separately, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

TABLE N1102.3
EQUIVALENT SHGC ~~REQUIREMENTS~~ FOR VERTICAL GLAZED FENESTRATION
WITH EXTERNAL SHADING

~~CLIMATE ZONE~~	~~1~~	~~2~~	~~3[a]~~
SHGC: *PF* = 0.25	0.30	~~0.30~~	~~0.30~~
SHGC: 0.25 ≤ *PF* < 0.50	0.36	~~0.36~~	~~0.36~~
SHGC: *PF* ≥ 0.50	0.45	~~0.45~~	~~0.45~~

~~a. There are no SHGC requirements in the Marine zone.~~

Commenter's Reason: We strongly prefer that the IECC and IRC be made identical, possibly based on RE4. This is a backup, in case RE4 is not approved.

This change offers a simple, traditional southern alternative to the SHGC, an overhang. It is based on the existing description of a projection factor in Chapter 5.

EC74 is modified to simplify the table by combining the identical columns. The footnote is not needed since there is no requirement

Public Comment 3:

Jeff Inks, representing Window & Door manufacturers Association, requests Disapproval.

Commenter's Reason: WDMA urges disapproval. This proposal should be disapproved for the same reasons it was disapproved by the Energy Code Committee for the IECC. As stated by the committee, "The use of projection factors are not as reliable as SHGC values given variables in the local climate. In addition, the technical support for projection factors ignore the impact of reflectance of light from the ground."

There are many factors that must be carefully considered in order to effectively use external shading. Prescriptive requirements for allowing external shading to serve as a trade-off for SHGC requirements in the IRC therefore need to be considered much more thoroughly, especially in determining what the trade-off values should be, if such trade-offs are to be permitted. The proposed values are based on extrapolations from ASHRAE 90.1 for commercial construction which requires different multipliers for each 10% change in projection factor. Further analysis must be provided. We strongly urge disapproval.

External shading is an attribute that can be applied for which selecting an option from a limited set of provisions can be relied upon to implement it correctly and effectively. , and if implemented incorrectly, can result in less efficient building operation and greater energy consumption.

Public Comment 4:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, requests Disapproval.

Commenter's Reason: *EC74 should be disapproved.*
The IECC Committee correctly rejected this proposal. In addition to the reasons offered by the Committee:

1. This proposal adds substantial unneeded complexity to what is intended to be a simple prescriptive compliance path. It would require substantial additional compliance and enforcement efforts for equivalent or less energy savings. Code officials would be required to do an inspection and measurement of each overhang, including length and width, as well as the distance from the overhang to the bottom of each window. Then a projection factor would need to be calculated separately for each window.
2. This proposal will increase energy use in many circumstances. Under the current code, homes under the prescriptive path get the energy savings benefit of any overhangs along with energy savings from the required SHGC – by encouraging builders to account for overhangs and increase the SHGC of windows, energy will be lost.
3. In cases where the home is specifically designed to benefit from overhangs, builders can use the performance path to properly and accurately account for the benefit.
4. This proposal allows the projection factor to be calculated for all windows on a weighted average basis, potentially resulting in inadequate shading on some windows and excessive shading on others to meet the requirement. The proposal also incorrectly assumes that the effect of the projection factor is the same for every orientation, which, as the proponent admits, is not true.

Final Action: AS AM AMPC____ D

EC79-09/10-PART I

402.4.1, 402.4.1.1 (New), Table 402.4.2, 402.4.2, 402.4.2.1, 402.4.1.2 (New), 402.4.1.2.1 (New), 402.4.2.2, 402.4.3, 403.5, Table 405.5.2(1)

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART I – IECC

1. Revise as follows:

402.4 Air leakage (Mandatory).

402.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections 402.4.1.1 and 402.4.1.2. ~~be durably sealed to limit infiltration.~~ The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

1. ~~All joints, seams and penetrations.~~
2. ~~Site-built windows, doors and skylights.~~
3. ~~Openings between window and door assemblies and their respective jambs and framing.~~
4. ~~Utility penetrations.~~
5. ~~Dropped ceilings or chases adjacent to the thermal envelope.~~
6. ~~Knee walls.~~
7. ~~Walls and ceilings separating a garage from conditioned spaces.~~
8. ~~Behind tubs and showers on exterior walls.~~
9. ~~Common walls between dwelling units.~~
10. ~~Attic access openings.~~
11. ~~Rim joist junction.~~
12. ~~Other sources of infiltration.~~

2. Add new text as follows:

402.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table 402.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table 402.4.1.1, as applicable to the method of construction. Where required by the *code official*, an *approved* party shall inspect all components and verify compliance.

3. Revise as follows:

TABLE ~~402.4.2~~ 402.4.1.1
AIR BARRIER AND INSULATION ~~INSPECTION COMPONENT CRITERIA~~ INSTALLATION

COMPONENT	CRITERIA
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. ~~Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.~~ Breaks or joints in the air barrier ~~are filled or repaired~~ shall be sealed. Air permeable insulation ~~is~~ shall not be used as a sealing material. Any ~~A~~air permeable insulation shall be installed ~~is~~ inside of an air barrier.
Ceiling / attic	The air barrier in any dropped ceiling / soffit ~~is substantially~~ shall be aligned with the insulation and any gaps ~~are~~ in the air barrier sealed. ~~Attic access (except unvented attic), knee wall door, or drop down stair is sealed.~~ Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be ~~are~~ insulated and the~~.~~ junction of the foundation and sill plate ~~is~~ shall be sealed. The junction of the top plate and top of exterior walls shall be sealed.

COMPONENT	CRITERIA
	Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing ~~is~~ shall be sealed.
Rim joists	Rim joists ~~are~~ shall be insulated and include ~~an~~ the air barrier.
Floors (including above garage and cantilevered floors)	Insulation ~~is~~ shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier ~~is~~ shall be installed at any exposed edge of insulation.
Crawlspace walls	Where provided in lieu of floor insulation, insulation ~~is~~ shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawlspaces ~~is~~ shall be covered with a class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, ~~knee walls,~~ and flue shafts opening to exterior or unconditioned space ~~are~~ shall be sealed.
Narrow cavities	Batts in narrow cavities ~~are~~ shall be cut to fit, or narrow cavities ~~are~~ shall be filled by ~~spayed/blown~~ insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing ~~is~~ shall be provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope ~~are~~ shall be airtight, IC rated, and sealed to the drywall. ~~Exception--fixtures in conditioned space.~~
Plumbing and Wiring	~~Insulation is placed between outside and pipes.~~ Batt insulation ~~is~~ shall be cut neatly to fit around wiring and plumbing in exterior walls, or ~~sprayed/blown~~ insulation that on installation readily conforms to available space shall extend~~s~~ behind piping and wiring.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs ~~on exterior walls~~ shall be ~~have~~ insulati~~on~~ed and ~~an~~ the air barrier installed separating them from the ~~exterior wall~~ showers and tubs.
Electrical / phone box on exterior walls	The air barrier ~~extends~~ shall be installed behind electrical or communication boxes or ~~an~~ air sealed ~~type~~ boxes ~~are~~ shall be installed.
Common wall	An air barrier ~~is~~ shall be installed in the common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building thermal envelope ~~are~~ shall be sealed to the subfloor or drywall.
Fireplace	An air barrier shall be installed on fireplace walls. ~~include an air barrier.~~ Fireplaces shall have gasketed doors.

~~**402.4.2 Air sealing and insulation.** Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Section 402.4.2.1 or 402.4.2.2.~~

~~**402.4.2.1 Testing option.** Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than seven air changes per hour (ACH) when tested with a blower door at a pressure of 33.5 psf (50 Pa).~~ ~~Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances.~~

402.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding 7 air changes per hour (ACH50) in Climate Zones 1 and 2, and 5 air changes per hour in Climate Zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* 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 rough in and creation of all penetrations of the *building thermal envelope*

Exception: Additions less than 1000 ft^2 are exempt from testing.

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, ~~including exhaust, intake, makeup air, backdraft and flue dampers~~ beyond intended infiltration control measures;

3. Interior doors, if installed at the time of test, shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s), if installed at the time of the test, shall be turned off; and
~~6. HVAC ducts shall not be sealed; and~~
~~7~~ 6. Supply and return registers, if installed at the time of the test, shall ~~not~~ be ~~sealed~~ fully open.

3. Add new text as follows:

402.4.1.2.1 Sampling. Where groups of seven or more buildings of similar design and construction are completed and are issued occupancy permits during a 120-day period, or where a multifamily structure contains more than four dwelling units, testing of less than 100 percent, but not less than 15 percent, of the buildings from a specific builder and/or contractor or of dwelling units in a multifamily structure shall be permitted when *approved* by the *code official*. The specific buildings or dwelling units to be tested shall be selected by the *code official*. If any tested building or dwelling unit fails to comply with the maximum air leakage requirement in Section 402.4.1.2 then all buildings or dwelling units shall be tested until a minimum of three consecutive buildings or dwelling units comply from that specific builder and/or contractor or multifamily structure before the *code official* may permit sampling to resume.

4. Delete without substitution:

~~**402.4.2.2 Visual inspection option.** Building envelope tightness and insulation installation shall be considered acceptable when the items listed in Table 402.4.2, applicable to the method of construction, are field verified. Where required by the *code official*, an *approved* party independent from the installer of the insulation shall inspect the air barrier and insulation.~~

5. Revise as follows:

402.4.3 Fireplaces. New wood-burning fireplaces shall have ~~gasketed doors and~~ outdoor combustion air.

403.5 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of Section M1507 of the *International Residential Code* 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.

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	~~Specific leakage area (SLA)[d] = 0.00036~~ Air leakage rate of 7 air changes per hour in zones 1 and 2, and 5 air changes per hour in zones 3 through 8 at a pressure of 0.2 inches w.g. (50 Pa). ~~assuming no energy recovery~~. The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than 0.01 x *CFA* + 7.5 x (*Nbr*+1) where: *CFA* = conditioned floor area *Nbr* = number of bedrooms Energy recovery shall not be assumed for mechanical ventilation.	For residences that are not tested, the same air leakage rate as the standard reference design. ~~For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate[e] but not less than 0.35 ACH~~ For tested residences ~~with mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1~~, the measured air exchange rate[e] ~~combined with the proposed mechanical ventilation rate, f which shall not be less than 0.01 x *CFA* + 7.5 x (*Nbr*+1)~~ ~~where:~~ ~~*CFA* = conditioned floor area~~ ~~*Nbr* = number of bedrooms~~

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
		The mechanical ventilation rate shall be in addition to the air leakage rate and shall be as proposed.

e. Where required by the code official, testing shall be conducted by an approved party. ~~Tested envelope leakage shall be determined and documented by an independent party approved by the *code official*.~~ Hourly calculations as specified in the ~~2001~~ASHRAE *Handbook of Fundamentals*~~, Chapter 26, page 26.21, Equation 40 (Sherman-Grimsrud model)~~ or the equivalent shall be used to determine the energy loads resulting from infiltration.

(Portions of table and footnotes not shown remain unchanged)

Reason: The purpose of this proposal is to substantially improve the energy performance of residential buildings by reducing air infiltration. This proposal would require testing for envelope air leakage with associated maximum allowable leakage rates. The test is based on the air leakage through the building envelope as measured by air changes per hour when the building is pressurized to 50 Pascals. This is a commonly used metric (for example, Energy Star uses ACH at 50 Pascals), there are other metrics such as specific leakage area that are acceptable as well and give similar results for most buildings.

The IECC and IRC already require the building envelope to be carefully sealed. The proposed maximum leakage rates are intended to insure proper enforcement of these sealing requirements.

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

ICCFILENAME: MAJETTE-EC-81-402.4-IRC N1102.4-

Public Hearing Results

PART I - IECC

Committee Action: **Approved as Submitted**

Committee Reason: This proposal is consistent with EC13. The energy performance of a building is enhanced by tightening air leakage rates.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment :

Stephen Turchen, Department of Public Works, Fairfax County, VA, representing Virginia Building and Code Officials Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.5 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of Section ~~M1507~~ M1507.3 of the *International Residential Code* 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.

(Portions of code change proposal not shown remain unchanged).

Commenter's Reason: At the Final Action Hearings in Dallas, RM17-09/10 was approved as modified by the Code Development Committee at the Baltimore hearings. A new section, M1507.3, and referenced sub-sections were approved to provide the design requirements for a whole house ventilation system. Changing the IRC reference to "M1507.3" should eliminate any ambiguity as to whether a whole house ventilation system is required under EC79. The problem with a simple reference to "M1507" is that the first code text one would read under Section M1507 (see M1507.1) states "Where local exhaust or whole house mechanical ventilation **is provided** [emphasis added], the equipment shall be designed in accordance with this section." M1507.1 does not impose any requirement; it only says that if a ventilation system is provided, it should be designed in a certain way. The requirement for the system is imposed by the revisions to IECC Sec. 403.5 and IRC Sec. N1103.5. Having imposed the requirement, the system design parameters of IRC Sec. M1507.3 shall be followed.

Final Action: AS AM AMPC____ D

EC79-09/10-PART II

N1102.4.1, N1102.4.1.1 (New), Table N1102.4.2, N1102.4.2, N1102.4.2.1, N1102.4.1.2 (New), N1102.4.1.2.1 (New), N1102.4.2.2, N1102.4.3, N1103.5

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART II – IRC BUILDING/ENERGY

1. Revise as follows:

N1102.4 Air leakage (Mandatory).

N1102.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections N1102.4.1.1 and N1102.4.1.2. ~~be durably sealed to limit infiltration.~~ The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

~~1. All joints, seams and penetrations.~~
~~2. Site-built windows, doors and skylights.~~
~~3. Openings between window and door assemblies and their respective jambs and framing.~~
~~4. Utility penetrations.~~
~~5. Dropped ceilings or chases adjacent to the thermal envelope.~~
~~6. Knee walls.~~
~~7. Walls and ceilings separating a garage from conditioned spaces.~~
~~8. Behind tubs and showers on exterior walls.~~
~~9. Common walls between dwelling units.~~
~~10. Attic access openings.~~
~~11. Rim joist junction.~~
~~12. Other sources of infiltration.~~

2. Add new text as follows:

N1102.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table N1102.4.1.1 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table N1102.4.1.1, as applicable to the method of construction. Where required by the *code official*, an *approved* party shall inspect all components and verify compliance.

3. Revise as follows:

TABLE N1102.4.~~2.~~1.1
AIR BARRIER AND INSULATION ~~INSPECTION COMPONENT CRITERIA~~ INSTALLATION

COMPONENT	CRITERIA
Air barrier and thermal barrier	A continuous air barrier shall be installed in the building envelope. ~~Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.~~ Breaks or joints in the air barrier ~~are~~ ~~filled or repaired~~ shall be sealed. Air permeable insulation ~~is~~ shall not be used as a sealing material. Any air permeable insulation shall be installed ~~is~~ inside of an air barrier.
Ceiling / attic	The air barrier in any dropped ceiling / soffit ~~is substantially~~ shall be aligned with the insulation and any gaps ~~are~~ in the air barrier sealed. ~~Attic access (except unvented attic), knee wall door, or drop down stair is sealed.~~ Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be sealed.
Walls	Corners and headers shall be ~~are~~ insulated and the~~.~~ junction of the foundation and sill plate ~~is~~ shall be sealed. The junction of the top plate and top of exterior walls shall be sealed.

COMPONENT	CRITERIA
	Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier. Knee walls shall be sealed.
Windows, skylights and doors	The space between window/door jambs and framing and skylights and framing ~~is~~ shall be sealed.
Rim joists	Rim joists ~~are~~ shall be insulated and include ~~an~~ the air barrier.
Floors (including above garage and cantilevered floors)	Insulation ~~is~~ shall be installed to maintain permanent contact with underside of subfloor decking. The air barrier ~~is~~ shall be installed at any exposed edge of insulation.
Crawlspace walls	Where provided in lieu of floor insulation, insulation ~~is~~ shall be permanently attached to the crawlspace walls. Exposed earth in unvented crawlspaces ~~is~~ shall be covered with a class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, ~~knee walls,~~ and flue shafts opening to exterior or unconditioned space ~~are~~ shall be sealed.
Narrow cavities	Batts in narrow cavities ~~are~~ shall be cut to fit, or narrow cavities ~~are~~ shall be filled by ~~spayed/blown~~ insulation that on installation readily conforms to the available cavity space.
Garage separation	Air sealing ~~is~~ shall be provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures installed in the building thermal envelope ~~are~~ shall be airtight, IC rated, and sealed to the drywall. ~~Exception--fixtures in conditioned space.~~
Plumbing and Wiring	~~Insulation is placed between outside and pipes.~~ Batt insulation ~~is~~ shall be cut neatly to fit around wiring and plumbing in exterior walls, or ~~sprayed/blown~~ insulation that on installation readily conforms to available space shall extend~~s~~ behind piping and wiring.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs ~~on exterior walls~~ shall be ~~have~~ insulati~~on~~ed and ~~an~~ the air barrier installed separating them from the ~~exterior wall~~ showers and tubs.
Electrical / phone box on exterior walls	The air barrier ~~extends~~ shall be installed behind electrical or communication boxes or ~~an~~ air sealed ~~type~~ boxes ~~are~~ shall be installed.
Common wall	An air barrier ~~is~~ shall be installed in the common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building thermal envelope ~~are~~ shall be sealed to the subfloor or drywall.
Fireplace	An air barrier shall be installed on fireplace walls. ~~include an air barrier.~~ Fireplaces shall have gasketed doors.

~~**N1102.4.2 Air sealing and insulation.** Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Section N1102.4.2.1 or N1102.4.2.2.~~

~~**N1102.4.2.1 Testing option.** Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than seven air changes per hour (ACH) when tested with a blower door at a pressure of 33.5 psf (50 Pa). Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances.~~

N1102.4.1.2 Testing. The building or dwelling unit shall be tested and verified as having an air leakage rate not exceeding 7 air changes per hour (ACH50) in Climate Zones 1 and 2, and 5 air changes per hour in Climate Zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 0.2 inches w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* 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 rough in and creation of all penetrations of the *building thermal envelope*

Exception: Additions less than 1000 ft^2 are exempt from testing.

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, ~~including exhaust, intake, makeup air, backdraft and flue dampers~~ beyond intended infiltration control measures;

3. Interior doors, if installed at the time of test, shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s), if installed at the time of the test, shall be turned off; and
6. ~~HVAC ducts shall not be sealed; and~~

~~7~~ 6. Supply and return registers, if installed at the time of the test, shall ~~not~~ be ~~sealed~~ fully open.

4. Add new text as follows:

N1102.4.1.2.1 Sampling. Where groups of seven or more buildings of similar design and construction are completed and are issued occupancy permits during a 120-day period, or where a multifamily structure contains more than four dwelling units, testing of less than 100 percent, but not less than 15 percent, of the buildings from a specific builder and/or contractor or of dwelling units in a multifamily structure shall be permitted when *approved* by the *code official*. The specific buildings or dwelling units to be tested shall be selected by the *code official*. If any tested building or dwelling unit fails to comply with the maximum air leakage requirement in Section N1102.4.1.2 then all buildings or dwelling units shall be tested until a minimum of three consecutive buildings or dwelling units comply from that specific builder and/or contractor or multifamily structure before the *code official* may permit sampling to resume.

5. Delete without substitution:

~~**N1102.4.2.2 Visual inspection option.** Building envelope tightness and insulation installation shall be considered acceptable when the items listed in Table N1102.4.2, applicable to the method of construction, are field verified. Where required by the *code official*, an *approved* party independent from the installer of the insulation shall inspect the air barrier and insulation.~~

6. Revise as follows:

N1102.4.3 Fireplaces. New wood-burning fireplaces shall have ~~gasketed doors and~~ outdoor combustion air.

N1103.5 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of Section M1507 of the *International Residential Code* 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: The purpose of this proposal is to substantially improve the energy performance of residential buildings by reducing air infiltration. This proposal would require testing for envelope air leakage with associated maximum allowable leakage rates. The test is based on the air leakage through the building envelope as measured by air changes per hour when the building is pressurized to 50 Pascals. This is a commonly used metric (for example, Energy Star uses ACH at 50 Pascals), there are other metrics such as specific leakage area that are acceptable as well and give similar results for most buildings.

The IECC and IRC already require the building envelope to be carefully sealed. The proposed maximum leakage rates are intended to insure proper enforcement of these sealing requirements.

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

ICCFILENAME: MAJETTE-EC-81-402.4-IRC N1102.4-

Public Hearing Results

PART II – IRC

Committee Action: **Disapproved**

Committee Reason: This proposal is inconsistent with portions of EC16. The language of the proposal uses the phrase “durably sealed”; however, that phrase is not easily defined. This would create an additional expense that is not necessary.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jeff Inks, representing Window & Door Manufacturers Association requests Approval as Submitted.

Commenter's Reason: WDMA urges approval as submitted for consistency with the action taken on Part I by the Energy Conservation Code Committee.

The proposed revisions will significantly improve the energy provisions of the IRC by including provisions that help ensure all building components are installed and tested properly to verify the building envelope is in compliance with the code.

Public Comment 2:

Shaunna Mozingo, City of Westminster, Co representing Colorado Chapter of ICC and Craig Conner, Building Quality, request Approval as Submitted.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This section of the code is already addressed by EC13 and is not needed if EC13 is approved. This change is not completely consistent with EC13. We recommend following DOE's lead on this.

Public Comment 3:

Stephen Turchen, Department of Public Works, Fairfax County, VA, representing Virginia Building and Code Officials Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1103.5 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of Section ~~M1507~~ M1507.3 of the *International Residential Code* 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.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: At the Final Action Hearings in Dallas, RM17-09/10 was approved as modified by the Code Development Committee at the Baltimore hearings. A new section, M1507.3, and referenced sub-sections were approved to provide the design requirements for a whole house ventilation system. Changing the IRC reference to "M1507.3" should eliminate any ambiguity as to whether a whole house ventilation system is required under EC79. The problem with a simple reference to "M1507" is that the first code text one would read under Section M1507 (see M1507.1) states "Where local exhaust or whole house mechanical ventilation **is provided** [emphasis added], the equipment shall be designed in accordance with this section." M1507.1 does not impose any requirement; it only says that if a ventilation system is provided, it should be designed in a certain way. The requirement for the system is imposed by the revisions to IECC Sec. 403.5 and IRC Sec. N1103.5. Having imposed the requirement, the system design parameters of IRC Sec. M1507.3 shall be followed.

Final Action: AS AM AMPC____ D

EC81-09/10-PART I

202 (New), 402.4.1, 402.4.2, 402.4.2.1, 402.4.2.2, 402.4.2.3, Table 402.4.2

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

1. Add new definition as follows:

SPECIFIC LEAKAGE AREA (SLA). The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where L and CFA are in the same units.

2. Revise as follows:

402.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Section 402.4.2 and be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:

1. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating a garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Attic access openings.
11. Rim joist junction.
12. Other sources of infiltration.

402.4.2 Air sealing and insulation. The components of the *building thermal envelope* as listed in Table 402.4.2 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table 402.4.2, as applicable to the method of construction. Building envelope air tightness and insulation installation shall be demonstrated to comply with ~~one of~~ the ~~following options given~~ requirements established by Section 402.4.2.1 ~~or~~ and 402.4.2.2:

402.4.2.1 Performance testing requirement ~~option~~. The building shall meet the air leakage standard set forth below as demonstrated by an air leakage test conducted as specified below:

1. Building envelope tightness ~~and insulation installation~~ shall be ~~considered acceptable when~~ tested by a party *approved* by the code official. Where required by the code official, the *approved* party shall be independent from both the builder and any other entity responsible for installing the insulation and air barrier and otherwise sealing the building. A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and *code official*.
2. The building shall be required to have an air leakage ~~is~~ less than 0.00030 *specific leakage area (SLA)* ~~seven air changes per hour (ACH)~~ when tested with a blower door at a pressure of 33.5 psf (50 Pa). Testing shall occur any time after rough in and after (i) installation of all penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances, and (ii) completion of sealing of the *building thermal envelope* as required in section 402.4.1.
3. During testing:

    1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed beyond the weather-stripping, caulking and other intended permanent air infiltration control measures;

2. Dampers shall be closed, but not sealed, including exhaust, intake, makeup air, backdraft, fireplace and flue dampers beyond intended permanent air infiltration control measures;
3. Interior doors connecting conditioned spaces shall be open, doors connecting to unconditioned spaces closed but not sealed;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s) shall be turned off;
~~6. HVAC ducts systems shall not be sealed; and~~
~~7~~ 6. Supply and return registers shall be fully open at the time of the test ~~not be sealed~~.

Exception: Multi-family residential buildings, with more than four dwelling units per building, may be individually exempted from the testing requirement only when meeting all of the following requirements:

1. The exemption is approved by the *code official* after inspection of the sealing of thermal envelope in accordance with Section 402.4.1 and Table 402.4.2;
2. At least 15 percent of the units are tested to have an air leakage less than 0.00036 *specific leakage area (SLA)* when tested with a blower door at a pressure of 33.5 psf (50 Pa), with the units to be tested specified by the code official; and
3. The tests demonstrate compliance for such units.

When any tested dwelling unit subject to this exception fails to meet the maximum air leakage requirement stated in Section 402.4.2.1, then the builder must resolve any leakage problems so that such unit passes the test and then must continue to test each additional dwelling unit in such building until a minimum of three consecutive dwelling units pass the test before the builder can return to testing as specified in subpart (ii) of this Exception.

402.4.2.2 Visual insulation inspection ~~option~~ (Mandatory). Building envelope ~~tightness and~~ insulation installation shall be ~~considered acceptable when the items listed in Table 402.4.2, applicable to the method of construction, are~~ field verified to meet the Insulation Installation Criteria in Table 402.4.2. Where required by the *code official*, an *approved* party independent from the builder and the installer of the insulation, shall inspect the ~~air barrier and~~ insulation; in such case, a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder before interior finish materials are applied.

3. Add new text as follows:

402.4.2.3 Visual air barrier inspection. For any building or dwelling unit not required to be tested under section 402.4.2.1, building envelope tightness shall be field verified to meet the Air Barrier Criteria in Table 402.4.2. Where required by the *code official*, an *approved* party independent from the builder and the installer of any air barrier materials, shall inspect the air barrier; in such case, a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder before interior finish materials are applied. In cases where the building or dwelling unit satisfies the testing requirement of section 402.4.2.1, the *code official* may also require field verification to show that the building meets the Air Barrier Criteria if deemed necessary.

4. Delete Table 402.4.2 and substitute as follows:

~~**TABLE 402.4.2**~~
~~**AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA**~~

TABLE 402.4.2
VISUAL AIR BARRIER AND INSULATION INSPECTION

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
General Requirements	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.	A continuous air barrier is installed in the thermal envelope. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.
Ceiling / attic	In any dropped ceiling/soffit, the insulation is substantially aligned with the air barrier.	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access, knee wall door or drop down stair to unconditioned attic is sealed.
Walls	All corners and headers are insulated. Insulation is in substantial contact and continuous	Junction of foundation and sill plate is sealed. Junction of exterior wall and top plate is sealed.

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
	alignment with air barrier.	Junction of the exterior wall and floor sheathing is sealed. Knee wall is sealed.
Fenestration		Space between fenestration jambs and framing is sealed.
Rim joists	Rim joists are insulated.	Air barrier is installed at the rim joist.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking.	Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls.	Exposed earth in unvented crawlspaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations		Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit; narrow cavities are filled by sprayed/blown insulation.	
Garage separation		Air sealing is provided between the garage and conditioned spaces.
Recessed lighting		Recessed light fixtures installed in the building thermal envelope are airtight, IC rated, and sealed to drywall.
Plumbing and Wiring	Insulation is placed between the exterior of the wall assembly and pipes. Batt insulation is cut and fitted around wiring and plumbing, or sprayed/blown insulation extends between piping and wiring and to the exterior of the wall assembly.	All plumbing and wiring penetrations shall be sealed to the air barrier.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs have insulation filling any gaps or voids between tub or shower walls and unconditioned space.	Exterior walls adjacent to showers and tubs have an air barrier separating the exterior wall from the shower and tubs.
Electrical / phone box on exterior walls	Insulation completely fills voids between the box and exterior sheathing	Air barrier extends behind boxes or air sealed type boxes are installed.
Common wall		Air barrier is installed in common wall between dwelling units.
HVAC register boots		HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace		Air barrier is installed on fireplace walls. Fireplace shall have gasketed doors.

Reason: Properly controlling air leakage and properly installing insulation are both critical to achieving additional energy savings in homes. In particular, reasonable control of air leakage can have an enormous positive effect on building energy efficiency. Since the builder is already required to properly install insulation and seal the building, the only true incremental cost is the cost of testing and inspection. This cost is fairly small compared to the benefits of proper sealing and insulation installation.

The changes approved in the 2009 *IECC* and *IRC* in this area improved existing code language by setting out clear steps for inspection and offering a testing option for air leakage. We are submitting this proposed modification because we believe that the code language and requirements can be substantially improved. For example, while the testing option as written will address air leakage (if this option is utilized), it does not address proper insulation installation. On the other hand, the inspection option does not guarantee reduced air leakage; the only way to guarantee it is to require testing.

In order to address these important issues, the proposed modification includes the following major improvements:

1. Makes both testing (with a written report) and a more limited visual inspection required;
2. Permits the code official to require independent testing and inspection with written reports;
3. Reduces the burden on code officials by reducing their inspection requirements by eliminating those requirements no longer necessary as a result of the test;
4. Replaces air changes per hour (ACH) with Specific Leakage Area (SLA), a more accurate and consistent measure, as the standard, improves the testing protocol and requires better air leakage performance; and
5. Separates the insulation installation inspection criteria from the air barrier inspection criteria to allow for each to be required or exempted based on the whether testing is conducted.

These changes will make this code change more enforceable and a substantial improvement in energy efficiency over the language in the current code. The following table portrays estimated savings from these measures:

	Climate Zone 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4M	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	2.1%	3.2%	4.0%	6.3%	6.2%	7.4%	11.7%	9.2%	8.6%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	1.5%	2.3%	2.9%	4.8%	4.8%	5.6%	9.3%	7.0%	6.8%

These energy savings are among the largest of the package of proposals submitted by the EECC. It is thus especially crucial to attaining the overall goal of improving the IECC by 30%.

This proposal also requires multifamily housing in excess of four units to be tested to a testing requirement. However in recognition of the differences in this type of housing, the requirement is 20% less stringent than a single family home to account for leakage to other conditioned space. The multifamily testing exemption also allows for sampling of 15% of the units similar to other sampling procedures by ENERGY STAR and RESNET due to issues related to testing larger multifamily buildings.

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

ICCFILENAME: PRINDLE-EC-19-202-402.4-R202-N1102.2.4

Public Hearing Results

PART I – IECC

Committee Action: Disapproved

Committee Reason: The approach taken and language used in EC13 is preferred. For instance EC13 uses the ACH metric rather than SLA. EC13 takes a different approach for sampling that is preferred. This proposal would allow air permeable insulation outside of the air barrier, which is undesirable.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**SPECIFIC LEAKAGE AREA (SLA).** The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with section 5.1 of ASHRAE 119 and where L and CFA are in the same units.~~

402.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Section 402.4.1.1, 402.4.1.2, 402.4.1.3 and 402.4.1.4 ~~402.4.2~~ and be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

1. ~~All joints, seams and penetrations.~~
2. ~~Site-built windows, doors and skylights.~~
3. ~~Openings between window and door assemblies and their respective jambs and framing.~~
4. ~~Utility penetrations.~~
5. ~~Dropped ceilings or chases adjacent to the thermal envelope.~~
6. ~~Knee walls.~~
7. ~~Walls and ceilings separating a garage from conditioned spaces.~~
8. ~~Behind tubs and showers on exterior walls.~~
9. ~~Common walls between dwelling units.~~
10. ~~Attic access openings.~~
11. ~~Rim joist junction.~~
12. ~~Other sources of infiltration.~~

402.4.1.1 Installation ~~402.4.2 Air sealing and insulation~~. The components of the *building thermal envelope* as listed in Table 402.4.1.1 ~~402.4.2~~ shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table 402.4.1.1 ~~402.4.2~~, as applicable to the method of construction. Building envelope air tightness and insulation installation shall be demonstrated to comply with the requirements established by Section 402.4.1.2 ~~402.4.2.1~~ and 402.4.1.3 ~~402.4.2.2:~~.

402.4.1.2 ~~402.4.2.1~~ Performance testing requirement. The building shall meet the air leakage standard set forth below as demonstrated by an air leakage test conducted as specified below:

1. Building envelope tightness shall be tested by a party *approved* by the code official. ~~Where required by the code official, the *approved* party shall be independent from both the builder and any other entity responsible for installing the insulation and air barrier and otherwise sealing the building.~~ A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and *code official*.
2. The building shall be required to have an air leakage less than ~~0.00030 *specific leakage area (SLA)*~~ five air changes per hour (ACH50) when tested with a blower door at a pressure of ~~33.5 psf~~ 0.2 inches w.g. (50 Pa). Testing shall occur any time after rough in and after (i) installation of all penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances, and (ii) completion of sealing of the *building thermal envelope* as required in section 402.4.1.
3. During testing:
    1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed beyond the weather-stripping, caulking and other intended permanent air infiltration control measures;
    2. Dampers shall be closed, but not sealed, including exhaust, intake, makeup air, backdraft, fireplace and flue dampers beyond intended permanent air infiltration control measures;
    3. Interior doors connecting conditioned spaces shall be open, doors connecting to unconditioned spaces closed but not sealed;
    4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;

5. Heating and cooling system(s) shall be turned off;
6. Supply and return registers shall be fully open at the time of the test.

Exception: Multi-family residential buildings, with more than four dwelling units per building, may be individually exempted from the testing requirement only when meeting all of the following requirements:

1. the exemption is approved by the *code official* after inspection of the sealing of thermal envelope in accordance with section 402.4.1 and Table 402.4.1.1 ~~402.4.2~~;
2. at least 15% of the units are tested and each tested unit has ~~to have~~ an air leakage less than ~~0.00036 *specific leakage area (SLA)*~~ seven air changes per hour (ACH50) when tested with a blower door at a pressure of ~~33.5 psf~~ 0.2 inches w.g. (50 Pa), with the units to be tested specified by the code official; and
3. the tests demonstrate compliance for such units.

When any tested dwelling unit subject to this exception fails to meet the maximum air leakage requirement stated in this exception ~~Section 402.4.2.1~~, then the builder must resolve any leakage problems so that such unit passes the test and then must continue to test each additional dwelling unit in such building until a minimum of three consecutive dwelling units pass the test before the builder can return to testing as specified in subpart (ii) of this Exception.

402.4.1.3 ~~402.4.2.2~~ Visual insulation inspection (Mandatory). Building envelope insulation installation shall be inspected and field verified to meet the Insulation Installation Criteria in Table 402.4.1.1 ~~402.4.2~~ before interior finish materials are installed. ~~Where required by t~~ The code official~~,~~ or an *approved* party ~~independent from the builder and the installer of the insulation,~~ shall inspect the insulation~~;~~. Where an *approved* party conducts the inspection, ~~in such case,~~ a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder ~~before interior finish materials are applied~~.

402.4.1.4 ~~402.4.2.3~~ Visual air barrier inspection. For any building or dwelling unit not required to be tested under section 402.4.1.2 ~~402.4.2.1~~, building envelope tightness shall be field verified to meet the Air Barrier Criteria in Table 402.4.1.1 ~~402.4.2~~. Visual air barrier inspection shall be completed prior to the installation of air permeable insulation. ~~Where required by t~~ The code official~~,~~ or an *approved* party ~~independent from the builder and the installer of any air barrier materials,~~ shall inspect the air barrier~~;~~. Where an *approved* party conducts the inspection, ~~in such case,~~ a written inspection report, including a checklist demonstrating compliance shall be provided to the *code official* and builder before interior finish materials are applied. In cases where the building or dwelling unit satisfies the testing requirement of section 402.4.1.2 ~~402.4.2.1~~, the *code official* may also require field verification to show that the building meets the Air Barrier Criteria if deemed necessary.

TABLE 402.4.1.1 ~~402.4.2~~
VISUAL AIR BARRIER AND INSULATION INSPECTION

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
General Requirements	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.	A continuous air barrier is installed in the thermal envelope. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.
Ceiling / attic	In any dropped ceiling/soffit, the insulation is substantially aligned with the air barrier.	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access, knee wall door or drop down stair to unconditioned attic is sealed.
Walls	All corners and headers are insulated. Insulation is in substantial contact and continuous alignment with air barrier.	Junction of foundation and sill plate is sealed. Junction of exterior wall and top plate is sealed. Junction of the exterior wall and floor sheathing is sealed. Knee wall is sealed.
Fenestration		Space between fenestration jambs and framing is sealed.
Rim joists	Rim joists are insulated.	Air barrier is installed at the rim joist.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking.	Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls.	Exposed earth in unvented crawlspaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations		Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit; narrow cavities are filled by sprayed/blown insulation.	
Garage separation		Air sealing is provided between the garage and conditioned spaces.
Recessed lighting		Recessed light fixtures installed in the building thermal envelope are airtight, IC rated, and sealed to drywall.
Plumbing and Wiring	Insulation is placed between the exterior of the wall assembly and pipes. Batt insulation is cut and fitted around wiring and plumbing, or sprayed/blown insulation extends between piping and wiring and to the exterior of the wall assembly.	All plumbing and wiring penetrations shall be sealed to the air barrier.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs have	Exterior walls adjacent to showers and tubs have

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
	insulation filling any gaps or voids between tub or shower walls and unconditioned space.	an air barrier separating the exterior wall from the shower and tubs.
Electrical / phone box on exterior walls	Insulation completely fills voids between the box and exterior sheathing	Air barrier extends behind boxes or air sealed type boxes are installed.
Common wall		Air barrier is installed in common wall between dwelling units.
HVAC register boots		HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace		Air barrier is installed on fireplace walls. Fireplace shall have gasketed doors.

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	*Specific leakage area (SLA)*[d] = 0.00036 assuming no energy recovery. Air leakage rate of 5 air changes per hour in zones 1 through 8 at a pressure of 0.2 inches w.g., (50 Pa). The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than 0.01 x CFA +7.5 x (Nbr + 1) where: *CFA* = conditioned floor area N_{br} = number of bedrooms Energy recovery shall not be assumed for mechanical ventilation. Exception: For multifamily buildings, the air leakage shall be 7 ACH50 assuming no energy recovery when tested with a blower door at a pressure of 0.2 inches w.g., (50 Pa).	The measured air exchange rate as determined through testing in accordance with Section 402.4.1.2. The mechanical ventilation rate shall be in addition to the air leakage rate and shall be as proposed. For residences that are not tested, the same as the standard reference design. For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate[e] but not less than 0.35 ACH. For residences with mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate[e] combined with the mechanical ventilation rate, [f] which shall not be less than 0.01 x *CFA* + 7.5 x (N_{br} + 1) where: *CFA* = conditioned floor area N_{br} = number of bedrooms

d. Where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:
SLA = L/CFA
where L and CFA are in the same units.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: *EC81 should be approved as modified by this public comment.*

EC81 as modified will improve both the energy efficiency and the clarity of insulation installation and air barrier requirements in the code, while ensuring that homes meet a reasonable tested air leakage standard. The modification in this public comment adopts the general approach to air leakage inspection and testing in EC13 and EC79, including numbering the sections so that it can work directly with the EC13 and EC79 language. At the same time, this approach is intended to capture the additional improvements included in the version of EC81 as submitted (beyond the energy efficiency of EC13), and to cleanup wording and section numbers as requested in testimony at the Committee Hearings.

EC81 as modified establishes clearer requirements that will achieve higher energy efficiency. This includes:

(1) tightening tested air leakage requirements for climate zones 1-2 to be consistent with the requirements in the remaining zones;
(2) requiring testing in all cases except for an appropriate limited exception for multifamily buildings (eliminating the more vague sampling exception and the exception for additions established through EC13 and EC79)
(3) organizing insulation inspection requirements and air barrier inspection requirements in a compliance-friendly side-by-side table,
(4) creating greater consistency between the performance and prescriptive paths as to air leakage in the IECC based on the proposed prescriptive path changes (note the proposed modifications to Table 405.5.2(1));
(5) requiring the insulation inspection in all cases and allowing the code official to avoid an unnecessary visual air barrier inspection when the building meets the air leakage test; and
(6) removing the unnecessary language from the proposal as submitted that explicitly permitted code officials to require independent parties to do air leakage tests– this language is unnecessary since the test is required to be conducted by an *approved* party (as a result, the code official or jurisdiction can require independence as part of the approval process if desired).

This public comment also picks up various improvements that are in EC13, including using ACH instead of SLA for air leakage testing requirements and removing the redundant requirements in section 402.4.1.

Final Action: AS AM AMPC____ D

EC81-09/10-PART II

R202 (New), N1102.4.1, N1102.4.2, N1102.4.2.1, N1102.4.2.2, N1102.4.2.3, Table N1102.4.2

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

1. Add new definition as follows:

SPECIFIC LEAKAGE AREA (SLA). The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where L and CFA are in the same units.

2. Revise as follows:

N1102.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Section N1102.4.2 and be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.

1. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating a garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Attic access openings.
11. Rim joist junction.
12. Other sources of infiltration.

N1102.4.2 Air sealing and insulation. The components of the *building thermal envelope* as listed in Table N1102.4.2 shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table N1102.4.2, as applicable to the method of construction. Building envelope air tightness and insulation installation shall be demonstrated to comply with ~~one of~~ the ~~following options given~~ requirements established by Section N1102.4.2.1 ~~or~~ and N1102.4.2.2.

N1102.4.2.1 Performance testing requirement ~~option~~. The building shall meet the air leakage standard set forth below as demonstrated by an air leakage test conducted as specified below:

1. Building envelope tightness shall be tested by a party *approved* by the code official. Where required by the building official, the *approved* party shall be independent from both the builder and any other entity responsible for installing the insulation and air barrier and otherwise sealing the building. A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and *building official*.
2. ~~Tested~~ The building shall be required to have an air leakage ~~is~~ less than 0.00030 *specific leakage area (SLA)* ~~7 ACH~~ when tested with a blower door at a pressure of 33.5 psf (50 Pa) ~~pascals (0.007 psi)~~. Testing shall occur any time after rough in and after (i) installation of all penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances, and (ii) completion of sealing of the *building thermal envelope* as required in section N1102.4.1.
3. During testing:
   1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed beyond the weather-stripping, caulking and other intended permanent air infiltration control measures;

2. Dampers shall be closed, but not sealed, including exhaust, intake, makeup air, backdraft, fireplace and flue dampers beyond intended permanent air infiltration control measures;
3. Interior doors connecting conditioned spaces shall be open, doors connecting to unconditioned spaces closed but not sealed;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s) shall be turned off;
~~6. HVAC ducts systems shall not be sealed; and~~
~~7~~ 6. Supply and return registers shall be fully open at the time of the test ~~not be sealed~~.

Exception: Multi-family residential buildings, with more than four dwelling units per building, may be individually exempted from the testing requirement only when meeting all of the following requirements:

1. The exemption is approved by the *building official* after inspection of the sealing of thermal envelope in accordance with section N1102.4.1 and Table N1102.4.2;
2. At least 15 percent of the units are tested to have an air leakage less than 0.00036 *specific leakage area (SLA)* when tested with a blower door at a pressure of 33.5 psf (50 Pa), with the units to be tested specified by the code official; and
3. The tests demonstrate compliance for such units.

When any tested dwelling unit subject to this exception fails to meet the maximum air leakage requirement stated in Section N1102.4.2.1, then the builder must resolve any leakage problems so that such unit passes the test and then must continue to test each additional dwelling unit in such building until a minimum of three consecutive dwelling units pass the test before the builder can return to testing as specified in subpart (ii) of this Exception.

N1102.4.2.2 Visual insulation inspection ~~option~~. ~~The items listed in Table N1102.4.2, applicable to the method of construction, are~~ Building envelope insulation installation shall be field verified to meet the Insulation Installation Criteria in Table N1102.4.2. Where required by the building official, an *approved* party independent from the builder and the installer of the insulation, shall inspect the ~~air barrier and~~ insulation; in such case, a written inspection report, including a checklist demonstrating compliance shall be provided to the *building official* and builder before interior finish materials are applied.

3. Add new text as follows:

N1102.4.2.3 Visual air barrier inspection. For any building or dwelling unit not required to be tested under Section N1102.4.2.1, building envelope tightness shall be field verified to meet the Air Barrier Criteria in Table N1102.4.2. Where required by the *building official*, an *approved* party independent from the builder and the installer of any air barrier materials, shall inspect the air barrier; in such case, a written inspection report, including a checklist demonstrating compliance shall be provided to the *building official* and builder before interior finish materials are applied. In cases where the building or dwelling unit satisfies the testing requirement of Section N1102.4.2.1, the *building official* may also require field verification to show that the building meets the Air Barrier Criteria if deemed necessary.

4. Delete Table N1102.4.2 and substitute as follows:

~~TABLE N1102.4.2~~
~~AIR BARRIER AND INSULATION INSPECTION~~

TABLE N1102.4.2
VISUAL AIR BARRIER AND INSULATION INSPECTION

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
General Requirements	Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with building envelope air barrier.	A continuous air barrier is installed in the thermal envelope. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.
Ceiling / attic	In any dropped ceiling/soffit, the insulation shall be substantially aligned with the air barrier.	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access, knee wall door or drop down stair to unconditioned attic is sealed.
Walls	All corners and headers are insulated. Insulation shall be substantial contact and continuous	Junction of foundation and sill plate is sealed. Junction of exterior wall and top plate is sealed.

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
	alignment with air barrier.	Junction of the exterior wall and floor sheathing is sealed. Knee wall is sealed.
Fenestration		Space between fenestration jambs and framing is sealed.
Rim joists	Rim joists are insulated.	Air barrier is installed at the rim joist.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking.	Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls.	Exposed earth in unvented crawlspaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations		Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit; narrow cavities shall be filled by sprayed/blown insulation.	
Garage separation		Air sealing is provided between the garage and conditioned spaces.
Recessed lighting		Recessed light fixtures installed in the building thermal envelope are airtight, IC rated, and sealed to drywall.
Plumbing and Wiring	Insulation shall be placed between the exterior of the wall assembly and pipes. Batt insulation is cut and fitted around wiring and plumbing, or sprayed/blown insulation extends between piping and wiring and to the exterior of the wall assembly.	All plumbing and wiring penetrations shall be sealed to the air barrier.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs have insulation filling any gaps or voids between tub or shower walls and unconditioned space.	Exterior walls adjacent to showers and tubs have an air barrier separating the exterior wall from the shower and tubs.
Electrical / phone box on exterior walls	Insulation completely fills voids between the box and exterior sheathing	Air barrier extends behind boxes or air sealed type boxes are installed.
Common wall		Air barrier is installed in common wall between dwelling units.
HVAC register boots		HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace		Air barrier is installed on fireplace walls. Fireplace shall have gasketed doors.

Reason: Properly controlling air leakage and properly installing insulation are both critical to achieving additional energy savings in homes. In particular, reasonable control of air leakage can have an enormous positive effect on building energy efficiency. Since the builder is already required to properly install insulation and seal the building, the only true incremental cost is the cost of testing and inspection. This cost is fairly small compared to the benefits of proper sealing and insulation installation.

The changes approved in the 2009 *IECC* and *IRC* in this area improved existing code language by setting out clear steps for inspection and offering a testing option for air leakage. We are submitting this proposed modification because we believe that the code language and requirements can be substantially improved. For example, while the testing option as written will address air leakage (if this option is utilized), it does not address proper insulation installation. On the other hand, the inspection option does not guarantee reduced air leakage; the only way to guarantee it is to require testing.

In order to address these important issues, the proposed modification includes the following major improvements:

1. Makes both testing (with a written report) and a more limited visual inspection required;
2. Permits the code official to require independent testing and inspection with written reports;
3. Reduces the burden on code officials by reducing their inspection requirements by eliminating those requirements no longer necessary as a result of the test;
4. Replaces air changes per hour (ACH) with Specific Leakage Area (SLA), a more accurate and consistent measure, as the standard, improves the testing protocol and requires better air leakage performance; and
5. Separates the insulation installation inspection criteria from the air barrier inspection criteria to allow for each to be required or exempted based on the whether testing is conducted.

These changes will make this code change more enforceable and a substantial improvement in energy efficiency over the language in the current code. The following table portrays estimated savings from these measures:

	Climate Zone 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4M	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	2.1%	3.2%	4.0%	6.3%	6.2%	7.4%	11.7%	9.2%	8.6%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	1.5%	2.3%	2.9%	4.8%	4.8%	5.6%	9.3%	7.0%	6.8%

These energy savings are among the largest of the package of proposals submitted by the EECC. It is thus especially crucial to attaining the overall goal of improving the IECC by 30%.

This proposal also requires multifamily housing in excess of four units to be tested to a testing requirement. However in recognition of the differences in this type of housing, the requirement is 20% less stringent than a single family home to account for leakage to other conditioned space. The multifamily testing exemption also allows for sampling of 15% of the units similar to other sampling procedures by ENERGY STAR and RESNET due to issues related to testing larger multifamily buildings.

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

ICCFILENAME: PRINDLE-EC-19-202-402.4-R202-N1102.2.4

Public Hearing Results

PART II - IRC

Committee Action: **Disapproved**

Committee Reason: The code change proposal regarding sampling would require some discretion on the part of the building official that could lead to accusations of impartial application of the code. Terminology changes (SLA instead of ACH) could cause confusion.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**SPECIFIC LEAKAGE AREA (SLA).** The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with section 5.1 of ASHRAE 119 and where L and CFA are in the same units.~~

N1102.4.1 Building thermal envelope. The *building thermal envelope* shall comply with Sections N1102.4.1.1, ~~N1102.4.2~~,N1102.4.1.2, N1102.4.1.4 and N1102.4.1.4 and be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.~~

1. ~~All joints, seams and penetrations.~~
2. ~~Site-built windows, doors and skylights.~~
3. ~~Openings between window and door assemblies and their respective jambs and framing.~~
4. ~~Utility penetrations.~~
5. ~~Dropped ceilings or chases adjacent to the thermal envelope.~~
6. ~~Knee walls.~~
7. ~~Walls and ceilings separating a garage from conditioned spaces.~~
8. ~~Behind tubs and showers on exterior walls.~~
9. ~~Common walls between dwelling units.~~
10. ~~Attic access openings.~~
11. ~~Rim joist junction.~~
12. ~~Other sources of infiltration.~~

N1102.4.1.1 Installation ~~**N1102.4.2 Air sealing and insulation.**~~ The components of the *building thermal envelope* as listed in Table N1102.4.1.1 ~~N1102.4.2~~ shall be installed in accordance with the manufacturer's instructions and the criteria listed in Table N1102.4.1.1 ~~N1102.4.2~~, as applicable to the method of construction. Building envelope air tightness and insulation installation shall be demonstrated to comply with the requirements established by Section N1102.4.1.2 ~~N1102.4.2.1~~ and N1102.4.1.3 ~~N1102.4.2.2~~.

N1102.4.1.2 ~~**N1102.4.2.1**~~ **Performance testing requirement.** The building shall meet the air leakage standard set forth below as demonstrated by an air leakage test conducted as specified below:

1. Building envelope tightness shall be tested by a party *approved* by the code official. ~~Where required by the building official, the *approved* party shall be independent from both the builder and any other entity responsible for installing the insulation and air barrier and otherwise sealing the building.~~ A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and *building official*.
2. The building shall be required to have an air leakage ~~is~~ less than ~~0.00030 *specific leakage area (SLA)*~~ five air changes per hour (ACH) when tested with a blower door at a pressure of ~~33.5 psf~~ 0.2 inches w.g. (50 Pa). Testing shall occur any time after rough in and after (i) installation of all penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances, and (ii) completion of sealing of the *building thermal envelope* as required in section N1102.4.1.
3. During testing:
   1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed beyond the weather-stripping, caulking and other intended permanent air infiltration control measures;
   2. Dampers shall be closed, but not sealed, including exhaust, intake, makeup air, backdraft, fireplace and flue dampers beyond intended permanent air infiltration control measures;
   3. Interior doors connecting conditioned spaces shall be open, doors connecting to unconditioned spaces closed but not sealed;
   4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;

5. Heating and cooling system(s) shall be turned off;
6. Supply and return registers shall be fully open at the time of the test.

Exception: Multi-family residential buildings, with more than four dwelling units per building, may be individually exempted from the testing requirement only when meeting all of the following requirements:

1. the exemption is approved by the *building official* after inspection of the sealing of thermal envelope in accordance with section N1102.4.1 and Table N1102.4.1.1 ~~N1102.4.2~~;
2. at least 15 percent of the units are tested and each tested unit has ~~to have~~ an air leakage less than ~~0.00036 *specific leakage area (SLA)*~~ seven air changes per hour (ACH) when tested with a blower door at a pressure of ~~33.5 psf~~ 0.2 inches w.g. (50 Pa), with the units to be tested specified by the code official; and
3. the tests demonstrate compliance for such units.

When any tested dwelling unit subject to this exception fails to meet the maximum air leakage requirement stated in this exception ~~Section N1102.4.2.1~~, then the builder must resolve any leakage problems so that such unit passes the test and then must continue to test each additional dwelling unit in such building until a minimum of three consecutive dwelling units pass the test before the builder can return to testing as specified in subpart (ii) of this Exception.

N1102.4.1.3 ~~**N1102.4.2.2**~~ **Visual insulation inspection.** Building envelope insulation installation shall be inspected and field verified to meet the Insulation Installation Criteria in Table N1102.4.1.1 ~~N1102.4.2~~ before interior finish materials are installed. ~~Where required by t~~ The building official~~,~~ or an *approved* party ~~independent from the builder and the installer of the insulation,~~ shall inspect the insulation~~;~~. Where an *approved* party conducts the inspection, ~~in such case,~~ a written inspection report, including a checklist demonstrating compliance shall be provided to the *building official* and builder ~~before interior finish materials are applied~~.

N1102.4.1.4 ~~**N1102.4.2.3**~~ **Visual air barrier inspection.** For any building or dwelling unit not required to be tested under Section N1102.4.2.1, building envelope tightness shall be field verified to meet the Air Barrier Criteria in Table N1102.4.1.1 ~~N1102.4.2~~. Visual air barrier inspection shall be completed prior to the installation of air permeable insulation. ~~Where required by t~~ The building official~~,~~ or an *approved* party ~~independent from the builder and the installer of any air barrier materials,~~ shall inspect the air barrier. Where an *approved* party conducts the inspection, ~~in such case,~~ a written inspection report, including a checklist demonstrating compliance shall be provided to the *building official* and builder before interior finish materials are applied. In cases where the building or dwelling unit satisfies the testing requirement of Section N1102.4.1.2 ~~N1102.4.2.1~~, the *building official* may also require field verification to show that the building meets the Air Barrier Criteria if deemed necessary.

TABLE N1102.4.1.1~~2~~
VISUAL AIR BARRIER AND INSULATION INSPECTION

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
General Requirements	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.	A continuous air barrier is installed in the thermal envelope. Breaks or joints in the air barrier are sealed. Air permeable insulation is not used as a sealing material.
Ceiling / attic	In any dropped ceiling/soffit, the insulation shall be substantially aligned with the air barrier.	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access, knee wall door or drop down stair to unconditioned attic is sealed.
Walls	All corners and headers are insulated. Insulation shall be in substantial contact and continuous alignment with air barrier.	Junction of foundation and sill plate is sealed. Junction of exterior wall and top plate is sealed. Junction of the exterior wall and floor sheathing is sealed. Knee wall is sealed.
Fenestration		Space between fenestration jambs and framing is sealed.
Rim joists	Rim joists are insulated.	Air barrier is installed at the rim joist.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking.	Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls.	Exposed earth in unvented crawlspaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations		Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit; narrow cavities are filled by sprayed/blown insulation.	
Garage separation		Air sealing is provided between the garage and conditioned spaces.
Recessed lighting		Recessed light fixtures installed in the building thermal envelope are airtight, IC rated, and sealed to drywall.
Plumbing and Wiring	Insulation is placed between the exterior of the wall assembly and pipes. Batt insulation is cut and fitted around wiring and plumbing, or sprayed/blown insulation extends between piping and wiring and to the exterior of the wall assembly.	All plumbing and wiring penetrations shall be sealed to the air barrier.
Shower / tub on exterior wall	Exterior walls adjacent to showers and tubs have insulation filling any gaps or voids between tub or	Exterior walls adjacent to showers and tubs have an air barrier separating the exterior wall from the

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
	shower walls and unconditioned space.	shower and tubs.
Electrical / phone box on exterior walls	Insulation completely fills voids between the box and exterior sheathing	Air barrier extends behind boxes or air sealed type boxes are installed.
Common wall		Air barrier is installed in common wall between dwelling units.
HVAC register boots		HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace		Air barrier is installed on fireplace walls. Fireplace shall have gasketed doors.

Commenter's Reason: *EC81 should be approved as modified by this public comment.*

EC81 as modified will improve both the energy efficiency and the clarity of insulation installation and air barrier requirements in the code, while ensuring that homes meet a reasonable tested air leakage standard. The modification in this public comment adopts the general approach to air leakage inspection and testing in EC13 and EC79, including numbering the sections so that it can work directly with the EC13 and EC79 language. At the same time, this approach is intended to capture the additional improvements included in the version of EC81 as submitted (beyond the energy efficiency of EC13), and to cleanup wording and section numbers as requested in testimony at the Committee Hearings.

EC81 as modified establishes clearer requirements that will achieve higher energy efficiency. This includes:

(1) tightening tested air leakage requirements for climate zones 1-2 to be consistent with the requirements in the remaining zones;
(2) requiring testing in all cases except for an appropriate limited exception for multifamily buildings (eliminating the more vague sampling exception and the exception for additions established through EC13 and EC79)
(3) organizing insulation inspection requirements and air barrier inspection requirements in a compliance-friendly side-by-side table,
(4) creating greater consistency between the performance and prescriptive paths as to air leakage in the IECC based on the proposed prescriptive path changes (note the proposed modifications to Table 405.5.2(1));
(5) requiring the insulation inspection in all cases and allowing the code official to avoid an unnecessary visual air barrier inspection when the building meets the air leakage test; and
(6) removing the unnecessary language from the proposal as submitted that explicitly permitted code officials to require independent parties to do air leakage tests– this language is unnecessary since the test is required to be conducted by an *approved* party (as a result, the code official or jurisdiction can require independence as part of the approval process if desired).

This public comment also picks up various improvements that are in EC13, including using ACH instead of SLA for air leakage testing requirements and removing the redundant requirements in section 402.4.1.

Final Action: AS AM AMPC____ D

EC84-09/10-PART I
402.4.1.1; IRC N1102.4.6

Proposed Change as Submitted

Proponent: Wendy Johnson, Midway City, representing the Utah Chapter of ICC

PART I – IECC

Add new text as follows:

402.4.1.1 Combustion air to rooms outside the thermal envelope. Where outside combustion air is supplied to liquid-, solid-, or fuel gas- burning appliances, a furnace or boiler room shall be provided to isolate the outside combustion air from the conditioned space. This room shall be insulated, isolated and sealed from the conditioned space per the requirements of this code. Supply and return ducts, and hot water lines located inside the room shall be insulated per the requirements this code. All water lines shall be protected from freezing. Outside combustion air ducts to this room, which pass through the conditioned space, shall be insulated and sealed in accordance with Section 403.2.

Exception:

1. Isolated rooms are not required where all liquid-, solid-, or fuel gas-appliances located inside the building envelope are direct vent.
2. Required combustion air for masonry fireplaces.

Reason: In areas where the seasonal interior/exterior temperature differential is significant, the combustion air ducts bring outside air, which is either quite cold or quite hot, into a mechanical room, crawl space, or unfinished basement. Unknowing homeowners often close off these ducts because the hot or cold air significantly impacts the temperature within the dwelling, or in extreme cases freezes water pipes. To have the 10", 11", or even 12" duct opening directly into what is then the thermal envelope of the structure is common practice, but certainly not what the energy code intends to happen. This new code section **clarifies** the intent of the code and outlines the minimum requirements for these spaces to meet the energy code.

Cost Impact: The code change proposal will increase the cost of construction, but lower energy consumption.

ICCFILENAME: JOHNSON(WENDY)-EC-1-402.4.1.1-RE-1-N1102.4.6

Public Hearing Results

PART I – IECC

Committee Action: **Disapproved**

Committee Reason: This would eliminate the use of certain types of heating products. If this is an issue that needs to be dealt with, the issue should be dealt with in the mechanical code by people that have the expertise to provide input regarding safety issues.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Brent Ursenbach, Salt Lake County, representing Utah Chapter of ICC, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Replace the proposal as follows:

402.4.1.1 Rooms with Outside Combustion Air. Where outside combustion air is supplied to an equipment enclosure or room for fuel burning equipment, the enclosure or room shall be considered to be outside the thermal envelope. The walls, ceiling, floor and doors into the room or enclosure shall be insulated and sealed per the requirements of this chapter. Where outside combustion air is supplied for the fuel burning equipment located in an open basement or other open area inside the thermal envelope, an equipment enclosure or room shall be provided. Such enclosures or rooms shall be insulated and sealed per the requirements of this chapter. Ducts, stud spaces and joist spaces used to transfer outside combustion air that pass through conditioned spaces must be insulated to a minimum of R-6. Supply, return and ventilation ducts located within such enclosures or rooms shall be insulated and sealed per the requirements of 403.2. Water lines shall be protected from freezing.

Exceptions:

1. Rooms or enclosures containing direct vent fuel burning equipment where the combustion air pipe or duct connects directly to the fuel burning equipment.
2. Fuel burning equipment located in any approved location where the combustion air pipe or duct connects directly to the fuel burning equipment.
3. Fuel burning equipment that is approved for installation using inside air for combustion by this Code, the *International Mechanical Code*, the *International Fuel Gas Code* and the manufacturer's installation instructions.
4. The slab-on-grade floor insulation requirements of 402.2.8 are not required for room or enclosure slabs that do not have an actual exterior wall.

Commenter's Reason: Building codes have continually added specific requirements for combustion air over the past 25 years due to the efforts of the various codes to reduce infiltration into a building. Simply stated, buildings have become so tight that sufficient air cannot 'leak' into the building to meet the combustion air requirements of the fuel burning equipment, therefore a hole must be cut into the thermal envelope to provide the required combustion air. What value is there in following all of the building thermal envelope requirements of this code if outside air is allowed and required to be discharged directly to inside the thermal envelope? Rooms with combustion air opening into the room need to be treated as if they are outside the thermal envelope. This change corrects an inconsistency between mechanical/fuel gas and the energy code and provides substantial energy savings.

The IECC committees' reasoning that this would eliminate certain types of heating products has been addressed in this modification. Their statement that this should be addressed by the mechanical code is not correct- this proposal is not about the sizing or any other 'safety' components of combustion air; it is about the huge quantity of energy that continues to be wasted when outside combustion air is introduced through the thermal envelope into a building. Insulating and sealing belongs in the energy code.

The IRC committees' reasoning that this would require fireplaces to be placed in a separate room is also incorrect. Direct vent equipment/fireplaces do not have open combustion air ducts and are addressed in the exception added. New wood burning fireplaces are now required by 2009 IECC to have gasketed doors and outside combustion air.

This proposal will also encourage the use of more efficient direct vent fuel fired equipment, eliminating the need for open combustion ducts into an isolated, insulated and sealed room.

The original proposal was Disapproved by Committee in Baltimore

Final Action: AS AM AMPC____ D

EC84-09/10-PART II
402.4.1.1; IRC N1102.4.6

Proposed Change as Submitted

Proponent: Wendy Johnson, Midway City, representing the Utah Chapter of ICC

PART II – IRC BUILDING/ENERGY

Add new text as follows:

N 1102.4.6 Combustion air to rooms to be outside the thermal envelope. Where outside combustion air is supplied to liquid- solid-, or fuel gas- burning appliances, a furnace or boiler room shall be provided to isolate the outside combustion air from the conditioned space. This room shall be insulated, isolated and sealed from the conditioned space per the requirements of this code. Supply and return ducts, and hot water lines located inside the room shall be insulated per the requirements of this code. All water lines shall be protected from freezing. Outside combustion air ducts to this room, which pass through the conditioned space, shall be insulated and sealed in accordance with Section N1103.2.1.

Exception:

1. Isolated rooms are not required where all liquid-, solid-, or fuel-gas-appliances located inside the building envelope are direct vent.
2. Required combustion air for masonry fireplaces.

Reason: In areas where the seasonal interior/exterior temperature differential is significant, the combustion air ducts bring outside air, which is either quite cold or quite hot, into a mechanical room, crawl space, or unfinished basement. Unknowing homeowners often close off these ducts because the hot or cold air significantly impacts the temperature within the dwelling, or in extreme cases freezes water pipes. To have the 10", 11", or even 12" duct opening directly into what is then the thermal envelope of the structure is common practice, but certainly not what the energy code intends to happen. This new code section **clarifies** the intent of the code and outlines the minimum requirements for these spaces to meet the energy code.

Cost Impact: The code change proposal will increase the cost of construction, but lower energy consumption.

ICCFILENAME: JOHNSON(WENDY)-EC-1-402.4.1.1-RE-1-N1102.4.6

Public Hearing Results

PART II – IRC

Committee Action: **Disapproved**

Committee Reason: The proposed change would require fireplaces to be placed in separate rooms, rather than the room in which it is to be used. This should be dealt with in the mechanical chapters of the code.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Brent Ursenbach, Salt Lake County, representing Utah Chapter of ICC requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Replace the proposal as follows:

N1102.4.6 Rooms with Outside Combustion Air. Where outside combustion air is supplied to an equipment enclosure or room for fuel burning equipment, the enclosure or room shall be considered to be outside the thermal envelope. The walls, ceiling, floor and doors into the room or enclosure shall be insulated and sealed per the requirements of this chapter. Where outside combustion air is supplied for the fuel burning equipment located in an open basement or other open area inside the thermal envelope, an equipment enclosure or room shall be provided. Such enclosures or rooms shall be insulated and sealed per the requirements of this chapter. Ducts, stud spaces and joist spaces used to transfer outside combustion air that pass through conditioned spaces must be insulated to a minimum of R-6. Supply, return and ventilation ducts located within such enclosures or rooms shall be insulated and sealed per the requirements of 1103.2. Water lines shall be protected from freezing.

Exceptions:

1. Rooms or enclosures containing direct vent fuel burning equipment where the combustion air pipe or duct connects directly to the fuel burning equipment.
2. Fuel burning equipment located in any approved location where the combustion air pipe or duct connects directly to the fuel burning equipment.
3. Fuel burning equipment that is approved for installation using inside air for combustion by this Code, the *International Mechanical Code*, the *International Fuel Gas Code* and the manufacturer's installation instructions.
4. The slab-on-grade floor insulation requirements of N1102.2.8 are not required for room or enclosure slabs that do not have an actual exterior wall.

Commenter's Reason: Commenter's Reason: Building codes have continually added specific requirements for combustion air over the past 25 years due to the efforts of the various codes to reduce infiltration into a building. Simply stated, buildings have become so tight that sufficient air cannot 'leak' into the building to meet the combustion air requirements of the fuel burning equipment, therefore a hole must be cut into the thermal envelope to provide the required combustion air. What value is there in following all of the building thermal envelope requirements of this code if outside air is allowed and required to be discharged directly to inside the thermal envelope? Rooms with combustion air opening into the room need to be treated as if they are outside the thermal envelope. This change corrects an inconsistency between mechanical/fuel gas and the energy code and provides substantial energy savings.

The IECC committees' reasoning that this would eliminate certain types of heating products has been addressed in this modification. Their statement that this should be addressed by the mechanical code is not correct- this proposal is not about the sizing or any other 'safety' components of combustion air; it is about the huge quantity of energy that continues to be wasted when outside combustion air is introduced through the thermal envelope into a building. Insulating and sealing belongs in the energy code.

The IRC committees' reasoning that this would require fireplaces to be placed in a separate room is also incorrect. Direct vent equipment/fireplaces do not have open combustion air ducts and are addressed in the exception added. New wood burning fireplaces are now required by 2009 IECC to have gasketed doors and outside combustion air.

This proposal will also encourage the use of more efficient direct vent fuel fired equipment, eliminating the need for open combustion ducts into an isolated, insulated and sealed room.

The original proposal was Disapproved by Committee in Baltimore

Final Action: AS   AM   AMPC____   D

EC86-09/10-PART I
Table 402.4.2

Proposed Change as Submitted

Proponent: Charles C. Cottrell, North American Insulation Manufacturers (NAIMA)

PART I – IECC

TABLE 402.4.2
VISUAL AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope contains a continuous air barrier Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material. ~~Air permeable insulation is inside of an air barrier.~~

(Portions of table not shown remain unchanged)

Reason: The current language requires that air permeable insulation be installed "inside of an air barrier." This would prohibit the use of the air-tight gypsum board air barrier practice which is an effective and widely used method of sealing the building envelope. This proposal would delete the language prohibiting this practice and add language stating, "Exterior thermal envelope contains a continuous air barrier," to clarify that the building envelope must contain an air barrier.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: COTTRELL-EC-2-T. 402.4.2-T. N1102.4.2.DOC

Public Hearing Results

PART I - IECC
Committee Action: **Approved as Submitted**

Committee Reason: See the proponent's reason statement. The present code text contains a provision that limits how to use an air barrier that was really never intended.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Gil Rosmiller, representing Colorado Chapter of ICC and Craig Conner, Building Quality, representing self request Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 402.4.2
VISUAL AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope contains a continuous air barrier Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material. <u>Air permeable insulation is inside of an air barrier[a].</u>

a. <u>Ceiling/roof air barriers shall be permitted to be to interior or exterior of insulation; or integral to roof of unvented attic. Wall air barriers in climate zones 1 through 3 shall be permitted to be to interior or exterior of insulation. Walls in climate zones 4 through 8 shall include air barriers both interior and exterior of insulation.</u>

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: The location of air barriers has been confusing at best. This proposal clarifies where the air barrier is required for air permeable insulation.

The original change in EC86 struck the requirement '*Air-Permeable insulation is inside an air barrier*' and replaced with the requirement '*Exterior thermal envelope contains a continuous air barrier*' Part of the proponents reason statement was "*This would prohibit the use of the air-tight gypsum board air barrier practice which is an effective and widely used method of sealing the building envelope.*" We agree that this is effective for house air infiltration rates, but suggest it is not effective for air permeable insulation.

Insulation works by trapping small pockets of air. Increasing the density of the insulation creates more 'pockets' and increases the insulating value. The problem is that air permeable insulation makes a great air filter, but a poor insulator if air flows through it. This is why in the 2009 IECC table 402.4.2 includes the requirement "*Air-Permeable insulation is not used as a air sealing material*". Air permeable insulation is most effective when air movement through and around it is eliminated.

An example would be attic knee walls or a skylight shaft walls which are located in a vented attic assembly. Using the air tight drywall approach would leave the air permeable insulation exposed to the air circulating in the attic area. Not a particularly effective or durable assembly. The same can be said for walls behind tubs and showers and chases at exterior walls.

Consider attic assemblies with blown in insulation. Would it be best to have the insulation encapsulated with an air barrier on all sides? Absolutely, but bowing to practicality we can allow the air barrier to be to the interior of ceiling insulation. This is why the first sentence in the proposed footnote allows air barriers to the interior or exterior of attic insulation.

The rest of the proposed footnote deals with air barriers in walls. For walls in climate zones 1 to 3 it allows either interior or exterior air barriers. Since walls will have both an interior covering, perhaps gypsum board, and an exterior siding, it is practical to require both interior and exterior air barriers. Walls in the coldest climates, climates zones 4 to 8, are required to have both interior and exterior air barriers. Energy Star makes a similar distinction in climate zones 4-8

This revised code requirement keeps the air barrier where it is most needed and most practical.

Final Action: AS AM AMPC____ D

EC86-09/10-PART II
IRC Table N1102.4.2

Proposed Change as Submitted

Proponent: Charles C. Cottrell, North American Insulation Manufacturers (NAIMA)

PART II – IRC ENERGY

TABLE N1102.4.2
VISUAL AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope contains a continuous air barrier Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material. ~~Air permeable insulation is inside of an air barrier.~~

(Portions of table not shown remain unchanged)

Reason: The current language requires that air permeable insulation be installed "inside of an air barrier." This would prohibit the use of the air-tight gypsum board air barrier practice which is an effective and widely used method of sealing the building envelope. This proposal would delete the language prohibiting this practice and add language stating, "Exterior thermal envelope contains a continuous air barrier," to clarify that the building envelope must contain an air barrier.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: COTTRELL-EC-2-T. 402.4.2-T. N1102.4.2.DOC

Public Hearing Results

PART II - IRC
Committee Action: **Approved as Submitted**

Committee Reason: See the proponent's reason statement. The present code text contains a provision that limits how to use an air barrier that was really never intended.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Gil Rossmiller, representing Colorado Chapter of ICC, and Craig Conner, Building Quality, representing himself request Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.4.2
VISUAL AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope contains a continuous air barrier. Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material. Air permeable insulation is inside of an air barrier.[a]

a. Ceiling/roof air barriers shall be permitted to be interior or exterior to insulation; or integral to roof of unvented attic. Wall air barriers in climate zones 1 through 3 shall be permitted to be interior or exterior to insulation. Walls in climate zones 4 through 8 shall include air barriers both interior and exterior to insulation.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: The location of air barriers has been confusing at best. This proposal clarifies where the air barrier is required for air permeable insulation.

The original change in EC86 struck the requirement '*Air-Permeable insulation is inside an air barrier*' and replaced with the requirement '*Exterior thermal envelope contains a continuous air barrier*' Part of the proponents reason statement was "*This would prohibit the use of the air-tight gypsum board air barrier practice which is an effective and widely used method of sealing the building envelope.*" We agree that this is effective for house air infiltration rates, but suggest it is not effective for air permeable insulation.

Insulation works by trapping small pockets of air. Increasing the density of the insulation creates more 'pockets' and increases the insulating value. The problem is that air permeable insulation makes a great air filter, but a poor insulator if air flows through it. This is why in the 2009 IECC table 402.4.2 includes the requirement "*Air-Permeable insulation is not used as a air sealing material*". Air permeable insulation is most effective when air movement through and around it is eliminated.

An example would be attic knee walls or a skylight shaft walls which are located in a vented attic assembly. Using the air tight drywall approach would leave the air permeable insulation exposed to the air circulating in the attic area. Not a particularly effective or durable assembly. The same can be said for walls behind tubs and showers and chases at exterior walls.

Consider attic assemblies with blown in insulation. Would it be best to have the insulation encapsulated with an air barrier on all sides? Absolutely, but bowing to practicality we can allow the air barrier to be to the interior of ceiling insulation. This is why the first sentence in the proposed footnote allows air barriers to the interior or exterior of attic insulation.

The rest of the proposed footnote deals with air barriers in walls. For walls in climate zones 1 to 3 it allows either interior or exterior air barriers. Since walls will have both an interior covering, perhaps gypsum board, and an exterior siding, it is practical to require both interior and exterior air barriers. Walls in the coldest climates, climates zones 4 to 8, are required to have both interior and exterior air barriers. Energy Star makes a similar distinction in climate zones 4-8

This revised code requirement keeps the air barrier where it is most needed and most practical.

Final Action: AS AM AMPC____ D

EC88-09/10
Table 402.4.2, Chapter 6

Proposed Change as Submitted

Proponent: Rob Pickett, Rob Pickett & Associates, LLC, representing Log Homes Council

1. Revise table as follows:

TABLE 402.4.2
AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA[a]

(No change to table contents)

a. Inspection of log structures shall be in accordance with the provisions of ICC-400-2007 IS LOG.

2. Add new standard to Chapter 6 as follows:

ICC
400-07 IS LOG Standard on the Design and Construction of Log Structures

Reason: The purpose of this change is to direct users of the code who are evaluating log structures to the ICC consensus standard pertaining to this unique and traditional construction method.

Log structures employ alternative methods of construction that are fully covered by ICC-400 IS-LOG *Standard for the Design and Construction of Log Structures.* ICC400-2007 is an ANSI-approved document that represents industry standards and guidelines for this form of construction. It gives the code official an important tool for inspection and understanding log construction, including thermal performance. Carefully written to cover all forms of log construction, the standard explains how to respond to design conditions, but it does not establish those conditions.

A major reason for this change is that field interpretations of the IECC requirements for log wall performance are often incorrect. ICC400-2007 addresses protection of air infiltration and vapor transfer in Section 305.1. In addition, log walls are designed to account for movement in the wall system per Section 304. These two sections combine to promote an effective air tight assembly as has been documented in many blower door tests and thermal imaging inspections. Since log walls offer an assembly that can be inspected at any stage of construction, the most crucial element of the inspection process is the assessment of settling as defined in ICC400-2007, Section 304.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard(s) proposed for inclusion in the code, ICC 400-07, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: PICKETT-EC-3-T. 402.4.2

Public Hearing Results

Committee Action: **Approved as Modified**

Modify proposal as follows:

a. In addition, inspection of log walls structures shall be in accordance with the provisions of ICC-400.

Committee Reason: Log walls have unique construction that require attention to assure that the construction is tight and the building thermal envelope is properly constructed. Therefore, it is appropriate to remind the code use that a separate standard exists for these buildings. The modification simply changes the footnote to state that the inspection provisions of the IECC must also apply.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Craig Conner, Building Quality, representing self, requests Disapproval.

Commenter's Reason: As approved this invokes the whole log home standard (ICC 400), rather than just the requirements related to the table. The proponent's intent was to substitute the ICC 400 requirements for the air barrier and insulation installation requirements in the table, not to add a long list of additional requirements.

Final Action: AS AM AMPC____ D

EC89-09/10-PART I
402.4.3, Chapter 6

Proposed Change as Submitted

Proponent: Joseph Hill, RA, representing the New York State Department of State

PART I – IECC

1. Revise as follows:

402.4.3 Fireplaces. ~~New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.~~ Tight-fitting noncombustible gasketed fireplace doors to control infiltration losses shall be installed on the following fireplace openings:

1. Masonry fireplaces or fireplace units designed to allow an open burn.
2. Decorative appliances (ANSI Standard Z21.60 gas-log style unit) installed in vented solid fuel fireplaces.
3. Vented decorative gas fireplace appliances (ANSI Standard Z21.50 unit).

Fireplaces shall be provided with a source of combustion air as required by the fireplace construction provisions of the *International Residential Code, or* the *International Building Code*

2. Add new standards to Chapter 6 as follows:

ANSI

Z21.50−03	Vented Gas Fireplaces—with Addenda Z21.50a-2003
Z21.60−03	Decorative Gas Appliances for Installation in Solid Fuel Burning Fireplaces—with Addenda Z21.60a-2003

Reason: For clarification and reference.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: ANSI Z21.50-03 and ANSI Z21.60-03 are currently referenced in the IRC.

ICCFILENAME: HILL-EC-5-402.4.3-RE-1-N1102.4.3

Public Hearing Results

PART I – IECC

Committee Action: **Disapproved**

Committee Reason: The proposed provision would be difficult to apply in situations where sampling is used. The committee believes that this would also be inconsistent with EC13.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Joseph Hill, representing New York State Department of State requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.4.3 Fireplaces. ~~New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.~~

Tight-fitting noncombustible gasketed fireplace doors to control infiltration losses shall be installed on fireplace openings as provided herein:

1. Masonry fireplaces or fireplace units designed to allow an open burn.
~~2. Decorative appliances (ANSI Standard Z21.60 gas-log style unit) installed in vented solid fuel fireplaces.~~
~~3. Vented decorative gas fireplace appliances (ANSI Standard Z21.50 unit).~~

Fireplaces shall be provided with a source of combustion air as required by the fireplace construction provisions of the *International Residential Code, or* the *International Building Code*

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Modified to remove language which committee saw as conflicting with life safety provisions.

Public Comment 2:

Thomas Stroud, Hearth, Patio & Barbeque Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**402.4.3 Fireplaces.** Tight-fitting noncombustible gasketed fireplace doors to control infiltration losses shall be installed on the following fireplace openings:~~

~~1. Masonry fireplaces or fireplace units designed to allow an open burn.~~
~~2. Decorative appliances (ANSI Standard Z21.60 gas-log style unit) installed in vented solid fuel fireplaces.~~
~~3. Vented decorative gas fireplace appliances (ANSI Standard Z21.50 unit).~~

~~Fireplaces shall be provided with a source of combustion air as required by the fireplace construction provisions of the *International Residential Code, or* the *International Building Code*.~~

402.4.3 Fireplaces. Wood-burning fireplaces shall be provided with combustion air directly from the outdoors and with a means to tightly close off the chimney flue and combustion air outlets when the fireplace is not in use.

~~**ANSI**~~
~~Z21.50−03 Vented Gas Fireplaces – with Addenda Z21.50a-2003~~
~~Z21.60−03 Decorative Gas Appliances for Installation in Solid Fuel Burning Fireplaces – with Addenda Z21.60a-2003~~

Commenter's Reason: This proposed language will add clarity to the issue of sealing of fireplaces without going against the safety standards that these products must meet in order to be marketed. This also lets the manufacturer or producer determine their own manner to meet the issue of tightness.

Final Action: AS AM AMPC____ D

EC89-09/10-PART II
N1102.4.3

Proposed Change as Submitted

Proponent: Joseph Hill, RA, representing the New York State Department of State

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1102.4.3 Fireplaces. ~~New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.~~ Tight-fitting noncombustible gasketed fireplace doors to control infiltration losses shall be installed on the following fireplace openings:

1. Masonry fireplaces or fireplace units designed to allow an open burn.
2. Decorative appliances (ANSI Standard Z21.60 gas-log style unit) installed in vented solid fuel fireplaces.
3. Vented decorative gas fireplace appliances (ANSI Standard Z21.50 unit).

Fireplaces shall be provided with a source of combustion air as required by the fireplace construction provisions of Section R1006 of the *International Residential Code*.

Reason: For clarification and reference.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: ANSI Z21.50-03 and ANSI Z21.60-03 are currently referenced in the IRC.

ICCFILENAME: HILL-EC-5-402.4.3-RE-1-N1102.4.3

Public Hearing Results

PART II – IRC

Committee Action: **Disapproved**

Committee Reason: The proposal could create potential conflicts with safety issues that the mechanical provisions of the code deal with.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Joseph Hill, representing New York State Department of State requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.4.3 Fireplaces. ~~New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.~~

Tight-fitting noncombustible gasketed fireplace doors to control infiltration losses shall be installed on fireplace openings as provided herein:

1. Masonry fireplaces or fireplace units designed to allow an open burn.
2. ~~Decorative appliances (ANSI Standard Z21.60 gas-log style unit) installed in vented solid fuel fireplaces.~~
3. ~~Vented decorative gas fireplace appliances (ANSI Standard Z21.50 unit).~~

Fireplaces shall be provided with a source of combustion air as required by the fireplace construction provisions of the *International Residential Code, Section R1006.*

Commenter's Reason: Modified to remove language which committee saw as conflicting with life safety provisions.

Public Comment 2:

Thomas Stroud, Hearth, Patio & Barbecue Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**N1102.4.3 Fireplaces.** Tight-fitting noncombustible gasketed fireplace doors to control infiltration losses shall be installed on the following fireplace openings:~~

1. ~~Masonry fireplaces or fireplace units designed to allow an open burn.~~
2. ~~Decorative appliances (ANSI Standard Z21.60 gas-log style unit) installed in vented solid fuel fireplaces.~~
3. ~~Vented decorative gas fireplace appliances (ANSI Standard Z21.50 unit).~~

~~Fireplaces shall be provided with a source of combustion air as required by the fireplace construction provisions of Section R1006 of the *International Residential Code*.~~

N1102.4.3 Fireplaces. Wood-burning fireplaces shall be provided with combustion air directly from the outdoors and with a means to tightly close off the chimney flue and combustion air outlets when the fireplace is not in use.

Commenter's Reason: This proposed language will add clarity to the issue of sealing of fireplaces without going against the safety standards that these products must meet in order to be marketed. This also lets the manufacturer or producer determine their own manner to meet the issue of tightness.

Final Action: AS AM AMPC____ D

EC91-09/10-PART I
402.4.4

Proposed Change as Submitted

Proponent: Jeff Lowinski, Window and Door Manufacturers Association (WDMA)

PART I – IECC

Revise as follows:

402.4.4 Fenestration air ~~leakage~~ infiltration. Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m2), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s/m2), when tested according to NFRC 400 or AAMA/WDMA/ CSA 101/I.S.2/A440 by an accredited, independent laboratory ~~and *listed*~~ and *labeled* by the manufacturer.

Reason (Part I): This proposal suggests several minor editorial revisions to make this language more consistent with other sections of the IECC. This proposal also resolves the issue that exterior fenestration are required to be labeled, but not listed, by other sections of the IECC. Exterior fenestration, for purposes of energy efficiency, is almost never listed. The exception is fire-rated exterior windows and doors which are listed for their fire rating.

Reason (Part II): This proposal suggests several minor editorial revisions to make this language more consistent with other sections of the IRC. This proposal also resolves the issue that exterior fenestration for residential applications are required to be labeled, but not listed, by other sections of the IRC. Exterior fenestration for residential applications is almost never listed. The exception may be fire-rated doors used between the attached garage and residential building.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: Lowinski-RE-1-N1102.4.4-EC-402.4.4

Public Hearing Results

PART I – IECC

Committee Action: **Disapproved**

Committee Reason: The code presently uses the correct terminology (air leakage), consistent with the test standard.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, requests Approval as Submitted.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This proposal removes the requirement that fenestration leakage be listed, leaving the requirement that fenestration be labeled. Labeled is the proper language for fenestration. Therefore we recommend approving this proposal as submitted.

Public Comment 2:

Jeff Inks, representing Window & Door Manufacturers Association requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.4.4 Fenestration air leakage ~~infiltration~~. Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cfm per square foot (1.5 L/s/m2), and swinging doors no more than 0.5 cfm per square foot (2.6 L/s/m2), when tested according to NFRC 400 or AAMA/WDMA/ CSA 101/I.S.2/A440 by an accredited, independent laboratory and labeled by the manufacturer.

Commenter's Reason: The primary and most important intent of the original proposal was to resolve the issue that exterior fenestration are only required to be labeled, and not listed, by other sections of the IECC. Exterior fenestration, for purposes of energy efficiency, is almost never listed. The exception is fire-rated exterior windows and doors which are listed for their fire rating.

The secondary intent was to address the use of "leakage" vs. "infiltration" in the section header with the proposal recommending the replacement of "leakage" with "infiltration."

The committee did not disagree with removing the listing requirement for the reasons stated but did not agree with replacing "leakage" with "infiltration" and therefore disapproved the proposal for that reason.

This public comment addresses the committees concern by maintaining the term "leakage" in the section header while still removing the listing requirement.

Final Action: AS AM AMPC____ D

EC91-09/10-PART II
N1102.4.4

Proposed Change as Submitted

Proponent: Jeff Lowinski, Window and Door Manufacturers Association (WDMA)

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1102.4.4 Fenestration air ~~leakage~~ infiltration. Windows, skylights and sliding glass doors shall have an air infiltration rate of no more than 0.3 cubic foot per minute per square foot [1.5(L/s)/m^2], and ~~swinging~~ side-hinged doors no more than 0.5 cubic foot per minute per square foot [2.5(L/s)/m^2], when tested according to NFRC400 or AAMA/WDMA/CSA101/I.S.2/A440 by an accredited, independent laboratory, ~~and listed~~ and labeled by the manufacturer.

Reason (Part I): This proposal suggests several minor editorial revisions to make this language more consistent with other sections of the IECC. This proposal also resolves the issue that exterior fenestration are required to be labeled, but not listed, by other sections of the IECC. Exterior fenestration, for purposes of energy efficiency, is almost never listed. The exception is fire-rated exterior windows and doors which are listed for their fire rating.

Reason (Part II): This proposal suggests several minor editorial revisions to make this language more consistent with other sections of the IRC. This proposal also resolves the issue that exterior fenestration for residential applications are required to be labeled, but not listed, by other sections of the IRC. Exterior fenestration for residential applications is almost never listed. The exception may be fire-rated doors used between the attached garage and residential building.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: Lowinski-RE-1-N1102.4.4-EC-402.4.4

Public Hearing Results

PART II – IRC

Committee Action: **Approved as Submitted**

Committee Reason: The fact that a product is listed has no bearing on the technical requirements of the code. In addition this will clean up inconsistent terminology.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Donald J Vigneau, Northeast Energy Efficiency Partnerships, Inc., representing self requests Disapproval.

Commenter's Reason: Public Comment is for Disapproval, since approval of Part II will create inconsistency between the two codes. The proposal would change term "air leakage" to "air infiltration." Besides being incorrect building science, and implying exfiltration is not regulated, the referenced NFRC Standard 400 is entitled: "Procedure For Determining Fenestration Product Air Leakage." No reason has been established by the proponent for the change other than "air infiltration" is more consistent with terms used in the codes.

Part I was Disapproved (D) by the Energy Code Development Committee.

Part II was Approved as Submitted (AS) by the Residential Building & Energy Code Development Committee.

IECC Committee Reason: The code presently uses the correct terminology (air leakage), consistent with the test standard.

Cost Impact: The code change proposal will not increase the cost of construction.

Final Action: AS AM AMPC____ D

EC96-09/10-PART I
402.5

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Revise as follows:

402.5 Maximum fenestration U-factor and SHGC (Mandatory). The area-weighted average ~~maximum~~ ~~fenestration~~ U-factor permitted for fenestration products when complying with this code using trade offs under ~~from~~ Section 402.1.4 or Section 405 shall not exceed ~~be 0.48 in zones 4 and 5 and~~ 0.40 in zones ~~6~~ 4 through 8 for vertical fenestration, and 0.75 in zones 4 through 8 for skylights. The area-weighted average ~~maximum fenestration~~ SHGC permitted for fenestration products when complying with this code using trade-offs from Section 405 in Zones 1 through 3 shall not exceed ~~be~~ 0.45~~0~~.

Reason: This proposal updates the fenestration U-factor and SHGC trade-off limits in the *IECC* to reflect the reductions in prescriptive U-factors and SHGCs in the *2009 IECC* and *IRC* and to ensure that effective, efficient glazing is being installed in all eight climate zones. The proposal also makes editorial changes to the language of this section to clarify the operation of the caps in response to criticisms from opponents to the caps in previous code cycles that the language was difficult to understand and/or confusing. Finally, it is proposed that this provision also be added to chapter 11 of the *IRC*, making the two codes consistent in this area.

Turning to the proposed changes in the requirements, this proposal replaces the 0.48 cap for climate zones 4-5 with the same 0.40 U-factor already applicable to zones 6-8. This change reflects the prescriptive U-factor changes last cycle, where a 0.35 U-factor is now the prescriptive requirement across all of these climate zones. Similarly, following the reduction in maximum SHGC in climate zones 1-3 from 0.40 in the *2006 IECC* to 0.30 SHGC in the *2009 IECC* and 0.35 in the *2009 IRC*, this proposal reduces the maximum value from 0.50 SHGC to 0.45 SHGC.

The fenestration trade-off limits currently found in Section 402.5 of the 2009 *IECC* are simple, mandatory measures that ensure all new homes contain high-quality, cost-effective windows that save energy, provide reasonable comfort, resist condensation in colder climates and block unwanted solar gain in warmer climates. Without the protection of Section 402.5, fenestration values could be traded away to levels unacceptable in modern building practice. Given the improvements to window efficiency brought about by the *2009 IECC* and the *2009 IRC* and our nation's high priority for energy efficiency, this proposal is a common-sense update to an effective code requirement.

- **Compliance is simple.** The current fenestration maximums are effective and easy to understand. These requirements have been successfully applied for the past few years. All states that have already adopted the 2004, 2006, and 2009 *IECC* have adopted these maximums without amendment. They are also already seamlessly built into compliance software such as the Department of Energy's REScheck. Compliance could not be simpler.

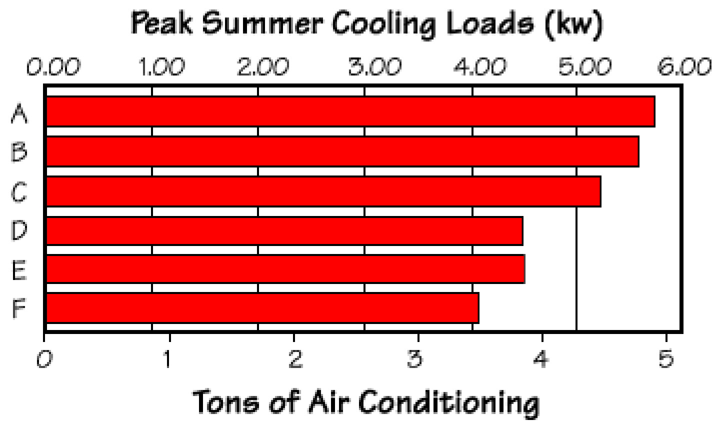
- **The standard is flexible.** The area-weighted average approach embodied in Section 402.5 allows considerable flexibility for builders to install decorative glass, glass block, and other fenestration products, while maintaining a baseline performance for the home's overall glazing. In short, not all products are required to individually meet the maximum values; only the area-weighted average of all products in the home is required to meet the maximum values specified in this code provision. Thus, there is substantial room and flexibility for the builder to utilize products that are exceptions. For example, with the 0.45 proposed SHGC limit, up to half of the glass installed could be a 0.55 SHGC (perhaps for a passive solar application), so long as the remainder was at or below 0.35 (the weighted average would be 0.45). In short, the limits constitute a modest backstop that can be easily satisfied by most glazing products currently on the market in each climate zone. The codes currently employ a number of other mandatory measures (including mandatory maximum fenestration air leakage) to ensure that the minimum code house is reasonably constructed – *IECC* Section 402.5 is no different.

- **Maximums protect the consumer and the builder.** The maximums are a key safety net and provide important homeowner and builder protection against bad or impractical trade-offs.

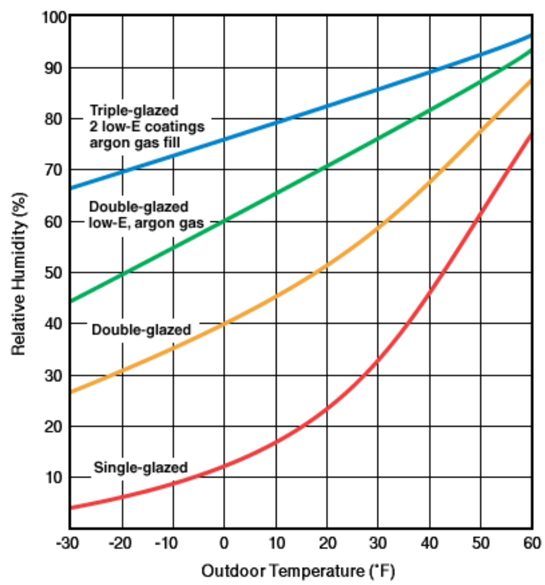
Benefits of Section 402.5 Fenestration Maximums:

1. Quality Windows, Energy Savings and Peak Demand Savings Nationwide. The fenestration maximums encourage the use of cost-effective low-e windows nationwide. Efficient windows bring immediate cost savings to the builder who can downsize heating and cooling equipment, and bring long-term energy savings, greater comfort and reduced condensation for consumers. On a larger scale, because low-SHGC windows reduce energy consumption during the peak summer months in warmer climates, and low U-Factor windows reduce energy consumption during peak heating months in colder climates, high-quality windows can help reduce the strain on the electric grid and delay the need to build peak generation. They will also reduce the need for natural gas and help to reduce the amount of oil that is imported. Consumers also enjoy the reduced costs that come with economies of scale and market transformation. By avoiding extreme trade-offs of windows with resulting long-term detriment, fenestration maximums are a critical part of a well-functioning energy code.

The following chart, developed by the U.S. Department of Energy's Lawrence Berkley National Laboratory (LBNL), which is found on the Efficient Window Collaborative (EWC) website (www.efficientwindows.org), shows the potential for saving peak demand for different window types. Window F is the low SHGC, low U-factor window that would satisfy the window maximums across the country (by contrast, window A is a single pane window). As is readily apparent, improved windows are crucial to lower peak cooling loads and smaller HVAC sizes (with lower costs).



2. Improved Condensation Resistance. Window condensation and the associated problems are a function of the window's U-factor, the indoor relative humidity, and the outside temperature. Glass with a lower U-factor maintains a higher room-side temperature, which means the glass can withstand lower exterior temperatures and more interior humidity without attracting condensation. Glass with a high U-factor will succumb to condensation much more easily. The following chart also provided by LBNL on the EWC website shows the condensation potential for different window types.

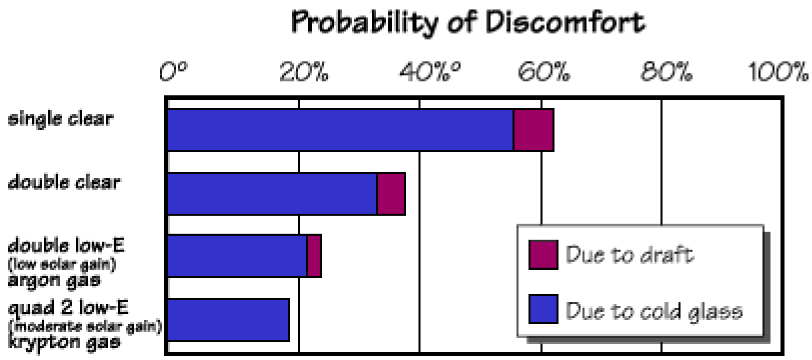


Note: Condensation occurs above the lines for each product type

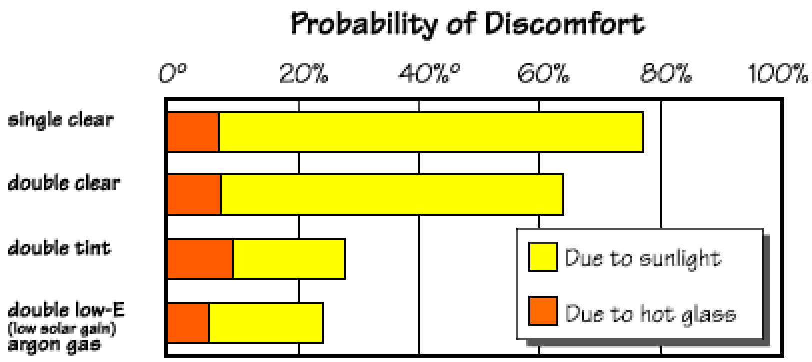
According to the chart, a typical double-glazed low-e window can withstand a 0 degree outdoor temperature and 60% relative humidity inside before condensation will begin to collect. By contrast, a regular double-glazed window can only withstand 40% humidity at the same outdoor temperature. In other words, a low-e window has a 50% more effective ability to resist condensation. A single-glazed *low-e* window is far worse – it can withstand less than 15% humidity at the same temperature – a virtual guarantee of damaging condensation. The fenestration maximums substantially reduce the likelihood of condensation in the colder months, enhancing durability and long-term benefits for the homeowner.

3. More Comfortable Homes and Less Energy Use. The energy code revolves around occupant comfort -- any perceived energy savings will be instantly lost if an occupant is uncomfortable and adjusts the thermostat. Incremental changes in window efficiency can have a disproportionate impact on occupant comfort because even the most efficient windows are, at best, still only the equivalent of an R-3 wall. Hot spots created by high solar gain in the summer and cold or drafty glass in the winter months can force an occupant to adjust the thermostat to compensate (which will increase cooling and heating bills at a time when natural gas costs about $1.20 per therm on the wholesale market and heating oil costs over $3.60 per gallon wholesale). The charts below, again produced by LBNL and displayed on the EWC website, show that occupant discomfort can double or triple, depending on the type of glass installed.

For example, the following chart shows the probability of discomfort during winter from poorer windows ranging from over 60% with single clear and almost 40% with double clear. This risk declines to almost 20% with a low-e window as specified by Section 402.5. This problem is due to the cold window -- at zero degrees outdoors, the single pane glass is less than 20 degrees on the inside surface, the double clear glass is slightly over 40 degrees, while the *low-e* glass is approaching 60 degrees. Obviously, the warmer the interior glass surface, the less likelihood of discomfort.



Similarly, the following chart shows the probability of discomfort during summer from sunlight and hot glass. The potential comfort problem from bad windows is even worse in the summer. The summertime probability of discomfort ranges from almost 80% with single clear and over 60% with double clear declining to almost 20% with windows as specified by Section 402.5.



In heating-dominated climates, a good low-e window will keep occupants more comfortable during the coldest months. In cooling-dominated climates, windows with low SHGC will protect against hot spots and occupant discomfort, and will make it less likely that occupants will need to adjust the thermostat and use more energy.

4. Conclusion. As shown above, the fenestration maximums serve an important role in ensuring residential energy efficiency. We recommend that the fenestration maximums in the *IECC* be updated to match the enhanced efficiency requirements in the 2009 *IECC* and also adopted for the *IRC*.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: PRINDLE-EC-20-402.5-N1102.3.6

Public Hearing Results

PART I – IECC

Committee Action: **Disapproved**

Committee Reason: The proposal makes the area weighted average approach unnecessarily restricted. This limits the flexibility of the code. The technical support provided is insufficient to allow a positive action.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

402.5 Maximum fenestration U-factor and SHGC (Mandatory). The area-weighted average U-factor ~~permitted~~ for fenestration products, when complying with this code using trade-offs under Section 402.1.4 or Section 405, shall not exceed 0.40 in climate zones 4 through 8 for vertical fenestration, and 0.75 in climate zones 4 through 8 for skylights. The area-weighted average SHGC ~~permitted~~ for fenestration products, when complying with this code using trade-offs from Section 405, ~~in zones 1 through 3~~ shall not exceed 0.40~~5~~ in climate zones 1-3.

Commenter's Reason: EC96 should be approved as modified by this public comment.

It should be approved as modified for the reasons set forth in the original reason statement and below (see also the reason statement in our public comment submitted on EC97).

The proposed modifications in this public comment seek to further improve the language in this code section and also to update this provision to fully reflect changes in the 2009 IECC – specifically by reducing the maximum SHGC from 0.50 to 0.40 to precisely reflect the 0.10 drop in prescriptive SHGC in the 2009 IECC (from 0.40 to 0.30) in these climate zones. This proposal would improve an important provision in the current code.

Final Action: AS AM AMPC____ D

EC96-09/10-PART II
N1102.3.6 (New)

<u>Proposed Change as Submitted</u>

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Add new text as follows:

<u>**N1102.3.6 Maximum fenestration U-factor and SHGC.** The area-weighted average U-factor permitted for fenestration products when complying with this code using trade offs under Section N1102.1.3 or Section 405 of the IECC shall not exceed 0.40 in zones 4 through 8 for vertical fenestration, and 0.75 in zones 4 through 8 for skylights. The area-weighted average SHGC permitted for fenestration products when complying with this code using trade-offs from Section 405 in Zones 1 through 3 shall not exceed 0.45.</u>

Reason: This proposal updates the fenestration U-factor and SHGC trade-off limits in the *IECC* to reflect the reductions in prescriptive U-factors and SHGCs in the *2009 IECC* and *IRC* and to ensure that effective, efficient glazing is being installed in all eight climate zones. The proposal also makes editorial changes to the language of this section to clarify the operation of the caps in response to criticisms from opponents to the caps in previous code cycles that the language was difficult to understand and/or confusing. Finally, it is proposed that this provision also be added to chapter 11 of the *IRC*, making the two codes consistent in this area.

Turning to the proposed changes in the requirements, this proposal replaces the 0.48 cap for climate zones 4-5 with the same 0.40 U-factor already applicable to zones 6-8. This change reflects the prescriptive U-factor changes last cycle, where a 0.35 U-factor is now the prescriptive requirement across all of these climate zones. Similarly, following the reduction in maximum SHGC in climate zones 1-3 from 0.40 in the *2006 IECC* to 0.30 SHGC in the *2009 IECC* and 0.35 in the *2009 IRC*, this proposal reduces the maximum value from 0.50 SHGC to 0.45 SHGC.

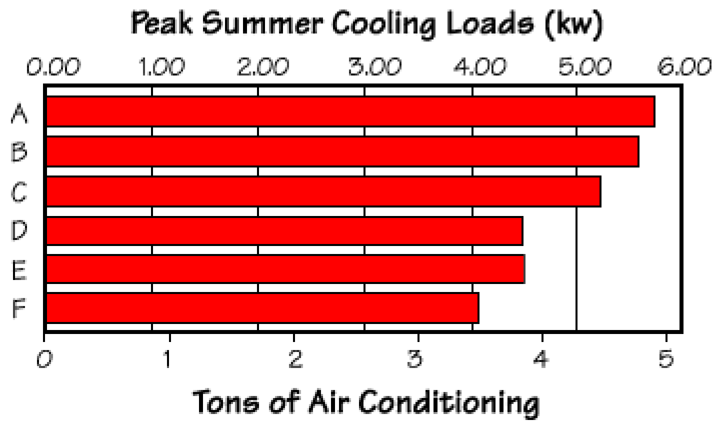
The fenestration trade-off limits currently found in Section 402.5 of the 2009 *IECC* are simple, mandatory measures that ensure all new homes contain high-quality, cost-effective windows that save energy, provide reasonable comfort, resist condensation in colder climates and block unwanted solar gain in warmer climates. Without the protection of Section 402.5, fenestration values could be traded away to levels unacceptable in modern building practice. Given the improvements to window efficiency brought about by the *2009 IECC* and the *2009 IRC* and our nation's high priority for energy efficiency, this proposal is a common-sense update to an effective code requirement.

- **Compliance is simple.** The current fenestration maximums are effective and easy to understand. These requirements have been successfully applied for the past few years. All states that have already adopted the 2004, 2006, and 2009 *IECC* have adopted these maximums without amendment. They are also already seamlessly built into compliance software such as the Department of Energy's REScheck. Compliance could not be simpler.
- **The standard is flexible.** The area-weighted average approach embodied in Section 402.5 allows considerable flexibility for builders to install decorative glass, glass block, and other fenestration products, while maintaining a baseline performance for the home's overall glazing. In short, not all products are required to individually meet the maximum values; only the area-weighted average of all products in the home is required to meet the maximum values specified in this code provision. Thus, there is substantial room and flexibility for the builder to utilize products that are exceptions. For example, with the 0.45 proposed SHGC limit, up to half of the glass installed could be a 0.55 SHGC (perhaps for a passive solar application), so long as the remainder was at or below 0.35 (the weighted average would be 0.45). In short, the limits constitute a modest backstop that can be easily satisfied by most glazing products currently on the market in each climate zone. The codes currently employ a number of other mandatory measures (including mandatory maximum fenestration air leakage) to ensure that the minimum code house is reasonably constructed – *IECC* Section 402.5 is no different.
- **Maximums protect the consumer and the builder.** The maximums are a key safety net and provide important homeowner and builder protection against bad or impractical trade-offs.

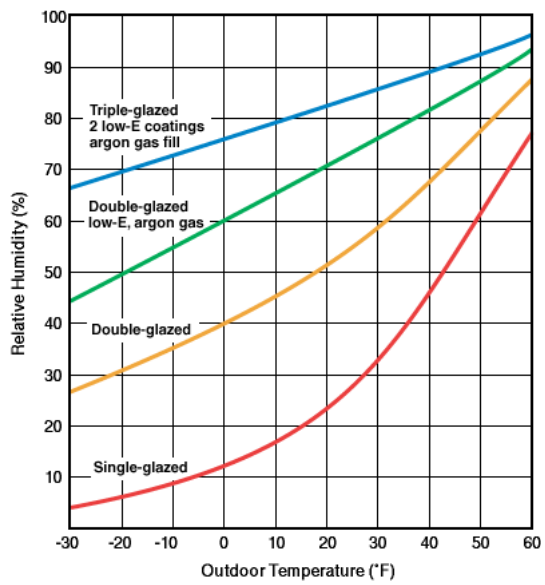
Benefits of Section 402.5 Fenestration Maximums:

1. Quality Windows, Energy Savings and Peak Demand Savings Nationwide. The fenestration maximums encourage the use of cost-effective low-e windows nationwide. Efficient windows bring immediate cost savings to the builder who can downsize heating and cooling equipment, and bring long-term energy savings, greater comfort and reduced condensation for consumers. On a larger scale, because low-SHGC windows reduce energy consumption during the peak summer months in warmer climates, and low U-Factor windows reduce energy consumption during peak heating months in colder climates, high-quality windows can help reduce the strain on the electric grid and delay the need to build peak generation. They will also reduce the need for natural gas and help to reduce the amount of oil that is imported. Consumers also enjoy the reduced costs that come with economies of scale and market transformation. By avoiding extreme trade-offs of windows with resulting long-term detriment, fenestration maximums are a critical part of a well-functioning energy code.

The following chart, developed by the U.S. Department of Energy's Lawrence Berkley National Laboratory (LBNL), which is found on the Efficient Window Collaborative (EWC) website (www.efficientwindows.org), shows the potential for saving peak demand for different window types. Window F is the low SHGC, low U-factor window that would satisfy the window maximums across the country (by contrast, window A is a single pane window). As is readily apparent, improved windows are crucial to lower peak cooling loads and smaller HVAC sizes (with lower costs).



2. Improved Condensation Resistance. Window condensation and the associated problems are a function of the window's U-factor, the indoor relative humidity, and the outside temperature. Glass with a lower U-factor maintains a higher room-side temperature, which means the glass can withstand lower exterior temperatures and more interior humidity without attracting condensation. Glass with a high U-factor will succumb to condensation much more easily. The following chart also provided by LBNL on the EWC website shows the condensation potential for different window types.

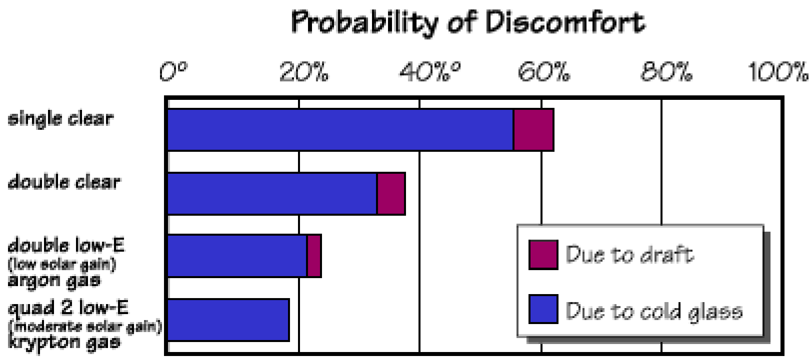


Note: Condensation occurs above the lines for each product type

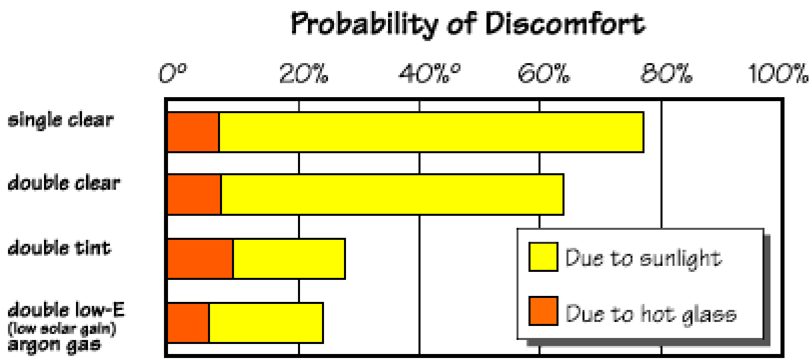
According to the chart, a typical double-glazed low-e window can withstand a 0 degree outdoor temperature and 60% relative humidity inside before condensation will begin to collect. By contrast, a regular double-glazed window can only withstand 40% humidity at the same outdoor temperature. In other words, a low-e window has a 50% more effective ability to resist condensation. A single-glazed *low-e* window is far worse – it can withstand less than 15% humidity at the same temperature – a virtual guarantee of damaging condensation. The fenestration maximums substantially reduce the likelihood of condensation in the colder months, enhancing durability and long-term benefits for the homeowner.

3. More Comfortable Homes and Less Energy Use. The energy code revolves around occupant comfort -- any perceived energy savings will be instantly lost if an occupant is uncomfortable and adjusts the thermostat. Incremental changes in window efficiency can have a disproportionate impact on occupant comfort because even the most efficient windows are, at best, still only the equivalent of an R-3 wall. Hot spots created by high solar gain in the summer and cold or drafty glass in the winter months can force an occupant to adjust the thermostat to compensate (which will increase cooling and heating bills at a time when natural gas costs about $1.20 per therm on the wholesale market and heating oil costs over $3.60 per gallon wholesale). The charts below, again produced by LBNL and displayed on the EWC website, show that occupant discomfort can double or triple, depending on the type of glass installed.

For example, the following chart shows the probability of discomfort during winter from poorer windows ranging from over 60% with single clear and almost 40% with double clear. This risk declines to almost 20% with a low-e window as specified by Section 402.5. This problem is due to the cold window -- at zero degrees outdoors, the single pane glass is less than 20 degrees on the inside surface, the double clear glass is slightly over 40 degrees, while the *low-e* glass is approaching 60 degrees. Obviously, the warmer the interior glass surface, the less likelihood of discomfort.



Similarly, the following chart shows the probability of discomfort during summer from sunlight and hot glass. The potential comfort problem from bad windows is even worse in the summer. The summertime probability of discomfort ranges from almost 80% with single clear and over 60% with double clear declining to almost 20% with windows as specified by Section 402.5.



In heating-dominated climates, a good low-e window will keep occupants more comfortable during the coldest months. In cooling-dominated climates, windows with low SHGC will protect against hot spots and occupant discomfort, and will make it less likely that occupants will need to adjust the thermostat and use more energy.

4. Conclusion. As shown above, the fenestration maximums serve an important role in ensuring residential energy efficiency. We recommend that the fenestration maximums in the *IECC* be updated to match the enhanced efficiency requirements in the 2009 *IECC* and also adopted for the *IRC*.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: PRINDLE-EC-20-402.5-N1102.3.6

Public Hearing Results

PART II – IRC

Committee Action: **Disapproved**

Committee Reason: The provisions are unnecessarily restrictive.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, IFC International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1102.3.6 Maximum fenestration U-factor and SHGC. The area-weighted average U-factor ~~permitted~~ for fenestration products, when complying with this code using trade-offs under Section N1102.1.3 or Section 405 of the IECC, shall not exceed 0.40 in climate zones 4 through 8 for vertical fenestration, and 0.75 in climate zones 4 through 8 for skylights. The area-weighted average SHGC ~~permitted~~ for fenestration products, when complying with this code using trade-offs from Section 405 of the IECC, ~~in Zones 1 through 3~~ shall not exceed 0.40~~5~~ in climate zones 1-3.

Commenters' Reason: EC96 should be approved as modified by this public comment.

It should be approved as modified for the reasons set forth in the original reason statement and below (see also the reason statement in our public comment submitted on EC97).

The proposed modifications in this public comment seek to further improve the language in this code section and also to update this provision to fully reflect changes in the 2009 IECC – specifically by reducing the maximum SHGC from 0.50 to 0.40 to precisely reflect the 0.10 drop in prescriptive SHGC in the 2009 IECC (from 0.40 to 0.30) in these climate zones. This proposal would improve an important provision in the current code.

Final Action: AS AM AMPC____ D

EC97-09/10
402.5

Proposed Change as Submitted

Proponent: Ken Sagan, representing National Association of Home Builders (NAHB)

Delete without substitution:

~~**402.5 Maximum fenestration *U*-factor and SHGC. (Mandatory).** The area weighted average maximum fenestration *U*-factor permitted using tradeoffs from Section 402.1.4 or Section 404 shall be 0.48 in zones 4 and 5 and 0.40 in zones 6 through 8 for vertical fenestration, and 0.75 in zones 4 through 8 for skylights. The area weighted average maximum fenestration SHGC permitted using trade-offs from Section 404 in Zones 1 through 3 shall be 0.50.~~

Reason: Limits on fenestration U-factor and SHGC tradeoffs restrict ways by which code compliance can be achieved.

By definition, trade-offs are energy neutral, and do not save energy, so this section is not necessary. This requirement is difficult to explain and confuses most code users who often interpret it as another prescriptive code requirement comparable to the more stringent prescriptive U-factor in Tables 402.1.1 and 402.1.3. The code would be better if it relied only on the U-factor and SHGC requirements in the main table. As previously reported in the last code cycle, some common products, such as glass block and garden windows, never meet these “hard limits.” In principle, a calculation or exemption would be required if more than a small area of these common products are used in new residences. Additions or renovations with significant areas of glass block or garden windows would be technically illegal.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: SAGAN-EC-6-402.5

Public Hearing Results

Errata: Add Craig Conner as a co-proponent for EC97. Mr. Conner’s reason statement for EC94 applies. See note on EC94.

Committee Action: **Approved as Submitted**

Committee Reason: The provisions given in this section are artificial constraints on design flexibility. Tradeoffs are limited. The proponents claim that the building occupants will always turn up the thermostat are overstated.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Craig Conner, Building Quality, representing himself, Jeff Inks, representing Window & Door Manufacturers Association, Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC, Bill Prindle ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Disapproval.

Commenter’s Reason: (Craig Conner) These limits affect the ability to trade off and limit design flexibility. However these limits do not affect energy use, since the tradeoffs are to be energy neutral. Therefore this is a constraint on flexibility without any resulting energy savings.

The code process has aligned the IECC and IRC by deleting these limits. They should not be reinstated.

(Jeff Inks) WDMA urges disapproval. Removal of these trade-off caps has not been justified in anyway. The provisions are not artificial constraints on design flexibility as stated by the committee. Rather they are critical to ensuring that appropriate and necessary limits are placed on trade-offs when applying them for compliance purposes and better ensures that the intended and required building energy performance is met.

(Shaunna Mozingo) The fenestration trade-off maximums that exist in this code section are simple, mandatory limits that help ensure that new homes constructed per the 2012 *IECC* contain fenestration units that are cost-effective based on the energy performance of the units. The limits in this section result in fenestration in the home providing better energy performance including resisting condensation forming on glazing in colder climate zones and blocking unwanted solar gain in warmer climate zones.

The limits apply to the area-weighted average maximum of the fenestration. That allows flexibility by permitting individual fenestration units to exceed these maximum U-factors or maximum SHGC when used in combination with other fenestration units that have better performing U-factors or SHGC. It is the area-weighted average of all the installed fenestration products that must not exceed these proposed limits. The proponent states that the requirement is difficult to explain and confuses most code users however, we have found that area-weighted average maximum values have in fact been successfully applied by jurisdictions that have adopted either the 2006 or 2009 editions of the *IECC*.

The proponent also included reasoning that this existing code requirement is unnecessary and does not save energy – these reasons are inaccurate at best. These limits save energy by reducing building loads, which in turn reduce equipment sizing and actually may have less of an up-front financial impact on the owner for mechanical equipment purchases. If you were to create a Manual J for a residence with a maximum U-Factor of .48 in Climate Zone 5 and its associated SHGC (SHGC is listed as "NR" for climate zone 5 but still has a significant impact on the building loads as calculated with Manual J) and then create a Manual J calculated on the exact same house with the exact same values for everything else but change the .48 to .51 U-value with its associated SHGC, which is a common window being proposed in climate zone 5 for builders using the performance path, you would see an increase in the building loads in the amount of BTUs needed for heating and cooling. This increase in Btu could easily require an upsize in equipment.

The Colorado Chapter of ICC recommends Disapproval of EC97 so that the existing language can stay in the code and be used for its intended purpose.

(Bill Prindle Group) *EC97 should be disapproved.* The proponents seek to eliminate an important energy efficiency measure that has been in the code for a number of years and their arguments are no different than those arguments that have consistently been rejected by the ICC in the past.

IECC Section 402.5 establishes simple minimum mandatory performance requirements for fenestration products that ensure all new homes contain high-quality, cost-effective windows that save energy, provide reasonable comfort, resist condensation in colder climates and block unwanted solar gain in warmer climates. EC97 would take a substantial step backward in energy efficiency by removing these protections entirely. Without the protection of Section 402.5, fenestration performance could be traded away without any limitation to levels unacceptable in modern building practice. For example, without the maximums, cold, uncomfortable windows with high condensation (including even single pane windows) could be used in colder climates and windows with no solar protection could be used in hot climates. Given our nation's high priority for energy efficiency and the low cost (if any) of achieving these maximum values, it is imperative that Section 402.5 remain in the IECC.

These requirements have been in the code since 2004. Although a number of opponents have attempted to remove these provisions over the years, the ICC has consistently decided to retain this insurance that reasonable windows will be installed in each climate. For example, in 2008 at the Final Action Hearings, the code officials voted overwhelmingly to retain this provision. Even in the current cycle, the IECC Committee decision was very close, approving this proposal by only one vote.

In upholding and retaining the requirements of Section 402.5 in previous code cycles, the IECC Committee stated:

> 2006/07 (EC58 and EC59) – "Therefore, the limits are needed to assure that other factors created by windows, such as moisture condensation and creation of hot spots do not cause a need to adjust the thermostat a great degree."
>
> 2004/05 (EC36) – "There is concern with removing the SHGC requirements in the warmer climate zones. The committee also supported keeping these values because the performance path can be used to accept other values and products which may not be possible under the prescriptive path. This limitation was placed in the IECC to help offset the fact that the window area limitations were eliminated by EC48-03/04 in the last code cycle. The area weighted average can also be used so that products which may not meet these hard limits can be used in conjunction with other openings which would offset their performance."

The mandatory maximum values in this section are far less stringent than the prescriptive values that have been in the code for many years – values that have always been, by definition, cost effective. Even the proponents of EC97 do not claim that these requirements fail a cost-benefit test; instead, they claim that the requirements may not be necessary because, they claim, energy trade-offs are "energy neutral," in that they block the use of certain types of windows (glass block and garden windows), and that these maximums limit flexibility and are confusing. These claims are not well-supported and are refuted by actual experience.

First, simply because the trade-off appears "energy neutral" in a computer simulation does not mean that the trade-off is truly energy neutral and does not create other problems that justify mandatory limits on such a trade-off measure. As discussed below, trade-offs based on energy analysis alone ignore other critical issues such as peak demand, HVAC sizing, home occupant comfort and condensation, which are also important code considerations. Only a mandatory limit, such as Section 402.5, can ensure that trade-offs do not result in creating problems in these other important areas.

Second, the current glazing maximums are effective and easy to understand. These requirements have been successfully applied for the past few years. All states that have already adopted the 2004, 2006 or 2009 IECC have adopted these maximums without amendment. They are also already seamlessly built into compliance software such as the Department of Energy's REScheck. In our experience, code officials have had no difficulty in enforcing these provisions. We believe that that the claim that compliance is a problem is not supported.

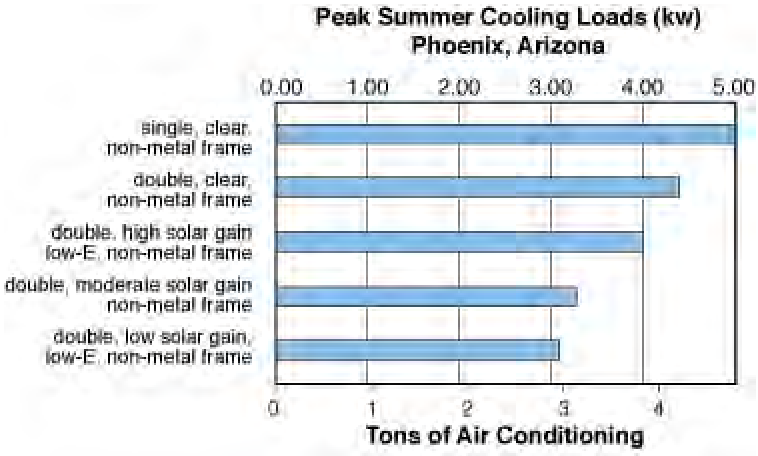
Third, the area-weighted average approach embodied in Section 402.5 allows considerable flexibility for builders to install specialized products used in very limited applications such as decorative glass and glass block, while maintaining a baseline performance for the home's overall glazing. In short, not all products need to individually meet the maximum values, only the area weighted average of all products in the home is required to meet the maximum. Thus, there is substantial room and flexibility for the builder to utilize products that are exceptions. For example, with the 0.50 SHGC limit, up to half of the glass installed could be a 0.55 SHGC (perhaps for a passive solar application), so long as the remainder was at or below 0.45 (the weighted average would be 0.50). Since over 89% of the millions of window types listed in the NFRC database are currently equal to or below 0.40, a 0.50 is hardly a significant constraint. Similarly, 79% of the windows appearing in the NFRC database have a U-factor that would meet the 0.40 U-factor in the northern-most climate zones. In short, the caps are modest numbers that are achievable by most glazing products that are already on the market in each climate zone. The IECC currently employs a number of other mandatory measures (including a mandatory maximum fenestration air leakage number) to ensure that the minimum code house is reasonably constructed – Section 402.5 is no different.

In sum, the fenestration maximums are a key safety net and provide important homeowner and builder protection against bad or impractical trade-offs. Additional technical detail supporting retaining IECC Section 402.5 is set forth below.

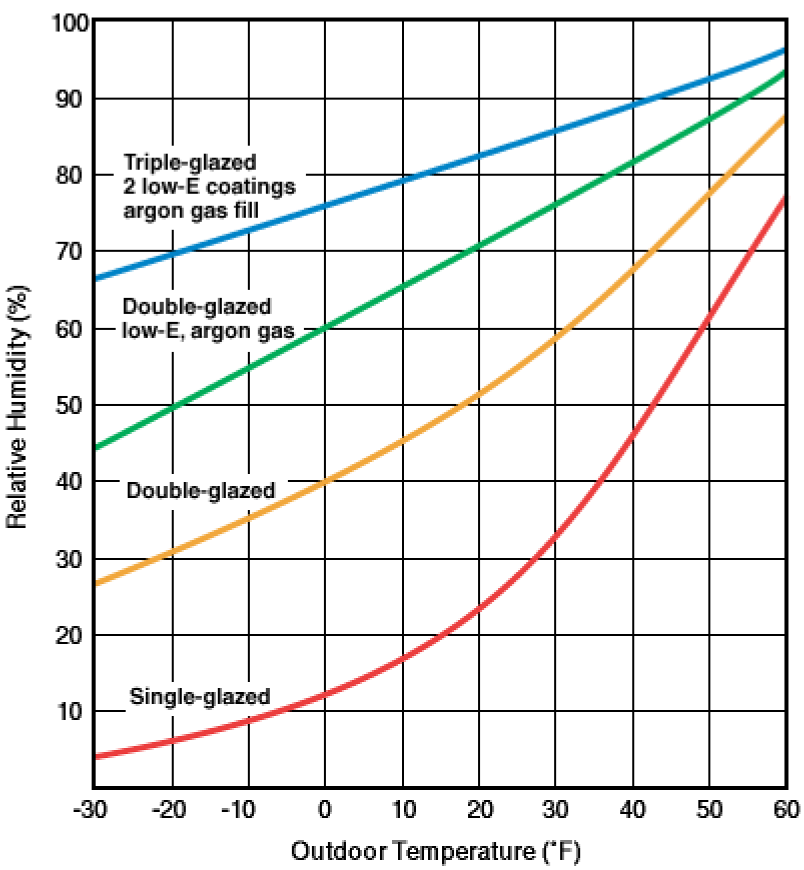
Benefits of Section 402.5 Fenestration Maximums:

1. Quality Windows, Energy Savings and Peak Demand Savings Nationwide. The fenestration maximums encourage the use of cost-effective low-e windows nationwide. Efficient windows bring immediate cost savings to the builder who can downsize heating and cooling equipment, and bring long-term energy savings, greater comfort and reduced condensation for consumers. On a larger scale, because low-SHGC windows reduce energy consumption during the peak summer months in warmer climates, and low U-Factor windows reduce energy consumption during peak heating months in colder climates, high-quality windows can help reduce the strain on the electric grid and delay the need to build peak generation. They will also reduce the need for natural gas and help to reduce the amount of oil that is imported. Consumers also enjoy the reduced costs that come with economies of scale and market transformation. While still allowing reasonable flexibility, but avoiding extreme trade-offs, fenestration maximums are a critical part of a well-functioning energy code.

The following chart, which was developed based on data from the U.S. Department of Energy's Lawrence Berkley National Laboratory (LBNL) and can be found on the Efficient Window Collaborative (EWC) website – http://www.efficientwindows.org/hvac.cfm – shows the potential for saving peak demand for different window types. The fourth and fifth windows are low SHGC windows that would easily satisfy the window maximums in southern climate zones. By contrast, the remaining windows would not satisfy the minimums. As depicted below and explained on the EWC website, using low-solar-gain low-e windows in Phoenix may allow cooling equipment to be two tons smaller than with single-pane windows and at least one ton smaller than with clear double-pane windows. As is readily apparent, improved windows are crucial to lower peak cooling loads and smaller HVAC sizes (with lower costs). Energy use trade-offs under the performance simulation compliance path simply do not account for this critical issue – which makes the window SHGC limits a crucial mandatory measure.



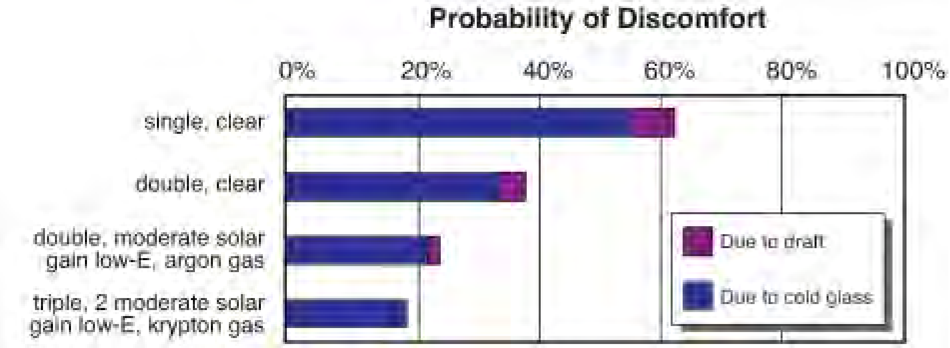
2. Improved Condensation Resistance. Window condensation and the problems associated with that phenomenon are a function of the window's U-factor, the indoor relative humidity, and the outside temperature. Glass with a lower U-factor maintains a higher room-side temperature, which means the glass can withstand lower exterior temperatures and more interior humidity without attracting condensation. Glass with a high U-factor will succumb to condensation much more easily. The following chart, also provided by LBNL and found on the EWC website – http://www.efficientwindows.org/condensation.cfm – shows the condensation potential for different window types.
The graph shows condensation potential on the center of glass area (the area at least 2.5" from the frame/glass edge) at various outdoor temperature and indoor relative humidity conditions. Condensation can occur at any points that fall on or above the curves. As the U-factor of windows improve, there is a much smaller range of conditions where condensation will occur. These values are based on center-of-glass temperatures. Condensation may occur at lower humidity levels on the glass edge.



According to the chart, a typical double-glazed low-e window (which will meet the northern climate zone U-factor maximums) can withstand a 0 degree outdoor temperature and 60% relative humidity inside before condensation will begin to collect. By contrast, a regular double-glazed window (which is unlikely to satisfy the maximums in northern climate zones) can only withstand 40% humidity at the same outdoor temperature. In other words, a low-e window has a 50% more effective ability to resist condensation. A single-glazed low-e window is far worse: it can withstand less than 15% humidity at the same temperature, a virtual guarantee of damaging condensation. The fenestration maximums substantially reduce the likelihood of condensation in the colder months, enhancing durability and long-term benefits for the homeowner.

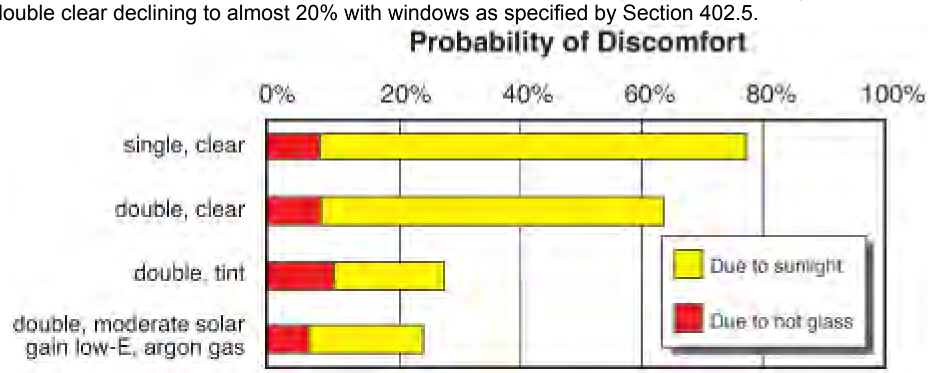
3. More Comfortable Homes and Less Energy Use. The energy code revolves around occupant comfort – any perceived energy savings will be instantly lost if an occupant is uncomfortable and adjusts the thermostat. Incremental changes in window efficiency can have a disproportionate impact on occupant comfort because even the most efficient windows are, at best, still only the equivalent of an R-3 wall. Hot spots created by high solar gain in the summer and cold or drafty glass in the winter months can force an occupant to adjust the thermostat to compensate, and such adjustments will use substantially more energy making the trade-off no longer energy neutral. The charts below, again produced by LBNL and displayed on the EWC website – http://www.efficientwindows.org/comfort.cfm – show that occupant discomfort can double or triple, depending on the type of glass installed.

For example, the following chart shows the probability of discomfort during winter from poorer windows ranging from over 60% with single clear and almost 40% with double clear. This risk declines to almost 20% with a low-e window as specified by Section 402.5. This problem is due to the cold window – at zero degrees outdoors, the single pane glass is less than 20 degrees on the inside surface, the double clear glass is slightly over 40 degrees, while the low-e glass is approaching 60 degrees. Obviously, the warmer the interior glass surface, the less likelihood of discomfort.



Source: Lawrence Berkeley National Laboratory (Lyons and Arasteh).

Similarly, the following chart shows the probability of discomfort during summer from sunlight and hot glass. The potential comfort problem from bad windows is even worse in the summer. The summertime probability of discomfort ranges from almost 80% with single clear and over 60% with double clear declining to almost 20% with windows as specified by Section 402.5.



Source: Lawrence Berkeley National Laboratory (Lyons and Arasteh).

In heating-dominated climates, a good low-e window will keep occupants more comfortable during the coldest months. In cooling-dominated climates, windows with low SHGC will protect against hot spots and occupant discomfort, and will make it less likely that occupants will need to adjust the thermostat and use more energy.

Final Action: AS AM AMPC____ D

EC99-09/10-PART I
202 (New), 403.5.1 (New), Table 403.5.1 (New), Chapter 6

Proposed Change as Submitted

Proponent: Mike Moore, Newport Ventures, representing Broan NuTone

PART I – IECC

1. Add new definition as follows:

WHOLE HOUSE MECHANICAL VENTILATION SYSTEM. An exhaust system, supply system, or combination thereof that is designed to mechanically exchange indoor air with outdoor air for the purpose of diluting and removing indoor air contaminants. The system shall be designed to provide ventilation air continuously or through a programmed intermittent schedule to satisfy the ventilation rates required for the whole house. Local exhaust or supply fans are permitted to serve as such a system.

2. Add new text and table as follows:

403.5.1 Whole-house mechanical ventilation system fan efficacy. When installed to function as a whole house mechanical ventilation system, fans shall meet the efficacy requirements of Table 403.5.1.

> **Exception:** Where whole-house mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.

TABLE 403.5.1
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY[A] (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
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

a. When tested in accordance with HVI Standard 916

3. Add new standard to Chapter 6 as follows:

HVI Home Ventilating Institute
1000 North Rand Road
Suite 214
Wauconda, IL 60084

HVI
916-09 Airflow Test Procedure

Reason: Findings from a recent LBNL study commissioned by the U.S. Department of Energy and the California Energy Commission identified that energy consumption of whole-house mechanical ventilation systems is significant.[1] Furthermore, the study revealed that large disparities exist in the energy consumption and associated operating costs of whole-house mechanical ventilation systems in cold; mild; and hot, dry climates. Within the study, exhaust only systems, balanced heat recovery systems, supply only systems, and central fan integrated systems were all modeled to assess resultant energy use and associated costs. When ventilation, distribution, and conditioning energy were taken into account, it was revealed that ventilation energy consumption for whole-house mechanical ventilation systems was between 630 kWh and 4500 kWh beyond that of a non-mechanically vented base case. Based on the graphs provided by the study, energy and cost premiums above the base case are summarized below:

Temperate climate: 900 kWh – 2100 kWh; $70 - $190
Hot dry climate: 630 kWh – 3500 kWh; $60 - $425
Cold climate: 2100 kWh – 4500 kWh; $140 - $410

The most logical way to reduce the amount of energy consumed by residential mechanical ventilation systems is to address the power consumption of the fans that are powering the system. This is especially important when fans are being used as part of a whole-house ventilation system (as opposed to simply being used for bath exhaust, for example) because these fans will now operate many hours per day instead of a few minutes per day. This proposal offers energy efficacy levels for exhaust fans and also addresses the efficacy of central fans/blowers ONLY when these fans are used within a whole-house mechanical ventilation system, as defined. The efficacy levels proposed for exhaust fans are the same as current Energy Star ventilation fan specifications, so they are very familiar to manufacturers.[2] In fact, Energy Star lists over 400 fans in its database that currently meet these efficacy levels.

Because central fan/blower efficacies are not typically listed and labeled in Watts/cfm, the efficacy threshold for central fans/blowers is satisfied by the specification of an electronically commutated motor (ECM). ECMs for residential blowers are now offered by many manufacturers and have demonstrated over 70% reduction in annual fan energy use versus a permanent split capacitor motor when operated continuously.[3] Again, this requirement only exists if the central fan/blower is used within a whole-house mechanical ventilation system. Heating and energy recovery ventilators (HRVs and ERVs) are excluded from the fan efficacy requirements because these systems typically have efficiency advantages over central-fan integrated and exhaust only systems based on their heat recovery capabilities.

Besides saving energy, high efficacy fans can also have an excellent payback when operated in a whole-house ventilation system. For example, based on first and operational cost comparisons between two market-available fans (one baseline and one that meets the proposed high efficacy requirements provided), the estimated payback of a high efficacy fan is 1.2 years. Furthermore, baseline fans are typically not rated for continuous operation, and so they will likely need to be replaced more often than high efficacy fans, making the high efficacy fan that much more affordable. Results of the payback analysis are given in the table below.

Fan Type	Example Product	Exhaust Rate (cfm)	Initial Cost	Power Draw (Watts)	Annual Energy Consumed (kWh)	Annual Operational Cost ($)	Simple Payback (years)	Annual CO2 ***Savings*** (pounds)
High Efficacy Fan	Broan QTXE050	50	$103.13	33	289	$32.84	1.2	772
Baseline Fan	NuTone 696N	50	$22.90	99	867	$98.52	N/A	N/A

Key assumptions include: U.S. average electricity rate of $0.1136/kWh (source: 2008 U.S. DOE EIA), retail costs of bath fans (www.iaqsource.com), continuous operation (a likely condition if the fan is used for whole-house ventilation), 1.336 lbs CO2/kWh (source: U.S. DOE EIA).

The reference to HVI 916 is provided to ensure that fans comply with industry standards for air flow verification. As a point of reference, Minnesota state residential energy code 7672.1000 currently references HVI 916. HVI 916 is a consensus standard that is also referenced by Energy Star's Ventilation Fan Specification for measurement and verification of fan flow rates (note that NO on-site measurement or verification is required).

References:

1. Sherman, M. and Walker, I. 2007. "Energy Impact of Residential Ventilation Standards in California", LBNL 61282. Lawrence Berkeley National Laboratory, Berkeley, CA.
2. ENERGY STAR® Program Requirements for Residential Ventilating Fans, Partner Commitments. http://www.energystar.gov/ia/partners/product_specs/program_reqs/vent_fans_prog_req_v2.2.pdf.
3. "Effects of ECPM Furnace Motors on Electricity and Gas Use", Canada Mortgage and Housing Corporation, Technical Series 05-101, June 2005, https://www03.cmhc-schl.gc.ca/b2c/b2c/mimes/pdf/63818.pdf.
4. HVI 916 Airflow Test Procedure. http://www.hvi.org/assets/pdfs/HVI916_01March2009.pdf

Cost Impact: The code change proposal will not increase the cost of construction for a home that does not install a whole-house mechanical ventilation system. For those homes that install whole-house mechanical ventilation systems that would have otherwise installed a baseline fan, the cost of construction will increase. However, this cost is expected to be recovered by energy and cost savings.

Analysis: A review of the standard(s) proposed for inclusion in the code, HVI 916, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: MOORE-EC-2-202-403-RE-1-R202-N1103

Public Hearing Results

PART I – IECC

Committee Action: Approved as Modified

Modify proposal as follows:

WHOLE HOUSE MECHANICAL VENTILATION SYSTEM. An exhaust system, supply system, or combination thereof that is designed to mechanically exchange indoor air with outdoor air ~~for the purpose of diluting and removing indoor air contaminants. The system shall be designed to provide ventilation air~~ <u>when operating</u> continuously or through a programmed intermittent schedule to satisfy the <u>whole house</u> ventilation rates. ~~required for the whole house. Local exhaust or supply fans are permitted to serve as such a system.~~

(Portions of code change not shown remain unchanged.)

Committee Reason: Based upon the proponent's reason statement, this proposal will bring significant energy savings.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC, and Craig Conner, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.5.1 ~~Whole-house m~~Mechanical ventilation system fan efficacy. ~~When installed to function as a whole house m~~Mechanical ventilation system~~,~~ fans shall meet the efficacy requirements of Table 403.5.1.

> **Exception:** Where ~~whole-house~~ mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.

TABLE 403.5.1
~~WHOLE-HOUSE~~ MECHANICAL VENTILATION SYSTEM FAN EFFICACY

~~a. When tested in accordance with HVI Standard 916~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes. Greater detail on aligning the IECC and IRC is provided in the reason statements for EC13, EC16 and EC17.

Efficient ventilation fans are very available and are a reasonable way to save energy. This comment simply deletes the requirement to know whether each fan was intended to be part of the whole house ventilation or not, so that the fan efficiency requirements apply to all ventilation fans.

Part I modifies the code approved by the IECC committee. As approved, EC99 differentiates between ventilation fans that are intended to be part of a whole house ventilation system and those that are not. How can the "intent" of a fan be known and enforced? Was one bath fan part of "whole-house ventilation system", while the other bath fan was not? Is the builder installing an efficient bath fan in one bathroom, and an inefficient fan in another? Is the code official going to verify whether each fan is efficient or inefficient, when both types of fans are allowed in the same building and all the fans are independently controlled?

It is simplest just to require fans to be efficient. Once the house is occupied, the residents will run the fans as they choose.

Part II aligns the IRC by making the same changes as in the IECC. Part II also adds the modifications made by the IECC committee.

Final Action: AS AM AMPC____ D

EC99-09/10-PART II
R202 (New), N1103.5.1 (New), Table N1103.5.1 (New), Chapter 44

Proposed Change as Submitted

Proponent: Mike Moore, Newport Ventures, representing Broan NuTone

PART II – IRC BUILDING/ENERGY

1. Add new definition as follows:

WHOLE HOUSE MECHANICAL VENTILATION SYSTEM. An exhaust system, supply system, or combination thereof that is designed to mechanically exchange indoor air with outdoor air for the purpose of diluting and removing indoor air contaminants. The system shall be designed to provide ventilation air continuously or through a programmed intermittent schedule to satisfy the ventilation rates required for the whole house. Local exhaust or supply fans are permitted to serve as such a system.

2. Add new text and table as follows:

N1103.5.1 Whole-house mechanical ventilation system fan efficacy. Where installed to function as a whole house mechanical ventilation system, fans shall meet the efficacy requirements of Table N1103.5.1.

> **Exception:** Where whole-house mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.

TABLE N1103.5.1
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY[a] (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
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

a. When tested in accordance with HVI Standard 916

3. Add new standard to Chapter 44 as follows:

HVI Home Ventilating Institute
1000 North Rand Road
Suite 214
Wauconda, IL 60084

HVI
916-09 Airflow Test Procedure

Reason: Findings from a recent LBNL study commissioned by the U.S. Department of Energy and the California Energy Commission identified that energy consumption of whole-house mechanical ventilation systems is significant.[1] Furthermore, the study revealed that large disparities exist in the energy consumption and associated operating costs of whole-house mechanical ventilation systems in cold; mild; and hot, dry climates. Within the study, exhaust only systems, balanced heat recovery systems, supply only systems, and central fan integrated systems were all modeled to assess resultant energy use and associated costs. When ventilation, distribution, and conditioning energy were taken into account, it was revealed that ventilation energy consumption for whole-house mechanical ventilation systems was between 630 kWh and 4500 kWh beyond that of a non-mechanically vented base case. Based on the graphs provided by the study, energy and cost premiums above the base case are summarized below:

Temperate climate: 900 kWh – 2100 kWh; $70 - $190
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Cold climate: 2100 kWh – 4500 kWh; $140 - $410

The most logical way to reduce the amount of energy consumed by residential mechanical ventilation systems is to address the power consumption of the fans that are powering the system. This is especially important when fans are being used as part of a whole-house ventilation system (as opposed to simply being used for bath exhaust, for example) because these fans will now operate many hours per day instead of a few minutes per day. This proposal offers energy efficacy levels for exhaust fans and also addresses the efficacy of central fans/blowers ONLY when these fans are used within a whole-house mechanical ventilation system, as defined. The efficacy levels proposed for exhaust fans are the same as current Energy Star ventilation fan specifications, so they are very familiar to manufacturers.[2] In fact, Energy Star lists over 400 fans in its database that currently meet these efficacy levels.

Because central fan/blower efficacies are not typically listed and labeled in Watts/cfm, the efficacy threshold for central fans/blowers is satisfied by the specification of an electronically commutated motor (ECM). ECMs for residential blowers are now offered by many manufacturers and have demonstrated over 70% reduction in annual fan energy use versus a permanent split capacitor motor when operated continuously.[3] Again, this requirement only exists if the central fan/blower is used within a whole-house mechanical ventilation system. Heating and energy recovery ventilators (HRVs and ERVs) are excluded from the fan efficacy requirements because these systems typically have efficiency advantages over central-fan integrated and exhaust only systems based on their heat recovery capabilities.

Besides saving energy, high efficacy fans can also have an excellent payback when operated in a whole-house ventilation system. For example, based on first and operational cost comparisons between two market-available fans (one baseline and one that meets the proposed high efficacy requirements provided), the estimated payback of a high efficacy fan is 1.2 years. Furthermore, baseline fans are typically not rated for continuous operation, and so they will likely need to be replaced more often than high efficacy fans, making the high efficacy fan that much more affordable. Results of the payback analysis are given in the table below.

Fan Type	Example Product	Exhaust Rate (cfm)	Initial Cost	Power Draw (Watts)	Annual Energy Consumed (kWh)	Annual Operational Cost ($)	Simple Payback (years)	Annual CO2 ***Savings*** (pounds)
High Efficacy Fan	Broan QTXE050	50	$103.13	33	289	$32.84	1.2	772
Baseline Fan	NuTone 696N	50	$22.90	99	867	$98.52	N/A	N/A

Key assumptions include: U.S. average electricity rate of $0.1136/kWh (source: 2008 U.S. DOE EIA), retail costs of bath fans (www.iaqsource.com), continuous operation (a likely condition if the fan is used for whole-house ventilation), 1.336 lbs CO2/kWh (source: U.S. DOE EIA).

The reference to HVI 916 is provided to ensure that fans comply with industry standards for air flow verification. As a point of reference, Minnesota state residential energy code 7672.1000 currently references HVI 916. HVI 916 is a consensus standard that is also referenced by Energy Star's Ventilation Fan Specification for measurement and verification of fan flow rates (note that NO on-site measurement or verification is required).

References:

1. Sherman, M. and Walker, I. 2007. "Energy Impact of Residential Ventilation Standards in California", LBNL 61282. Lawrence Berkeley National Laboratory, Berkeley, CA.
2. ENERGY STAR® Program Requirements for Residential Ventilating Fans, Partner Commitments. http://www.energystar.gov/ia/partners/product_specs/program_reqs/vent_fans_prog_req_v2.2.pdf.
3. "Effects of ECPM Furnace Motors on Electricity and Gas Use", Canada Mortgage and Housing Corporation, Technical Series 05-101, June 2005, https://www03.cmhc-schl.gc.ca/b2c/b2c/mimes/pdf/63818.pdf.
4. HVI 916 Airflow Test Procedure. http://www.hvi.org/assets/pdfs/HVI916_01March2009.pdf

Cost Impact: The code change proposal will not increase the cost of construction for a home that does not install a whole-house mechanical ventilation system. For those homes that install whole-house mechanical ventilation systems that would have otherwise installed a baseline fan, the cost of construction will increase. However, this cost is expected to be recovered by energy and cost savings.

Analysis: A review of the standard(s) proposed for inclusion in the code, HVI 916, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: MOORE-EC-2-202-403-RE-1-R202-N1103

Public Hearing Results

PART II – IRC

Committee Action: Disapproved

Committee Reason: This provides for controls on fans when installed as whole house ventilators. The committee felt that this was limiting. Control of fans that are not installed for whole house ventilation could be controlled as well. In addition, the definition contains technical requirements.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Mike Moore, Newport Ventures, representing Broan NuTone requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

WHOLE HOUSE MECHANICAL VENTILATION SYSTEM. An exhaust system, supply system, or combination thereof that is designed to mechanically exchange indoor air with outdoor air ~~for the purpose of diluting and removing indoor air contaminants. The system shall be designed to provide ventilation air~~ when operating continuously or through a programmed intermittent schedule to satisfy the whole house ventilation rates ~~required for the whole house. Local exhaust or supply fans are permitted to serve as such a system~~.

N1103.5.1 Whole-house mechanical ventilation system fan efficacy. Where installed to function as a whole house mechanical ventilation system, fans shall meet the efficacy requirements of Table N1103.5.1.

> **Exception:** Where whole-house mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.

TABLE N1103.5.1
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY[a] (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
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

~~a. When tested in accordance with HVI Standard 916~~

~~**HVI** Home Ventilating Institute~~
~~1000 North Rand Road~~
~~Suite 214~~
~~Wauconda, IL 60084~~
~~**HVI**~~
~~916-09 Airflow Test Procedure~~

Commenter's Reason: At the Final Action Hearings in Dallas, RM17, a proposal that defined whole house mechanical ventilation systems and provided guidance for installing these systems, was approved by the assembly. Also approved was M156, which requires that a "whole house mechanical ventilation system" be provided for homes which have an air-tightness rating below 5 ACH 50. These proposals were approved at both the public hearings and final action hearings because they work to ensure that as homes become tighter that they also maintain acceptable indoor air quality.

EC99 was proposed to ensure that as whole house mechanical ventilation system fans are specified that they are also energy efficient. Unlike spot ventilation fans, which typically only operate for a few minutes per day, fans used for whole house mechanical ventilation will typically operate continuously. So, requiring high efficacy fans for whole house mechanical ventilation is cost effective (paybacks typically less than 2 years) and energy efficient. The efficacy levels required by EC99 are based on Energy Star criteria for the various fan locations. EC99 Part I was approved as modified by the IECC, with text that was identical to this comment. Further, the changes made within this comment to the definition of "whole house mechanical ventilation system" will ensure that the definition is exactly the same as that approved for use within the IRC through the approval of M156 and RM17. Approval of this comment is necessary to ensure consistency between the codes.

Public Comment 2:

Shaunna Mozingo, City of Westminster, Co, representing Colorado Chapter of ICC and Craig Conner request Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1103.5.1 ~~Whole house mechanical~~ Mechanical ventilation system fan efficacy. ~~Where installed to function as a whole house mechanical~~ Mechanical ventilation system fans shall meet the efficacy requirements of Table N1103.5.1.

> **Exception:** Where ~~whole house~~ mechanical ventilation fans are integral to tested and listed HVAC equipment, they shall be powered by an electronically commutated motor.

TABLE N1103.5.1
~~WHOLE HOUSE~~ MECHANICAL VENTILATION SYSTEM FAN EFFICACY

FAN LOCATION	AIR FLOW RATE MINIMUM (CFM)	MINIMUM EFFICACY[a] (CFM/WATT)	AIR FLOW RATE MAXIMUM (CFM)
Range hoods	any	2.8 cfm/watt	any
n-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

~~a. When tested in accordance with HVI Standard 916~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes. Greater detail on aligning the IECC and IRC is provided in the reason statements for EC13, EC16 and EC17.

Efficient ventilation fans are very available and are a reasonable way to save energy. This comment simply deletes the requirement to know whether each fan was intended to be part of the whole house ventilation or not, so that the fan efficiency requirements apply to all ventilation fans.

Part I modifies the code approved by the IECC committee. As approved, EC99 differentiates between ventilation fans that are intended to be part of a whole house ventilation system and those that are not. How can the "intent" of a fan be known and enforced? Was one bath fan part of "whole-house ventilation system", while the other bath fan was not? Is the builder installing an efficient bath fan in one bathroom, and an inefficient fan in another? Is the code official going to verify whether each fan is efficient or inefficient, when both types of fans are allowed in the same building and all the fans are independently controlled?

It is simplest just to require fans to be efficient. Once the house is occupied, the residents will run the fans as they choose.
Part II aligns the IRC by making the same changes as in the IECC. Part II also adds the modifications made by the IECC committee.

Final Action: AS AM AMPC____ D

EC100-09/10, Part I
403.1, 403.1.3 (New)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

1. Revise as follows:

403.1 Controls (Mandatory). At least one thermostat shall be provided for each separate heating and cooling zone as defined by Section 403.1.3 ~~system~~.

2. Add new text as follows:

403.1.3 Heating and cooling zone. Each dwelling unit shall have at least one heating and cooling zone per story or per 1000 square feet of floor space, whichever requires fewer zones. Each zone shall have a separate return and supply. Each system shall be designed to operate within the equipment manufacturer's specifications. Each heating and cooling zone shall be served by:

1. An individual system or
2. An automatic air duct damper or automatic zone valve separately controlled by a thermostat for that zone for systems serving multiple zones. Each system serving multiple zones shall be capable of reducing or increasing the delivered air or water flow with a variable-speed fan or pump, and modulating the heating or cooling equipment output, based on a signal from the thermostat that the air duct damper or zone valve is being open of closed.

Reason: Significant energy can be wasted in buildings that have single zone conditioning. The www.energysavers.gov website from the DOE states that "zone heating can produce energy savings of more than 20% compared to heating both occupied and unoccupied areas of your house." This proposal sets a requirement to have separate HVAC zone control for homes that have combinations of floor area and building height that makes them susceptible to inefficient space conditioning.

Number of Stories:
Due to the fact that hot air rises and cool air settles to the lowest floor, conditioning multiple stories as one zoned space creates a large temperature difference between the hottest and coldest space in the home. This leads to overcooling some areas in summer and overheating some areas in winter. Zoning reduces the excess energy consumption that can result from single zoning by supplying heating or cooling to each zone on a separately-controlled basis.

Floor Area:
As homes get larger in floor area, controlling space temperatures across extensive area even on the same level becomes increasingly harder. Walls facing different directions experience solar loads that vary throughout the day and year, while other spaces experience differing internal heat gains throughout the day or year. Under such conditions, one space conditioning zone control simply cannot keep all spaces in the house comfortable without wasting energy. This proposal reduces such energy waste by requiring one zone per 1000 square feet of floor area of a given story.

Direct from www.toolbase.org:

> An HVAC "smart" zoning control system divides the home into two or three zones, with a thermostat in each zone. It works with single-stage gas, oil, heat pump or electric HVAC equipment or internally staged, multi-stage equipment. The control system includes automatic dampers that fit into the ducts and a control panel that allows for the feedback of information between the programmable thermostat, indoor climate and damper position. The drive damper actuator assembly does not use wear- and friction-producing gears for damper control. Instead, a synthetic cord transfers the motor rotation to the lever arm. Flexible-link or air-driven dampers are considered more reliable than typical gear-driven dampers for controlling HVAC system zone output. Mechanical, electric, digital, or programmable thermostats by other manufacturers or by RP can be used. It is cost-effective to install when the HVAC system is being replaced, or in new construction. Manufacturers claim that proper installation can result in 10 to 20% energy savings from thermostat setbacks that prevent over-conditioning zones. Comfort is more readily achieved in each zone, and additional, targeted thermostats are more convenient to control than those at a single location.

DOE Reference: www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12520

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

ICCFILENAME: PRINDLE-EC-22-403.1-N1103.1

Public Hearing Results

PART I - IECC
Committee Action: **Disapproved**

Committee Reason: There is no evidence provided that heating and cooling zones save energy. This provision would be too far reaching in regulating building heating and cooling system design.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Name: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.1 Controls (Mandatory). At least one thermostat shall be provided for each separate heating and cooling zone as defined by section 403.1.3.

403.1.3 Heating and cooling Zone. Each dwelling unit with 2,000 square feet or more of conditioned floor area shall have at least one heating and cooling zone per story ~~or per 1000 square feet of floor space, whichever requires fewer zones. Each zone shall have a separate return and supply~~. Each system shall be designed to operate within the equipment manufacturer's specifications. Each heating and cooling zone shall be served by:

1. An individual system or
2. An automatic air duct damper or automatic zone valve separately controlled by a thermostat for that zone for systems serving multiple zones. Each system serving multiple zones shall be capable of reducing or increasing the delivered air or water flow with a variable-speed fan or pump, and modulating the heating or cooling equipment output, based on a signal from the thermostat that the air duct damper or zone valve is being open or closed.

Commenter's Reason: *EC100 Parts I & II should be approved as modified by this public comment.*
Significant energy is wasted in buildings that have single zone conditioning. The Department of Energy states that "**zone heating can produce energy savings of more than 20%.**" See http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12520. This public comment modification is intended to establish a straightforward requirement to apply energy-saving multi-zone requirements while addressing the Code Development Committee's concerns about the cost of installation. The proposal has been modified to apply only to dwellings with more than 2000 square feet or more of conditioned area. Although we believe the original EC100 would have saved even more energy, EC100 as modified above would still result in more comfortable, more efficient homes.

Because hot air rises and cool air settles to the lowest floor, conditioning multiple stories as one zoned space creates a large temperature difference between the hottest and coldest space in the home. To correct for the temperature imbalances, occupants often set the thermostat unnecessarily low or high just to make one story of the home more comfortable. This common situation causes increased energy use for space conditioning – which is responsible for 56% of the energy use in a typical home. See www.energysavers.gov. Zoning reduces the excess energy consumption that can result from single zoning by supplying heating or cooling to each zone on a separately-controlled basis. EC100, which applies only to dwelling units of 2000 square feet or more of conditioned space, provides two methods to achieve multiple conditioned zones – either through individual systems for each floor or through "smart" zoning controls with automatic duct dampers or zone valves for each zone. While more precise zonal controls for all homes may be appropriate in the future, we believe that this proposal moves the IRC and IECC in the right direction.

Final Action: AS AM AMPC____ D

EC100-09/10, Part II
N1103.1, N1103.1.3 (New)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

1. Revise as follows:

N1103.1 Controls. At least one thermostat shall be installed for each separate heating and cooling zone as defined by section N1103.1.3 ~~system~~.

2. Add new text as follows:

N1103.1.3 Heating and cooling zone. Each dwelling unit shall have at least one heating and cooling zone per story or per 1000 square feet of floor space, whichever requires fewer zones. Each zone shall have a separate return and supply. Each system shall be designed to operate within the equipment manufacturer's specifications. Each heating and cooling zone shall be served by:

1. An individual system or
2. An automatic air duct damper or automatic zone valve separately controlled by a thermostat for that zone for systems serving multiple zones. Each system serving multiple zones shall be capable of reducing or increasing the delivered air or water flow with a variable-speed fan or pump, and modulating the heating or cooling equipment output, based on a signal from the thermostat that the air duct damper or zone valve is being open of closed.

Reason: Significant energy can be wasted in buildings that have single zone conditioning. The www.energysavers.gov website from the DOE states that "zone heating can produce energy savings of more than 20% compared to heating both occupied and unoccupied areas of your house." This proposal sets a requirement to have separate HVAC zone control for homes that have combinations of floor area and building height that makes them susceptible to inefficient space conditioning.

Number of Stories:
Due to the fact that hot air rises and cool air settles to the lowest floor, conditioning multiple stories as one zoned space creates a large temperature difference between the hottest and coldest space in the home. This leads to overcooling some areas in summer and overheating some areas in winter. Zoning reduces the excess energy consumption that can result from single zoning by supplying heating or cooling to each zone on a separately-controlled basis.

Floor Area:
As homes get larger in floor area, controlling space temperatures across extensive area even on the same level becomes increasingly harder. Walls facing different directions experience solar loads that vary throughout the day and year, while other spaces experience differing internal heat gains throughout the day or year. Under such conditions, one space conditioning zone control simply cannot keep all spaces in the house comfortable without wasting energy. This proposal reduces such energy waste by requiring one zone per 1000 square feet of floor area of a given story.

Direct from www.toolbase.org:

> An HVAC "smart" zoning control system divides the home into two or three zones, with a thermostat in each zone. It works with single-stage gas, oil, heat pump or electric HVAC equipment or internally staged, multi-stage equipment. The control system includes automatic dampers that fit into the ducts and a control panel that allows for the feedback of information between the programmable thermostat, indoor climate and damper position. The drive damper actuator assembly does not use wear- and friction-producing gears for damper control. Instead, a synthetic cord transfers the motor rotation to the lever arm. Flexible-link or air-driven dampers are considered more reliable than typical gear-driven dampers for controlling HVAC system zone output. Mechanical, electric, digital, or programmable thermostats by other manufacturers or by RP can be used. It is cost-effective to install when the HVAC system is being replaced, or in new construction. Manufacturers claim that proper installation can result in 10 to 20% energy savings from thermostat setbacks that prevent over-conditioning zones. Comfort is more readily achieved in each zone, and additional, targeted thermostats are more convenient to control than those at a single location.

DOE Reference: www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12520

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

ICCFILENAME: PRINDLE-EC-22-403.1-N1103.1

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: There is no evidence provided that heating and cooling zones save energy. This provisions would be too far reaching in regulating building heating and cooling system design.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1103.1 Controls. At least one thermostat shall be installed for each separate heating and cooling zone as defined by section N1103.1.3.

N1103.1.3 Heating and cooling Zone. Each dwelling unit with 2,000 square feet or more of conditioned floor area shall have at least one heating and cooling zone per story ~~or per 1000 square feet of floor space, whichever requires fewer zones. Each zone shall have a separate return and supply~~. Each system shall be designed to operate within the equipment manufacturer's specifications. Each heating and cooling zone shall be served by:

1. An individual system or
2. An automatic air duct damper or automatic zone valve separately controlled by a thermostat for that zone for systems serving multiple zones. Each system serving multiple zones shall be capable of reducing or increasing the delivered air or water flow with a variable-speed fan or pump, and modulating the heating or cooling equipment output, based on a signal from the thermostat that the air duct damper or zone valve is being open or closed.

Commenter's Reason: *EC100 Parts I & II should be approved as modified by this public comment.*

Significant energy is wasted in buildings that have single zone conditioning. The Department of Energy states that "**zone heating can produce energy savings of more than 20%.**" See http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12520. This public comment modification is intended to establish a straightforward requirement to apply energy-saving multi-zone requirements while addressing the Code Development Committee's concerns about the cost of installation. The proposal has been modified to apply only to dwellings with more than 2000 square feet or more of conditioned area. Although we believe the original EC100 would have saved even more energy, EC100 as modified above would still result in more comfortable, more efficient homes.

Because hot air rises and cool air settles to the lowest floor, conditioning multiple stories as one zoned space creates a large temperature difference between the hottest and coldest space in the home. To correct for the temperature imbalances, occupants often set the thermostat unnecessarily low or high just to make one story of the home more comfortable. This common situation causes increased energy use for space conditioning – which is responsible for 56% of the energy use in a typical home. See www.energysavers.gov. Zoning reduces the excess energy consumption that can result from single zoning by supplying heating or cooling to each zone on a separately-controlled basis. EC100, which applies only to dwelling units of 2000 square feet or more of conditioned space, provides two methods to achieve multiple conditioned zones – either through individual systems for each floor or through "smart" zoning controls with automatic duct dampers or zone valves for each zone. While more precise zonal controls for all homes may be appropriate in the future, we believe that this proposal moves the IRC and IECC in the right direction.

Final Action: AS AM AMPC____ D

EC101-09/10-PART I
202 (New), 403.1.1, Table 403.1.1 (New)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

1. Add new definition as follows:

HEAT PUMP RECOVERY. A feature of a programmable thermostat that allows the heat pump to recover gradually from an energy-saving set point temperature to a comfort set point temperature. The heat pump recovery feature is designed to minimize the use of auxiliary heat while also minimizing the on-time of the system. This feature must prevent auxiliary or supplementary heat pump operation when the heat pump can meet the heating load.

2. Revise as follows:

403.1.1 Programmable thermostat. Where the primary heating system is a forced air furnace or forced air split system heat pump, packaged unit heat pump, water boiler, or steam boiler, at least one thermostat per 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. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55ºF (13ºC) or up to 85ºF (29ºC). The thermostat shall initially be programmed with a default heating and cooling temperature set points as detailed in Table 403.1.1 ~~no higher than 70ºF (21ºC) and a cooling temperature set point no lower than 78ºF (26ºC)~~. Programmable thermostat models installed for heat pump systems shall be equipped with a heat pump recovery system.

3. Add new table as follows:

TABLE 403.1.1
PROGRAMMABLE THERMOSTAT SET POINT TIMES & TEMPERATURES

SETTING TIME	SET POINT TEMPERATURE (HEAT)	SET POINT TEMPERATURE (COOL)
Wake: 6:00 a.m.	≤ 70° F	≥ 78° F
Day: 8:00 a.m.	Setback at least 8° F	Setup at least 7° F
Evening: 6:00 p.m.	≤ 70° F	≥ 78° F
Sleep: 10:00 p.m.	Setback at least 8° F	Setup at least 4° F

Reason: During the 2009 code cycle, the requirement for a programmable thermostat in homes with forced air furnaces was approved. This code proposal attempts to bring all equipment types that can utilize programmable thermostats into the same requirement for increased internal consistency in the code.

The language for Heat Pump Recovery is based on ENERGY STAR definition at the following website: http://www.energystar.gov/ia/partners/product_specs/eligibility/thermostats_elig.pdf and on the provisions of section IECC 503.2.4.1.1.

As noted in the ENERGY STAR document, heat pump recovery is a feature of a programmable thermostat that allows the heat pump to recover gradually from an energy-saving setpoint temperature to a comfort set-point temperature. The heat pump recovery feature is designed to minimize the use of auxiliary heat while also minimizing the on-time of the system.

The proposed change to the default heating temperature setpoints, set out in the new table is to encourage users to use the HVAC equipment at a lower setting to save energy. These default temperature setpoints, originally from the ENERGY STAR thermostat program, are consistent with commercially available product default settings today.
ENERGY STAR source: http://www.energystar.gov/index.cfm?c=thermostats.pr_thermostats

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

ICCFILENAME: PRINDLE-EC-21-202-403.1.1-R202-N1103.1.1

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The thermostat settings do not represent any significant energy savings. We have different lifestyles, with widely varying times that we need the thermostat settings at different levels. This does not address that, and seems to assume that we all sleep, eat, play, and work at the same times.

Assembly Action: **Approved as Submitted**

Individual Consideration Agenda

This code change proposal is on the agenda for individual consideration because the proposal received a successful assembly action. Note that the assembly action, Approved as Submitted, will be the initial motion on the floor for consideration when this item is called. In addition public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing Energy Efficient Codes Coalition, Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE), Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edition Electric Institute, request Approval as Submitted.

Commenter's Reason: During the 2009 code cycle, the requirement for a programmable thermostat in homes with forced air furnaces was approved. This code proposal attempts to bring all equipment types that can utilize programmable thermostats into the same requirement for increased internal consistency in the code.

The language for Heat Pump Recovery is based on ENERGY STAR definition at the following website: http://www.energystar.gov/ia/partners/product_specs/eligibility/thermostats_elig.pdf and on the provisions of section IECC 503.2.4.1.1.

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The proposed change to the default heating temperature setpoints, set out in the new table is to encourage users to use the HVAC equipment at a lower setting to save energy. These default temperature setpoints, originally from the ENERGY STAR thermostat program, are consistent with commercially available product default settings today.

ENERGY STAR source: http://www.energystar.gov/index.cfm?c=thermostats.pr_thermostats

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

Public Comment 2:

Rick Fortner, Building Safety Division, City of Norfolk, VA, representing Virginia Building Code Officials Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**HEAT PUMP RECOVERY.** A feature of a programmable thermostat that allows the heat pump to recover gradually from an energy-saving set point temperature to a comfort set point temperature. The heat pump recovery feature is designed to minimize the use of auxiliary heat while also minimizing the on-time of the system. This feature must prevent[s] auxiliary or supplementary heat pump operation when the heat pump can meet the heating load.~~

403.1.1 Programmable thermostat. Where the primary heating system is a forced air furnace or forced air split system heat pump, packaged unit heat pump, water boiler, or steam boiler, at least one thermostat per 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. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55ºF (13ºC) or up to 85ºF (29ºC). ~~The thermostat shall initially be programmed with a default heating and cooling temperature set points as detailed in Table 403.1.1 no higher than 70ºF (21ºC) and a cooling temperature set point no lower than 78ºF (26ºC). Programmable thermostat models installed for heat pump systems shall be equipped with a heat pump recovery system.~~

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: Including terminology such as "must" into the definitions will imply that definitions are an enforceable part of the code. This is not typically the case.

Providing thermostats with setback capabilities in the ranges specified provide the ability for increased energy savings. Making the setbacks mandatory is realistically unenforceable. Homeowners will have the ability to set their thermostats at any setpoints they choose within the capable range provided by the thermostat manufacturers and it would be impossible for code enforcement professionals to enforce.

Public Comment 3:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality request Disapproval.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

Multiple research studies have shown that setback thermostats don't save energy. Code Officials do not want to be responsible for checking thermostat settings, which can be changed any time. We recommend disapproval of this item due to lack of energy impact, to be consistent with what both committees did, and due to the complexity of the code change.

*"An Unexpected Setback for Programmable Thermostats"***.** Energy Design Update (11/2000)
"Automatic Setback Thermostats: Measure Persistence and Customer Behavior". Proceedings of the 1997 International Energy Program Evaluation Conference, Chicago, August 27-29, 1997. David Cross and David Judd.
"Surprise! There Are People Inside Those Buildings". Energy Design Update (1/2001). Craig Conner, Pacific Northwest National Laboratory.
http://www.greenbuildingadvisor.com/blogs/dept/musings/martin-s-useless-products-list

Final Action: AS AM AMPC____ D

EC101-09/10-PART II
R202 (New), N1103.1.1, Table N1103.1.1 (New)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

1. Add new definition as follows:

HEAT PUMP RECOVERY. A feature of a programmable thermostat that allows the heat pump to recover gradually from an energy-saving set point temperature to a comfort set point temperature. The heat pump recovery feature is designed to minimize the use of auxiliary heat while also minimizing the on-time of the system. This feature must prevent auxiliary or supplementary heat pump operation when the heat pump can meet the heating load.

2. Revise as follows:

N1103.1.1 Programmable thermostat. Where the primary heating system is a forced air furnace or forced air split system heat pump, packaged unit heat pump, water boiler, or steam boiler, at least one thermostat per 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. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55ºF (13ºC) or up to 85ºF (29ºC). The thermostat shall initially be programmed with a default heating and cooling temperature set points as detailed in Table N1103.1.1 ~~no higher than 70ºF (21ºC) and a cooling temperature set point no lower than 78ºF (26ºC)~~. Programmable thermostat models installed for heat pump systems shall be equipped with a heat pump recovery system.

3. Add new table as follows:

TABLE N1103.1.1
PROGRAMMABLE THERMOSTAT SET POINT TIMES & TEMPERATURES

SETTING TIME	SET POINT TEMPERATURE (HEAT)	SET POINT TEMPERATURE (COOL)
Wake: 6:00 a.m.	≤ 70° F	≥ 78° F
Day: 8:00 a.m.	Setback at least 8° F	Setup at least 7° F
Evening: 6:00 p.m.	≤ 70° F	≥ 78° F
Sleep: 10:00 p.m.	Setback at least 8° F	Setup at least 4° F

Reason: During the 2009 code cycle, the requirement for a programmable thermostat in homes with forced air furnaces was approved. This code proposal attempts to bring all equipment types that can utilize programmable thermostats into the same requirement for increased internal consistency in the code.

The language for Heat Pump Recovery is based on ENERGY STAR definition at the following website: http://www.energystar.gov/ia/partners/product_specs/eligibility/thermostats_elig.pdf and on the provisions of section IECC 503.2.4.1.1.

As noted in the ENERGY STAR document, heat pump recovery is a feature of a programmable thermostat that allows the heat pump to recover gradually from an energy-saving setpoint temperature to a comfort set-point temperature. The heat pump recovery feature is designed to minimize the use of auxiliary heat while also minimizing the on-time of the system.

The proposed change to the default heating temperature setpoints, set out in the new table is to encourage users to use the HVAC equipment at a lower setting to save energy. These default temperature setpoints, originally from the ENERGY STAR thermostat program, are consistent with commercially available product default settings today.

ENERGY STAR source: http://www.energystar.gov/index.cfm?c=thermostats.pr_thermostats

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

ICCFILENAME: PRINDLE-EC-21-202-403.1.1-R202-N1103.1.1

Public Hearing Results

PART II – IRC

Committee Action: **Disapproved**

Committee Reason: It is unreasonable to assume that certain temperature set back setting will help save energy given the fact that people have varying life styles and therefore different needs for setting the thermostat. In addition, the definition of heat pump recovery is vague and therefore does not provide useful information as to what the code really requires.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute requests Approval as Submitted.

Commenter's Reason: *EC101, Part II should be approved as submitted.*
This public comment is consistent with the approved proposal by floor action at the IECC Committee hearings. This proposal is simply intended to extend the programmable thermostat requirement approved in the 2009 IECC to include the other residential HVAC system types. This proposal also includes the language for the thermostat equipment to be set in the homes with the preset energy efficient setback settings that are widely used by the industry thanks to the former ENERGY STAR thermostat program.

Public Comment 2:

Rick Fortner, City of Norfolk, VA, representing Virginia Building Code Officials Association, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

~~**HEAT PUMP RECOVERY.** A feature of a programmable thermostat that allows the heat pump to recover gradually from an energy-saving set point temperature to a comfort set point temperature. The heat pump recovery feature is designed to minimize the use of auxiliary heat while also minimizing the on-time of the system. This feature must prevent[s] auxiliary or supplementary heat pump operation when the heat pump can meet the heating load.~~

N1103.1.1 Programmable thermostat. Where the primary heating system is a forced air furnace or forced air split system heat pump, packaged unit heat pump, water boiler, or steam boiler, at least one thermostat per 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. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55ºF (13ºC) or up to 85ºF (29ºC). ~~The thermostat shall initially be programmed with a default heating and cooling temperature set points as detailed in Table N1103.1.1 no higher than 70ºF (21ºC) and a cooling temperature set point no lower than 78ºF (26ºC). Programmable thermostat models installed for heat pump systems shall be equipped with a heat pump recovery system.~~

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: Including terminology such as "must" into the definitions will imply that definitions are an enforceable part of the code. This is not typically the case.
Providing thermostats with setback capabilities in the ranges specified provide the ability for increased energy savings. Making the setbacks mandatory is realistically unenforceable. Homeowners will have the ability to set their thermostats at any setpoints they choose within the capable range provided by the thermostat manufacturers and it would be impossible for code enforcement professionals to enforce.

Final Action: AS AM AMPC____ D

EC102-09/10-PART I
Table 402.1.3, Table 405.5.2(1)

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART I – IECC

Revise as follows:

TABLE 402.1.3
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[d]	Crawl Space Wall U-Factor[d]
1	1.20	0.75	0.035	0.082	0.197	0.064	~~0.360~~ 0.948	~~0.477~~ 0.948
2	0.65	0.75	0.035	0.082	0.165	0.064	~~0.360~~ 0.948	~~0.477~~ 0.948
3	0.50	0.65	0.035	0.082	0.141	0.047	~~0.091~~ 0.154[c]	~~0.136~~ 0.154
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	~~0.059~~ 0.084	~~0.065~~ 0.084
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.037	~~0.059~~ 0.084	~~0.065~~ 0.084
6	0.35	0.60	0.026	0.060	0.060	0.033	~~0.050~~ 0.059	~~0.065~~ 0.084
7 and 8	0.35	0.60	0.026	0.057	0.057	0.028	~~0.050~~ 0.059	~~0.065~~ 0.084

a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 except Marine, and the same as the frame wall U-factor in Marine zone 4 and zones 5 through 8.
c. Basement wall U-factor of ~~0.360~~ 0.948 in warm-humid locations as defined by Figure 301.1 and Table 301.2.
d. Foundation U-factor requirements include wall construction and interior air films but exclude soil conductivity and exterior air films. U-factors for determining code compliance in accordance with Section 402.1.4 (total UA alternative) or Section 405 (Simulated Performance Alternative) shall be modified to include soil conductivity and exterior air films.

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Building Component	Standard Reference Design	Proposed Design
Foundations	Type: same as proposed foundation wall Area above and below grade: 2 ft. or same as proposed, whichever is less	As proposed As proposed

(Portions of table and footnotes not shown remain unchanged)

Reason: The purpose of this code change is to remove the ground (earth) conductance from the U-factor requirements in the IECC and Chapter 11 of the IRC. The ground is not an inherent characteristic of the building and is therefore an unnecessary and confusing element to include as part of the code's U-factor requirements. Additionally, the code gives no information about how the ground conductance effect is to be accounted for in the U-factor requirements and it is therefore difficult for code users (including code compliance software developers) to correctly and consistently match their calculations to the code requirements.

The proposed U-factors include only the foundation structure and insulation elements. They are based on the assumption of solid concrete foundation walls with an R-value of 0.375 for an assumed 6 inches of concrete. Where R-13 cavity or R-10 continuous insulation is required, the U-factor proposed here is based on the assumption of a finished framed wall with R-13 cavity insulation.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: MAJETTE-EC-71-T. 403.1.3-IRC T. N1102.1.2

Public Hearing Results

PART I – IECC

Committee Action: **Approved as Submitted**

Committee Reason: The committee agrees with the proponent that factoring in the ground for the basement wall U-Factor provides confusion to those using this table for prescriptive applications.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, US Department of Energy requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.3

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[d]	Crawl Space Wall U-Factor[d]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.948	0.948
2	0.65	0.75	0.035	0.082	0.165	0.064	0.948	0.948
3	0.50	0.65	0.035	0.082	0.141	0.047	0.154[c]	0.154
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.084	0.084
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.037	~~0.084~~0.059	~~0.084~~0.059
6	0.35	0.60	0.026	0.060	0.060	0.033	0.059	~~0.084~~0.059
7 and 8	0.35	0.60	0.026	0.057	0.057	0.028	0.059	~~0.084~~0.059

a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 except Marine, and the same as the frame wall U-factor in Marine zone 4 and zones 5 through 8.
c. Basement wall U-factor of 0.948 in warm-humid locations as defined by Figure 301.1 and Table 301.2.
d. Foundation U-factor requirements include wall construction and interior air films but exclude soil conductivity and exterior air films. U-factors for determining code compliance in accordance with Section 402.1.4 (total UA alternative) or Section 405 (Simulated Performance Alternative) shall be modified to include soil conductivity and exterior air films.

(Portion of code change proposal not shown remain unchanged)

Commenter's Reason: Code change proposal EC50 increases basement wall insulation in climate zone 5 and crawl space wall insulation in climate zones 5-8. EC50 was approved for inclusion in the IECC at the initial action hearing. The changes proposed in this public comment are purely to make the U-factor requirements correspond to insulation R-value requirements in EC50. If EC50 is approved and these changes to EC102 are not approved, the U-factor requirements will not correctly correspond to the R-value requirements.

Public Comment 2:

Don Surrena, representing National Association of Home Builders (NAHB) requests Disapproval.

Commenter's Reason: This proposal increases the complexity of using the U-Factor table (Table 402.1.3). The U-factor requirement of the wall will change with the grade level of the soil and the soil type. No direction is provided to assign either soil conductivity or air films.

Also, the basement wall u-values are treated as if they are wood framed walls rather than mass walls (see figure).

Climate Zone	Wood Wall R	Wood Wall U	Mass Wall R	Mass Wall U	Basement R	Proposed Basement U
4 except Marine	13	0.082	10	0.141	10/13	0.084

U-values as they are have worked fine for years. This is an unnecessary complication to the code and should be disapproved.

Final Action: AS AM AMPC____ D

EC102-09/10-PART II

IRC Table N1102.1.2

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART II – IRC BUILDING/ENERGY

Revise as follows:

TABLE N1102.1.2
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[d]	Crawl Space Wall U-Factor[d]
1	1.20	0.75	0.035	0.082	0.197	0.064	~~0.360~~ 0.948	~~0.477~~ 0.948
2	0.65	0.75	0.035	0.082	0.165	0.064	~~0.360~~ 0.948	~~0.477~~ 0.948
3	0.50	0.65	0.035	0.082	0.141	0.047	~~0.091~~ 0.154[c]	~~0.136~~ 0.154
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	~~0.059~~ 0.084	~~0.065~~ 0.084
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.037	~~0.059~~ 0.084	~~0.065~~ 0.084
6	0.35	0.60	0.026	0.060	0.060	0.033	~~0~~.059 0.084	~~0.065~~ 0.084
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	~~0.059~~ 0.084	~~0.065~~ 0.084

a. Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.
b. When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 except Marine, and the same as the frame wall U-factor in Marine zone 4 and zones 5 through 8.
c. Basement wall U-factor of ~~0.360~~ 0.948 in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.
d. Foundation U-factor requirements include wall construction and interior air films but exclude soil conductivity and exterior air films. U-factors for determining code compliance in accordance with Section N1102.1.3 (total UA alternative) shall be modified to include soil conductivity and exterior air films.

Reason: The purpose of this code change is to remove the ground (earth) conductance from the U-factor requirements in the IECC and Chapter 11 of the IRC. The ground is not an inherent characteristic of the building and is therefore an unnecessary and confusing element to include as part of the code's U-factor requirements. Additionally, the code gives no information about how the ground conductance effect is to be accounted for in the U-factor requirements and it is therefore difficult for code users (including code compliance software developers) to correctly and consistently match their calculations to the code requirements.

The proposed U-factors include only the foundation structure and insulation elements. They are based on the assumption of solid concrete foundation walls with an R-value of 0.375 for an assumed 6 inches of concrete. Where R-13 cavity or R-10 continuous insulation is required, the U-factor proposed here is based on the assumption of a finished framed wall with R-13 cavity insulation.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: MAJETTE-EC-71-T. 403.1.3-IRC T. N1102.1.2

Public Hearing Results

PART II – IRC

Committee Action: **Disapproved**

Committee Reason: The committee disagreed that this code change would be less confusing. Quite to the contrary, the committee believes that the application of the table is more often needed for the UA alternative and therefore the interpretation of the code is more confusing with the proposed change.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Shaunna Mozingo, City of Westminster, CO representing Colorado Chapter of ICC, and Craig Conner, requests Approval as Submitted.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

The proposal as submitted was an improvement to how basement and crawl U-factors are calculated prescriptively and we recommend approval as submitted for EC102, Part II to be consistent with Part I.

Public Comment 2:

Ronald Majette, US Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE N1102.1.2
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[d]	Crawl Space Wall U-Factor[d]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.948	0.948
2	0.65	0.75	0.035	0.082	0.165	0.064	0.948	0.948
3	0.50	0.65	0.035	0.082	0.141	0.047	0.154[c]	0.154
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.084	0.084
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.037	~~0.084~~0.059	~~0.084~~0.059
6	0.35	0.60	0.026	0.060	0.060	0.033	0.084	~~0.084~~0.059
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.084	~~0.084~~0.059

(a) Nonfenestration U-factors shall be obtained from measurement, calculation or an approved source.
(b) When more than half the insulation is on the interior, the mass wall U-factors shall be a maximum of 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 except Marine, and the same as the frame wall U-factor in Marine zone 4 and zones 5 through 8.
(c) Basement wall U-factor of 0.948 in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.
(d) Foundation U-factor requirements include wall construction and interior air films but exclude soil conductivity and exterior air films. U-factors for determining code compliance in accordance with Section N1102.1.3 (total UA alternative) shall be modified to include soil conductivity and exterior air films.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: Code change proposal EC50 increases basement wall insulation in climate zone 5 and crawl space wall insulation in climate zones 5-8. EC50 was approved for inclusion in the IECC at the initial action hearing. The changes proposed in this public comment are purely to make the U-factor requirements correspond to insulation R-value requirements in EC50. If EC50 is approved and these changes to EC102 are not approved, the U-factor requirements will not correctly correspond to the R-value requirements.

Final Action: AS AM AMPC____ D

EC103-09/10-PART I

403.2.1, 403.2.2, 403.2.3

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Revise as follows:

403.2.1 Insulation (Prescriptive). Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

> **Exception:** Where all ~~D~~ducts ~~or portions thereof~~ are located completely within *conditioned space* ~~inside the *building thermal envelope*~~, supply ducts shall be insulated to a minimum of R-4.

403.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes~~, and building cavities used as ducts~~ shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code* or Section 603.9 of the *International Mechanical Code,* as applicable.

Duct tightness shall be verified by a test performed by a party *approved* by the *code official* after construction is completed. Where required by the code official, testing shall be conducted by an approved party independent from the builder and the installer of the ducts. ~~either of the following:~~ A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and the *code official*.

~~1.~~ ~~Post-construction test: L~~ As tested, total duct l~~L~~eakage ~~to outdoors~~ shall be less than ~~or equal to 8 cfm (226.5 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* or a total leakage less than~~ or equal to 6 ~~12~~ cfm (226.5~~12~~ L/min) per 100 square feet (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

~~2.~~ ~~Rough-in test: Total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*.~~

> **Exceptions:** ~~Duct tightness test is not required if~~ Where the air handler and all ducts are located within conditioned space, total duct leakage shall not exceed 12 cfm per 100 square feet of conditioned floor area when tested as specified above.

403.2.3 Building cavities (Mandatory). Building framing cavities shall not be used as ~~supply~~ ducts.

Reason: This proposal is intended to substantially improve the code's current duct insulation, sealing and testing requirements. It is well-recognized that properly designed, constructed, insulated and sealed ducts are crucial for an energy efficient home and occupant comfort. Among other items, this proposal:

- Reduces allowed total duct leakage by 50% in homes where ducts are not located in conditioned space;
- Requires a less stringent duct tightness test for ducts in conditioned space to ensure that conditioned air is delivered to its intended destination;
- Requires R-4 duct insulation when ducts are located in the conditioned space to address condensation and house durability issues;
- Eliminates the use of building framing cavities as ducts;
- Establishes requirements for a written test report, to increase and simplify enforceability and accountability;
- Creates the ability for the code official to require an independent party to conduct the test;
- Simplifies and makes consistent testing requirements by reducing the four possible tests to a single post-construction test of total duct leakage;
- Requires final testing of the ducts when construction is complete to ensure that the home owner is receiving a home that meets the intent of the code.

Field experience with duct sealing shows that these reduced leakage rates are attainable with today's technology and practice. It also shows that duct leakage, even when ducts are in conditioned spaces, can induce energy losses. For example, a leaky duct that does not supply sufficient airflow to a given space can create negative pressure in that space, inducing air filtration that would not otherwise occur. Such a condition would also reduce comfort, and could cause occupants to adjust thermostat settings, increasing energy use for the whole zone or house.

These changes are relatively simple and yet add significant energy savings potential and improved enforcement. The estimated savings as shown in the table below are savings from this proposal in addition to the requirements in the 2009 IECC, which first established a requirement for testing or locating the ducts in conditioned space in the code. The additional cost for achieving the tested values in this proposal are minimal compared to energy savings.

	Climate Zone 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4M	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	2.8%	2.7%	2.5%	2.6%	2.6%	2.7%	2.9%	2.7%	2.5%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	2.0%	1.9%	1.8%	1.9%	2.0%	2.0%	2.3%	2.1%	2.0%

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

ICCFILENAME: PRINDLE-EC-23-403.2.1-N1103.2.1

<u>Public Hearing Results</u>

PART I – IECC

Committee Action: Disapproved

Committee Reason: There is no standard for the particular test proposed. In addition, this could conflict with the mechanical code by not allowing building cavities to be used as ducts. Finally, it is impractical to conduct a test such as this after completion of the building.

Assembly Action: None

<u>Individual Consideration Agenda</u>

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle. ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.2.1 Insulation (Prescriptive). Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Where all ducts are located completely within *conditioned space,* supply ducts shall be insulated to a minimum of R-4.

403.2.2 Sealing (<u>Prescriptive</u>~~Mandatory~~). All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code* or Section 603.9 of the *International Mechanical Code,* as applicable.

Duct tightness shall be verified by a test performed by a party *approved* by the *code official* after construction is completed. ~~Where required by the code official, testing shall be conducted by an approved party independent from the builder and the installer of the ducts.~~ A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and the *code official*.

As tested, total duct leakage shall be less than or equal to <u>4</u> ~~6~~ cfm (<u>113.3</u> ~~226.5~~ L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

Exception~~s~~: Where the air handler and all ducts are located within conditioned space, total duct leakage shall not exceed <u>8</u> ~~12~~ cfm <u>(226.5 L/min)</u> per 100 ft^2 of conditioned floor area when tested as specified above.

403.2.3 Building cavities (Mandatory). Building framing cavities shall not be used as ducts.

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	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.~~ Duct insulation: From Section 403.2.1 ~~For tested duct systems, the leakage rate shall be the applicable maximum rate from Section 403.2.2.~~	~~As tested or as specified in Table 405.5.2 (2) if not tested~~ The air leakage rate or DSE shall be as tested in accordance with Section 403.2.2. Duct insulation shall be as proposed. Exception: Proposed distribution systems that qualify for default values under Table 405.5.2 may use the DSE specified in Table 405.5.2(2) in lieu of tested air leakage values. Forced air systems located entirely in conditioned space, may use the default value only when ducts are also tested and meet the maximum value set forth in the Exception to 403.2.2. and are insulated as required in Section 403.2.1.

(Portions of table not shown remain unchanged)

TABLE 405.5.2(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 d~~Distribution systems entirely located in conditioned space[c]	0.88	1
"Ductless" systems[d]	1	-

(Portions of table not shown remain unchanged)

Commenter's Reason: *EC103 should be approved as modified by this public comment.*

The modifications included in this public comment are intended to create more consistency with DOE's proposals on this subject, EC13 and EC107, while capturing further improvement to the duct requirements in the code. Ducts are a large cause for HVAC system energy loss, and this proposal will require achievable duct tightness and insulation levels that will save significant amounts of energy.

Some of the more important features of this proposal as modified include:

(1) The duct leakage requirement has been tightened consistent with EC13.

(2) Ducts in conditioned space are required to be insulated (although at a less stringent level). This will increase the likelihood that the conditioned air will actually reach the location in the home at the temperature that is intended, thereby improving comfort and reducing energy use.

(3) The language in the proposal as submitted that permitted code officials to require independent parties to do duct tests has been removed – this language is unnecessary since the test is required to be conducted by an *approved* party. The code official or jurisdiction can require independence as part of the approval process if desired.

(4) The treatment of ducts in the performance path in the IECC has also been improved and made more consistent with the proposed changes to the prescriptive path (note the proposed modifications to Table 405.5.2(1)).

(5) This proposal requires that duct tightness be verified at the completion of construction, which is critical for the accountability of the building community. It will also ensure that the homeowner is receiving a home that complies with the intent of the code. This proposal does not prevent earlier testing throughout construction to ensure proper construction and to allow the builder to correct any problems, which is simply good building practice. However, a final post-construction test is necessary to verify that the final product truly meets the necessary requirements and that nothing has occurred during final construction phases to cause additional leakage.

Final Action: AS AM AMPC____ D

EC103-09/10-PART II
N1103.2.1, N1103.2.2, N1103.2.3

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1103.2.1 Insulation. Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

> **Exception:** Where all ducts ~~or portions thereof~~ are located completely within *conditioned space* ~~inside the *building thermal envelope*~~, supply ducts shall be insulated to a minimum of R-4.

N1103.2.2 Sealing. All ducts, air handlers, and filter boxes~~, and building cavities used as ducts~~ shall be sealed. Joints and seams shall comply with Section M1601.4 of the *International Residential Code.*

Duct tightness shall be verified by a test performed by a party *approved* by the *building official* after construction is completed. Where required by the building official, testing shall be conducted by an approved party independent from the builder and the installer of the ducts. ~~either of the following:~~ A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and the *building official*.

~~1.~~ ~~Post-construction test: L~~ As tested, total duct lLeakage ~~to outdoors~~ shall be less than ~~or equal to 8 cfm (3.78 L/S) per 100 ft² (9.29 m²) of conditioned floor area or a total leakage less than~~ or equal to 6 ~~12~~ cfm (226.5 L/min ~~5.66 L/S~~) per 100 square feet (9.29 m²) of *conditioned floor area* when tested at a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler ~~end closure~~ enclosure. All register boots shall be taped or otherwise sealed during the test.

~~2.~~ ~~Rough-in test: Total leakage shall be less than or equal to 6 cfm (2.83 L/S) per 100 ft² (9.29 m²) of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm (1.89 L/S) per 100 ft2 (9.29 m²) of conditioned floor area.~~

> **Exceptions:** ~~Duct tightness test is not required if~~ Where the air handler and all ducts are located within conditioned space, total duct leakage shall not exceed 12 cfm per 100 square feet of conditioned floor area when tested as specified above.

N1103.2.3 Building cavities. Building framing cavities shall not be used as ~~supply~~ ducts.

Reason: This proposal is intended to substantially improve the code's current duct insulation, sealing and testing requirements. It is well-recognized that properly designed, constructed, insulated and sealed ducts are crucial for an energy efficient home and occupant comfort. Among other items, this proposal:

- Reduces allowed total duct leakage by 50% in homes where ducts are not located in conditioned space;
- Requires a less stringent duct tightness test for ducts in conditioned space to ensure that conditioned air is delivered to its intended destination;
- Requires R-4 duct insulation when ducts are located in the conditioned space to address condensation and house durability issues;
- Eliminates the use of building framing cavities as ducts;
- Establishes requirements for a written test report, to increase and simplify enforceability and accountability;
- Creates the ability for the code official to require an independent party to conduct the test;
- Simplifies and makes consistent testing requirements by reducing the four possible tests to a single post-construction test of total duct leakage;
- Requires final testing of the ducts when construction is complete to ensure that the home owner is receiving a home that meets the intent of the code.

Field experience with duct sealing shows that these reduced leakage rates are attainable with today's technology and practice. It also shows that duct leakage, even when ducts are in conditioned spaces, can induce energy losses. For example, a leaky duct that does not supply sufficient airflow to a given space can create negative pressure in that space, inducing air filtration that would not otherwise occur. Such a condition would also reduce comfort, and could cause occupants to adjust thermostat settings, increasing energy use for the whole zone or house.

These changes are relatively simple and yet add significant energy savings potential and improved enforcement. The estimated savings as shown in the table below are savings from this proposal in addition to the requirements in the 2009 IECC, which first established a requirement for testing or locating the ducts in conditioned space in the code. The additional cost for achieving the tested values in this proposal are minimal compared to energy savings.

	Climate Zone 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4M	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
Heating, Cooling, Hot Water Purchased Energy Cost Percent Savings	2.8%	2.7%	2.5%	2.6%	2.6%	2.7%	2.9%	2.7%	2.5%
Total Purchased Energy Cost Percent Savings (also including major appliances and lighting)	2.0%	1.9%	1.8%	1.9%	2.0%	2.0%	2.3%	2.1%	2.0%

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

ICCFILENAME: PRINDLE-EC-23-403.2.1-N1103.2.1

Public Hearing Results

PART II – IRC

Committee Action: Disapproved

Committee Reason: It is impractical to wait until the completion of the building to perform the leakage test. In addition, there is no test standard. Finally, no technical justification was provided for increasing insulation to R-4.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute, request Approval as Modified by this Public Comment.

Modify the proposal as follows

N1103.2.1 Insulation. Supply ducts in attics shall be insulated to a minimum of R-8. All other ducts shall be insulated to a minimum of R-6.

Exception: Where all ducts are located completely within *conditioned space,* supply ducts shall be insulated to a minimum of R-4.

N1103.2.2 Sealing. All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4 of the *International Residential Code.*

Duct tightness shall be verified by a test performed by a party *approved* by the *building official* after construction is completed. ~~Where required by the building official, testing shall be conducted by an approved party independent from the builder and the installer of the ducts.~~ A written report specifying the results of the test and attesting to the accuracy of the results shall be signed by the party conducting the testing and provided to the builder and the *building official*.

As tested, total duct leakage shall be less than or equal to 4 ~~6~~ cfm (113.3 ~~226.5~~ L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

> **Exception~~s~~:** Where the air handler and all ducts are located within conditioned space, total duct leakage shall not exceed 8 ~~12~~ cfm (226.5 L/min) per 100 ft^2 of conditioned floor area when tested as specified above.

N1103.2.3 Building cavities. Building framing cavities shall not be used as ducts.

Commenter's Reason: *EC103 should be approved as modified by this public comment.*

The modifications included in this public comment are intended to create more consistency with DOE's proposals on this subject, EC13 and EC107, while capturing further improvement to the duct requirements in the code. Ducts are a large cause for HVAC system energy loss, and this proposal will require achievable duct tightness and insulation levels that will save significant amounts of energy.

Some of the more important features of this proposal as modified include:

(1) The duct leakage requirement has been tightened consistent with EC13.

(2) Ducts in conditioned space are required to be insulated (although at a less stringent level). This will increase the likelihood that the conditioned air will actually reach the location in the home at the temperature that is intended, thereby improving comfort and reducing energy use.

(3) The language in the proposal as submitted that permitted code officials to require independent parties to do duct tests has been removed – this language is unnecessary since the test is required to be conducted by an *approved* party. The code official or jurisdiction can require independence as part of the approval process if desired.

(4) The treatment of ducts in the performance path in the IECC has also been improved and made more consistent with the proposed changes to the prescriptive path (note the proposed modifications to Table 405.5.2(1)).

(5) This proposal requires that duct tightness be verified at the completion of construction, which is critical for the accountability of the building community. It will also ensure that the homeowner is receiving a home that complies with the intent of the code. This proposal does not prevent earlier testing throughout construction to ensure proper construction and to allow the builder to correct any problems, which is simply good building practice. However, a final post-construction test is necessary to verify that the final product truly meets the necessary requirements and that nothing has occurred during final construction phases to cause additional leakage.

Final Action: AS AM AMPC____ D

EC105-09/10

403.2.2, 402.2.3, 403.6, Chapter 6

Proposed Change as Submitted

Proponent: Wesley R. Davis, Air Conditioning Contractors of America

1. Revise as follows:

403.2.2 Sealing (~~Mandatory~~ Prescriptive). All ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*.

403.2.3 Sealing (Mandatory). Duct tightness shall be verified ~~by either of the following:~~ in accordance with ACCA 5 QI.

1. ~~Postconstruction test: Leakage to outdoors shall be less than or equal to 8 cfm (226.5 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* or a total leakage less than or equal to 12 cfm (12 L/min) per 100 ft2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.~~
2. ~~Rough-in test: Total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 ft2 (9.29 m2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of *conditioned floor area*.~~

   ~~**Exception:** Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.~~

~~**403.6 Equipment sizing (Mandatory).** Heating and cooling equipment shall be sized in accordance with Section M1401.3 of the *International Residential Code*.~~

403.6 HVAC equipment performance. Equipment shall meet the minimum requirements of ACCA 5 – QI when measured in accordance with the standard's acceptable procedures.

2. Add new standard to Chapter 6 as follows:

ACCA
ANSI/ACCA QI – 2007 HVAC Quality Installation Specifications

Reason: An HVAC system is comprised of equipment, ducts and components, How they interact determines the amount of energy they will use to deliver the desired comfort level. Referencing the ANSI/ACCA QI-2007 (HVAC Quality Installation Specification) will address each element of an HVAC system installation corporately rather than individually.

The ANSI/ACCA 5 QI specification was developed by a coalition of HVAC industry stakeholders to establish the minimum performance requirements, approved test procedures and required documentation to ensure proper HVAC system design and installation. Adoption of this standard will simplify the code and point to one, unified, free (www.acca.org/quality) reference for HVAC system installation. For example, the ACCA 5 QI provides the following requirements for duct leakage tolerances (to replace Section 403.2.2) and equipment sizing (to replace Section 403.6):

COMPARISON OF REQUIREMENTS IN IECC 2009 TO ANSI/ACCA 5-QI		
HVAC system installation element	IECC 2009	ANSI/ACCA 5 – QI
Duct leakage	4, 6, 8 or 12 cfm/100 sq. ft. (depending on the application)	4 cfm/100 sq. ft.
Equipment sizing	ACCA Manual J and Manual S	ACCA Manual J and Manual S

The standard, a level of performance that, if satisfactorily achieved, serves as an indicator that sound industry practices were likely used. It is available for free download.

Promotion of high HVAC equipment efficiency ratings, tight ducts and equipment selection are meaningless if the HVAC "system" is improperly designed or installed. The ANSI/ACCA 5 QI has been implemented by HVAC contractors across America. It is also the source document for a US EPA EnergyStar program to ensure their EnergyStar rated HVAC appliances are properly installed.

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

Analysis: Analysis: A review of the standard(s) proposed for inclusion in the code, ANSI/ACCA QI-2007, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: DAVIS-EC1-403.2.2.DOC

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposed referenced standard does not comply with ICC criteria.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Wesley R. Davis, representing Air Conditioning Contractors of America requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.2.2 Sealing (Prescriptive). All ducts, air handlers, and filter boxes ~~and building cavities used as ducts~~ shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*.

403.2.3 Sealing (Mandatory). Duct tightness shall be verified in accordance with ACCA 5 QI.

Commenter's Reason: This requirement will refer to the appropriate industry-developed nationally-recognized standard for HVAC installations. The ANSI standard is available as a *FREE* .pdf download at www.acca.org/quality.

The new requirement provides tolerances for ducts that are located in conditioned space, out of conditioned space, and for duct leakage to the outdoors. These duct leakage tolerances offer a way to measure duct leakage with reference to the equipment's capacity, not the size of the home. This tolerance generally yields a tighter duct system, and reduces energy costs. Examples of adoption are:

- o EnergyStar™ Quality Installation program (which has standard forms demonstrating compliance) – Exhibit A
- o EnergyStar ™ Qualified New Homes program (2012) – Exhibit B
- o USGBC LEED for Homes rating system - a prerequisite for certification (Draft version pending public comment) – Exhibit C
- o The California Public Utility Commission based their installation requirements the ACCA 5 QI – Exhibit D
- o Various OEMs have required HVAC system installation per the ACCA 5 QI from their dealer base – Exhibit E
- o Numerous utilities have incorporated elements of the QI standards into their incentive programs.
- o recommended by the Department of Energy *Builders Challenge* program – Exhibit F
- o The electric utility organization Consortium for Energy Efficiency (CEE) is adopting the QI Standard as the recommended standard for its member's energy programs.

The ANSI/ACCA 5 QI specification was developed by a broad coalition of HVAC industry stakeholders to establish:
o the minimum performance tolerances,
o approved test procedures, and
o required documentation to ensure proper HVAC system design and installation. Installing an HVAC system to this standard will promote energy efficiency.

This new requirement supports the previous duct leakage tolerances and provides greater flexibility for code enforcement officials, without compromising the purpose of this code - to save energy. Request that you vote to approve EC105 as modified.

Exhibit A: Letter of Support from EnergyStar™ Quality Installation Program Manager

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460
October 26, 2009

OFFICE OF AIR AND RADIATION

Climate Protection Partnership Division
U.S. EPA 6202J
Washington, DC 20460

IECC Technical Committee:

ENERGY STAR® is a voluntary partnership program that promotes energy efficiency in products, homes, and buildings in an effort to reduce carbon dioxide emissions. When earned, the ENERGY STAR label signifies superior energy efficiency over standard performance. The ENERGY STAR program also strives to improve energy performance in buildings and existing homes that may never achieve the label, but can still realize considerable energy savings. The program is managed by the U.S. Environmental Protection Agency (EPA).

EPA has been labeling high efficiency heating and cooling equipment since 1995. Unfortunately, studies show that more than half of all air conditioners in U.S. homes do not perform to their rated efficiency as a result of poor installation practices[1]. Improper installation of even high efficiency equipment can reduce performance by as much as 30 percent. This affects not only the homeowner's utility bills, but can also result in a variety of comfort problems, including insufficient dehumidification, and poor air distribution.

To address this problem, ENERGY STAR has developed a strategy for encouraging proper installation of residential heating, ventilation and air conditioning (HVAC) systems called the ENERGY STAR HVAC Quality Installation (QI) Program. This program helps public utilities, state energy offices and other stakeholders go beyond high efficiency product incentives to deliver additional KW and kWh savings by improving installation procedures. The program defines a quality installation using the Air Conditioning Contractors of America's (ACCA), ANSI recognized, HVAC Quality Installation Standard. EPA uses the Standard because it sets performance tolerances and establishes the minimum requirements for system design, equipment and duct installation. It also outlines minimum documentation requirements for demonstrating compliance, allowing for system verification and better quality assurance.

EPA is also investigating the use of the ACCA QI Standard as a requirement for the ENERGY STAR New Homes program and for its retrofit program, Home Performance with ENERGY STAR.

Regards,

Ted Leopkey
ENERGY STAR HVAC QI National Program Manager

1. Source: C. Neme, J. Proctor, S. Nadel, *National Energy Savings Potential from Addressing Residential HVAC Installation Problems*, 1999

Exhibit B: EnergyStar™ for Qualified New Homes Quality Installation Checklist

ENERGY STAR Qualified Homes
HVAC System Quality Installation Contractor Checklist[1]

Home Address: ______ City: ______ State: ______

1. Whole-Building Mechanical Ventilation Design[2]

1.1	Ventilation system designed to meet ASHRAE 62.2-2007 requirements[3]	☐ Contractor Approved	
1.2	Ventilation system does not utilize an intake duct to the return side of the HVAC system unless coupled with a motorized damper and control system	☐ Contractor Approved	
1.3	Documentation is attached with ventilation system type, location and design rate	☐ Contractor Approved	
1.4	If present, continuously-operating ventilation and exhaust fans designed to operate during all occupiable hours	☐ Contractor Approved	☐ N/A
1.5	If present, intermittently-operating whole-house ventilation system designed to automatically operate at least once per day and at least 10% of every 24 hours	☐ Contractor Approved	☐ N/A

2. Heating & Cooling System Design[2,4] - *The following design parameters shall be used in the design calculations:*

A. Outdoor design temps. comply with procedure being used[5]
B. Indoor temp. setpoints = 70°F for heating; 75°F for cooling
C. Infiltration rate = "Tight", or equivalent rate
D. Insulation levels and window U-Values/SHGC's match rated home
E. Airflow accounts for MERV 6 air filter
F. ASHRAE 62.2 ventilation load accounted for

2.1	Heat Loss / Gain Method:	☐ Manual J v8	☐ ASHRAE 2005	☐ Other: ______	
2.2	Duct Design Method:	☐ Manual D	☐ Other: ______		
2.3	Equipment Selection Method:	☐ Manual S	☐ OEM Recommended	☐ Other: ______	
2.4	Outdoor Design Temperatures Used:	1%: ______ °F	99%: ______	°F	
2.5	Design Latent Heat Gain:	______		BTUh	
2.6	Design Sensible Heat Gain:	______		BTUh	
2.7	Design Total Heat Gain:	______		BTUh	
2.8	Design Sensible Heat Ratio (SHR):	______		(Value 2.6 ÷ Value 2.7)	
2.9	Design Total Heat Loss:	______		BTUh	
2.10	Design Airflow:	______		CFM	
2.11	Design Duct Static Pressure:	______		IWC	
2.12	Copy of load calculations attached?			☐ Contractor Approved	

3. Selected Cooling Equipment, If Cooling Equipment to be Installed

3.1	Condensor Manufacturer & Model:	______			
3.2	Condensor Serial #:	______			
3.3	Evaporator Manufacturer & Model:	______			
3.4	Evaporator Serial #:	______			
3.5	AHRI Reference #:[6]	______			☐ N/A
3.6	Listed Efficiency:	______ EER	______ SEER		
3.7	Metering Device Type:	☐ TXV	☐ Fixed orifice	☐ Other: ______	
3.8	Refrigerant Type:	☐ R-22	☐ R-410a	☐ Other: ______	
3.9	Fan Speed Type:[7]	☐ Fixed	☐ Variable (ECM/ICM)	☐ Other: ______	
3.10	Selected Latent Capacity at Design Cond.:	______		BTUh	
3.11	Selected Sensible Capacity at Design Cond.:	______		BTUh	
3.12	Selected Total Capacity at Design Cond.:	______		BTUh	
3.13	Selected Sensible Heat Ratio (SHR):	______		(Value 3.11 ÷ Value 3.12)	
3.14	Selected SHR (Value 3.13) ≤ Design SHR (Value 2.8)			☐ Contractor Approved	☐ No
3.15	If No, ENERGY STAR qualified dehumidifier installed?			☐ Contractor Approved	☐ N/A
3.16	Capacity (Value 3.12) is 95-115% of Design Heat Gain (Value 2.7) or next nom. size			☐ Contractor Approved	☐ N/A
	Or for Heat Pumps in Climate Zones 4-8, 95-125% or next nominal size			☐ Contractor Approved	☐ N/A
3.17	AHRI Certificate Attached?[6]			☐ Contractor Approved	

4. Selected Heat Pump Equipment, If Heatpump to be Installed

4.1	AHRI Listed Efficiency:	______	HSPF
4.2	Performance at 17°F:	Capacity: ______ BTUh	Efficiency: ______ COP
4.3	Performance at 47°F:	Capacity: ______ BTUh	Efficiency: ______ COP

5. Selected Furnace, If Furnace to be Installed

5.1	Furnace Manufacturer & Model:	______	
5.2	Furnace Serial #:	______	
5.3	Listed Efficiency:	______	AFUE
5.4	Selected Gross Capacity:	______	BTUh
5.5	Gross capacity (Value 5.4) is 100-140% of design heat loss (Value 2.9) or next nom. size		☐ Contractor Approved

Effective 1/1/2011 Revised 4/8/2010 6

See Footnote 1from checklist above.

ENERGY STAR Qualified Homes
HVAC System Quality Installation Contractor Notes

1. The HVAC System Quality Installation Contractor Checklist is designed to align with the requirements of ASHRAE 62.2-2007 and published addenda and ANSI / ACCA's 5 QI-2007 protocol, thereby improving the performance of HVAC equipment in new homes when compared to homes built to minimum code. However, these features alone cannot prevent all ventilation, indoor air quality, or HVAC problems; for instance those caused by a lack of maintenance by the occupants. Therefore, this checklist is not a guarantee of proper ventilation, indoor air quality, or HVAC performance.

   This checklist applies to ventilation systems, split air conditioners, unitary air conditioners, air-source/water-source heat pumps up to 65,000 Btu/h and furnaces up to 225,000 Btu/h. All other equipment is exempt.

   This checklist shall be provided by the Rater to the HVAC contractor who shall complete one checklist for each system. Upon completion, the HVAC contractor shall return the checklist(s) to the Rater.

   This checklist with supporting documents may also be used to demonstrate compliance with Indoor airPLUS specifications 4.1, 4.2, 4.5, 4.6, and 7.1.

Exhibit C: Prerequisite in LEED for Homes Rating System (25 May 2010 draft – pending Public Comment)

EA PREREQUISITE 1 PERFORMANCE OF ENERGY STAR FOR HOMES

Intent
Improve the overall energy performance of a home to lower the building's greenhouse gas emissions.

Requirements

SINGLE FAMILY & MULTI-FAMILY LOWRISE

Option 1: Performance Pathway

Meet all of the following requirements:

1. Meet the performance requirements of ENERGY STAR for Homes version 3, including all of the following:
   - Successful completion of the thermal enclosure system rater checklist, **the HVAC system quality installation rater and contractor checklists**, and the water management system builder and rater checklists;
   - Achieve a HERS Index below the ENERGY STAR for Homes version 3 HERS Index Target

2. At least one of the following appliances must be ENERGY STAR qualified and installed in each dwelling unit:
   - Refrigerator
   - Dishwasher
   - Clothes Washer

Note: For buildings that do not have in-unit kitchens or laundry rooms, projects must install ENERGY STAR qualified appliances for all of their refrigerators, dishwashers, or clothes washers in their central kitchen or laundry room.

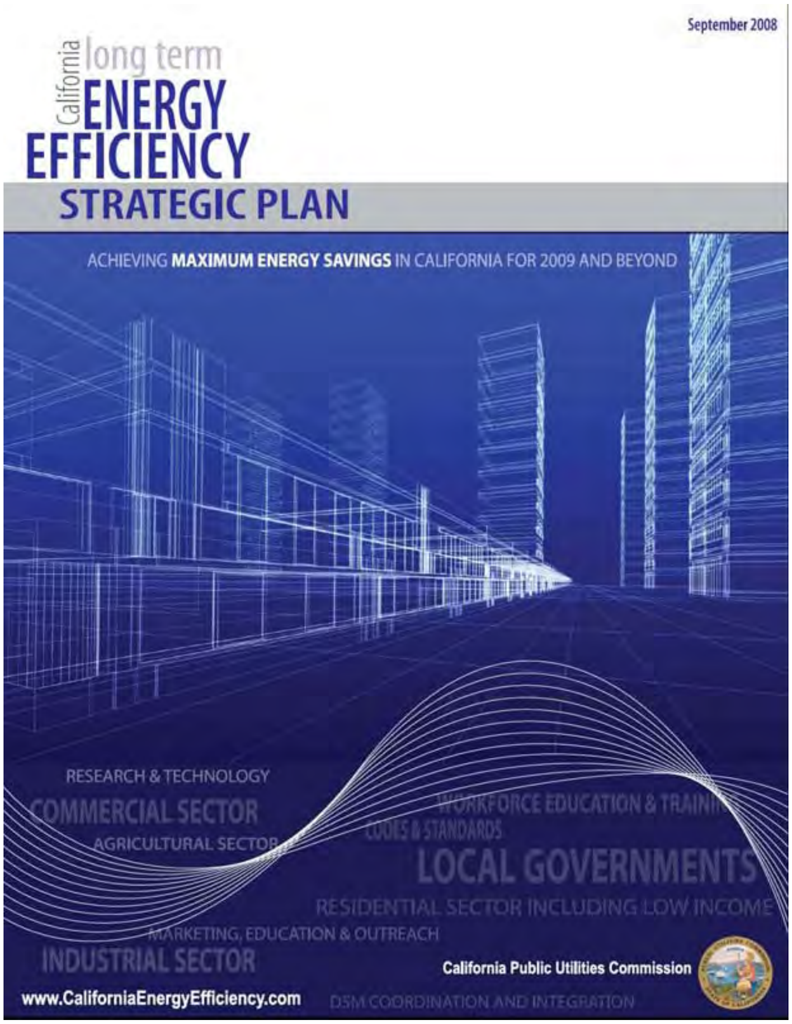
OR

Option 2: Prescriptive Pathway

Meet all of the following requirements:

1. Meet the prescriptive requirements of ENERGY STAR for Homes version 3, including all of the following:
   - Successful completion of the thermal enclosure system rater checklist, **the HVAC system quality installation rater and contractor checklists**, and the water management system builder and rater checklists;
   - Meet the requirements of the ENERGY STAR for Homes version 3 Prescriptive Pathway, which includes meeting or exceeding all components of the ENERGY STAR Reference Design.

Exhibit D: Implementation Plan and Timeline from California Long Term Energy Efficiency Strategic Plan



From page 61

Goal 1: Improve Code Compliance

Implementation Plan and Timeline				
Strategies	**Non-CPUC Partners**	**Near Term 2009 – 2011**	**Mid Term 2012 – 2015**	**Long Term 2016 – 2020**
1-1: Develop streamlined local government HVAC permitting systems, including on-line HVAC replacement permitting.	Local Governments CALBO Utilities Distributors Contractors	• Convene an industry/local government stakeholder group; develop proposed new system; pilot test with local governments.	• Revise pilots and expand to other cities; develop framework for statewide program.	• Expand statewide.
1-2: Streamline process for obtaining and overseeing contractor business licenses.	Local Governments CALBO Calif. Contractor State License Board	• Pilot test streamlined process with local building departments. • Explore possible common business licenses for multiple jurisdictions.	• Revise pilot and expand pilot testing to other cities; develop framework for statewide program.	• Expand statewide.
1-3: Replace Title 24's current optional quality control requirements with mandatory requirements (ACCA/ANSI QI/QM specification).	Energy Commission ACCA/ANSI Utilities Contractors	• Adopt ANSI standards into Title 24; integrate into existing utility program designs.	• Explore steadily higher QI/QM standards as baseline becomes commonplace.	• Ongoing
1-4: Develop affordable	Utilities	• Convene stakeholder group;	• If recommended for	• Expand statewide if

Exhibit E: Extract from an Equipment Manufacturer's 2010 Sales Plan, Dealer Responsibilities

[redacted]

Sales Plan

TITLE:

[redacted] Program

Addendum 2 – Performance Guarantee

DATE: **January 1, 2010** NO: **SP1029.2**
DEPARTMENT: **Channel Marketing**
FILE NO: 2.1.09

I. EFFECTIVE PERIOD:

January 1, 2010 through December 31, 2010

II. PURPOSE: Heating and air conditioning products must be applied and installed properly in order to perform as designed by the manufacturer. In essence, the independent [redacted] dealer is completing the manufacturing process when they install [redacted] equipment in their customer's home. The Commissioning Checklist (Exhibit A) described in this sales plan is in fact the final quality control test for the system. The following process is designed to provide the consumer with an additional level of confidence that the [redacted] system and installing [redacted] dealer will address their comfort needs and deliver the factory rated performance of the HVAC system. This sales plan addendum will detail the elements of **100% Performance Guarantee** offered by independent [redacted] dealers to homeowners purchasing new complete system(s) for their home.

III. ELIGIBLE PARTICIPANTS:

2010 independent [redacted] dealers (referred to as "dealers" throughout this sales plan)

Next Page…

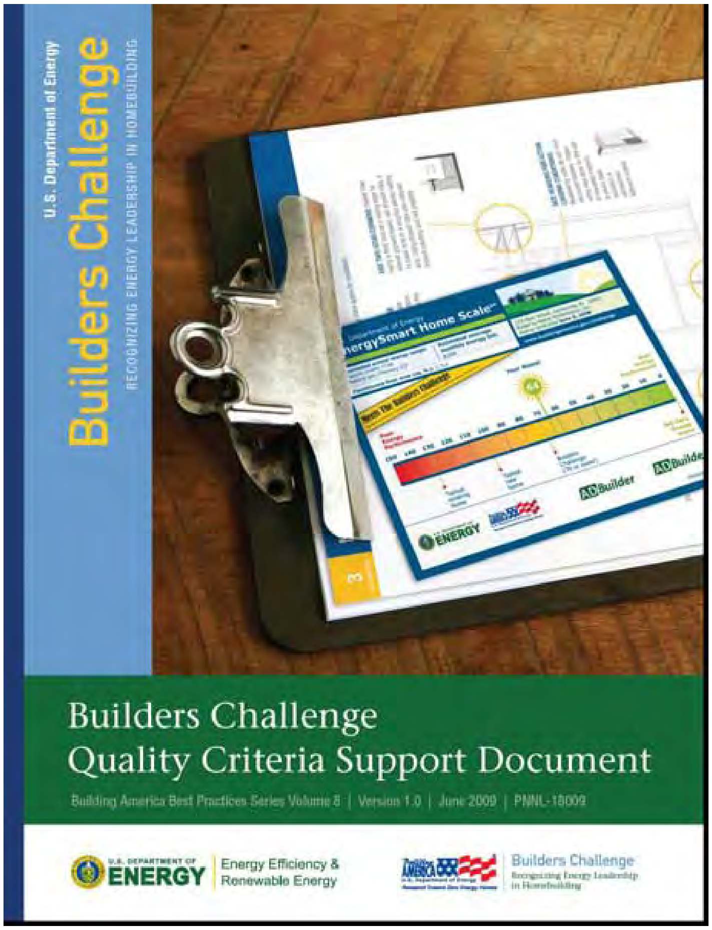
B. [redacted] Dealer Responsibilities

- The dealer must perform a heat gain / heat loss calculation for every system they install and be able to provide evidence that the selected equipment will satisfy the house sensible and latent load requirement at outdoor design temperatures.

- The dealer must also inspect and evaluate the existing ductwork and discuss any deficiencies that could cause comfort issues with the homeowner and **note them on the proposal.**

- After the [redacted] system has been installed, the dealer **must complete the designated commissioning check list,** which is based on the HVAC Quality Installation Specification (ANSI / ACCA Standard 5-2007) (Exhibit C) in either the heating or cooling mode based on the ambient conditions at the time of installation.
    - The checklist can be completed in one of two ways
        - Electronically with the performance Excel spreadsheet

Exhibit F: Extract from Department of Energy Builders Challenge Program



8 Space-Conditioning System Installation

BUILDERS CHALLENGE QUALITY CRITERIA	BUILDER DOCUMENTATION & VERIFICATION REQUIREMENTS	THIRD-PARTY VERIFICATION REQUIREMENTS
8. Space-Conditioning System Installation – Recommended: Space-conditioning system installation meets ACCA Quality Installation Specification.		

The Air Conditioning Contractors of America's Quality Installation Specification is available at www.acca.org/quality/. This ANSI-approved standard provides precise steps for a quality HVAC installation. According to ACCA, proper installation includes correct selection of equipment and controls and following all the steps for correct installation. In this specification, five core areas are characterized: equipment design, equipment installation, duct distribution, system documentation, and owner education.

Figure 8.1. Space-conditioning systems should meet the ACCA Quality Installation Specification

Want to Learn More?

Designing and Building Interior Duct Systems, FSEC-PF-365-01. Available from the Florida Solar Energy Center at http://securedb.fsec.ucf.edu/pub/pub_show_detail?v_pub_id=4013

Better Duct Systems for Home Heating and Cooling, NREL/BR-550-30506; DOE/GO-102004-1606. Available from Building America at www.buildingamerica.gov

Thermal Energy Distribution Website at http://ducts.lbl.gov

Related Standards & Procedures

Air Conditioning Contractors of America. 2007. ACCA Standard 5, *HVAC Quality Installation Specification*. ANSI/ACCA 5 QI-2007, Air Conditioning Contractors of America, 2800 Shirlington Road, Suite 300, Arlington, Virginia. Available at www.acca.org

Building America Best Practices

The U.S. Department of Energy has produced a series of builders guides that provide instructions for construction "best practices" that can help builders achieve high-performance homes. These guides can be found at www.eere.energy.gov/buildings/building_america/

Analysis: New standard was proposed before in EC 105.

Final Action: AS AM AMPC____ D

EC106-09/10-PART I
403.2.2 (New), Chapter 6

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART I – IECC

1. Add new text as follows:

403.2.2.1 Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested accordance with ASHRAE 193.

2. Add new standard to Chapter 6 as follows:

ASHRAE
193 Method of Text for Determining the Air Leakage Rate for HVAC Equipment

Reason: The proposed addition above addresses the issue of air handler tightness. Currently air handlers and other portions of the duct system are to be sealed. Duct tightness is verified by one of two tests. The proposed text adds a recognized test procedure and leakage metric for air handlers, which are technically not a part of the duct but are part of the duct system. Energy conservation measures in the air conditioning industry have driven the manufacturers of systems and components to establish compliance with leakage limits in ducts and air-handling units. The standards set by American Society of Heating Refrigerating and Air-conditioning Engineers (ASHRAE) form the basis for testing. Establishing an air handler leakage rate, given the availability of a uniform test procedure is prudent as any leakage in the air-handling units contributes to wastage of energy. The magnitude of leakage has a direct bearing on energy use and indoor air quality (IAQ).

Cost Impact: The code change proposal will increase the cost of construction to the degree that air handlers not currently meeting this criterion will now have to meet this criterion.

Analysis: A review of the standard(s) proposed for inclusion in the code, ASHRAE 193, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: MAJETTE-EC-61-403.2.2.1-N1103.2.2.1

Public Hearing Results

PART I – IECC

Committee Action: **Disapproved**

Committee Reason: Proponent requested disapproval given that the referenced standard proposed is not available.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Craig Conner, Building Quality requests Approval as Submitted.

Commenter's Reason: This was Disapproved due to the proposed reference standard not being available. The reference standard is now available.

Public Comment 2:

Ronald Majette, US Department of Energy requests Approval as Submitted.

Commenter's Reason: The Committee's reason for recommending disapproval was the unavailability of the proposed reference standard. That standard, ASHRAE 193, has now been released and is available.

Final Action: AS AM AMPC____ D

106-09/10-PART II
IRC N1103.2.2.1 (New), Chapter 44

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART II – IRC Energy

1. Add new text as follows:

N1103.2.2.1 Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested accordance with ASHRAE 193.

2. Add new standard to Chapter 44 as follows:

ASHRAE
193 Method of Text for Determining the Air Leakage Rate for HVAC Equipment

Reason: The proposed addition above addresses the issue of air handler tightness. Currently air handlers and other portions of the duct system are to be sealed. Duct tightness is verified by one of two tests. The proposed text adds a recognized test procedure and leakage metric for air handlers, which are technically not a part of the duct but are part of the duct system. Energy conservation measures in the air conditioning industry have driven the manufacturers of systems and components to establish compliance with leakage limits in ducts and air-handling units. The standards set by American Society of Heating Refrigerating and Air-conditioning Engineers (ASHRAE) form the basis for testing. Establishing an air handler leakage rate, given the availability of a uniform test procedure is prudent as any leakage in the air-handling units contributes to wastage of energy. The magnitude of leakage has a direct bearing on energy use and indoor air quality (IAQ).

Cost Impact: The code change proposal will increase the cost of construction to the degree that air handlers not currently meeting this criterion will now have to meet this criterion.

Analysis: A review of the standard(s) proposed for inclusion in the code, ASHRAE 193, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: MAJETTE-EC-61-403.2.2.1-N1103.2.2.1

Public Hearing Results

PART II - IRC

Committee Action: **Disapproved**

Committee Reason: The proposed referenced standard is not available.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Craig Conner, Building Quality requests Approval as Submitted.

Commenter's Reason: This was Disapproved due to the proposed reference standard not being available. The reference standard is now available.

Public Comment 2:

Ronal Majette, US Department of Energy requests Approval as Submitted.

Commenter's Reason: The Committee's reason for recommending disapproval was the unavailability of the proposed reference standard. That standard, ASHRAE 193, has now been released and is available.

Final Action: AS AM AMPC____ D

EC107-09/10-PART I
403.2.2

Proposed Change as Submitted

Proponent: Ronald Majette, US Department of Energy

PART I - IECC

Revise as follows:

403.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes ~~and building cavities used as ducts~~ shall be sealed. Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*.

Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage ~~to outdoors~~ shall be less than or equal to ~~8~~ 6 cfm (~~226.5~~ 113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* ~~or a total leakage less than or equal to 12 cfm (12 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*~~ when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to ~~6~~ 4 cfm (~~169.9~~ 113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the ~~roughed in~~ system, including the manufacturer's air handler enclosure. All register~~boot~~s shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to ~~4~~ 3 cfm (~~113.3~~ 85.0 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*.

   Exceptions: Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.

Reason: The purpose of this proposal is to substantially reduce duct leakage rates. Requirements related to testing of duct leakages were approved in the 07/08 code cycle. While testing of ducts was widely supported, many felt that the allowable leakage rates were excessively loose. For example, the 2009 IECC allows 288 cubic feet per minute of total leakage in a 2400 ft^2 house. This permits a block of air larger than 6 feet tall, 6 feet wide, and 6 feet long to leak out of the ducts every single minute at the test pressure level. This proposal significantly reduces the allowable leakage rate. This proposal limits the leakage test to total leakage (including leaks to both the inside and outside of the building), eliminating the alternative of measuring leakage to outdoors. Limiting the test to total leakage simplifies the code and gives a clearer indication of how well sealed the ducts are.

Cost Impact: The code change proposal may slightly increase the cost of construction by requiring more attention to detail when sealing ducts.

ICCFILENAME: MAJETTE-EC-73-403.2.2-IRC N1103.2.2

Public Hearing Results

PART I – IECC

Committee Action: **Approved as Submitted**

Committee Reason: The proposed revisions are compatible with (and included in) EC13.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Ronald Majette, US Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.2.2 Sealing ~~(Mandatory)~~. All ducts, air handlers, and filter boxes shall be sealed (Mandatory). Joints and seams shall comply with Section M1601.4.1 of the *International Residential Code*.

Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage shall be less than or equal to 6 cfm (~~113.3~~ 169.9 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure (Prescriptive). All register boots shall be taped or otherwise sealed during the test.

2. Rough-in test: Total leakage shall be less than or equal to ~~4 cfm~~ 6 cfm (~~113.3~~ 169.9 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure (Prescriptive). All registers shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to ~~3 cfm~~ 4 cfm (~~85.0~~ 113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* (Prescriptive).

   Exception: Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.

Commenter's Reason: This proposal slightly relaxes the duct leakage rates permitted from the original EC107 proposal. These relaxed leakage levels of 6 cfm for the rough-in test including air handler are still much more stringent than the requirements in the 2009 IECC and are as stringent as Energy Star and the DOE Builder Challenge. This also corrects an error in the metric units (L/min) in the post-construction test requirements.

Final Action: AS AM AMPC____ D

EC107-09/10-PART II
IRC N1103.2.2

Proposed Change as Submitted

Proponent: Ronald Majette, US Department of Energy

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1103.2.2 Sealing (Mandatory). All ducts, air handlers, and filter boxes ~~and building cavities used as ducts~~ shall be sealed. Joints and seams shall comply with Section M1601.4. Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage ~~to outdoors~~ shall be less than or equal to ~~8~~ 6 cfm (~~226.5~~ 113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* ~~or a total leakage less than or equal to 12 cfm (12 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*~~ when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to ~~6~~ 4 cfm (~~169.9~~ 113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the ~~roughed in~~ system, including the manufacturer's air handler enclosure. All register~~ boot~~s shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to ~~4~~ 3 cfm (~~113.3~~ 85.0 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*.

   Exceptions: Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.

Reason: The purpose of this proposal is to substantially reduce duct leakage rates. Requirements related to testing of duct leakages were approved in the 07/08 code cycle. While testing of ducts was widely supported, many felt that the allowable leakage rates were excessively loose. For example, the 2009 IECC allows 288 cubic feet per minute of total leakage in a 2400 ft^2 house. This permits a block of air larger than 6 feet tall, 6 feet wide, and 6 feet long to leak out of the ducts every single minute at the test pressure level. This proposal significantly reduces the allowable leakage rate. This proposal limits the leakage test to total leakage (including leaks to both the inside and outside of the building), eliminating the alternative of measuring leakage to outdoors. Limiting the test to total leakage simplifies the code and gives a clearer indication of how well sealed the ducts are.

Cost Impact: The code change proposal may slightly increase the cost of construction by requiring more attention to detail when sealing ducts.

PART II – IRC

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: MAJETTE-EC-73-403.2.2-IRC N1103.2.2

Public Hearing Results

PART II – IRC

Committee Action: **Disapproved**

Committee Reason: The tighter leakage rate for testing a rough-in is not supported by any statistics regarding expected differences in performance and is therefore arbitrary.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, US Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1103.2.2 Sealing ~~(Mandatory)~~. All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with Section M1601.4. Duct tightness shall be verified by either of the following:

1. Postconstruction test: Total leakage shall be less than or equal to ~~8~~ 6 cfm (~~113.3~~ 169.9 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.

2. Rough-in test: Total leakage shall be less than or equal to ~~4 cfm~~ 6 cfm (~~113.3~~ 169.9 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure. All registers shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to ~~3 cfm~~ 4 cfm (~~85.0~~ 113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*.

   Exception: Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.

Commenter's Reason: This proposal slightly relaxes the duct leakage rates permitted from the original EC107 proposal. These relaxed leakage levels of 6 cfm for the rough-in test including air handler are still much more stringent than the requirements in the 2009 IECC and are as stringent as Energy Star and the DOE Builder Challenge. This also corrects an error in the metric units (L/min) in the post-construction test requirements.

Public Comment 2:

Shaunna Mozingo City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, requests Approval as Submitted.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This proposal somewhat relaxes duct leakage requirements set in EC13. The proposal is not needed if EC13 is approved. This comment is only to allow a discussion in the unlikely event that EC13 is disapproved. We recommend following DOE's lead on EC107.

Final Action: AS AM AMPC____ D

EC108-09/10

403.2.2, 403.6, 405.6.1, Table 404.5.2(1), Chapter 6

Proposed Change as Submitted

Proponent: Donald J. Vigneau, AIA, Northeast Energy Efficiency Partnerships, Inc.

1. Revise as follows:

403.2.2 Sealing (Mandatory). All ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints and seams shall comply with ~~Section M1601.4.1 of the *International Residential Code*~~ ACCA Manual J. Duct tightness shall be verified by either of the following:

1. Post construction test: Leakage to outdoors shall be less than or equal to 8 cfm (226.5 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* or a total leakage less than or equal to 12 cfm (12 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 ft2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area*.

   Exceptions: Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.

403.6 Equipment sizing. Heating and cooling equipment shall be sized in accordance with ACCA Manual J-02. ~~M1401.3 of the *International Residential Code*~~.

405.6.1 Minimum capabilities. Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the *standard reference design* and the *proposed design* and shall include the following capabilities:

1. Computer generation of the *standard reference design* using only the input for the *proposed design*. The calculation procedure shall not allow the user to directly modify the building component characteristics of the *standard reference design*.
2. Calculation of whole-building (as a single *zone*) sizing for the heating and cooling equipment in the *standard reference design* residence in accordance with ~~Section M1401.3 of the *International Residential Code*~~ ACCA Manual J.
3. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air-conditioning equipment based on climate and equipment sizing.
4. Printed *code official* inspection checklist listing each of the *proposed design* component characteristics from Table 405.5.2(1) determined by the analysis to provide compliance, along with their respective performance ratings (e.g., *R*-value, *U*-factor, SHGC, HSPF, AFUE, SEER, EF, etc.).

TABLE 404.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems[g, h]	As proposed Capacity: sized in accordance with ~~Section M1401.3 of the *International Residential Code*~~ ACCA Manual J	As proposed
Cooling systems[g, i]	As proposed Capacity: sized in accordance with ~~Section M1401.3 of the *International Residential Code*~~ ACCA Manual J	As proposed

(Portions of table and footnotes not shown remain unchanged)

2. Add new standards organization and standard to Chapter 6 as follows:

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

ACCA
Manual J-02 Residential Load Calculations Eighth Edition

Reason: The International Residential Code is a stand-alone code with its own references, covering R-4 and limited R-3 occupancies. It was designed to be adopted without reference to any other I-Codes, since it may be the only code allowed by law for adoption in certain jurisdictions (other codes adopted by different jurisdictions, such as state or county).
Therefore, references to specific provisions within the IRC should be limited to the IRC wherever possible.

References to specific code provisions should be found within the integrated I-Codes, should reference those document sources and not reference the IRC. The document is already approved for adoption in the International Residential Code.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard(s) proposed for inclusion in the code, ACCA, Manual J-02, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: VIGNEAU-EC-2-403.2.2

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee had some concerns with technical issues in ACCA Manual J.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Donald J. Vigneau, Northeast Energy Efficiency Partnerships, Inc. representing himself, requests Approval as Modified by this Public Comment

Modify the proposal as follows

403.2.2 Sealing (Mandatory). All ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section 603.9 of the *International Mechanical Code* ~~ACCA Manual J~~.

Exceptions:

1. Air-impermeable spray foam products shall be permitted to be applied without additional joint seals.
2. Where a duct connection is made that is partially inaccessible, three screws or rivets shall be equally spaced on the exposed portion of the joint so as to prevent a hinge effect.
3. Continuously welded and locking type longitudinal joints and seams in ducts operating at static pressures less than 2 inches of water column (500 Pa) pressure classification shall not require additional closure systems.

Duct tightness shall be verified by either of the following:

1. Post construction test: Leakage to outdoors shall be less than or equal to 8 cfm (226.5 L/min) per 100 ft2 (9.29 m2) of *conditioned floor area* or a total leakage less than or equal to 12 cfm (12 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 6 cfm (169.9 L/min) per 100 ft^2 (9.29 m^2) of *conditioned floor area* when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of *conditioned floor area*.

Exception~~s~~: Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.

403.6 Equipment sizing. Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J~~-02~~ or other *approved* heating and cooling calculation methodologies.

405.6.1 Minimum capabilities. Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the *standard reference design* and the *proposed design* and shall include the following capabilities:

1. Computer generation of the *standard reference design* using only the input for the *proposed design*. The calculation procedure shall not allow the user to directly modify the building component characteristics of the *standard reference design*.
2. Calculation of whole-building (as a single *zone*) sizing for the heating and cooling equipment in the *standard reference design* residence in accordance with Section 403.6. ~~ACCA Manual J.~~
3. Calculations that account for the effects of indoor and outdoor temperatures and part-load ratios on the performance of heating, ventilating and air-conditioning equipment based on climate and equipment sizing.
4. Printed *code official* inspection checklist listing each of the *proposed design* component characteristics from Table 405.5.2(1) determined by the analysis to provide compliance, along with their respective performance ratings (e.g., *R*-value, *U*-factor, SHGC, HSPF, AFUE, SEER, EF, etc.).

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems [g, h]	As proposed Sized in accordance with Section ~~M1401.3 of the *International Residential Code*~~ 403.6	As proposed
Cooling systems [g, i]	As proposed Sized in accordance with Section ~~M1401.3 of the *International Residential Code*~~ 403.6	As proposed

(Portions of Table 404.5.2(1) and footnotes not shown remain unchanged)

Add new standards organization and standard to Chapter 6 as follows:

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

ACCA	Manual J-02 Residential Load Calculations Eighth Edition	403.6
	Manual S-04 Residential Equipment Selection	403.6

ICC International Code Council, Inc.
500 New Jersey Avenue, NW
6th Floor
Washington, DC 20001

IMC—09 International Mechanical Code® . . . . 603.9 .G2402.3

Commenter's Reason: The intent of the proposed change is to integrate ACCA standards (already referenced in the IRC) into IECC Chapter 4 and Chapter 6 Referenced Standards without the code user having to look up requirements in another code to discover the applicable standards. Approval of the referenced ACCA standards listed has already been accomplished in the IRC 2009 process.

Disapproved by the Committee was requested by the proponent at the CD Hearings because a necessary modification to the original proposal to correct reference standard citations was ruled out of order by the Committee Chair. Those citations have been corrected through this Public Comment.

Exceptions listed in the Section 403.2.2 portion of this change are edited from the International Residential Code to make the separate code provisions consistent. The Exception 1 changes within the IRC are simply to eliminate a product-specific requirement with generic language.

The proposed changes to 403.6 and its use in Table 405.5.2(1) are intended to coordinate these requirements with current IRC provisions but eliminate the present process where an applicable standard can only be found by referencing another code. Section 403.6 change makes the IRC and IECC provisions consistent.

The International Residential Code is designed to be adopted without reference to any other I-Codes, since it may be the only code allowed by law for adoption in certain jurisdictions (other codes adopted by different jurisdictions, such as a state or county). As such, references to specific provisions within the IECC should not have to refer to the IRC when the applicable approved standard may be referenced directly.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A new standard, ACCA Manual S has been proposed for inclusion in the code by the modification offered in this public comment. This standard, was not reviewed or considered by the IECC Code Development committee and it was not considered by the hearing attendees at the time of the code development hearings. Section 3.6.3.1 of Council Policy #28, *Code Development,* requires that new standards be introduced in the original code change proposal, therefore, the introduction of a new standard via a public comment is not in accordance with the process required by CP# 28 for adding new standards to the code.

Final Action: AS AM AMPC____ D

EC109-09/10-PART I
403.2.3

<u>Proposed Change as Submitted</u>

Proponent: Ronald Majette, representing US Department of Energy

PART I – IECC

Revise as follows:

403.2.3 Building cavities. Building framing cavities shall not be used as ~~supply~~ ducts <u>or plenums</u>.

Reason: It is difficult to effectively use building framing cavities within the building envelope due to insulation requirements for the ducts and the thermal envelope and the difficulty in sealing them against air leakage. This is the basis for the current requirement in the code for supply ducts. Other than a lower temperature in return ducts their negative pressure in relation to the outside environment can and will draw unconditioned air into the HVAC system, increasing loads on the HVAC equipment and inducing building infiltration/exfiltration unless the cavities can be effectively sealed. Just as cavities are not allowed for supply due in part to the difficulty in sealing they should also be precluded from being used as part of the return air duct system.

Cost Impact: The code change proposal may increase or decrease the cost of construction depending on the builder's choices with regard to duct system design, construction and location compared to previous expenses involved with framing, enclosing, and sealing building cavities as part of the duct system.

ICCFILENAME: MAJETTE-EC-75-403.2.3-IRC N1103.2.3-REDONE

<u>Public Hearing Results</u>

PART I – IECC

Committee Action: **Approved as Submitted**

Committee Reason: This represents good practice to deal with air leakage. The return air should be regulated the same way as supply air.

Assembly Action: **None**

<u>Individual Consideration Agenda</u>

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Richard Grace, Fairfax Virginia, Virginia Plumbing and Mechanical Inspectors Association (VPMIA), Virginia Building Code Officials Association, ICC Region VII requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.2.3 Building cavities. Building framing cavities <u>in the outside walls of building envelope assemblies</u> shall not be used as <u>air</u> ducts or plenums.

Commenter's Reason: The proposed change, as approved by the IECC committee, will directly conflict with IMC **602.3 Stud cavity and joist space plenums.** IMC 602.3 allows for the use of building cavities as a return air path. IRC M1601.1.1 basically mirrors the IMC 602.3 requirements providing consistency between the two International Codes. This proposed modification (parts I and II) is an attempt to restore consistency between the <u>three</u> International Codes based on the language that was approved in the Dallas hearings with M97-09/10 Parts I and II.

Public Comment 2:

Richard Grace, Fairfax County, VA, representing Virginia Plumbing and Mechanical Inspectors Association (VPMIA), Virginia Building Code Officials Association, ICC Region VII requests Disapproval.

Commenter's Reason: This change, as approved by the IECC committee, will directly conflict with IMC **602.3 Stud cavity and joist space plenums.** This IMC section allows for the use of building cavities as a return air path. IRC M1601.1.1 basically mirrors the IMC 602.3 requirements providing consistency between the two International Codes. This change to the IECC does not promote such consistency and should be returned back to the original language.

Final Action: AS AM AMPC____ D

EC109-09/10-PART II
N1103.2.3

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1103.2.3 Building cavities. Building framing cavities shall not be used as ~~supply~~ ducts or plenums.

Reason: It is difficult to effectively use building framing cavities within the building envelope due to insulation requirements for the ducts and the thermal envelope and the difficulty in sealing them against air leakage. This is the basis for the current requirement in the code for supply ducts. Other than a lower temperature in return ducts their negative pressure in relation to the outside environment can and will draw unconditioned air into the HVAC system, increasing loads on the HVAC equipment and inducing building infiltration/exfiltration unless the cavities can be effectively sealed. Just as cavities are not allowed for supply due in part to the difficulty in sealing they should also be precluded from being used as part of the return air duct system.

Cost Impact: The code change proposal may increase or decrease the cost of construction depending on the builder's choices with regard to duct system design, construction and location compared to previous expenses involved with framing, enclosing, and sealing building cavities as part of the duct system.

ICCFILENAME: MAJETTE-EC-75-403.2.3-IRC N1103.2.3-REDONE

Public Hearing Results

PART II - IRC
Committee Action: **Disapproved**

Committee Reason: This type of requirement dealing with plenums is better placed in the mechanical section of the IRC. In addition, the committee was concerned that this text could be interpreted to mean that crawl spaces cannot be used for supply air.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality requests Approval as Submitted.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This proposal would eliminate the use of framing cavities as return ducts, which we strongly agree with. In practice framing cavities make leaky ducts. We recommend approval as submitted for EC109 Part II to be consistent with Part I.

Public Comment 2:

Richard Grace, Fairfax Virginia, Virginia Plumbing and Mechanical Inspectors Association (VPMIA), Virginia Building Code Officials Association, ICC Region VII requests Approval as Modified by this Public Comment.

Modify proposal as follows:

N1103.2.3 Building cavities. Building framing cavities in the outside walls of building envelope assemblies shall not be used as ~~supply~~ air ducts or plenums.

Commenter's Reason: Part II of EC109-09/10 was disapproved by the IRC Energy Committee. Part I was approved by the IECC committee causing a direct conflict with IMC **602.3 Stud cavity and joist space plenums.** IMC 602.3 allows for the use of building cavities as a return air path.

IRC M1601.1.1 basically mirrors the IMC 602.3 requirements providing consistency between the two International Codes. This proposed modification (parts I and II) is an attempt to restore consistency between the three International Codes based on the language that was approved in the Dallas hearings with M97-09/10 Parts I and II.

Final Action: AS AM AMPC____ D

EC110-09/10
403.3.1(New)

Proposed Change as Submitted

Proponent: Howard Ahern Plumberex, representing self

Add new text as follows:

403.3.1 Protection of piping insulation. Piping insulation exposed to weather shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind by means including, aluminum, sheet metal, painted canvas, or plastic cover or other protection suitable for outdoor service. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material. Adhesives tape shall not be permitted.

Reason: Outdoor piping insulation needs to be protected from weather, physical damage or from UV deterioration. Pipe insulation in outdoor locations is typically protected by an aluminum or sheet metal jacket, painted canvas, plastic cover, or coating that is water retardant and UV resistant.

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. 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. Protection can also keep silted pipe insulation from commonly separating thus saving additional energy cost. This simple common sense proposal is cost-effective as it will save energy and will prolong insulation life reducing replacement.

This proposal will save residential building energy cost following the same initiative being taken by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) to improve energy efficiency levels by 30% in the **ASHRAE 90.1 2007 Section 6.4.4.1.1** commercial building standards. It also reflects the energy efficiency improvement approved by Congress American Recovery and Reinvestment Act of 2009 (ARRA).

ASHRAE 90.1 2007 Section 6.4.4.1.1:
Piping Insulation exposed to weather shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind but not limited to the following

A. Piping Insulation exposed to weather shall be suitable for outdoor service e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.

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

FILENAME: AHERN-EC-1-403.3.1

Public Hearing Results

Committee Action: **Approved as Modified**

Modify proposal as follows:

403.3.1 Protection of piping insulation. Piping insulation exposed to weather shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, ~~and~~ wind, ~~by means including, aluminum, sheet metal, painted canvas, or plastic cover or other protection suitable for outdoor service. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant~~ and shall provide shielding from solar radiation that can cause degradation of the material. Adhesives tape shall not be permitted.

Committee Reason: Protection of outside piping insulation is necessary to assure durable materials to meet the energy code requirements. The modification simply removes the laundry list of possible protections, as the committee felt this was unnecessary.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Richard Grace, Fairfax County, VA, representing Virginia Plumbing and Mechanical Inspectors Association (VPMIA), Virginia Building Code Officials Association, ICC Region VII requests Disapproval.

Commenter's Reason: As much as I think it is important to maintain the integrity of piping insulation (installed outdoors or indoors), this code change just doesn't get us there. The first statement alone leaves enforcement and interpretation of this section completely up to each authority having jurisdiction, and there will not be consistency among any of them. "Shall be protected from damage, including . . ." What method of protection can possibly be used to protect the piping insulation from all manners of "damage"? Not only must the piping insulation be protected from sunlight, moisture (does hail fall under this category?), wind (does this include hurricanes or tornados?), and solar radiation, but it must also be protected from maintenance personnel who might either step on it, poke with a screwdriver, run into when they lose their balance, or even run into it with their vehicles. Additionally, "damage" can be caused by lawn mowers, weed whackers, rodents, and many other creative ways. The only possible way to protect the piping insulation from all of those elements would be to encase the entire system in concrete.

Final Action: AS AM AMPC____ D

EC112-09/10-PART I

202 (New), 403.4, 403.4.1, 403.4.2 (New), Table 403.4.2

Proposed Change as Submitted

Proponents: Ronald Majette, US Department of Energy; Craig Conner, Building Quality

PART I – IECC

1. Add new definition as follows:

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where pump(s) prime the service hot water piping with heated water upon demand for hot water.

2. Revise as follows:

403.4 Service hot water systems. Energy conservation measures for service hot water systems shall be in accordance with Sections 403.4.1 and 403.4.2.

403.4.1 Circulating hot water systems (Mandatory). ~~All circulating service hot water piping shall be insulated to at least R-2.~~ Circulating hot water systems shall ~~include~~ be provided with an automatic or readily *accessible* manual switch that can turn off the hot water circulating pump when not in use.

3. Add new text and table as follows:

403.4.2 Hot water pipe insulation (Prescriptive). Insulation for hot water pipe with a minimum thermal resistance (R-value) of at least R-3 shall be applied to the following:

1. Piping larger than 3/4 in. nominal diameter
2. Piping serving more than one dwelling unit
3. Piping from the water heater to kitchen outlets
4. Piping located outside the conditioned space
5. Piping from the water heater to a distribution manifold
6. Piping located under a floor slab
7. Buried piping
8. Supply and return piping in recirculation systems other than demand recirculation systems
9. Piping with run lengths greater than the maximum run lengths for the nominal pipe diameter given in Table 403.4.2.

TABLE 403.4.2
MAXIMUM RUN LENGTH (feet)[a]

Nominal Pipe Diameter of Largest Diameter Pipe in the Run (in.)	3/8	1/2	3/4	> 3/4
Maximum Run Length	30	20	10	5

a. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.

Reason: (Majette) The purpose of this code change is to add pipe insulation requirements for domestic hot water. The IECC and IRC have minimal requirements for energy efficiency related to water heating. The proposed pipe insulation requirements represent a modest initial investment that will save energy for decade after decade. The proposed requirements are structured to allow "short and skinny" pipe runs as an alternative to pipe insulation in many cases. Either way, these requirements help save water and help limit the energy wasted when the faucet is turned off and the pipes are left full of hot water.

Reason: (Conner) There are two parts to this proposal: insulation of hot water piping and reducing the volume of water in the hot water piping from the source of hot water to the outlets. Both parts are deemed essential because hot water piping is intended to be a long-lived subsystem of the building, lasting 50 years or more before it will be replaced and because much of the piping is not easily accessible to make modifications during this long period of time.

1. Insulation of hot water piping reduces the waste of energy, water and time during the delivery, use and cool-down phases of a hot water event. During the delivery phase, when the piping runs in unconditioned spaces, in a slab, when it is buried or when the flow rate is very low (less than 1 gpm) pipe insulation significantly reduces the heat loss and helps to ensure that hot enough water gets to the outlets. Getting the hot water to the outlets hotter, also gets it there quicker. During the use phase, the insulation keeps the water hotter by reducing the temperature drop from the source of hot water to the outlet. This saves energy by making it possible to reduce the storage

temperature: every 1F reduction in storage temperature reduces standby heat losses by almost 2%. During the cool-down phase, pipe insulation increases the time it takes for the temperature of the water to cool down, roughly doubling the cool-down time for ½ inch nominal pipe and tripling it for ¾ inch nominal pipe. This saves energy, water and time for all those hot water events that are clustered between 10 and 45 minutes apart: think morning rush hour (getting ready for work and school) and evening plateau (coming home from school and work, preparing, eating and cleaning up from dinner and getting ready for bed), and of course lunch when people are home during the day.

2. Reducing the volume between the source of hot water and the outlet also saves energy, water and time. Volume is a combination of length and diameter. Less volume between the source and the outlet means less cost in hot and cold water piping and, if the floor plan is done well, in the drain lines too. In many homes today, little if any consideration is given to the layout of hot water outlets, resulting in very long waits for hot water (over 1 minute and more than 2 gallons are wasted) at the fixtures furthest from the water heater, which are often the master bathroom and the kitchen, the two most-used hot water locations in a home. Reducing the volume saves water and time during the delivery phase of a hot water event because less not-hot water needs to be cleared out when hot water is desired at the outlet. It saves energy during the use phase because for a given pipe diameter and flow rate, there is less temperature drop over a shorter distance. And during the cool-down phase, it saves energy because there is a smaller volume that that will lose its heat when the temperature of the water in the pipe cools down.

References:
Klein, Gary, "Hot Water Distribution Research," The Official Magazine, September-October 2006, pages 39-44.
Klein, Gary, "Designing 'Green' Hot Water Distribution Systems," PM Engineer, July 2008, pages 16-24.

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

ICCFILENAME: MAJETTE-EC-82-CONNER-EC-13-202-403.4-IRC R202-N1103.4-REDONE

Public Hearing Results

PART I – IECC

Committee Action: Approved as Submitted

Committee Reason: This proposal is consistent with EC13.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Stephen Turchen, Fairfax County, VA, representing Virginia Building and Code Officials Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.4 ~~Service hot water~~ <u>Water distribution</u> systems. ~~Energy conservation measures for service hot water systems shall be in accordance with Sections 403.4.1 and 403.4.2.~~

403.4.1 Circulating hot water systems (Mandatory). Circulating hot water systems shall be provided with an automatic or readily accessible manual switch that can turn off the hot water circulation pump when not in use.

403.4.2 Hot water pipe insulation (Prescriptive). Insulation ~~for hot water pipe~~ with a minimum thermal resistance (R-value) of ~~at least~~ R3 shall be applied to ~~the following~~ <u>all hot water piping in the distribution system meeting any of the following conditions:</u>

1. Piping larger than ¾ inch nominal diameter.
2. ~~Piping serving more than one dwelling unit.~~
3. Piping from the water heater to <u>all</u> kitchen ~~outlets~~ <u>appliances and fixtures.</u>
4. Piping located outside the conditioned space.
5. ~~Piping from the water heater to a distribution manifold.~~
6. Piping located under a floor slab.
7. Buried piping.
8. Supply and return piping in recirculation systems other than demand recirculation <u>water</u> systems.
9. ~~Piping with run lengths greater than the maximum run lengths for the nominal pipe diameter given in Table 403.4.2.~~

<u>**Exception:** Any flexible connection between the end of the rigid distribution system piping and the fixture served by that piping.</u>

TABLE 403.4.2
MAXIMUM RUN LENGTH (feet)[a]

Nominal Pipe Diameter of Largest Diameter Pipe in the Run (in.)	3/8	1/2	3/4	> 3/4
Maximum Run Length	30	20	10	5

a. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: *Service hot water system* is not a defined term under the IECC or IRC. *Water service pipe* is defined in the 2009 International Plumbing Code (the pipe from the water main or other potable water source that runs into the building), but is likely not the scope of intention by the EC112 proponent. *Water distribution pipe* (from the water service pipe to the fixtures where water is used) are the critical pipes for insulating. Thus section 403.4 / N1103.4 has been re-titled for consistency with other I-codes.

New Section 403.4.2 / N1103.4.2 and its associated table will be difficult to enforce by field inspectors as written in the original proposal. Basically every element of the distribution system will have to be carefully examined to see if it qualifies under one of the exemptions. "Piping serving more than one dwelling unit" is not relevant, in our view, because the function or location of the pipe is the critical issue. A pipe might serve 10 dwelling units, but if there is infrequent demand for the water in that pipe, little energy is saved by insulating it. "Distribution manifold" is undefined in the IECC, IRC, and IPC and therefore subject to broad interpretation. If maximum run lengths for various pipe sizes are observed as being "very long" by an inspector and perhaps close to the threshold limits, these pipe runs will have to be measured by the inspector or contractor, a time-consuming process, or the lengths "certified" by the installer, producing irregular energy savings depending on the degree of effort expended by the inspector or the installer to make these measurements. As an enforcement process, it is much simpler and quicker to simply require that all hot water distribution system piping be insulated to R3 in easily identifiable locations (larger than ¾", outside conditioned space, going to kitchen, etc.), as in the suggested revision.

The suggested "Exception" was added to the proposed modification because it is not practical to insulate flexible distribution pipe connections; e.g., the flexible hose installed between the shut-off valve and the water inlet at the faucet or other fixture. Without this exception, there may be unnecessary confusion in the field as to whether these connections must be insulated. In a typical residential system, the flexible piping represents a small percentage of the overall length of the total distribution system, so the energy savings foregone should be minimal.

Final Action: AS AM AMPC____ D

EC112-09/10-PART II

R202 (New), N1103.4, N1103.4.1, N1103.4.2 (New), Table N1103.4.2 (New)

Proposed Change as Submitted

Proponents: Ronald Majette, US Department of Energy; Craig Conner, Building Quality

PART II – IRC BUILDING/ENERGY

1. Add new definition as follows:

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where pump(s) prime the service hot water piping with heated water upon demand for hot water.

2. Revise as follows:

N1103.4 ~~Service~~ Hot water service systems. Energy conservation measures for hot water service systems shall be in accordance with Sections 403.4.1 and 403.4.2.

N1103.4.1 Circulating hot water systems (Mandatory). ~~All circulating service hot water piping shall be insulated to at least R-2.~~ Circulating hot water systems shall ~~include~~ be provided with an automatic or readily *accessible* manual switch that can turn off the hot water circulating pump when not in use.

3. Add new text and table as follows:

N1103.4.2 Hot water pipe insulation (Prescriptive). Insulation for hot water pipe with a minimum thermal resistance (R-value) of at least R-3 shall be applied to the following:

1. Piping larger than 3/4 in. nominal diameter
2. Piping serving more than one dwelling unit
3. Piping from the water heater to kitchen outlets
4. Piping located outside the conditioned space
5. Piping from the water heater to a distribution manifold
6. Piping located under a floor slab
7. Buried piping
8. Supply and return piping in recirculation systems other than demand recirculation systems
9. Piping with run lengths greater than the maximum run lengths for the nominal pipe diameter given in Table 403.4.2.

TABLE N1103.4.2
MAXIMUM RUN LENGTH (feet)[a]

Nominal Pipe Diameter of Largest Diameter Pipe in the Run (in.)	3/8	1/2	¾	> 3/4
Maximum Run Length	30	20	10	5

a. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.

Reason: (Majette) The purpose of this code change is to add pipe insulation requirements for domestic hot water. The IECC and IRC have minimal requirements for energy efficiency related to water heating. The proposed pipe insulation requirements represent a modest initial investment that will save energy for decade after decade. The proposed requirements are structured to allow "short and skinny" pipe runs as an alternative to pipe insulation in many cases. Either way, these requirements help save water and help limit the energy wasted when the faucet is turned off and the pipes are left full of hot water.

Reason: (Conner) There are two parts to this proposal: insulation of hot water piping and reducing the volume of water in the hot water piping from the source of hot water to the outlets. Both parts are deemed essential because hot water piping is intended to be a long-lived subsystem of the building, lasting 50 years or more before it will be replaced and because much of the piping is not easily accessible to make modifications during this long period of time.

1. Insulation of hot water piping reduces the waste of energy, water and time during the delivery, use and cool-down phases of a hot water event. During the delivery phase, when the piping runs in unconditioned spaces, in a slab, when it is buried or when the flow rate is very low (less than 1 gpm) pipe insulation significantly reduces the heat loss and helps to ensure that hot enough water gets to the outlets. Getting the hot water to the outlets hotter, also gets it there quicker. During the use phase, the insulation keeps the water hotter by

reducing the temperature drop from the source of hot water to the outlet. This saves energy by making it possible to reduce the storage temperature: every 1F reduction in storage temperature reduces standby heat losses by almost 2%. During the cool-down phase, pipe insulation increases the time it takes for the temperature of the water to cool down, roughly doubling the cool-down time for ½ inch nominal pipe and tripling it for ¾ inch nominal pipe. This saves energy, water and time for all those hot water events that are clustered between 10 and 45 minutes apart: think morning rush hour (getting ready for work and school) and evening plateau (coming home from school and work, preparing, eating and cleaning up from dinner and getting ready for bed), and of course lunch when people are home during the day.

2. Reducing the volume between the source of hot water and the outlet also saves energy, water and time. Volume is a combination of length and diameter. Less volume between the source and the outlet means less cost in hot and cold water piping and, if the floor plan is done well, in the drain lines too. In many homes today, little if any consideration is given to the layout of hot water outlets, resulting in very long waits for hot water (over 1 minute and more than 2 gallons are wasted) at the fixtures furthest from the water heater, which are often the master bathroom and the kitchen, the two most-used hot water locations in a home. Reducing the volume saves water and time during the delivery phase of a hot water event because less not-hot water needs to be cleared out when hot water is desired at the outlet. It saves energy during the use phase because for a given pipe diameter and flow rate, there is less temperature drop over a shorter distance. And during the cool-down phase, it saves energy because there is a smaller volume that that will lose its heat when the temperature of the water in the pipe cools down.

References:
Klein, Gary, "Hot Water Distribution Research," The Official Magazine, September-October 2006, pages 39-44.
Klein, Gary, "Designing 'Green' Hot Water Distribution Systems," PM Engineer, July 2008, pages 16-24.

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

ICCFILENAME: MAJETTE-EC-82-CONNER-EC-13-202-403.4-IRC R202-N1103.4-REDONE

Public Hearing Results

PART II – IRC

Committee Action: Disapproved

Committee Reason: The proposed text should be in the plumbing section of the IRC.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, requests Approval as Submitted.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

This proposal requires insulation of the hot-water pipes that are most used. It encourages short hot-water pipe runs with less water in the pipes, which saves both energy and water, by exempting many pipe runs that are sufficiently short and made up of smaller diameter pipes. This proposal is entirely contained in EC13 and is not needed if EC13 is approved. We recommend approval as submitted for EC112 Part II to be consistent with Part I.

Public Comment 2:

Stephen Turchen, Fairfax County, VA, representing Virginia Building and Code Officials Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1103.4 ~~Service hot water~~ Water distribution systems. ~~Energy conservation measures for service hot water systems shall be in accordance with Sections 403.4.1 and 403.4.2.~~

N1103.4.1 Circulating hot water systems (Mandatory). Circulating hot water systems shall be provided with an automatic or readily accessible manual switch that can turn off the hot water circulation pump when not in use.

N1103.4.2 Hot water pipe insulation (Prescriptive). Insulation ~~for hot water pipe~~ with a minimum thermal resistance (R-value) of ~~at least~~ R3 shall be applied to ~~the following~~ all hot water piping in the distribution system meeting any of the following conditions:

1. Piping larger than ¾ inch nominal diameter.
2. ~~Piping serving more than one dwelling unit.~~
3. Piping from the water heater to all kitchen ~~outlets~~ appliances and fixtures.
4. Piping located outside the conditioned space.
5. ~~Piping from the water heater to a distribution manifold.~~
6. Piping located under a floor slab.
7. Buried piping.
8. Supply and return piping in recirculation systems other than demand recirculation water systems.
9. ~~Piping with run lengths greater than the maximum run lengths for the nominal pipe diameter given in Table 403.4.2.~~

Exception: Any flexible connection between the end of the rigid distribution system piping and the fixture served by that piping.

~~TABLE N1103.4.2~~
~~MAXIMUM RUN LENGTH (feet)~~[a]

~~Nominal Pipe Diameter of Largest Diameter Pipe in the Run (in.)~~	~~3/8~~	~~1/2~~	~~¾~~	~~> 3/4~~
~~Maximum Run Length~~	~~30~~	~~20~~	~~10~~	~~5~~

~~a. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: Commenter's Reason: *Service hot water system* is not a defined term under the IECC or IRC. *Water service pipe* is defined in the 2009 International Plumbing Code (the pipe from the water main or other potable water source that runs into the building), but is likely not the scope of intention by the EC112 proponent. *Water distribution pipe* (from the water service pipe to the fixtures where water is used) are the critical pipes for insulating. Thus section 403.4 / N1103.4 has been re-titled for consistency with other I-codes.

New Section 403.4.2 / N1103.4.2 and its associated table will be difficult to enforce by field inspectors as written in the original proposal. Basically every element of the distribution system will have to be carefully examined to see if it qualifies under one of the exemptions. "Piping serving more than one dwelling unit" is not relevant, in our view, because the function or location of the pipe is the critical issue. A pipe might serve 10 dwelling units, but if there is infrequent demand for the water in that pipe, little energy is saved by insulating it. "Distribution manifold" is undefined in the IECC, IRC, and IPC and therefore subject to broad interpretation. If maximum run lengths for various pipe sizes are observed as being "very long" by an inspector and perhaps close to the threshold limits, these pipe runs will have to be measured by the inspector or contractor, a time-consuming process, or the lengths "certified" by the installer, producing irregular energy savings depending on the degree of effort expended by the inspector or the installer to make these measurements. As an enforcement process, it is much simpler and quicker to simply require that all hot water distribution system piping be insulated to R3 in easily identifiable locations (larger than ¾", outside conditioned space, going to kitchen, etc.), as in the suggested revision.

The suggested "Exception" was added to the proposed modification because it is not practical to insulate flexible distribution pipe connections; e.g., the flexible hose installed between the shut-off valve and the water inlet at the faucet or other fixture. Without this exception, there may be unnecessary confusion in the field as to whether these connections must be insulated. In a typical residential system, the flexible piping represents a small percentage of the overall length of the total distribution system, so the energy savings foregone should be minimal.

Final Action: AS AM AMPC____ D

EC114-09/10-PART I
403.4 (New), 403.4.1 (New), 403.4.2 (New), 403.4.3 (New)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

1. Add new text as follows:

403.4 Service water heating (Mandatory). Service hot water piping shall be installed in accordance with Sections 403.4.1 through 403.4.3.

403.4.1 Pipe length and Insulation. Service hot water piping shall be no more than a total of 60 linear feet of pipe length to all fixtures being served by one service water heating unit. All service hot water piping shall be insulated to at least R-3 for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter for the distance between the service water heating equipment to within 5 feet of each fixture connected to the hot water pipe. In addition, the first 5 feet of hot and cold water pipes from the storage tank for non-recirculating service water heating systems shall be insulated to at least R-3 for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter.

Exception: Hot water distribution systems that supply hot water from one of the following sources (this exception does not apply to portions of hot water distribution systems located below ground or in a mass floor or mass wall in contact with the ground):

1. Condensing gas service water heating equipment,
2. Solar thermal water heating equipment that is designed to provide more than 50 percent of annual hot water requirements from solar heated water,
3. Heat pump electric service water heating equipment,
4. Tankless demand service gas water heating equipment, or
5. Tankless demand service electric heating equipment, where either:
   - 5.1. Heated water is provided through piping that is insulated to R-3 or
   - 5.2. There is no more than a total of 15 linear feet of pipe length to all fixtures being served by each unit.

2. Revise as follows:

403.4.2 ~~403.4~~ Circulating hot water systems ~~(Mandatory)~~. All circulating service hot water piping shall be insulated to at least R-3~~2~~ for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

3. Add new text as follows:

403.4.3 Heat traps. Water heating equipment not supplied with integral heat traps and serving non-circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment.

Reason: Water heating energy is becoming a large percentage of the overall energy use in homes due to significant improvements that have occurred to heating, cooling and lighting energy efficiency. This proposal is intended to improve hot water efficiency by requiring improvement of either the efficiency of the hot water distribution system or the water heating equipment (due to issues with federal NAECA preemption, the code cannot require an improved hot water heater, but can permit such an improvement as an exception to an alternative requirement not involving improved equipment).

The efficiency of the hot water distribution system is based on the pipe length, pipe diameter and pipe insulation. This proposal requires increased insulation as the pipe diameter increases in all homes. The proposal also requires system zoning if the distribution pipe from one system exceeds 60 linear feet. Assuming an average of 30 linear feet per 1000 SF of conditioned floor area for a typical hot water distribution system, this second requirement will promote more efficient distribution design in larger homes.

This proposal also allows high performance water heating equipment to be installed as an exception in lieu of improving the hot water distribution. The improvement in water heating equipment has a significant impact on the overall energy used for hot water in a home. The following table from ACEEE shows estimated annual energy use by equipment type, with the bold equipment selected for the exceptions.

Water Heater Type	Efficiency (EF)	Yearly Energy Cost
Conventional gas storage	0.60	$350
High-efficiency gas storage	0.65	$323
Condensing gas storage	**0.80**	**$262**
Demand gas (no pilot)	**0.82**	**$228**
Conventional oil-fired storage	0.55	$654
Minimum Efficiency electric storage	0.90	$463
High-eff. electric storage	0.95	$439
Electric heat pump water heater	**2.20**	**$190**
Solar with electric back-up	**1.20**	**$175**

source: http://www.aceee.org/consumerguide/waterheating.htm

Electric tankless demand water heating, while not analyzed by ACEEE in the study above, is also included due to increased EF ratings compared to electric storage as an exception with an additional requirement for insulation or the length of pipe serviced by the equipment. This additional requirement is meant to limit the electric demand impact and also improve the distribution efficiency for improved system performance. Literature shows that electric tankless heaters have very high efficiency ratings (around 0.98 and 0.99) and have opportunity to save significant energy when coupled with reduced distribution losses.

The US DOE (http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13060) states that "insulating your hot water pipes reduces heat loss and can raise water temperature 2ºF–4ºF hotter than uninsulated pipes can deliver, allowing for a lower water temperature setting". This is the main reason for having a strong focus on improving the hot water distribution which will allow for reduced energy use on the overall hot water system. The DOE also recommends insulation of all accessible hot water pipes, with the most important being within 3 feet of the water heater.

In addition to the insulation language, this proposal also adds language that requires a heat trap for systems that are not supplied with a heat trap. This language is exactly based on section 504.4 of the IECC and is being included to ensure that more energy is not lost from the hot water equipment to the piping based on the recommendation from the DOE: http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13100

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

ICCFILENAME: PRINDLE-EC-24-403.4-N1103.4

Public Hearing Results

PART I – IECC

Committee Action: Disapproved

Committee Reason: The issues in this proposal have already been dealt with in EC112 and EC13.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.4 Service water heating (Mandatory). Service hot water piping shall be installed in accordance with Sections 403.4.1 through 403.4.3.

403.4.1 Pipe length and Insulation. Service hot water piping shall be no more than a total of 120 ~~60~~ linear feet of total developed pipe length to all fixtures being served by one service water heating unit. All service hot water piping shall be insulated to at least R-3 for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter for the distance between the service water heating equipment to within 5 feet of each fixture connected to the hot water pipe. In addition, the first 5 feet of hot and cold water pipes from the storage tank for non-recirculating service water heating systems shall be insulated to at least R-3 for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter.

~~**Exception**: Hot water distribution systems that supply hot water from one of the following sources (this exception does not apply to portions of hot water distribution systems located below ground or in a mass floor or mass wall in contact with the ground):~~

1. ~~Condensing gas service water heating equipment,~~
2. ~~Solar thermal water heating equipment that is designed to provide more than 50 percent of annual hot water requirements from solar heated water,~~
3. ~~Heat pump electric service water heating equipment,~~
4. ~~Tankless demand service gas water heating equipment, or~~
5. ~~Tankless demand service electric heating equipment, where either:~~
   ~~5.1 Heated water is provided through piping that is insulated to R-3 or~~
   ~~5.2 There is no more than a total of 15 linear feet of pipe length to all fixtures being served by each unit.~~

403.4.2 Circulating hot water systems. All circulating service hot water piping shall be insulated to at least R-3 for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

403.4.3 Heat Traps. Water heating equipment not supplied with integral heat traps and serving non-circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment.

Commenter's Reason: *EC114 should be approved as modified by this public comment.*
EC114, as modified in this public comment, will bring substantial savings through increased efficiency in hot water heating systems. Although the original EC114 proposed a variety of equipment alternatives that, if selected, would have saved additional energy, the concern was raised at the Committee Hearings that these provisions may risk legal challenges on the basis of federal preemption. Although we do not necessarily believe the original proposal to be preempted, we do not want to risk subjecting the 2010 IECC and IRC to lengthy delays due to litigation.

The modification above removes the alternatives to insulation and pipe length and adds the industry term of "total developed pipe length" to set the requirements for increasing the energy efficiency of the hot water distribution system. The modification also increases the maximum length of total developed pipe length to be served by a single system in an effort to ease the requirement somewhat based on comments at the Development Committee hearing.

This proposal, as modified, will save more energy than other proposals because it requires both a minimum level of R-value insulation for all service hot water piping, as well as placing limits on pipe length (shorter pipes mean less hot water sitting in pipes to get cold). Equally important, this proposal is straightforward and will not be difficult to apply or to enforce, since it does not create exceptions for various types of piping and/or vary the insulation level depending on pipe length. As a result, this proposal will decrease the cost of construction by encouraging improved designs of hot water distribution systems while saving energy and water over the lifetime of the home.

Final Action: AS AM AMPC____ D

EC114-09/10-PART II

N1103.4 (New), N1103.4.1 (New), N1103.4.2 (New), N1103.4.3 (New)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

1. Add new text as follows:

N1103.4 Service water heating. Service hot water piping shall be installed in accordance with Sections 403.4.1 through 403.4.3.

N1103.4.1 Pipe length and Insulation. Service hot water piping shall be no more than a total of 60 linear feet of pipe length to all fixtures being served by one service water heating unit. All service hot water piping shall be insulated to at least R-3 for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter for the distance between the service water heating equipment to within 5 feet of each fixture connected to the hot water pipe. In addition, the first 5 feet of hot and cold water pipes from the storage tank for non-recirculating service water heating systems shall be insulated to at least R-3 for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter.

> **Exception**: Hot water distribution systems that supply hot water from one of the following sources (this exception does not apply to portions of hot water distribution systems located below ground or in a mass floor or mass wall in contact with the ground):
>
> 1. Condensing gas service water heating equipment,
> 2. Solar thermal water heating equipment that is designed to provide more than 50 percent of annual hot water requirements from solar heated water,
> 3. Heat pump electric service water heating equipment,
> 4. Tankless demand service gas water heating equipment, or
> 5. Tankless demand service electric heating equipment, where either:
>   - 5.1. Heated water is provided through piping that is insulated to R-3 or
>   - 5.2. There is no more than a total of 15 linear feet of pipe length to all fixtures being served by each unit.

2. Revise as follows:

N1103.4.2 ~~N1103.4~~ Circulating hot water systems. All circulating service hot water piping shall be insulated to at least ~~R-~~2 R-3 for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

3. Add new text as follows:

N1103.4.3 Heat traps. Water heating equipment not supplied with integral heat traps and serving non-circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment.

Reason: Water heating energy is becoming a large percentage of the overall energy use in homes due to significant improvements that have occurred to heating, cooling and lighting energy efficiency. This proposal is intended to improve hot water efficiency by requiring improvement of either the efficiency of the hot water distribution system or the water heating equipment (due to issues with federal NAECA preemption, the code cannot require an improved hot water heater, but can permit such an improvement as an exception to an alternative requirement not involving improved equipment).

The efficiency of the hot water distribution system is based on the pipe length, pipe diameter and pipe insulation. This proposal requires increased insulation as the pipe diameter increases in all homes. The proposal also requires system zoning if the distribution pipe from one system exceeds 60 linear feet. Assuming an average of 30 linear feet per 1000 SF of conditioned floor area for a typical hot water distribution system, this second requirement will promote more efficient distribution design in larger homes.

This proposal also allows high performance water heating equipment to be installed as an exception in lieu of improving the hot water distribution. The improvement in water heating equipment has a significant impact on the overall energy used for hot water in a home. The following table from ACEEE shows estimated annual energy use by equipment type, with the bold equipment selected for the exceptions.

Water Heater Type	Efficiency (EF)	Yearly Energy Cost
Conventional gas storage	0.60	$350
High-efficiency gas storage	0.65	$323
Condensing gas storage	**0.80**	**$262**
Demand gas (no pilot)	**0.82**	**$228**
Conventional oil-fired storage	0.55	$654
Minimum Efficiency electric storage	0.90	$463
High-eff. electric storage	0.95	$439
Electric heat pump water heater	**2.20**	**$190**
Solar with electric back-up	**1.20**	**$175**

source: http://www.aceee.org/consumerguide/waterheating.htm

Electric tankless demand water heating, while not analyzed by ACEEE in the study above, is also included due to increased EF ratings compared to electric storage as an exception with an additional requirement for insulation or the length of pipe serviced by the equipment. This additional requirement is meant to limit the electric demand impact and also improve the distribution efficiency for improved system performance. Literature shows that electric tankless heaters have very high efficiency ratings (around 0.98 and 0.99) and have opportunity to save significant energy when coupled with reduced distribution losses.

The US DOE (http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13060) states that "insulating your hot water pipes reduces heat loss and can raise water temperature 2ºF–4ºF hotter than uninsulated pipes can deliver, allowing for a lower water temperature setting". This is the main reason for having a strong focus on improving the hot water distribution which will allow for reduced energy use on the overall hot water system. The DOE also recommends insulation of all accessible hot water pipes, with the most important being within 3 feet of the water heater.

In addition to the insulation language, this proposal also adds language that requires a heat trap for systems that are not supplied with a heat trap. This language is exactly based on section 504.4 of the IECC and is being included to ensure that more energy is not lost from the hot water equipment to the piping based on the recommendation from the DOE: http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=13100

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

ICCFILENAME: PRINDLE-EC-24-403.4-N1103.4

Public Hearing Results

PART II – IRC

Committee Action: Disapproved

Committee Reason: This is an issue that should be dealt with in the plumbing section of the IRC.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1103.4 Service water heating. Service hot water piping shall be installed in accordance with Sections ~~403.4.1~~ N1103.4.1 through ~~403.4.3~~ N1103.4.3.

N1103.4.1 Pipe length and Insulation. Service hot water piping shall be no more than a total of 120 ~~60~~ linear feet of total developed pipe length to all fixtures being served by one service water heating unit. All service hot water piping shall be insulated to at least R-3 for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter for the distance between the service water heating equipment to within 5 feet of each fixture connected to the hot water pipe. In addition, the first 5 feet of hot and cold water pipes from the storage tank for non-recirculating service water heating systems shall be insulated to at least R-3 for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter.

> ~~**Exception**: Hot water distribution systems that supply hot water from one of the following sources (this exception does not apply to portions of hot water distribution systems located below ground or in a mass floor or mass wall in contact with the ground):~~
>
> ~~1. Condensing gas service water heating equipment,~~
> ~~2. Solar thermal water heating equipment that is designed to provide more than 50 percent of annual hot water requirements from solar heated water,~~
> ~~3. Heat pump electric service water heating equipment,~~
> ~~4. Tankless demand service gas water heating equipment, or~~
> ~~5. Tankless demand service electric heating equipment, where either:~~
> ~~5.1 Heated water is provided through piping that is insulated to R-3 or~~
> ~~5.2 There is no more than a total of 15 linear feet of pipe length to all fixtures being served by each unit.~~

N1103.4.2 Circulating hot water systems. All circulating service hot water piping shall be insulated to at least R-3 for pipes sized 1 inch in diameter or less and R-4 for pipes larger than 1 inch in diameter. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

N1103.4.3 Heat Traps. Water heating equipment not supplied with integral heat traps and serving non-circulating systems shall be provided with heat traps on the supply and discharge piping associated with the equipment.

Commenter's Reason: *EC114 should be approved as modified by this public comment.*

EC114, as modified in this public comment, will bring substantial savings through increased efficiency in hot water heating systems. Although the original EC114 proposed a variety of equipment alternatives that, if selected, would have saved additional energy, the concern was raised at the Committee Hearings that these provisions may risk legal challenges on the basis of federal preemption. Although we do not necessarily believe the original proposal to be preempted, we do not want to risk subjecting the 2010 IECC and IRC to lengthy delays due to litigation.

The modification above removes the alternatives to insulation and pipe length and adds the industry term of "total developed pipe length" to set the requirements for increasing the energy efficiency of the hot water distribution system. The modification also increases the maximum length of total developed pipe length to be served by a single system in an effort to ease the requirement somewhat based on comments at the Development Committee hearing.

This proposal, as modified, will save more energy than other proposals because it requires both a minimum level of R-value insulation for all service hot water piping, as well as placing limits on pipe length (shorter pipes mean less hot water sitting in pipes to get cold). Equally important, this proposal is straightforward and will not be difficult to apply or to enforce, since it does not create exceptions for various types of piping and/or vary the insulation level depending on pipe length. As a result, this proposal will decrease the cost of construction by encouraging improved designs of hot water distribution systems while saving energy and water over the lifetime of the home.

Final Action: AS AM AMPC____ D

EC115-09/10-PART I
403.4

Proposed Change as Submitted

Proponent: Michael Resetar, Armacell LLC; Roger Schmidt, K-Flex USA; Shawn Dunahue, Nomaco Insulation

PART I – IECC

Revise as follows:

403.4 Circulating hot water systems. All circulating service hot water piping shall be insulated to at least ~~R-2~~ R-4. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

Reason: Shifting from an R-2 requirement to an R-4 insulation requirement helps achieve 29.4% gain in performance efficiency. Focusing on all hot water piping will not only target energy efficiency but also help reduce water waste by maintaining a temperature above 105°F longer between uses. (Supporting Documents Attached)

Past History:

IRC 2009/2010: (Proposal)
Increase all insulation to R-4
R-4 on Flat Surface calculation is equal a thickness of 1"
R-4 on Radial Surface calculation is equal a thickness of ¾"

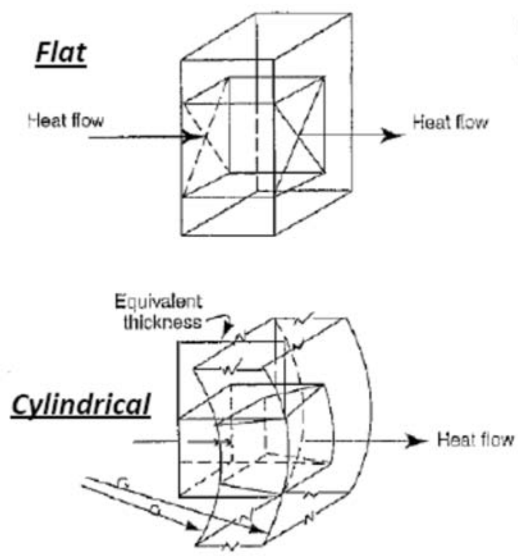
TARGET:
30% Conservation Savings Achieved shifting from R-2 to R-4

	Summer Performance		Winter Performance	
Conditional Information	**R-2**	**R-3**	**R-2**	**R-3**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	1.60
Outer diameter of pipe (inches)	0.875	0.875	0.875	0.875
Required thickness of insulation (inches)	0.36	0.49	0.36	0.49
Heat Flow of Pipe (Btu/(lin ft-h)	5.9	5.1	11.0	9.5
Btu savings	0.8		1.5	
Saving in %	13.6%		13.6%	
	Summer Performance		**Winter Performance**	
Conditional Information	**R-3**	**R-4**	**R-3**	**R-4**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	1.60
Outer diameter of pipe (inches)	0.875	0.875	0.875	0.875
Required thickness of insulation (inches)	0.49	0.76	0.49	0.76
Heat Flow of Pipe (Btu/(lin ft-h)	5.1	4.2	9.5	7.7
Btu savings	0.9		1.8	
Saving in %	17.6%		18.9%	
	Summer Performance		**Winter Performance**	
Conditional Information	**R-2**	**R-4**	**R-2**	**R-4**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	1.60

Outer diameter of pipe (inches)	0.875	0.875	0.875	0.875
Required thickness of insulation (inches)	0.36	0.76	0.36	0.76
Heat Flow of Pipe (Btu/(lin ft-h)	5.9	4.2	11.0	7.7
Btu savings	1.7		3.3	
Saving in %	28.8%		30.0%	

Data provided based on elastomeric pipe insulation

Don't compare typical flat sheet insulation "R" values with cylindrical pipe insulation "R" values.



Cylindrical Pipe Insulation "R" value Calculation:

$$R = \frac{r2 \ln\left(\frac{r2}{r1}\right)}{k}$$

Where r_1 = uninsulated pipe radius in inches
r_2 = insulated pipe radius in inches
k = thermal conductivity.

This equation yields an *"R"* value on a ***square foot basis***

R" value or thermal resistance is a measure of the ability of a material to retard heat flow. "R" is the numerical reciprocal of "C" (thermal conductance). Thermal resistance is used in combination with numerals to designate thermal resistance values. The higher the "R" value the higher the insulating value. This value is normally calculated on a square foot basis.

Flat Sheet Calculation Example:

$$R = \frac{\text{Thickness of Material}}{\text{Material Thermal Conductivity}}$$

Sheet Insulation Thickness: 2"
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting "R" Value : R-8.0 *(R-8 equals 8 resistance units)*

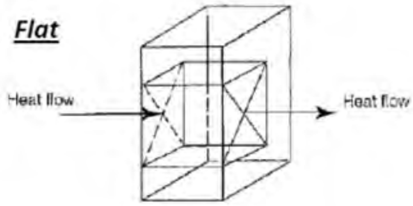
(*) It is common knowledge that with flat layer of insulation increasing the "R" value increases the thermal efficiency by the same factor.

The simple relations for flat sheet insulation do not hold true for when looking at cylindrical pipe insulations. For these materials, heat flow is not the simple straight –through heat flow found in flat surface/sheet material, but rather a radial heat flow. The reasoning is based on that fact that the inner radius surface area is much smaller than the outer radius surface area.

These differences in surface area support the need to calculate heat flow must be done using an equivalent thickness. For cylindrical pipe insulation the **Cylindrical Pipe Insulation "R" value Calculation** detailed above.

Don't compare typical flat sheet insulation "R" values with cylindrical pipe insulation "R" values.

Flat



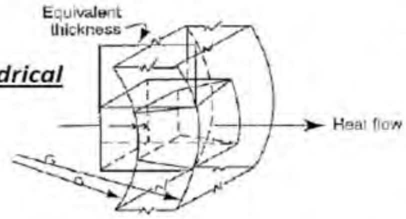
$$R = \frac{\text{Thickness of Flat Sheet Material}}{\text{Material Thermal Conductivity}}$$

Wall Thickness (inches)

	3/8	1/2	3/4	1	1-1/2	2
R-Value	1.6	2.1	3.1	4.2	6	8

Insulation Thermal Conductivity: 0.25 Btu•in/h•ft²•°F

Cylindrical



Cylindrical Pipe Insulation "R" value Calculation:

$$R = \frac{r2\ln(\frac{r2}{r1})}{k}$$

Wall Thickness

Pipe Insulation ID Size	Nom. 3/8	Nom. 1/2	Nom. 3/4	Nom. 1	Nom. 1-1/2
3/8	2.9	3.4	5.7	7.4	—
1/2	2.7	3.3	5.6	7.2	—
5/8	2.5	3.3	5.5	7.1	11.4
3/4	2.4	3.3	5.4	6.9	10.8
7/8	2.3	3.3	5.4	6.9	10.3
1-1/8	2.2	3.2	5.3	7.2	9.6
1-3/8	2.1	3.1	5.1	7.3	9.0
1-5/8	2.4	3.1	4.9	7.2	8.6
1-1/2 IPS	2.3	3.1	4.8	6.9	8.3
2-1/8	2.3	3.1	4.7	6.7	8.1
2 IPS	2.2	3.1	4.6	6.6	7.8
2-5/8	2.2	3.0	4.5	6.4	7.7
2-1/2 IPS	2.2	3.0	4.4	6.3	7.5
3-1/8	2.2	2.9	4.3	6.2	7.4
3 IPS	2.1	2.9	4.3	6.1	7.2
3-5/8	2.1	2.9	4.2	6.0	7.1
4-1/8	2.1	2.8	4.2	5.9	7.0
4 IPS	2.1	2.8	4.1	5.8	6.8
5 IPS	2.1	2.8	4.0	5.6	6.6
6 IPS	2.0	2.7	3.9	5.6	6.4

Insulation Thermal Conductivity: 0.25 Btu•in/h•ft²•°F

Past History:

IRC 2000:
Had Table N1103.5

PIPING SYSTEM TYPES	FLUID TEMP RANGE (ºF)	INSULATION THICKNESS inches[b]
Heating systems		
Low pressure/temperature	201-250	1.5
Low temperature	120-200	1.0
Steam condensate (for feed water)	Any	1.5
Cooling systems		
Chilled water, refrigerant or brine	40-55	0.75
	Below 40	1.25

For SI: 1 inch = 25.4 mm, ºC = [(ºF)–32]/1.8.

a. The pipe insulation thicknesses specified in this table are based on insulation *R*-values ranging from R-4 to R-4.6 per inch of thickness. For materials with an *R*-value greater than R-4.6, the insulation thickness specified in this table may be reduced as follows:

$$\text{New Minimum Thickness} = \frac{4.6 \times \text{Table Thickness}}{\text{Actual R-Value}}$$

For materials with an R-value less than R-4, the minimum insulation thickness shall be increased as follows:

$$\text{New Minimum Thickness} = \frac{4.0 \times \text{Table Thickness}}{\text{Actual R-Value}}$$

b. For piping exposed to outdoor air, increase thickness by 0.5 inch.

Cold/Chilled Water Temperature: 40°F - 55°F (Insulation Thickness= ¾”)
Low Temperature: 120°F - 200°F (Insulation Thickness= 1”)

IRC 2003:
Had Table N1103.5

PIPING SYSTEM TYPES	**FLUID TEMP RANGE (°F)**	**INSULATION THICKNESS (inches)[b]**
Heating systems		
Low pressure/temperature	201-250	1.5
Low temperature	120-200	1.0
Steam condensate (for feed water)	Any	1.5
Cooling systems		
Chilled water, refrigerant or brine	40-55	0.75
	Below 40	1.25

For SI: 1 inch = 25.4 mm, °C =[(°F)-32]/1.8.

a. The pipe insulation thicknesses specified in this table are based on insulation *R*-values ranging from R-4 to R-4.6 per inch of thickness. For materials with an *R*-value greater than R-4.6, the insulation thickness specified in this table may be reduced as follows:

$$\text{New Minimum Thickness} = \frac{4.6 \times \text{Table Thickness}}{\text{Actual } R\text{-Value}}$$

For materials with an *R*-value less than R-4, the minimum insulation thickness shall be increased as follows:

$$\text{New Minimum Thickness} = \frac{4.0 \times \text{Table Thickness}}{\text{Actual } R\text{-Value}}$$

b. For piping exposed to outdoor air, increase thickness by 0.5 inch.

Cold/Chilled Water Temperature: 40°F - 55°F (Insulation Thickness= ¾”)
Low Temperature: 120°F - 200°F (Insulation Thickness= 1”)

IRC 2006:
Removed Table N1103.5
Moved all insulation to R-2
R-2 on Flat Surface calculation is equal a thickness of ½”
R-2 on Radial Surface calculation is equal a thickness of 3/8”

IRC 2007/2008:
All insulation remained at R-2
R-2 on Flat Surface calculation is equal a thickness of ½”
R-2 on Radial Surface calculation is equal a thickness of 3/8”

IRC 2009/2010: (Proposal)
Increase all insulation to R-4
R-4 on Flat Surface calculation is equal a thickness of 1”
R-4 on Radial Surface calculation is equal a thickness of ¾”

TARGET:
30% Conservation Savings Achieved shifting from R-2 to R-4

	Summer Performance		**Winter Performance**	
Conditional Information	**R-2**	**R-3**	**R-2**	**R-3**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	1.60
Outer diameter of pipe (inches)	0.875	0.875	0.875	0.875
Required thickness of insulation (inches)	0.36	0.49	0.36	0.49
Heat Flow of Pipe (Btu/(lin ft-h)	5.9	5.1	11.0	9.5
Btu savings	0.8		1.5	

	Summer Performance		Winter Performance	
Saving in %	13.6%		13.6%	
	Summer Performance		**Winter Performance**	
Conditional Information	**R-3**	**R-4**	**R-3**	**R-4**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	1.60
Outer diameter of pipe (inches)	0.875	0.875	0.875	0.875
Required thickness of insulation (inches)	0.49	0.76	0.49	0.76
Heat Flow of Pipe (Btu/(lin ft-h)	5.1	4.2	9.5	7.7
Btu savings	0.9		1.8	
Saving in %	17.6%		18.9%	
	Summer Performance		**Winter Performance**	
Conditional Information	**R-2**	**R-4**	**R-2**	**R-4**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
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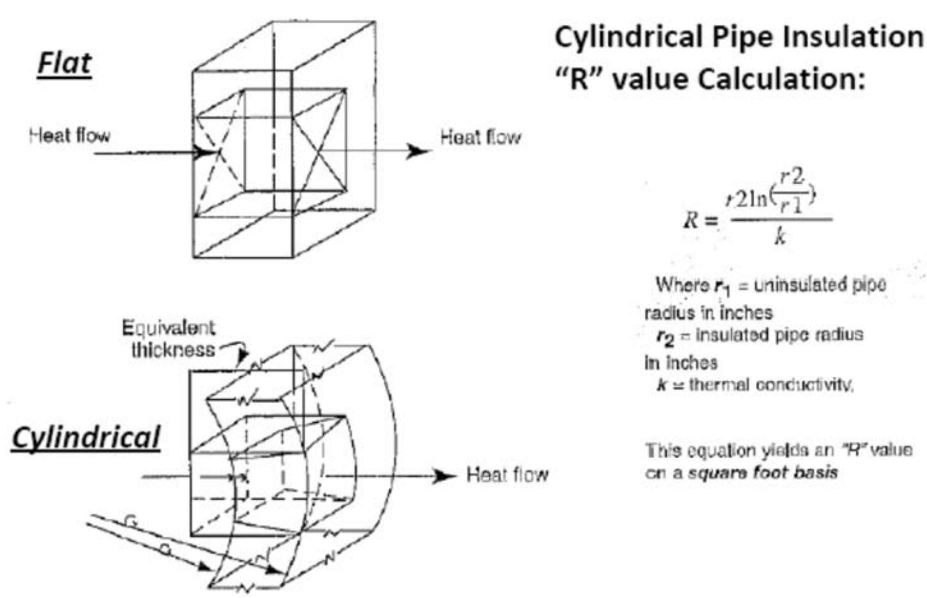
Heat Flow of Pipe (Btu/(lin ft-h)	5.9	4.2	11.0	7.7
Btu savings	1.7		3.3	
Saving in %	28.8%		30.0%	

Data provided based on elastomeric pipe insulation

Don’t compare typical flat sheet insulation “R” values with cylindrical pipe insulation “R” values.



R” value or thermal resistance is a measure of the ability of a material to retard heat flow. “R” is the numerical reciprocal of “C” (thermal conductance). Thermal resistance is used in combination with numerals to designate thermal resistance values. The higher the “R” value the higher the insulating value. This value is normally calculated on a square foot basis.

Flat Sheet Calculation Example:

$$R = \frac{\text{Thickness of Material}}{\text{Material Thermal Conductivity}}$$

Sheet Insulation Thickness: 2"
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting "R" Value : R-8.0 *(R-8 equals 8 resistance units)*

(*) It is common knowledge that with flat layer of insulation increasing the "R" value increases the thermal efficiency by the same factor.

The simple relations for flat sheet insulation do not hold true for when looking at cylindrical pipe insulations. For these materials, heat flow is not the simple straight –through heat flow found in flat surface/sheet material, but rather a radial heat flow. The reasoning is based on that fact that the inner radius surface area is much smaller than the outer radius surface area.

These differences in surface area support the need to calculate heat flow must be done using an equivalent thickness. For cylindrical pipe insulation the **Cylindrical Pipe Insulation "R" value Calculation** detailed above.

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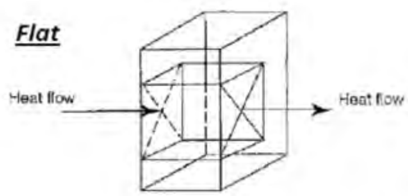
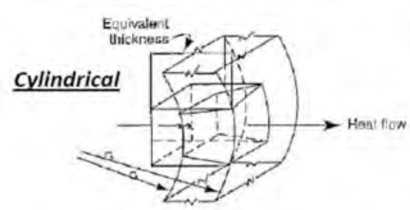


$$R = \frac{\text{Thickness of Flat Sheet Material}}{\text{Material Thermal Conductivity}}$$

Wall Thickness (inches)

	3/8	1/2	3/4	1	1-1/2	2
R-Value	1.6	2.1	3.1	4.2	6	8

Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F



Cylindrical Pipe Insulation "R" value Calculation:

$$R = \frac{r2 \ln(\frac{r2}{r1})}{k}$$

Wall Thickness

Pipe Insulation ID Size	Nom. 3/8	Nom. 1/2	Nom. 3/4	Nom. 1	Nom. 1-1/2
3/8	2.9	3.4	5.7	7.4	—
1/2	2.7	3.3	5.6	7.2	—
5/8	2.5	3.3	5.5	7.1	11.4
3/4	2.4	3.3	5.4	6.9	10.8
7/8	2.3	3.3	5.4	6.9	10.3
1-1/8	2.2	3.2	5.3	7.2	9.6
1-3/8	2.1	3.1	5.1	7.3	9.0
1-5/8	2.4	3.1	4.9	7.2	8.6
1-1/2 IPS	2.3	3.1	4.8	6.9	8.3
2-1/8	2.3	3.1	4.7	6.7	8.1
2 IPS	2.2	3.1	4.6	6.6	7.8
2-5/8	2.2	3.0	4.5	6.4	7.7
2-1/2 IPS	2.2	3.0	4.4	6.3	7.5
3-1/8	2.2	2.9	4.3	6.2	7.4
3 IPS	2.1	2.9	4.3	6.1	7.2
3-5/8	2.1	2.9	4.2	6.0	7.1
4-1/8	2.1	2.8	4.2	5.9	7.0
4 IPS	2.1	2.8	4.1	5.8	6.8
5 IPS	2.1	2.8	4.0	5.6	6.6
6 IPS	2.0	2.7	3.9	5.5	6.4

Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F

Cost Impact: Shifting from an R-2 requirement to an R-4 insulation requirement helps achieve 29.4% gain in performance efficiency.

ICCFILENAME: RESETAR-SCHMIDT-DUNAHUE-EC-1-403.4-RE-2-N1103.4

Public Hearing Results

PART I - IECC
Committee Action: Disapproved

Committee Reason: Insulation of circulating service hot water piping is covered in EC13. The committee was not sure that, given EC13, this proposed increase is necessary.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, requests Disapproval.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

It is our opinion that this topic, hot-water pipe insulation, is better addressed in the EC13 proposal, and therefore we recommend disapproval of EC112 Part I to be consistent with Part II.

Final Action: AS AM AMPC____ D

EC115-09/10-PART II
N1103.4

Proposed Change as Submitted

Proponent: Michael Resetar, Armacell LLC; Roger Schmidt, K-Flex USA; Shawn Dunahue, Nomaco Insulation

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1103.4 Circulating hot water systems. All circulating service hot water piping shall be insulated to at least ~~R-2~~ R-4. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

Reason: Shifting from an R-2 requirement to an R-4 insulation requirement helps achieve 29.4% gain in performance efficiency. Focusing on all hot water piping will not only target energy efficiency but also help reduce water waste by maintaining a temperature above 105°F longer between uses. (Supporting Documents Attached)

Past History:

IRC 2009/2010: (Proposal)
Increase all insulation to R-4
R-4 on Flat Surface calculation is equal a thickness of 1"
R-4 on Radial Surface calculation is equal a thickness of ¾"

TARGET:
30% Conservation Savings Achieved shifting from R-2 to R-4

	Summer Performance		Winter Performance	
Conditional Information	**R-2**	**R-3**	**R-2**	**R-3**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	1.60
Outer diameter of pipe (inches)	0.875	0.875	0.875	0.875
Required thickness of insulation (inches)	0.36	0.49	0.36	0.49
Heat Flow of Pipe (Btu/(lin ft-h)	5.9	5.1	11.0	9.5
Btu savings	0.8		1.5	
Saving in %	13.6%		13.6%	
	Summer Performance		Winter Performance	
Conditional Information	**R-3**	**R-4**	**R-3**	**R-4**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	1.60
Outer diameter of pipe (inches)	0.875	0.875	0.875	0.875
Required thickness of insulation (inches)	0.49	0.76	0.49	0.76
Heat Flow of Pipe (Btu/(lin ft-h)	5.1	4.2	9.5	7.7
Btu savings	0.9		1.8	
Saving in %	17.6%		18.9%	
	Summer Performance		Winter Performance	
Conditional Information	**R-2**	**R-4**	**R-2**	**R-4**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264

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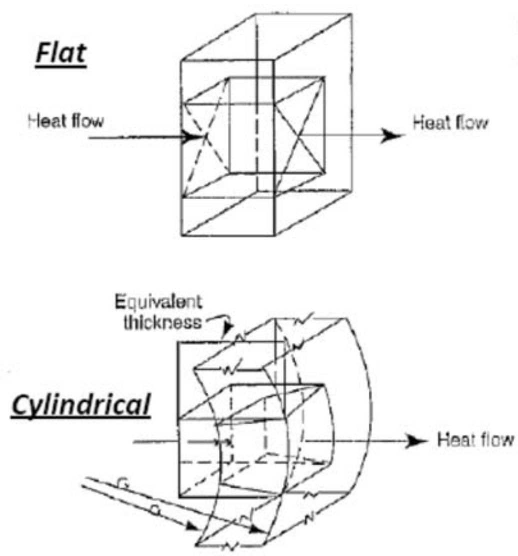
Heat Flow of Pipe (Btu/(lin ft-h)	5.9	4.2	11.0	7.7
Btu savings	1.7		3.3	
Saving in %	28.8%		30.0%	

Data provided based on elastomeric pipe insulation

Don't compare typical flat sheet insulation "R" values with cylindrical pipe insulation "R" values.



Cylindrical Pipe Insulation "R" value Calculation:

$$R = \frac{r2 \ln(\frac{r2}{r1})}{k}$$

Where r_1 = uninsulated pipe radius in inches
r_2 = insulated pipe radius in inches
k = thermal conductivity.

This equation yields an "R" value on a ***square foot basis***

R" value or thermal resistance is a measure of the ability of a material to retard heat flow. "R" is the numerical reciprocal of "C" (thermal conductance). Thermal resistance is used in combination with numerals to designate thermal resistance values. The higher the "R" value the higher the insulating value. This value is normally calculated on a square foot basis.

Flat Sheet Calculation Example:

R = $\frac{\textit{Thickness of Material}}{\textit{Material Thermal Conductivity}}$

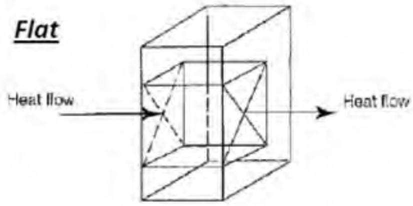
Sheet Insulation Thickness: 2"
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting "R" Value : R-8.0 *(R-8 equals 8 resistance units)*

(*) It is common knowledge that with flat layer of insulation increasing the "R" value increases the thermal efficiency by the same factor.

The simple relations for flat sheet insulation do not hold true for when looking at cylindrical pipe insulations. For these materials, heat flow is not the simple straight –through heat flow found in flat surface/sheet material, but rather a radial heat flow. The reasoning is based on that fact that the inner radius surface area is much smaller than the outer radius surface area.

These differences in surface area support the need to calculate heat flow must be done using an equivalent thickness. For cylindrical pipe insulation the **Cylindrical Pipe Insulation "R" value Calculation** detailed above.

Don't compare typical flat sheet insulation "R" values with cylindrical pipe insulation "R" values.

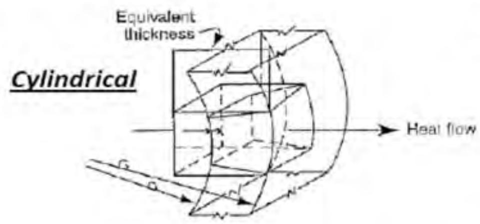


$$R = \frac{\text{Thickness of Flat Sheet Material}}{\text{Material Thermal Conductivity}}$$

Wall Thickness (inches)

	3/8	1/2	3/4	1	1-1/2	2
R-Value	1.6	2.1	3.1	4.2	6	8

Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F



Cylindrical Pipe Insulation "R" value Calculation:

$$R = \frac{r2\ln(\frac{r2}{r1})}{k}$$

Wall Thickness

Pipe Insulation ID Size	Nom. 3/8	Nom. 1/2	Nom. 3/4	Nom. 1	Nom. 1-1/2
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5/8	2.5	3.3	5.5	7.1	11.4
3/4	2.4	3.3	5.4	6.9	10.8
7/8	2.3	3.3	5.4	6.9	10.3
1-1/8	2.2	3.2	5.3	7.2	9.6
1-3/8	2.1	3.1	5.1	7.3	9.0
1-5/8	2.4	3.1	4.9	7.2	8.6
1-1/2 IPS	2.3	3.1	4.8	6.9	8.3
2-1/8	2.3	3.1	4.7	6.7	8.1
2 IPS	2.2	3.1	4.6	6.6	7.8
2-5/8	2.2	3.0	4.5	6.4	7.7
2-1/2 IPS	2.2	3.0	4.4	6.3	7.5
3-1/8	2.2	2.9	4.3	6.2	7.4
3 IPS	2.1	2.9	4.3	6.1	7.2
3-5/8	2.1	2.9	4.2	6.0	7.1
4-1/8	2.1	2.8	4.2	5.9	7.0
4 IPS	2.1	2.8	4.1	5.8	6.8
5 IPS	2.1	2.8	4.0	5.6	6.6
6 IPS	2.0	2.7	3.9	5.5	6.4

Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F

Past History:

IRC 2000:
Had Table N1103.5

PIPING SYSTEM TYPES	FLUID TEMP RANGE (ºF)	INSULATION THICKNESS inches[b]
Heating systems		
Low pressure/temperature	201-250	1.5
Low temperature	120-200	1.0
Steam condensate (for feed water)	Any	1.5
Cooling systems		
Chilled water, refrigerant or brine	40-55	0.75
	Below 40	1.25

For SI: 1 inch = 25.4 mm, ºC = [(ºF)–32]/1.8.

a. The pipe insulation thicknesses specified in this table are based on insulation *R*-values ranging from R-4 to R-4.6 per inch of thickness. For materials with an *R*-value greater than R-4.6, the insulation thickness specified in this table may be reduced as follows:

$$\text{New Minimum Thickness} = \frac{4.6 \times \text{Table Thickness}}{\text{Actual R-Value}}$$

For materials with an R-value less than R-4, the minimum insulation thickness shall be increased as follows:

$$\text{New Minimum Thickness} = \frac{4.0 \times \text{Table Thickness}}{\text{Actual R-Value}}$$

b. For piping exposed to outdoor air, increase thickness by 0.5 inch.

Cold/Chilled Water Temperature: 40°F - 55°F (Insulation Thickness= ¾")
Low Temperature: 120°F - 200°F (Insulation Thickness= 1")

IRC 2003:
Had Table N1103.5

PIPING SYSTEM TYPES	FLUID TEMP RANGE (°F)	INSULATION THICKNESS (inches)[b]
Heating systems		
Low pressure/temperature	201-250	1.5
Low temperature	120-200	1.0
Steam condensate (for feed water)	Any	1.5
Cooling systems		
Chilled water, refrigerant or brine	40-55	0.75
	Below 40	1.25

For SI: 1 inch = 25.4 mm, °C =[(°F)-32]/1.8.

a. The pipe insulation thicknesses specified in this table are based on insulation *R*-values ranging from R-4 to R-4.6 per inch of thickness. For materials with an *R*-value greater than R-4.6, the insulation thickness specified in this table may be reduced as follows:

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Cold/Chilled Water Temperature: 40°F - 55°F (Insulation Thickness= ¾")
Low Temperature: 120°F - 200°F (Insulation Thickness= 1")

IRC 2006:
Removed Table N1103.5
Moved all insulation to R-2
R-2 on Flat Surface calculation is equal a thickness of ½"
R-2 on Radial Surface calculation is equal a thickness of 3/8"

IRC 2007/2008:
All insulation remained at R-2
R-2 on Flat Surface calculation is equal a thickness of ½"
R-2 on Radial Surface calculation is equal a thickness of 3/8"

IRC 2009/2010: (Proposal)
Increase all insulation to R-4
R-4 on Flat Surface calculation is equal a thickness of 1"
R-4 on Radial Surface calculation is equal a thickness of ¾"

TARGET:
30% Conservation Savings Achieved shifting from R-2 to R-4

	Summer Performance		Winter Performance	
Conditional Information	**R-2**	**R-3**	**R-2**	**R-3**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	1.60
Outer diameter of pipe (inches)	0.875	0.875	0.875	0.875
Required thickness of insulation (inches)	0.36	0.49	0.36	0.49
Heat Flow of Pipe (Btu/(lin ft-h)	5.9	5.1	11.0	9.5
Btu savings	0.8		1.5	

Saving in %	13.6%		13.6%	
	Summer Performance		**Winter Performance**	
Conditional Information	**R-3**	**R-4**	**R-3**	**R-4**
Line temperature °F	40.0	40.0	105.0	105.0
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Heat Flow of Pipe (Btu/(lin ft-h)	5.1	4.2	9.5	7.7
Btu savings	0.9		1.8	
Saving in %	17.6%		18.9%	
	Summer Performance		**Winter Performance**	
Conditional Information	**R-2**	**R-4**	**R-2**	**R-4**
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Btu savings	1.7		3.3	
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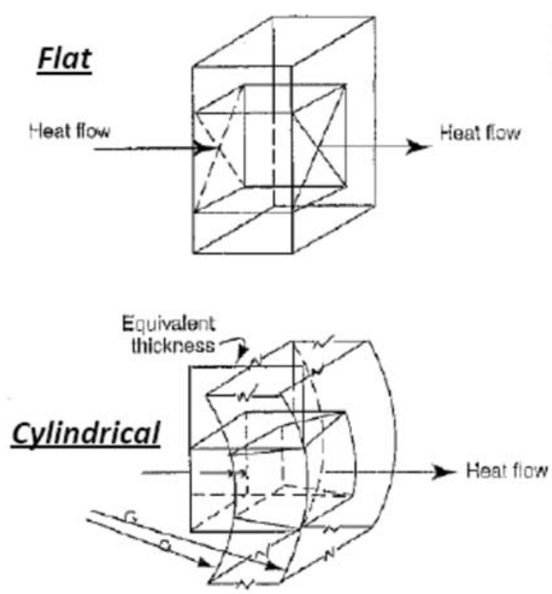

Cylindrical Pipe Insulation "R" value Calculation:

$$R = \frac{r2 \ln\left(\frac{r2}{r1}\right)}{k}$$

Where r_1 = uninsulated pipe radius in inches
r_2 = insulated pipe radius in inches
k = thermal conductivity.

This equation yields an "R" value on a ***square foot basis***

R" value or thermal resistance is a measure of the ability of a material to retard heat flow. "R" is the numerical reciprocal of "C" (thermal conductance). Thermal resistance is used in combination with numerals to designate thermal resistance values. The higher the "R" value the higher the insulating value. This value is normally calculated on a square foot basis.

Flat Sheet Calculation Example:

$$R = \frac{\textit{Thickness of Material}}{\textit{Material Thermal Conductivity}}$$

Sheet Insulation Thickness: 2"
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting "R" Value : R-8.0 *(R-8 equals 8 resistance units)*

(*) It is common knowledge that with flat layer of insulation increasing the "R" value increases the thermal efficiency by the same factor.

The simple relations for flat sheet insulation do not hold true for when looking at cylindrical pipe insulations. For these materials, heat flow is not the simple straight –through heat flow found in flat surface/sheet material, but rather a radial heat flow. The reasoning is based on that fact that the inner radius surface area is much smaller than the outer radius surface area.

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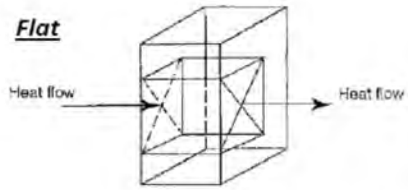
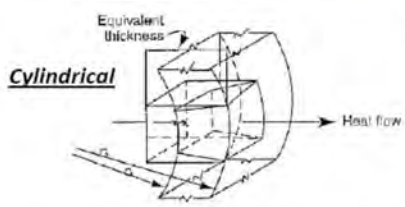


$$R = \frac{\textit{Thickness of Flat Sheet Material}}{\textit{Material Thermal Conductivity}}$$

Wall Thickness (inches)

	3/8	1/2	3/4	1	1-1/2	2
R-Value	1.6	2.1	3.1	4.2	6	8

Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F



Cylindrical Pipe Insulation "R" value Calculation:

$$R = \frac{r2\ln(\frac{r2}{r1})}{k}$$

Wall Thickness

Pipe Insulation ID Size	Nom. 3/8	Nom. 1/2	Nom. 3/4	Nom. 1	Nom. 1-1/2
3/8	2.9	3.4	5.7	7.4	—
1/2	2.7	3.3	5.6	7.2	—
5/8	2.5	3.3	5.5	7.1	11.4
3/4	2.4	3.3	5.4	6.9	10.8
7/8	2.3	3.3	5.4	6.9	10.3
1-1/8	2.2	3.2	5.3	7.2	9.6
1-3/8	2.1	3.1	5.1	7.3	9.0
1-5/8	2.4	3.1	4.9	7.2	8.6
1-1/2 IPS	2.3	3.1	4.8	6.9	8.3
2-1/8	2.3	3.1	4.7	6.7	8.1
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2-5/8	2.2	3.0	4.5	6.4	7.7
2-1/2 IPS	2.2	3.0	4.4	6.3	7.5
3-1/8	2.2	2.9	4.3	6.2	7.4
3 IPS	2.1	2.9	4.3	6.1	7.2
3-5/8	2.1	2.9	4.2	6.0	7.1
4-1/8	2.1	2.8	4.2	5.9	7.0
4 IPS	2.1	2.8	4.1	5.8	6.8
5 IPS	2.1	2.8	4.0	5.6	6.6
6 IPS	2.0	2.7	3.9	5.5	6.4

Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F

Cost Impact: Shifting from an R-2 requirement to an R-4 insulation requirement helps achieve 29.4% gain in performance efficiency.

Public Hearing Results

PART II – IRC

Committee Action: **Approved as Submitted**

Committee Reason: See the proponent's reason statement.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC, and Craig Conner, Building Quality requests Disapproval.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

It is our opinion that this topic, hot-water pipe insulation, is better addressed in the EC13 proposal, and therefore we recommend disapproval of EC112 Part I to be consistent with Part II.

Final Action: AS AM AMPC____ D

EC119-09/10-PART I

202 (New), 403.5 (New), Chapter 6

NOTE: PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS ON THE CONSENT AGENDA, PART II IS REPRODUCED ONLY FOR INFORMATION PURPOSES FOLLOWING ALL OF PART I.

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART I – IECC

Add new text as follows:

DESUPERHEATER/WATER HEATER. A factory-made assembly of elements by which the flows of refrigerant vapor and water are maintained in such heat transfer relationship that the refrigerant vapor is desuper-heated and the water is heated. A water circulating pump may be included as part of the assembly.

403.5 Desuperheater (Prescriptive). A desuperheater water heater tested and listed in accordance with ARI 470 and connected to the hot water storage tank shall be provided for a vapor compression air conditioner or heat pump with a cooling capacity of 3 tons or more installed in climate zones 1 and 2. Where multiple air conditioners or heat pumps and hot water storage tanks are installed only one of each shall be required to have a desuperheater.

Exceptions:

1. Heat pump water heaters
2. Water heaters provided with solar heating systems having a minimum Solar Fraction of 0.30 when tested in accordance with OG-300

2. Add new standards to Chapter 6 as follows:

AHRI
470-06 Performance Rating of Desuperheater/Water Heaters

SRCC
OG-300 Operating Guidelines and Minimum Standards for Certifying Solar Water Heating Systems

Reason: There is considerable heat rejected in the summer by cooling equipment that can be reclaimed and used for other purposes. One such purpose that all residential buildings have is domestic hot water. Desuperheater/water heaters are simply a heat exchanger that transfers heat from the hot gas side of the cooling equipment to the hot water storage tank. Ten to 30% of the condenser heat rejected can be reclaimed and used to heat water at a rate of 5 to 8 gallons per hour per ton of cooling capacity. For a typical 3 ton central air conditioning unit, a desuperheater could provide a full tank of hot water every 3 hours.. Desuperheater savings estimates are shown in the table below *(source Energy Sta*r), for a typical household and an electric rate of 8¢ per kWh.

City	Annual Energy Savings From Desuperheater		
	(kWh/yr)	% of Total Hot Water Load	Cost Savings
Tampa	1910	40%	$153
Las Vegas	1410	32%	$113
Fort Worth	1210	25%	$97
Atlanta	910	18%	$73
Raleigh	820	16%	$66
Washington	790	15%	$63
Chicago	580	10%	$46

Source: Lawrence Berkeley National Laboratory. Estimates assume a family of four, 52 gallon electric water heater, and a 3 ton central air conditioner. Air conditioner efficiency is 12.5vSEER in cooling-dominant climates and 10.4 SEER in heating-dominant climates.

At the NWPPC Regional Technology Forum in August 2008 cost information for 3 systems was provided that showed installed cost from $900 to $1500. Annual electricity savings were 2053 kwh in Portland, 1903 in Seattle, 2526 in Phoenix and 1617 in Los Angeles. At $0.08 per kwh electric cost the savings for the electricity savings above would range from $129 to $202 per year. Considering the installed cost above that yields a simple payback range of 4.5 to 11.6 years.

Another study below from Technical Update Bulletin 458 by Jim Dulley (2008) addresses the issue of electricity cost, hot water usage, and other factors.

Hot Water Cost and Savings — Table 1						
Family Size	Daily Hot Water Usage	Annual Water Heating Cost per Kw				
		8.0¢	8.5¢	9.0¢	9.5¢	10.0¢
2	40 gal.	$239	$254	$269	$284	$299
3	55 gal.	$329	$350	$370	$391	$412
4	70 gal.	$419	$445	$471	$498	$524
5	85 gal.	$509	$541	$572	$604	$636
6	100 gal.	$599	$636	$673	$711	$748

The annual cost includes both heating up cold water to replace the hot water you use and the loss of heat from your water heater and piping between your uses of hot water. Calculate the savings by multiplying the annual cost figure from the table by the fraction of the year that you operate your air conditioning (i.e. 6/12 or 8/12 or 4/12 etc.)

Payback Example — for a family of 4 with a 3 ton A/C, 6 months of cooling and 9.0¢ per KwH electricity

Average installed cost of heat recovery	$600.00
Less: Hot water savings (6/12 x $471 = 235.50)	235.50
Less: A/C improvement savings (6 x $13 = $78.00)	78.00
Net First Year Cost	$286.50

Cost Impact: The proposed change will increase the first cost of construction but decrease operating expenses so as to reduce the overall cost of operating the subject building an amount greater than the increase in first cost.

Analysis: A review of the standard(s) proposed for inclusion in the code, AHRI 470-06 and SRCC OG-300, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: MAJETTE-EC-68-202-403.5-CH 6-IRC-R202-N1103.5-CH 44

Public Hearing Results

Note: The following analysis was not in the Code Change Proposal book but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf:

Analysis: Review of the proposed new standard AHRI 470-06 indicated that, in the opinion of ICC staff, the standard did comply with ICC standards criteria.

PART I – IECC

Committee Action: Disapproved

Committee Reason: Proponent requested disapproval to allow him to clean up the language and work with industry on the requirements.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Ronald Majette, US Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows

DESUPERHEATER/WATER HEATER. A factory-made assembly of elements by which the flows of refrigerant vapor and water are maintained in such heat transfer relationship that the refrigerant vapor is desuper-heated and the water is heated, with or without the use of a ~~. A~~ water circulating pump ~~may be included as part of the assembly~~.

403.5 ~~Desuperheater~~ Water Heating Systems (Prescriptive). ~~A desuperheater water heater tested and listed in accordance with ARI 470 and connected to the hot water storage tank shall be provided for a vapor compression air conditioner or heat pump with a cooling capacity of 3 tons or more installed in climate zones 1 and 2. Where multiple air conditioners or heat pumps and hot water storage tanks are installed only one of each shall be required to have a desuperheater.~~

~~**Exceptions:**~~

1. ~~Heat pump water heaters~~
2. ~~Water heaters provided with solar heating systems having a minimum Solar Fraction of 0.30 when tested in accordance with OG-300~~

In climate zones 1 and 2 each dwelling unit shall be provided with one or a combination of the following:

1. a desuperheater water heater tested and listed in accordance with ARI 470
2. a heat pump water heater dedicated to providing potable hot water
3. a solar water heating system with a minimum Solar Fraction of 0.40 when tested in accordance with OG-300
4. a gas fired instantaneous water heater

AHRI
470-06 Performance Rating of Desuperheater/Water Heaters

SRCC
OG-300 Operating Guidelines and Minimum Standards for Certifying Solar Water Heating Systems

Commenter's Reason: DOE requested disapproval at the first hearing to allow DOE to work with industry and others to "enhance" the proposal to be more acceptable. During the first 6 months of 2010 DOE did that via a public meeting on May 10th and continual posting of the public comment on the DOE web site for input by interested parties. It also reached out to a number of entities that live and work in climate zones 1 and 2 for their input and recommendations. As the reason states in the original code change proposal, desuperheaters are cost effective in climate zones 1 and 2. More importantly as efforts continue to enhance the energy efficiency of homes through the IECC fewer opportunities exist in these climate zones to achieve energy savings through the thermal envelope. The original proposal focused only on desuperheaters as a technology to reduce energy use associated with heating water for potable purposes. Based on additional discussions with stakeholders in these climate zones the proposed changes to the code change add additional (heat pump water heater, solar water heating system and instantaneous water heater), allowing for a much more robust list of options from which to choose the most appropriate and cost effective technology application for the structure. Each of these technologies are cost effective over the life of the building and the technology in these climate zones and will provide for additional efficiency and cost savings that are increasingly more difficult to obtain through further stringency in thermal envelope, lighting or HVAC system criteria.

A heat pump water heater applied to a home with a hot water demand of 60 gpd would save 2,628 kWh/year installing a unit with a 2.5 EF over a standard electric resistance water heater. At $0.10 per kWh this yields $262 savings per year and the $1500 installation cost is paid back in less than 6 years (DOE).

Desuperheaters for residential applications cost $400 to $700 and in Tampa FL would yield a $153 per year energy cost savings (EPA). This yields at worst a 5 year payback.

Annual operating costs for an electric storage water heater are $463 and gas $350 and gas demand $262 (family of 4 at $0.095 per kWh and $1.40 per therm. This yields a cost savings from almost $100 to $200 dollars. The cost differential between gas demand and conventional storage is on the order of $900 (ACEEE) leading to at worst a payback of 9 years.

Savings from solar systems are on the order of 50 to 75% over conventional systems (ACEEE). Using the costs above for storage systems yields from $175 to $315 per year. Costs for passive systems installed are $1,000 to $2,000 and active systems, which produce 80 to 100 gallons of hot water per day, are $2,500 to $3,500. Based on the operational cost savings above such a system would have a payback as low as less than 4 years to upwards of 20 years.

These are examples from reputable sources. Certainly they cannot cover the myriad of conditions expected, which is why DOE has only proposed application of this provision to climate zones 1 and 2.

Final Action: AS AM AMPC____ D

NOTE: PART II REPRODUCED FOR INFORMATION PURPOSES ONLY – SEE ABOVE

PART II – IRC BUILDING/ENERGY

1. Add new text as follows:

DESUPERHEATER/WATER HEATER. A factory-made assembly of elements by which the flows of refrigerant vapor and water are maintained in such heat transfer relationship that the refrigerant vapor is desuper-heated and the water is heated. A water circulating pump may be included as part of the assembly.

N1103.5 Desuperheater. A desuperheater water heater tested and listed in accordance with ARI 470 and connected to the hot water storage tank shall be provided for a vapor compression air conditioner or heat pump with a cooling capacity of 3 tons or more installed in climate zones 1 and 2. Where multiple air conditioners or heat pumps and hot water storage tanks are installed only one of each shall be required to have a desuperheater.

Exceptions:

1. Heat pump water heaters
2. Water heaters provided with solar heating systems having a minimum Solar Fraction of 0.30 when tested in accordance with OG-300

2. Add new standards to Chapter 44 as follows:

AHRI
470-06 Performance Rating of Desuperheater/Water Heaters

SRCC
OG-300 Operating Guidelines and Minimum Standards for Certifying Solar Water Heating Systems

PART II – IRC

Committee Action: **Disapproved**

Committee Reason: Proponent requested disapproval to allow him to clean up the language and work with industry on the requirements.

Assembly Action: **None**

EC121-09/10-PART I
403.6, Table 403.6 (New), Chapter 6

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

1. Revise as follows:

403.6 Equipment sizing (Mandatory). Heating and cooling equipment shall be sized in accordance with Section 503.2.1, 503.2.2 and Table 403.6 ~~M1401.3 of the *International Residential Code*~~.

2. Add new table as follows:

TABLE 403.6
HEATING AND COOLING EQUIPMENT SIZING

UNIT	MAXIMUM PERCENTAGE OVESIZING [a,b]	CLIMATE ZONE	MINIMUM EFFICIENCY & TEST PROCEDURES
Air Conditioners	15%	ALL	Air Cooled: AHRI 210/240
Multi-speed[c] Air-Source Heat Pumps and Ground-Source Heat Pumps	15%	ALL	Air Cooled: AHRI 210/240 Water or Ground: AHRA/ASHRAE 13256-1
Single –speed Air-Source Heat Pumps and Ground Source Heat Pumps	15% 25%	1-3 ---- 4-8	Air Cooled: AHRI 210/240 Water or Ground: AHRA/ASHRAE 13256-1 Packaged: AHRI 310/380
All fuel-fired heating appliances	40%	ALL	DOE 10 CFR Part 430 or: Gas Fired: ANSI Z21.47 Oil Fired: UL 727

a. Equipment shall be sized in accordance with ACCA Manual J:
   1. Indoor and outdoor coils shall be matched for size;
   2. Outdoor temperatures shall be the 99.0% and 1.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the most representative city for which design temperature data are available, or other approved source;
   3. Indoor temperatures shall be 75 F for cooling and 72 F for heating;
   4. Infiltration rate shall be assumed as 0.00036 Specific Leakage Area (SLA).

b. Once the appropriate equipment size is determined, if that specific size does not exist, the next larger size of manufactured equipment shall be acceptable, regardless of the percentage listed.

c. Multi-speed units shall be permitted to exceed the listed percentage only to the cooling capacity necessary to control humidity levels.

3. Add new standard to Chapter 6 as follows:

ACCA Manual J 2006 Residential Load Calculation

Reason: By establishing specific requirements in the IECC for proper equipment sizing, this proposal is an important part of the goal to increase the energy efficiency in the code. Equipment that is excessively oversized utilizes more energy and fails to properly condition the space. Research and survey data is limited, but typically indicates that air conditioning equipment may be over-sized by more than 50%, resulting in increased energy consumption and adverse impacts on energy use, comfort and moisture control. Moreover, oversizing of equipment can lead to unnecessary higher construction cost.

The current *IECC* and *IRC* energy chapter merely reference section M1401.3 of the IRC. Section M1401.3 then directs the user to ACCA Manual J. In response to this concern, this proposal specifically directs the user to Manual J and adds Manual J as a referenced standard to the IECC. Since Manual J is already an approved referenced standard in the *IRC*, we believe that adding the reference to a second I-code (IECC) is not an issue. Additionally, since the test procedures (AHRI 210/240, AHRI 310/380, AHRA/ASHRAE 13256-1, ANSI Z21.47, DOE 10 CFR Part 430, UL

727) are referenced standards that are used in Chapter 5 of the IECC, we believe that adding these references to a second I-code (IRC) should also not be an issue.

Current code language, in M1401.3, references ACCA Manual J for load calculation, but does not require that the installed equipment meet a required size. The new language sets a requirement and includes explicit information needed for consistent load calculations and installed equipment size. The actual installed equipment size may be oversized and installed at the next available manufactured size.

The proposed requirements are primarily based on limits that are suggested in ACCA Manual S, which states the following:

- Cooling-only equipment should be sized so that the total cooling capacity does not exceed the total cooling load by more than 15%.
- If heat pump equipment (air-source or water-source) is installed in a warm or moderate climate, the total cooling capacity should not exceed the total cooling load by more than 15%.
- If heat pump equipment (air-source or water-source) is installed in a cold climate (where heating costs are a primary concern), the total cooling capacity can exceed the total cooling load by as much as 25%.

Furnace and boiler oversizing is not recommended because comfort may be compromised when a furnace or boiler short-cycles. The output capacity of the furnace or boiler must be greater than the design load, but no more than 40% larger than the design heating load.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard(s) proposed for inclusion in the code, ACCA-06, AHRI 210/240, 310/380, AHRA/ASHRAE 13256-1, ANSI Z21.47, DOE 10 CFR Part 430, UL 727, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: PRINDLE-EC-25-403.6-N1103.6

Public Hearing Results

PART I – IECC

Committee Action: Disapproved

Committee Reason: ACCA Manual J is not the correct standard for the purpose intended in the code change proposal.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.6 Equipment sizing (Mandatory). Heating and cooling equipment shall be sized in accordance with ~~Section 503.2.1, 503.2.2 and~~ Table 403.6.

TABLE 403.6
~~HEATING AND COOLING~~ EQUIPMENT SIZING REQUIREMENTS

UNIT	MAXIMUM PERCENTAGE ~~OVESIZING~~ OVERSIZING [a,b]	CLIMATE ZONE	~~MINIMUM EFFICIENCY & TEST PROCEDURES~~
Air Conditioners	15%	ALL	~~Air Cooled: AHRI 210/240~~
Multi-speed[c] Air-Source Heat Pumps and Ground-Source Heat Pumps	15%	ALL	~~Air Cooled: AHRI 210/240~~ ~~Water or Ground: AHRA/ASHRAE 13256-1~~
Single –speed Air-Source Heat Pumps and Ground Source Heat Pumps	15% 25%	1-3 4-8	~~Air Cooled: AHRI 210/240~~ ~~Water or Ground: AHRA/ASHRAE 13256-1~~ ~~Packaged: AHRI 310/380~~
All fuel-fired heating appliances	40%	ALL	~~DOE 10 CFR Part 430 or:~~ ~~Gas Fired: ANSI Z21.47~~ ~~Oil Fired: UL 727~~

a. Equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J:
   1. Indoor and outdoor coils shall be matched for size;

2. Outdoor temperatures shall be the 99.0% and 1.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the most representative city for which design temperature data are available, or other approved source;
3. Indoor temperatures shall be 75 F for cooling and 72 F for heating;
4. Infiltration rate shall be as specified in section 402.4.2.1~~assumed as 0.00036 Specific Leakage Area (SLA)~~.

b. Once the appropriate equipment size is determined, if that specific size does not exist, the next larger size of manufactured equipment shall be acceptable, regardless of the percentage listed.
c. Multi-speed units shall be permitted to exceed the listed percentage only to the cooling capacity necessary to control humidity levels.

Commenter's Reason: *EC121 Parts I & II should be approved as modified by this public comment.*

The modifications in this public comment include a clarification of the reference to both ACCA Manual S and Manual J in the IECC and IRC, which was the only reason cited by the Code Development Committees in their reasons for disapproval. The modifications above also ensure that the infiltration rate is consistent with the code requirements, regardless of the final requirement decided upon for the 2012 IECC. The modification also simplifies the table by removing the column for minimum efficiency and test procedures, which are not relevant to the sizing of HVAC systems.

This proposal, both as proposed and as modified, helps protect homeowners from unnecessary costs and will reduce the first cost of construction. HVAC system over-sizing is a common problem in homes throughout the country. Although the 2009 IECC and IRC Chapter 11 require sizing according to ACCA manuals S and J by reference in IRC section M1401.3, it is not often clear to builders or code officials exactly what is required. By including the specific requirements for equipment sizing in the IECC and the IRC energy chapters, the code will clarify that loads and equipment sizes must be appropriately sized, protecting homeowners from overpaying for a larger system at initial construction and from overpaying for higher energy use over the life of the HVAC system. (Larger HVAC systems use more energy due to lower operating efficiencies when the system is cycling on and off.)

In addition, for jurisdictions that adopt only the IECC (and not the IRC), the code requirement will be straightforward from the text of the IECC.

Public Comment 2:

Martha VanGeem, CTL Group, representing Masonry Alliance for Codes and Standards, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

403.6 Sizing. Heating and cooling equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies.

~~TABLE 403.6~~
~~HEATING AND COOLING EQUIPMENT SIZING~~

~~UNIT~~	~~MAXIMUM PERCENTAGE OVESIZING~~ [a,b]	~~CLIMATE ZONE~~	~~MINIMUM EFFICIENCY & TEST PROCEDURES~~
~~Air Conditioners~~	~~15%~~	~~ALL~~	~~Air Cooled: AHRI 210/240~~
~~Multi-speed~~[c] ~~Air-Source Heat Pumps and Ground-Source Heat Pumps~~	~~15%~~	~~ALL~~	~~Air Cooled: AHRI 210/240~~ ~~Water or Ground: AHRA/ASHRAE 13256-1~~
~~Single - speed~~ ~~Air-Source Heat Pumps and Ground Source Heat Pumps~~	~~15%~~ ~~25%~~	~~1-3~~ ~~----~~ ~~4-8~~	~~Air Cooled: AHRI 210/240~~ ~~Water or Ground: AHRA/ASHRAE 13256-1~~ ~~Packaged: AHRI 310/380~~
~~All fuel-fired heating appliances~~	~~40%~~	~~ALL~~	~~DOE 10 CFR Part 430 or:~~ ~~Gas Fired: ANSI Z21.47~~ ~~Oil Fired: UL 727~~

~~a. Equipment shall be sized in accordance with ACCA Manual J:~~
~~1. Indoor and outdoor coils shall be matched for size;~~
~~2. Outdoor temperatures shall be the 99.0% and 1.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the most representative city for which design temperature data are available, or other approved source;~~
~~3. Indoor temperatures shall be 75 F for cooling and 72 F for heating;~~
~~4. Infiltration rate shall be assumed as 0.00036 Specific Leakage Area (SLA).~~
~~b. Once the appropriate equipment size is determined, if that specific size does not exist, the next larger size of manufactured equipment shall be acceptable, regardless of the percentage listed.~~
~~c. Multi-speed units shall be permitted to exceed the listed percentage only to the cooling capacity necessary to control humidity levels.~~

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This text is from section M1401.3 of the IRC, and is the appropriate text for this section.

Final Action: AS AM AMPC____ D

EC121-09/10PART II
N1103.6, Table N1103.6 (New), Chapter 44

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

1. Revise as follows:

N1103.6 Equipment sizing. Heating and cooling *equipment* shall be sized ~~as specified~~ in accordance with Section M1401.3 and Table N1103.6.

2. Add new table as follows:

TABLE N1103.6

UNIT	MAXIMUM PERCENTAGE OVESIZING [a,b]	CLIMATE ZONE	MINIMUM EFFICIENCY & TEST PROCEDURES
Air Conditioners	15%	ALL	Air Cooled: AHRI 210/240
Multi-speed[c] Air-Source Heat Pumps and Ground-Source Heat Pumps	15%	ALL	Air Cooled: AHRI 210/240 Water or Ground: AHRA/ASHRAE 13256-1
Single -speed Air-Source Heat Pumps and Ground Source Heat Pumps	15% 25%	1-3 ---- 4-8	Air Cooled: AHRI 210/240 Water or Ground: AHRA/ASHRAE 13256-1 Packaged: AHRI 310/380
All fuel-fired heating appliances	40%	ALL	DOE 10 CFR Part 430 or: Gas Fired: ANSI Z21.47 Oil Fired: UL 727

a. Equipment shall be sized in accordance with ACCA Manual J:
   1. Indoor and outdoor coils shall be matched for size;
   2. Outdoor temperatures shall be the 99.0% and 1.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the most representative city for which design temperature data are available, or other approved source;
   3. Indoor temperatures shall be 75 F for cooling and 72 F for heating;
   4. Infiltration rate shall be assumed as 0.00036 Specific Leakage Area (SLA).

b. Once the appropriate equipment size is determined, if that specific size does not exist, the next larger size of manufactured equipment shall be acceptable, regardless of the percentage listed.

c. Multi-speed units shall be permitted to exceed the listed percentage only to the cooling capacity necessary to control humidity levels.

3. Add new standards to Chapter 44 as follows:

AHRI

210/240 —03 Unitary Air-Conditioning and Air-Source Heat Pump Equipment

310/380 —93 Standard for Packaged Terminal Air-conditioners and Heat Pumps

AHRA/ASHRAE

13256-1 (2005) Water-source Heat Pumps—Testing and Rating for Performance—Part 1: Water-to-air and Brine-to-air Heat Pumps (ANSI/ASHRAE/IESNA 90.1-2004)

ANSI
Z21.47-03 Gas-Fired Central Furnaces

DOE
10 CFR Part 430 , Subpart B,
Appendix E (1998) Uniform Test Method for Measuring the Energy Consumption of Water Heaters

UL
727 —06 Oil-fired Central Furnaces

Reason: By establishing specific requirements in the IECC for proper equipment sizing, this proposal is an important part of the goal to increase the energy efficiency in the code. Equipment that is excessively oversized utilizes more energy and fails to properly condition the space. Research and survey data is limited, but typically indicates that air conditioning equipment may be over-sized by more than 50%, resulting in increased energy consumption and adverse impacts on energy use, comfort and moisture control. Moreover, oversizing of equipment can lead to unnecessary higher construction cost.

The current *IECC* and *IRC* energy chapter merely reference section M1401.3 of the IRC. Section M1401.3 then directs the user to ACCA Manual J. In response to this concern, this proposal specifically directs the user to Manual J and adds Manual J as a referenced standard to the IECC. Since Manual J is already an approved referenced standard in the *IRC*, we believe that adding the reference to a second I-code (IECC) is not an issue. Additionally, since the test procedures (AHRI 210/240, AHRI 310/380, AHRA/ASHRAE 13256-1, ANSI Z21.47, DOE 10 CFR Part 430, UL 727) are referenced standards that are used in Chapter 5 of the IECC, we believe that adding these references to a second I-code (IRC) should also not be an issue.

Current code language, in M1401.3, references ACCA Manual J for load calculation, but does not require that the installed equipment meet a required size. The new language sets a requirement and includes explicit information needed for consistent load calculations and installed equipment size. The actual installed equipment size may be oversized and installed at the next available manufactured size.

The proposed requirements are primarily based on limits that are suggested in ACCA Manual S, which states the following:

- Cooling-only equipment should be sized so that the total cooling capacity does not exceed the total cooling load by more than 15%.
- If heat pump equipment (air-source or water-source) is installed in a warm or moderate climate, the total cooling capacity should not exceed the total cooling load by more than 15%.
- If heat pump equipment (air-source or water-source) is installed in a cold climate (where heating costs are a primary concern), the total cooling capacity can exceed the total cooling load by as much as 25%.

Furnace and boiler oversizing is not recommended because comfort may be compromised when a furnace or boiler short-cycles. The output capacity of the furnace or boiler must be greater than the design load, but no more than 40% larger than the design heating load.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard(s) proposed for inclusion in the code, ACCA-06, AHRI 210/240, 310/380, AHRA/ASHRAE 13256-1, ANSI Z21.47, DOE 10 CFR Part 430, UL 727, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: PRINDLE-EC-25-403.6-N1103.6

Public Hearing Results

PART II – IRC

Committee Action: **Disapproved**

Committee Reason: The proponent seeks to reference ACCA Manual J; however, Manual S is the appropriate standard.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Modified by this Public Comment

Modify the proposal as follows:

N1103.6 Equipment sizing. Heating and cooling *equipment* shall be sized in accordance with Section M1401.3 and Table N1103.6.

TABLE N1103.6
~~HEATING AND COOLING~~ EQUIPMENT SIZING REQUIREMENTS

UNIT	MAXIMUM PERCENTAGE ~~OVESIZING~~ OVERSIZING [a,b]	CLIMATE ZONE	~~MINIMUM EFFICIENCY & TEST PROCEDURES~~
Air Conditioners	15%	ALL	~~Air Cooled: AHRI 210/240~~
Multi-speed[c] Air-Source Heat Pumps and Ground-Source Heat Pumps	15%	ALL	~~Air Cooled: AHRI 210/240~~ ~~Water or Ground: AHRA/ASHRAE 13256-1~~
Single –speed Air-Source Heat Pumps and Ground Source Heat Pumps	15% 25%	1-3 ---- 4-8	~~Air Cooled: AHRI 210/240~~ ~~Water or Ground: AHRA/ASHRAE 13256-1~~ ~~Packaged: AHRI 310/380~~
All fuel-fired heating appliances	40%	ALL	~~DOE 10 CFR Part 430 or:~~ ~~Gas Fired: ANSI Z21.47~~ ~~Oil Fired: UL 727~~

a. Equipment shall be sized in accordance with ACCA Manual S based on building loads calculated in accordance with ACCA Manual J:
   1. Indoor and outdoor coils shall be matched for size;
   2. Outdoor temperatures shall be the 99.0% and 1.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the most representative city for which design temperature data are available, or other approved source;
   3. Indoor temperatures shall be 75 F for cooling and 72 F for heating;
   4. Infiltration rate shall be as specified in section N1102.4.1.2 ~~assumed as 0.00036 Specific Leakage Area (SLA)~~.

b. Once the appropriate equipment size is determined, if that specific size does not exist, the next larger size of manufactured equipment shall be acceptable, regardless of the percentage listed.

c. Multi-speed units shall be permitted to exceed the listed percentage only to the cooling capacity necessary to control humidity levels.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: *EC121 Parts I & II should be approved as modified by this public comment.*

The modifications in this public comment include a clarification of the reference to both ACCA Manual S and Manual J in the IECC and IRC, which was the only reason cited by the Code Development Committees in their reasons for disapproval. The modifications above also ensure that the infiltration rate is consistent with the code requirements, regardless of the final requirement decided upon for the 2012 IECC. The modification also simplifies the table by removing the column for minimum efficiency and test procedures, which are not relevant to the sizing of HVAC systems.

This proposal, both as proposed and as modified, helps protect homeowners from unnecessary costs and will reduce the first cost of construction. HVAC system over-sizing is a common problem in homes throughout the country. Although the 2009 IECC and IRC Chapter 11 require sizing according to ACCA manuals S and J by reference in IRC section M1401.3, it is not often clear to builders or code officials exactly what is required. By including the specific requirements for equipment sizing in the IECC and the IRC energy chapters, the code will clarify that loads and equipment sizes must be appropriately sized, protecting homeowners from overpaying for a larger system at initial construction and from overpaying for higher energy use over the life of the HVAC system. (Larger HVAC systems use more energy due to lower operating efficiencies when the system is cycling on and off.)

In addition, for jurisdictions that adopt only the IECC (and not the IRC), the code requirement will be straightforward from the text of the IECC.

Final Action: AS AM AMPC____ D

EC124-09/10-PART I
403.9, 403.9.1, 403.9.2, 403.9.3

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART I – IECC

Revise as follows:

403.9 Pools, hot tubs and spas (Mandatory). Pools, hot tubs and spas shall ~~be provided with energy-conserving measures in accordance~~ shall comply with Sections 403.9.1 through 403.9.3.

403.9.1 ~~Pool~~ Heaters. All ~~pool~~ heaters shall be equipped with a readily *accessible* on-off switch to allow shutting off the heater without adjusting the thermostat setting. ~~Pool~~ Heaters fired by natural or LP gas shall not have continuously burning pilot lights.

403.9.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on ~~swimming pool~~ heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar- and waste-heat-recovery ~~pool heating~~ systems.

403.9.3 ~~Pool~~ Covers. Heated pools, hot tubs and spas shall be ~~equipped~~ provided with a vapor-retardant ~~pool~~ cover ~~on or at the water surface~~. Pools, hot tubs and spas capable of being heated to more than 90°F (32°C) shall ~~have a pool~~ be provided with a cover ~~with~~ having a minimum insulation value of R-12.

~~**Exception:** Pools deriving over 60 percent of the energy for heating from site-recovered energy or solar energy source.~~

Reason: Clarification. The current text does not apply to hot tubs and spas and it should. The text has been revised to address that issue. LP gas has been added for consistency with the current text in IECC Chapter 5. The text in 403.9.3 has been revised to be applied during inspection prior to approval of the subject pool, hot tub or spa. As written one could interpret the requirements as enforceable after a use permit has been issued. It is not likely code officials could nor would want to enforce the cover provisions in a post-occupancy condition as suggested by the current text. The exception for solar or site recovered energy has been eliminated simply because there is no rationale why a pool, hot tub or spa getting 39% of its energy from non-renewables should not be exempt and one getting 41% from renewable should. Also how is this provision even determined in plan review and capable of being readily enforced.

Cost Impact: The proposed code change will not increase the cost of construction other than pools that were heated with solar or site recovered energy systems will now require the use of a pool cover.

ICCFILENAME: MAJETTE-EC-77-403.9-IRC N1103.8

Public Hearing Results

PART I – IECC

Committee Action: **Approved as Submitted**

Committee Reason: The present code intends that hot tubs be regulated by this code section. Therefore, this is essentially an editorial fix to the code that will prevent abuse of the code requirements.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jennifer Hatfield, Association of Pool & Spa Professionals requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.9 Pools, and inground permanently installed spas (Mandatory). Pools and inground permanently installed spas shall ~~be provided with energy-conserving measures in accordance~~ comply with Sections 403.9.1 through 403.9.3.

403.9.1 ~~Pool~~ Heaters. All ~~pool~~ heaters shall be equipped with a readily *accessible* on-off switch that is mounted outside of the heater to allow shutting off the heater without adjusting the thermostat setting. ~~Pool~~ Gas-fired heaters ~~fired by natural gas~~ shall not ~~have continuously burning~~ be equipped with constant burning pilot lights.

403.9.2 Time switches. Time switches or other control method that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on all ~~swimming pool~~ heaters and pumps. Heaters, pumps and motors that have built in timers shall be deemed in compliance with this requirement.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and waste-heat-recovery pool heating systems.

403.9.3 ~~Pool~~ Covers. Heated pools and inground permanently installed spas shall be ~~equipped~~ provided with a vapor-retardant ~~pool~~ cover ~~on or at the water surface~~. ~~Pools capable of being heated to more than 90ºF (32ºC) shall have a pool cover with a minimum insulation value of R-12.~~

Exception: Pools deriving over ~~60~~ 70 percent of the energy for heating from site-recovered energy, such as a heat pump or solar energy source computed over an operating season.

Commenter's Reason: We believe we are staying with the intent of the original proposal, but making clarifications that are needed, specifically this comment does the following:

1. The original proposal added hot tubs and spas to the energy requirements under section 403.9. This comment seeks to clarify exactly what type of hot tubs and spas must meet the requirements under 403.9. There are inground permanently installed spas and portable electric spas, i.e. hot tubs. Inground permanently installed spas have their own set of standards they must meet and portable electric spas have a different set of standards, see for example ANSI/APSP-3 Standard for Permanently Installed Residential Spas and ANSI/APSP-6 Standard for Portable Spas. That same rationale applies to energy efficient requirements. Portable electric spas must meet their own set of energy efficient requirements separate from pools and inground permanently installed spas that are built on site. Factory built portable spas are stand alone appliances that are a pre-assembled unit that must be tested as a unit, in accordance with their own set of safety and energy efficient standards. Factory built portable spas must be certified to the UL 1563 standard in order to meet safety requirements such as the federal Virginia Graeme Baker Pool & Spa Safety Act suction entrapment avoidance requirements. Further, most portable spa manufacturers are now meeting California Energy Code (Title 20) energy efficient requirements – these California requirements are currently being developed into an ANSI/APSP approved standard (APSP-14, Energy Efficiency for Portable Spas) and are referenced in federal energy legislation that is slated to pass Congress later this summer to be incorporated into DOE regulations. Therefore, portable spas have their own energy efficiency requirements to meet and need to be considered separate from other installations. This comment makes this needed clarification.

   It should also be pointed out that many building departments do not consider a factory built portable spa under their purview since it is an appliance and not always a permitted item. Requiring factory built portable spas to follow federal regulations will help to ensure manufacturers meet these requirements. This language provides clarity for the code official to distinguish between an "inground permanently installed spa" and a "portable spa/hot tub."
2. This comment makes slight adjustments to the wording found in 403.9.1, but does not change in the intent of the original proposal. These changes are consistent with the language found in both the Florida Energy & Conservation Code, and in Title 24 of the California Energy Code (provides pump and heater requirements for pools and inground spas). Making these changes ensures all documents use the same words for the same meaning, so to provide clarity and consistency. This language is also found in the draft APSP-15 Energy Efficiency Standard for Residential Pools and Inground Spas, slated for ANSI approval in 2011.

   The comment also provides clarification under 403.9.3 "Time Switches." The language maintains the intent of the requirement while allowing solid-state timers and digital controllers (other control method) to be used in addition to tradition mechanical switches. It ensures that "all" heaters and pumps be included in the requirement and clarifies that equipment with onboard time clocks and controls meet the requirement. Some modern heaters and pumps include built-in controls to program operating times, and some include the ability to control other equipment, in all cases the full intent is achieved.
3. The comment removes the R-12 cover requirement. The proposal clarified that hot tubs and spas must also meet this requirement, but as previously discussed, with regard to factory built portable spas, they must meet their own unique set of standards and cover requirements are part of the test protocol found in Section 1604, Title 20 of the CEC, which is referenced in the federal legislation and the draft ANSI/APSP-14 standard; therefore, the R-12 requirement should not be applied to factory built portable spas. The R-12 requirement should also be removed for pools and inground spas for the following reasons:
   a. Water evaporation has the most significant negative impact on energy conservation. The most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. The R value has no relevance to evaporation and it is only one way to measure heat retention and should not be the only method specified. The code language should strive for performance language setting the goal for what needs to be accomplished without specifying how it is to be done. This inhibits technical innovation.

b. The R value for a cover is extremely difficult to measure. Most quoted numbers are calculations based on “hoped for” values. The largest heat loss on a cover are the gaps that are not sealed allowing heated water to escape. These seams for spas or gaps between the cover and deck for pools can negate any relevance of the R factor. R value calculations simply do not address this.

c. The R-12 requirement is not feasible for pools and inground permanently installed spas as there are no R 12 value pool covers in the market today for those applications. There appears to be no data or studies that give credence to why the R-12 value was applied to pools in the first place (was added in 2009).

d. Many inground pool and inground spas are equipped with automatic covers. These covers are usually in place every time the pool is not in use. As mentioned previously, evaporative heat loss is the primary culprit. Automatic covers solve that problem and reduce a significant amount of heat loss; at the same time they provide critical safety barrier protection (barrier protection is required by many states and how those requirements interconnect with energy efficient covers should be considered). While an automatic cover is not wanted or possible on every pool, adding an R-12 requirement would prevent automatic covers from being installed in many cases, which would actually result in a higher amount of energy loss, since the pool would not be covered when not in use much of the swimming season resulting in significant evaporative heat loss. This would not accomplish the goal of the energy code and would needlessly harm the automatic cover market in states that adopt this code. There are no automatic cover options that have an R 12 value.

The original proposal removed the exception found in 403.9.3, this comment seeks to put it back with slight changes. We understand that water evaporation has the most significant negative impact on energy conservation and that the most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. However, requiring covers to be installed on a heated pool becomes problematic as there is no guarantee it will be used after the final permit and if it is not used, the increased energy efficiency will not occur. A cover is a temporary, movable device that could be viewed as beyond the purview of a building code. For those consumers who may not want a cover and will not use it after the final permit, adding back in the exception encourages use of renewable heating devices to ensure some level of energy efficiency and conservation. The clarification that heat pumps also fall under this category and that the percentage is computed over an operating season provides for clarity. The increase in percentage provides for a higher requirement in order to opt out of the cover requirement. These changes are consistent with the Florida Energy & Conservation Code.

Public Comment 2:

Jennifer Hatfield, Association of Pool & Spa Professionals requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.9 Pools, inground permanently installed spas, and factory built portable spas (Mandatory). Pools and inground permanently installed spas shall ~~be provided with energy-conserving measures in accordance~~ comply with Sections 403.9.1 through 403.9.3. Factory built portable spas shall comply with section 403.9.4.

403.9.1 ~~Pool~~ Heaters. All ~~pool~~ heaters shall be equipped with a readily *accessible* on-off switch that is mounted outside of the heater to allow shutting off the heater without adjusting the thermostat setting. ~~Pool~~ Gas-fired heaters ~~fired by natural gas~~ shall not ~~have continuously burning~~ be equipped with constant burning pilot lights.

403.9.2 Time switches. Time switches or other control method that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on all ~~swimming pool~~ heaters and pumps. Heaters, pumps and motors that have built in timers shall be deemed in compliance with this requirement.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and waste-heat-recovery pool heating systems.

403.9.3 ~~Pool~~ Covers. Heated pools and inground permanently installed spas shall be ~~equipped~~ provided with a vapor-retardant ~~pool~~ cover ~~on or at the water surface~~. ~~Pools capable of being heated to more than 90ºF (32ºC) shall have a pool cover with a minimum insulation value of R-12.~~

Exception: Pools deriving over ~~60~~ 70 percent of the energy for heating from site-recovered energy, such as a heat pump or solar energy source computed over an operating season.

403.9.4 Factory built portable spas and swim spas. Factory built portable electric spas and swim spas shall require less than the maximum allowed power calculated by the formula $5(V^{2/3})$ watts when tested as follows: Where V is the fill Volume (B) of the spa in gallons.

1. Minimum continuous testing time shall be 72 hours.
2. The spa shall be filled with water to the halfway point between the bottom of the skimmer basket opening and the overflow level of the spa. In the absence of a wall skimmer, the fill volume is 6 inches below the overflow level of the spa.
3. The water temperature of the spa or spa potion of a combination swim spa shall be a minimum of 100°F, for the duration of the test. The water temperature of the swim spa or swim portion of a combination swim spa shall be a minimum of 85°F, for the duration of the test.
4. The ambient air temperature shall be a maximum of 63°F for the duration of the test.
5. The specified cover shall be used during the test.
6. The test shall start when the water temperature has been at 102°F, ± 2°F, (at 87°F, ± 2°F for swim spas) for at least a four hour stabilizing period.
7. Record the total energy use for the period of test, starting at the end of the first heating cycle after the stabilization period specified in (F), and finishing at the end of the first heating cycle after 72 hours has elapsed.
8. Exception: For spas without heaters, substitute heating cycle with filter or purge cycle.
9. The unit shall remain covered and in the default operation mode during the test. Energy-conserving circulation functions, if present, must not be enabled if not appropriate for continuous, long-term use. The minimum filtration rate shall be 12 water turns within a 24 hour peiod. Ancillary equipment including, but not limited to lights, audio systems, and water treatment devices, shall remain connected to the mains but may be turned off during the test if their controls are user accessible.

10. The measured standby power (Pmeas) shall be normalized (Pnorm) to a temperature difference of 37°F using the equation~~,~~:

    Pnorm = Pmeas (ΔTstd / ΔTmeas)

    Where:

    Pmeas = measured standby power during test (E/t)
    ΔTstd = 37°F
    ΔT meas = T water avg – T air avg
    T water avg = Average water temperature during test
    T air avg = Average air temperature during test.

11. Data required shall include: spa identification (make, model); volume of the unit in gallons; maximum allowed power and normalized standby power (Pnorm, in watts).

Commenter's Reason: We believe we are staying with the intent of the original proposal, but making clarifications that are needed, specifically this comment does the following:

1. The original proposal added hot tubs and spas to the energy requirements under section 403.9. This comment seeks to clarify exactly what type of hot tubs and spas must meet the requirements under 403.9. There are inground permanently installed spas and portable electric spas, i.e. hot tubs. Inground permanently installed spas have their own set of standards they must meet and portable electric spas have a different set of standards, see for example ANSI/APSP-3 Standard for Permanently Installed Residential Spas and ANSI/APSP-6 Standard for Portable Spas. That same rationale applies to energy efficient requirements. Portable electric spas must meet their own set of energy efficient requirements separate from pools and inground permanently installed spas that are built on site. Factory built portable spas are stand alone appliances that are a pre-assembled unit that must be tested as a unit, in accordance with their own set of safety and energy efficient standards. Factory built portable spas must be certified to the UL 1563 standard in order to meet safety requirements such as the federal Virginia Graeme Baker Pool & Spa Safety Act suction entrapment avoidance requirements. Further, most portable spa manufacturers are now meeting California Energy Code (Title 20) energy efficient requirements – these California requirements are currently being developed into an ANSI/APSP approved standard (APSP-14, Energy Efficiency for Portable Spas) and are referenced in federal energy legislation that is slated to pass Congress later this summer. Therefore, portable spas have their own energy efficiency requirements to meet and need to be considered separate from other installations.
2. The APSP-14 standard is slated to be ANSI approved by 2011 in order to incorporate into DOE regulations if the federal legislation passes. It will also be submitted as a proposal to the 2015 IECC. Recognizing that most portable spa manufacturers are already meeting the CEC requirements and due to the fact the proposed federal requirements and APSP-14 standard are not yet approved, this comment clarifies that inground permanently installed spas must meet the current requirements and adds a new section for portable spas. The new section for portable spas inserts the test method found in the CEC regulations for portable spa energy efficiency. It appears the intent of the original proposal was to make sure portable spas (hot tubs) also had to meet energy efficient requirements, this comment stays true to that intent, but recognizes that these factory built assembly unit appliances have their own unique set of requirements that must be followed. This comment ensures that the requirements factory built portable spa manufacturers must meet, follow what is already a California energy regulation and what is slated to become a federal energy regulation and an ANSI approved energy efficient standard. The test protocol in Title 20 includes all aspects of the portable spa, including the portable spa cover and heating elements.
3. It should also be pointed out that many building departments do not consider a factory built portable spa under their purview since it is an appliance and not always a permitted item. Requiring factory built portable spas to follow federal regulations will help to ensure manufacturers meet these requirements. This language provides clarity for the code official to distinguish between an "inground permanently installed spa" and a "portable spa/hot tub," at the same time making sure the factory built portable spas that may require a permit do meet section 1604, Title 20, CEC requirements.
4. This comment makes slight adjustments to the wording found in 403.9.1, but does not change in the intent of the original proposal. These changes are consistent with the language found in both the Florida Energy & Conservation Code, and in Title 24 of the California Energy Code (provides pump and heater requirements for pools and inground spas). Making these changes ensures all documents use the same words for the same meaning, so to provide clarity and consistency. This language is also found in the draft APSP-15 Energy Efficiency Standard for Residential Pools and Inground Spas, slated for ANSI approval in 2011.
5. The comment also provides clarification under 403.9.2 "Time Switches." The language maintains the intent of the requirement while allowing solid-state timers and digital controllers (other control method) to be used in addition to tradition mechanical switches. It ensures that "all" heaters and pumps be included in the requirement and clarifies that equipment with onboard time clocks and controls meet the requirement. Some modern heaters and pumps include built-in controls to program operating times, and some include the ability to control other equipment, in all cases the full intent is achieved.
6. The comment removes the R-12 cover requirement. The proposal clarified that hot tubs and spas must also meet this requirement, but as previously discussed, with regard to factory built portable spas, cover requirements are part of the test protocol found in Section 1604, Title 20 of the CEC; therefore, the R-12 requirement should not be applied to factory built portable spas. The R-12 requirement should also be removed for pools and inground spas for the following reasons:
    a. Water evaporation has the most significant negative impact on energy conservation. The most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. The R value has no relevance to evaporation and it is only one way to measure heat retention and should not be the only method specified. The code language should strive for performance language setting the goal for what needs to be accomplished without specifying how it is to be done. This inhibits technical innovation.
    b. The R value for a cover is extremely difficult to measure. Most quoted numbers are calculations based on "hoped for" values. The largest heat loss on a cover are the gaps that are not sealed allowing heated water to escape. These seams for spas or gaps between the cover and deck for pools can negate any relevance of the R factor. R value calculations simply do not address this.
    c. The R-12 requirement is not feasible for pools and inground permanently installed spas as there are no R 12 value pool covers in the market today for those applications. There appears to be no data or studies that give credence to why the R-12 value was applied to pools in the first place (was added in 2009).
    d. Many inground pool and inground spas are equipped with automatic covers. These covers are usually in place every time the pool is not in use. As mentioned previously, evaporative heat loss is the primary culprit. Automatic covers solve that problem and reduce a significant amount of heat loss; at the same time they provide critical safety barrier protection (barrier protection is required by many states and how those requirements interconnect with energy efficient covers should be considered). While an automatic cover is not wanted or possible on every pool, adding an R-12 requirement would prevent automatic covers from being installed in many cases, which would actually result in a higher amount of energy loss, since the pool would not be covered when not in use much of the swimming season

resulting in significant evaporative heat loss. This would not accomplish the goal of the energy code and would needlessly harm the automatic cover market in states that adopt this code. There are no automatic cover options that have an R 12 value.

7. The original proposal removed the exception found in 403.9.3, this comment seeks to put it back with slight changes. We understand that water evaporation has the most significant negative impact on energy conservation and that the most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. However, requiring covers to be installed on a heated pool becomes problematic as there is no guarantee it will be used after the final permit and if it is not used, the increased energy efficiency will not occur. A cover is a temporary, movable device that could be viewed as beyond the purview of a building code. For those consumers who may not want a cover and will not use it after the final permit, adding back in the exception encourages use of renewable heating devices to ensure some level of energy efficiency and conservation. The clarification that heat pumps also fall under this category and that the percentage is computed over an operating season provides for clarity. The increase in percentage provides for a higher requirement in order to opt out of the cover requirement. These changes are consistent with the Florida Energy & Conservation Code.

Final Action: AS AM AMPC____ D

EC124-09/10-PART II
N1103.8, N1103.8.1, N1103.8.2, N1103.8.3

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1103.8 Pools, hot tubs and spas (Mandatory). Pools, hot tubs and spas shall ~~be provided with energy-conserving measures in accordance~~ comply with Sections N1103.8.1 through N1103.8.3.

N1103.8.1 ~~Pool~~ Heaters. All ~~pool~~ heaters shall be equipped with a readily *accessible* on-off switch to allow shutting off the heater without adjusting the thermostat setting. ~~Pool~~ Heaters fired by natural or LP gas shall not have continuously burning pilot lights.

N1103.8.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on ~~swimming pool~~ heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar- and waste-heat-recovery ~~pool heating~~ systems.

N1103.8.3 ~~Pool~~ Covers. Heated pools, hot tubs and spas shall be ~~equipped~~ provided with a vapor-retardant ~~pool~~ cover ~~on or at the water surface~~. Pools, hot tubs and spas capable of being heated to more than 90°F (32°C) shall ~~have a pool~~ be provided with a cover ~~with~~ having a minimum insulation value of R-12.

~~**Exception:** Pools deriving over 60 percent of the energy for heating from site-recovered energy or solar energy source.~~

Reason: Clarification. The current text does not apply to hot tubs and spas and it should. The text has been revised to address that issue. LP gas has been added for consistency with the current text in IECC Chapter 5. The text in 403.9.3 has been revised to be applied during inspection prior to approval of the subject pool, hot tub or spa. As written one could interpret the requirements as enforceable after a use permit has been issued. It is not likely code officials could nor would want to enforce the cover provisions in a post-occupancy condition as suggested by the current text. The exception for solar or site recovered energy has been eliminated simply because there is no rationale why a pool, hot tub or spa getting 39% of its energy from non-renewables should not be exempt and one getting 41% from renewable should. Also how is this provision even determined in plan review and capable of being readily enforced.

Cost Impact: The proposed code change will not increase the cost of construction other than pools that were heated with solar or site recovered energy systems will now require the use of a pool cover.

ICCFILENAME: MAJETTE-EC-77-403.9-IRC N1103.8

Public Hearing Results

PART II – IRC

Committee Action: **Approved as Submitted**

Committee Reason: This proposal makes the code clearer in specifying its original intent that hot tubs are part of the products that need to be regulated.

Assembly Action: **None**

<u>Individual Consideration Agenda</u>

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jennifer Hatfield, Association of Pool & Spa Professionals requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1103.8 Pools, <u>inground permanently installed spas</u> (Mandatory). Pools <u>and inground permanently installed spas</u> shall ~~be provided with energy-conserving measures in accordance~~ <u>comply</u> with Sections N1103.8.1 through N1103.8.3.

N1103.8.1 ~~Pool~~ Heaters. All ~~pool~~ heaters shall be equipped with a readily *accessible* on-off switch <u>that is mounted outside of the heater</u> to allow shutting off the heater without adjusting the thermostat setting. ~~Pool~~ <u>Gas-fired</u> heaters ~~fired by natural gas~~ shall not ~~have continuously burning~~ <u>be equipped with constant</u> burning pilot lights.

N1103.8.2 Time switches. Time switches <u>or other control method</u> that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on <u>all</u> ~~swimming pool~~ heaters and pumps. <u>Heaters, pumps and motors that have built in timers shall be deemed in compliance with this requirement.</u>

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and waste-heat-recovery pool heating systems.

N1103.8.3 ~~Pool~~ Covers. Heated pools <u>and inground permanently installed spas</u> shall be ~~equipped~~ <u>provided</u> with a vapor-retardant ~~pool~~ cover ~~on or at the water surface~~. ~~Pools capable of being heated to more than 90ºF (32ºC) shall have a pool cover with a minimum insulation value of R-12.~~

Exception: Pools deriving over ~~60~~ <u>70</u> percent of the energy for heating from site-recovered energy, <u>such as a heat pump</u> or solar energy source <u>computed over an operating season.</u>

Commenter's Reason: We believe we are staying with the intent of the original proposal, but making clarifications that are needed, specifically this comment does the following:

1. The original proposal added hot tubs and spas to the energy requirements under section N1103.8. This comment seeks to clarify exactly what type of hot tubs and spas must meet the requirements under N110.3.8. There are inground permanently installed spas and portable electric spas, i.e. hot tubs. Inground permanently installed spas have their own set of standards they must meet and portable electric spas have a different set of standards, see for example ANSI/APSP-3 Standard for Permanently Installed Residential Spas and ANSI/APSP-6 Standard for Portable Spas. That same rationale applies to energy efficient requirements. Portable electric spas must meet their own set of energy efficient requirements separate from pools and inground permanently installed spas that are built on site. Factory built portable spas are stand alone appliances that are a pre-assembled unit that must be tested as a unit, in accordance with their own set of safety and energy efficient standards. Factory built portable spas must be certified to the UL 1563 standard in order to meet safety requirements such as the federal Virginia Graeme Baker Pool & Spa Safety Act suction entrapment avoidance requirements. Further, most portable spa manufacturers are now meeting California Energy Code (Title 20) energy efficient requirements – these California requirements are currently being developed into an ANSI/APSP approved standard (APSP-14, Energy Efficiency for Portable Spas) and are referenced in federal energy legislation that is slated to pass Congress later this summer to be incorporated into DOE regulations. Therefore, portable spas have their own energy efficiency requirements to meet and need to be considered separate from other installations. This comment makes this needed clarification.

   It should also be pointed out that many building departments do not consider a factory built portable spa under their purview since it is an appliance and not always a permitted item. Requiring factory built portable spas to follow federal regulations will help to ensure manufacturers meet these requirements. This language provides clarity for the code official to distinguish between an "inground permanently installed spa" and a "portable spa/hot tub."
2. This comment makes slight adjustments to the wording found in N1103.8.1, but does not change in the intent of the original proposal. These changes are consistent with the language found in both the Florida Energy & Conservation Code, and in Title 24 of the California Energy Code (provides pump and heater requirements for pools and inground spas). Making these changes ensures all documents use the same words for the same meaning, so to provide clarity and consistency. This language is also found in the draft APSP-15 Energy Efficiency Standard for Residential Pools and Inground Spas, slated for ANSI approval in 2011.

   The comment also provides clarification under N1103.8.2 "Time Switches." The language maintains the intent of the requirement while allowing solid-state timers and digital controllers (other control method) to be used in addition to tradition mechanical switches. It ensures that "all" heaters and pumps be included in the requirement and clarifies that equipment with onboard time clocks and controls meet the requirement. Some modern heaters and pumps include built-in controls to program operating times, and some include the ability to control other equipment, in all cases the full intent is achieved.
3. The comment removes the R-12 cover requirement. The proposal clarified that hot tubs and spas must also meet this requirement, but as previously discussed, with regard to factory built portable spas, they must meet their own unique set of standards and cover requirements are part of the test protocol found in Section 1604, Title 20 of the CEC, which is referenced in the federal legislation and the draft ANSI/APSP-14 standard; therefore, the R-12 requirement should not be applied to factory built portable spas. The R-12 requirement should also be removed for pools and inground spas for the following reasons:
   a. Water evaporation has the most significant negative impact on energy conservation. The most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. The R value has no relevance to evaporation and it is only one way to measure heat retention and should not be the only method specified. The code language should strive for performance language setting the goal for what needs to be accomplished without specifying how it is to be done. This inhibits technical innovation.

b. The R value for a cover is extremely difficult to measure. Most quoted numbers are calculations based on "hoped for" values. The largest heat loss on a cover are the gaps that are not sealed allowing heated water to escape. These seams for spas or gaps between the cover and deck for pools can negate any relevance of the R factor. R value calculations simply do not address this.

c. The R-12 requirement is not feasible for pools and inground permanently installed spas as there are no R 12 value pool covers in the market today for those applications. There appears to be no data or studies that give credence to why the R-12 value was applied to pools in the first place (was added in 2009).

d. Many inground pool and inground spas are equipped with automatic covers. These covers are usually in place every time the pool is not in use. As mentioned previously, evaporative heat loss is the primary culprit. Automatic covers solve that problem and reduce a significant amount of heat loss; at the same time they provide critical safety barrier protection (barrier protection is required by many states and how those requirements interconnect with energy efficient covers should be considered). While an automatic cover is not wanted or possible on every pool, adding an R-12 requirement would prevent automatic covers from being installed in many cases, which would actually result in a higher amount of energy loss, since the pool would not be covered when not in use much of the swimming season resulting in significant evaporative heat loss. This would not accomplish the goal of the energy code and would needlessly harm the automatic cover market in states that adopt this code. There are no automatic cover options that have an R 12 value.

The original proposal removed the exception found in N1103.8.3, this comment seeks to put it back with slight changes. We understand that water evaporation has the most significant negative impact on energy conservation and that the most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. However, requiring covers to be installed on a heated pool becomes problematic as there is no guarantee it will be used after the final permit and if it is not used, the increased energy efficiency will not occur. A cover is a temporary, movable device that could be viewed as beyond the purview of a building code. For those consumers who may not want a cover and will not use it after the final permit, adding back in the exception encourages use of renewable heating devices to ensure some level of energy efficiency and conservation. The clarification that heat pumps also fall under this category and that the percentage is computed over an operating season provides for clarity. The increase in percentage provides for a higher requirement in order to opt out of the cover requirement. These changes are consistent with the Florida Energy & Conservation Code.

Public Comment 2:

Jennifer Hatfield, Association of Pool & Spa Professionals requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1103.8 Pools, inground permanently installed spas, and factory built portable spas (Mandatory). Pools and inground permanently installed spas shall ~~be provided with energy conserving measures in accordance~~ comply with Sections N1103.8.1 through N1103.8.3. Factory built portable spas shall comply with section N1103.8.4.

N1103.8.1 ~~Pool~~ Heaters. All ~~pool~~ heaters shall be equipped with a readily *accessible* on-off switch that is mounted outside of the heater to allow shutting off the heater without adjusting the thermostat setting. ~~Pool~~ Gas-fired heaters ~~fired by natural gas~~ shall not ~~have continuously burning~~ be equipped with constant burning pilot lights.

N1103.8.2 Time switches. Time switches or other control method that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on all ~~swimming pool~~ heaters and pumps. Heaters, pumps and motors that have built in timers shall be deemed in compliance with this requirement.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and waste-heat-recovery pool heating systems.

N1103.8.3 ~~Pool~~ Covers. Heated pools and inground permanently installed spas shall be ~~equipped~~ provided with a vapor-retardant ~~pool~~ cover ~~on or at the water surface~~. ~~Pools capable of being heated to more than 90ºF (32ºC) shall have a pool cover with a minimum insulation value of R-12.~~

Exception: Pools deriving over ~~60~~ 70 percent of the energy for heating from site-recovered energy, such as a heat pump or solar energy source computed over an operating season.

N103.8.4 Factory built portable spas and swim spas. Factory built portable electric spas and swim spas shall require less than the maximum allowed power calculated by the formula $5(V^{2/3})$ watts when tested as follows: Where V is the fill Volume (B) of the spa in gallons.

1. Minimum continuous testing time shall be 72 hours.
2. The spa shall be filled with water to the halfway point between the bottom of the skimmer basket opening and the overflow level of the spa. In the absence of a wall skimmer, the fill volume is 6 inches below the overflow level of the spa.
3. The water temperature of the spa or spa potion of a combination swim spa shall be a minimum of 100°F, for the duration of the test. The water temperature of the swim spa or swim portion of a combination swim spa shall be a minimum of 85°F, for the duration of the test.
4. The ambient air temperature shall be a maximum of 63°F for the duration of the test.
5. The specified cover shall be used during the test.
6. The test shall start when the water temperature has been at 102°F, ± 2°F, (at 87°F, ± 2°F for swim spas) for at least a four hour stabilizing period.
7. Record the total energy use for the period of test, starting at the end of the first heating cycle after the stabilization period specified in (F), and finishing at the end of the first heating cycle after 72 hours has elapsed.
8. Exception: For spas without heaters, substitute heating cycle with filter or purge cycle.
9. The unit shall remain covered and in the default operation mode during the test. Energy-conserving circulation functions, if present, must not be enabled if not appropriate for continuous, long-term use. The minimum filtration rate shall be 12 water turns within a 24 hour peiod. Ancillary equipment including, but not limited to lights, audio systems, and water treatment devices, shall remain connected to the mains but may be turned off during the test if their controls are user accessible.
10. The measured standby power (Pmeas) shall be normalized (Pnorm) to a temperature difference of 37°F using the equation~~,~~:

Pnorm = Pmeas (ΔTstd / ΔTmeas)

Where:

Pmeas = measured standby power during test (E/t)
ΔTstd = 37°F
ΔT meas = T water avg – T air avg
T water avg = Average water temperature during test
T air avg = Average air temperature during test.

11. Data required shall include: spa identification (make, model); volume of the unit in gallons; maximum allowed power and normalized standby power (Pnorm, in watts).

Commenter's Reason: We believe we are staying with the intent of the original proposal, but making clarifications that are needed, specifically this comment does the following:

1. The original proposal added hot tubs and spas to the energy requirements under section N1103.8. This comment seeks to clarify exactly what type of hot tubs and spas must meet the requirements under N1103.8. There are inground permanently installed spas and portable electric spas, i.e. hot tubs. Inground permanently installed spas have their own set of standards they must meet and portable electric spas have a different set of standards, see for example ANSI/APSP-3 Standard for Permanently Installed Residential Spas and ANSI/APSP-6 Standard for Portable Spas. That same rationale applies to energy efficient requirements. Portable electric spas must meet their own set of energy efficient requirements separate from pools and inground permanently installed spas that are built on site. Factory built portable spas are stand alone appliances that are a pre-assembled unit that must be tested as a unit, in accordance with their own set of safety and energy efficient standards. Factory built portable spas must be certified to the UL 1563 standard in order to meet safety requirements such as the federal Virginia Graeme Baker Pool & Spa Safety Act suction entrapment avoidance requirements. Further, most portable spa manufacturers are now meeting California Energy Code (Title 20) energy efficient requirements – these California requirements are currently being developed into an ANSI/APSP approved standard (APSP-14, Energy Efficiency for Portable Spas) and are referenced in federal energy legislation that is slated to pass Congress later this summer. Therefore, portable spas have their own energy efficiency requirements to meet and need to be considered separate from other installations.
2. The APSP-14 standard is slated to be ANSI approved by 2011 in order to incorporate into DOE regulations if the federal legislation passes. It will also be submitted as a proposal to the 2015 IECC. Recognizing that most portable spa manufacturers are already meeting the CEC requirements and due to the fact the proposed federal requirements and APSP-14 standard are not yet approved, this comment clarifies that inground permanently installed spas must meet the current requirements and adds a new section for portable spas. The new section for portable spas inserts the test method found in the CEC regulations for portable spa energy efficiency. It appears the intent of the original proposal was to make sure portable spas (hot tubs) also had to meet energy efficient requirements, this comment stays true to that intent, but recognizes that these factory built assembly unit appliances have their own unique set of requirements that must be followed. This comment ensures that the requirements factory built portable spa manufacturers must meet, follow what is already a California energy regulation and what is slated to become a federal energy regulation and an ANSI approved energy efficient standard. The test protocol in Title 20 includes all aspects of the portable spa, including the portable spa cover and heating elements.
3. It should also be pointed out that many building departments do not consider a factory built portable spa under their purview since it is an appliance and not always a permitted item. Requiring factory built portable spas to follow federal regulations will help to ensure manufacturers meet these requirements. This language provides clarity for the code official to distinguish between an "inground permanently installed spa" and a "portable spa/hot tub," at the same time making sure the factory built portable spas that may require a permit do meet section 1604, Title 20, CEC requirements.
4. This comment makes slight adjustments to the wording found in N1103.8.1, but does not change in the intent of the original proposal. These changes are consistent with the language found in both the Florida Energy & Conservation Code, and in Title 24 of the California Energy Code (provides pump and heater requirements for pools and inground spas). Making these changes ensures all documents use the same words for the same meaning, so to provide clarity and consistency. This language is also found in the draft APSP-15 Energy Efficiency Standard for Residential Pools and Inground Spas, slated for ANSI approval in 2011.
5. The comment also provides clarification under N1103.8.3 "Time Switches." The language maintains the intent of the requirement while allowing solid-state timers and digital controllers (other control method) to be used in addition to tradition mechanical switches. It ensures that "all" heaters and pumps be included in the requirement and clarifies that equipment with onboard time clocks and controls meet the requirement. Some modern heaters and pumps include built-in controls to program operating times, and some include the ability to control other equipment, in all cases the full intent is achieved.
6. The comment removes the R-12 cover requirement. The proposal clarified that hot tubs and spas must also meet this requirement, but as previously discussed, with regard to factory built portable spas, cover requirements are part of the test protocol found in Section 1604, Title 20 of the CEC; therefore, the R-12 requirement should not be applied to factory built portable spas. The R-12 requirement should also be removed for pools and inground spas for the following reasons:
    a. Water evaporation has the most significant negative impact on energy conservation. The most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. The R value has no relevance to evaporation and it is only one way to measure heat retention and should not be the only method specified. The code language should strive for performance language setting the goal for what needs to be accomplished without specifying how it is to be done. This inhibits technical innovation.
    b. The R value for a cover is extremely difficult to measure. Most quoted numbers are calculations based on "hoped for" values. The largest heat loss on a cover are the gaps that are not sealed allowing heated water to escape. These seams for spas or gaps between the cover and deck for pools can negate any relevance of the R factor. R value calculations simply do not address this.
    c. The R-12 requirement is not feasible for pools and inground permanently installed spas as there are no R 12 value pool covers in the market today for those applications. There appears to be no data or studies that give credence to why the R-12 value was applied to pools in the first place (was added in 2009).
    d. Many inground pool and inground spas are equipped with automatic covers. These covers are usually in place every time the pool is not in use. As mentioned previously, evaporative heat loss is the primary culprit. Automatic covers solve that problem and reduce a significant amount of heat loss; at the same time they provide critical safety barrier protection (barrier protection is required by many states and how those requirements interconnect with energy efficient covers should be considered). While an automatic cover is not wanted or possible on every pool, adding an R-12 requirement would prevent automatic covers from being installed in many cases, which would actually result in a higher amount of energy loss, since the pool would not be covered when not in use much of the swimming season resulting in significant evaporative heat loss. This would not accomplish the goal of the energy code and would needlessly harm the automatic cover market in states that adopt this code. There are no automatic cover options that have an R 12 value.

7. The original proposal removed the exception found in N1103.8, this comment seeks to put it back with slight changes. We understand that water evaporation has the most significant negative impact on energy conservation and that the most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. However, requiring covers to be installed on a heated pool becomes problematic as there is no guarantee it will be used after the final permit and if it is not used, the increased energy efficiency will not occur. A cover is a temporary, movable device that could be viewed as beyond the purview of a building code. For those consumers who may not want a cover and will not use it after the final permit, adding back in the exception encourages use of renewable heating devices to ensure some level of energy efficiency and conservation. The clarification that heat pumps also fall under this category and that the percentage is computed over an operating season provides for clarity. The increase in percentage provides for a higher requirement in order to opt out of the cover requirement. These changes are consistent with the Florida Energy & Conservation Code.

Final Action: AS AM AMPC____ D

EC125-09/10-PART I
403.10 (New)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

Add new text as follows:

403.10 Fireplace systems (Mandatory). Fireplace systems shall not have continuously burning pilot lights.

PART II – IRC BUILDING/ENERGY

Add new text as follows:

N1103.9 Fireplace systems. Fireplace systems shall not have continuously burning pilot lights.

Reason: This language is consistent with the ban on continuously burning pilot lights for pool heaters currently in the *IECC*. Under a recent US Department of Energy rulemaking, residential gas cooking equipment will also not be allowed to have continuously burning pilot lights.

According to the Hearth, Patio, and Barbecue Association, between 1.0 and 2.1 million gas fireplace / hearth systems are shipped to North America every year (about 54 to 69% of total hearth shipments. See http://www.hpba.org/index.php?id=238 for more details). Many of these units are shipped to new homes with pilot lights that are only capable of burning continuously, ranging from 800 to 1,200 Btu's per hour. For a fireplace that has a pilot light using 1,000 Btu/hr, and is in "standby" mode for 8000 hours per year (fireplace is used 5 hours per day for 150 days of the year), the pilot light uses 8 million Btu's, or 80 therms. At a national average cost of $1.20 per therm, the cost to a typical consumer is $96 per year.

As a reference point, according to AGA Gas Facts 2007, a typical gas range uses about 55 therms per year, and a typical clothes dryer uses about 50 therms per year (Table 10-1, page 78). In fact, according to the AGA publication, in the Pacific region of the US, residential natural gas fireplaces use almost as much energy (20.8 Mcf) as residential natural gas water heaters (21.3 Mcf).

Significant energy savings are available with current technology. With advanced controls (electronic spark ignition, for example), the standby energy losses are eliminated, and the average consumer saves at least $96, based on the example shown.

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

ICCFILENAME: PRINDLE-EC-26-403.10-N1103.9

Public Hearing Results

PART I – IECC

Committee Action: **Approved as Submitted**

Committee Reason: At this time, there are sufficient products available to allow the code to require pilotless lighters for fireplace systems.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Gregg Achman, representing Hearth & Home Technologies requests Approved as Submitted.

Commenter's Reason: Non-continuous burning pilot systems (Hot Surface Ignition, Intermittent Pilot Ignition, Direct Spark Ignition etc…) have been an ignition means provided by gas fireplace manufacturers for close to 20 years. ANSI/CSA standards for gas fireplaces (ANSI Z21.50/CSA 2.22, Z21.60/CSA 2.26and Z21.88/CSA 2.33) provide testing requirements for various ignition means to ensure product safety and performance requirements are met. The systems are readily available, safe and are more consumer friendly since the consumer will no longer have to manually go through the steps of lighting and extinguishing the pilot each season; it can now be done by the press of a button.

Although the annual savings to the consumer are not large, $90 to $100 as indentified in earlier review and comments on this issue, the total savings per year is substantial at a national level in both dollars and fuel. An example of the potential fuel savings on a typical gas fireplace:

With an input rate of 25,000 Btu/hr, a pilot input rate of 1,200 Btu/hr for a continuous burning (standing pilot) pilot, and a seasonal operation cycle of 5 hours per day for 150 days, the total fuel usage per year would be 283.5 therms, of which, 33% of the fuel usage (96 therms) would be used by the continuously burning pilot when the fireplace is not operating.

Public Comment 2:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

403.10 Fireplace systems (Mandatory). Fireplace systems shall not have continuously burning pilot lights.

Exception: Fireplace systems regulated by the U.S. Department of Energy.

Commenter's Reason: *EC125 should be approved as modified by this public comment.*
Although EC125 was recommended for approved as submitted by the IECC Code Development Committee, a concern was raised at the hearing that fireplace systems regulated by the U.S. Department of Energy would be preempted by federal law. This public comment adds an exception that will alleviate any preemption issues that may arise from adding requirements to DOE-regulated equipment.

Public Comment 3:

Robert Beauregard, American Public Gas Association, Ken Belding, Empire Comfort Systems , Inc., Rick Curkeet, Intertek Testing Services, NA, Inc., Patrick A. McLaughlin, McLaughlin & Associates, Roger Purinton, Jøtul North America, Inc., James Ranfone, American Gas Association, Thomas Stroud, Hearth, Patio & Barbecue Association, Bruce Swiecicki. National Propane Gas Association, request Disapproval.

Commenter's Reason: (Robert Beauregard) The proponent overstated expected savings from elimination of standing pilot lights and ignored the ban's negative impacts. The IRC committee disapproved the same proposed code change submitted to the IRC for the following reason: *"The committee was concerned that, in some cases, pilots are safety devices, and therefore the proposal would severely hurt some product manufacturers. In addition, this represents minimal savings."*

1. Overstating Savings: The proponent's calculated savings are based on a full year of operation. Homeowners typically shut down the standing pilot on fireplace appliances or shut off the gas valve during parts of the year when the appliance is unlikely to be operated.
2. Bans vent free room heaters: The standing pilot on vent-free room heaters is often designed for fireplaces and is part of their oxygen depletion safety (ODS) system. There is no practical way to design a vent free room heater without a standing pilot. The proposal would effectively ban vent free heaters designed for fireplace installation without providing any technical justification.

Does not account for the negative environmental impact of continued wood burning. Banning pilot equipped gas logs would reduce gas log installation given the significantly higher costs for electrically equipped ignition systems for gas logs

(Ken Belding) 1. Continuous pilot operation allows for keeping the system and pilot clean and free from spider webs and or corrosive atmospheric elements which can damage the heating system .Condensation as an example can form prematurely causing a replacement needing to be made.

2. Manufacturers, such as Empire are feeling the recession / depression as well as every other fireplace mfr. And at a minimum would like this revisited at a later date. The cost to recertify every sku for intermittent ignition would easily run in to the six figure category and that does not include another six figures for retooling and developing the system needed for intermittent or direct ignition.
3. Many of our customers live through power outage situations during the winter. This product categorized by the DOE as a direct heating appliance was recognized by DOE in the most recent rule making on energy efficiency to be perfectly acceptable with standing pilot because of the safety issue associated with when this product is needed , the winter . There are many documented cases of people freezing to death and or having their house mechanicals freezing during a bad winter storm, especially those involving a large accumulation of ice.
4. Vent free room heaters and log sets / fireplaces require an oxygen depletion sensor pilot which is a standing pilot. This again is a safety feature required on these types of heaters. Consumers use these products as heaters and again are recognized by DOE as an efficient heating device which was emphasized again in the most recent energy efficiency rulemaking by DOE published on 4.16.10.
5. IRC-Energy as I understand has rejected a proposal to ban standing pilots because of the need for more study due to safety concerns. We believe that safety should be the first priority in any code rule and this proposal recognized by your own code group has issues that need to be considered further and taken care of with safety in the equation.
6. We appreciate the concern for efficiency but this is one tool designed with safety in mind and has the potential to over ride a hundred years of serving that purpose.

Thank you for your consideration of our concerns with this proposal and please disapprove the proposal.

(Rick Curkeet) The proposal to ban the use of standing pilot safety controls on gas fired fireplaces should be disapproved for several reasons. First, gas fireplaces are not similar to pool heaters or kitchen ranges. They are installed in living areas and frequently have large glass doors. They are often used for supplemental or emergency heating. Units with standing pilots do not require electric power to operate and are therefore capable of providing heating during extended power outages. They only require a gas line to be installed and thus avoid the cost of additional electrical circuit installation.

The term "fireplace systems" in the proposal is overly broad. This could be interpreted to include virtually any product that operates on gas fuel and has the aesthetic quality of a visible flame. This would include "Vented Gas Fireplace Heaters", "Vented Decorative Gas Fireplaces", "Decorative Gas Appliances for Installation in Solid-Fuel Burning Fireplaces" and "Unvented Gas-Fired Room Heaters". All of these appliance types are covered by ANSI Safety Standards specified in the codes and all are required to have proven gas ignition safety controls which include standing pilots. In the case of Unvented Room Heaters, an Oxygen Depletion Sensor (ODS) is required and this device is a specialized form of a standing pilot. Thus, the code change could have the effect of banning unvented room heaters even though these products are, by definition, nearly 100% energy efficient.

Standing pilots have also long been proven to be a very reliable safety device as they are very effective at preventing explosive delayed ignitions. This is of particular concern when dealing with fireplaces that have glass fronts as explosive ignitions resulting from slow accumulation of gas in the appliance can cause glass breakage and personal injury. Intermittent electronic ignition systems do not detect the presence of a flammable gas/air mixture before energizing the igniter. This means that when a gas valve fails to close completely and a small amount of gas continues to flow, it's quite possible to fill the entire appliance and vent system with a flammable air/gas mixture which will create a powerful explosion upon attempted ignition. Standing pilots have been proven to be effective at preventing this condition by igniting the gas as soon as the lower flammability limit is reached.

Standing pilots also maintain the temperature of the appliance at somewhat above the ambient temperature which aids in establishing proper draft and venting and prevents water condensation within the appliance and vent system. Condensation prevention reduces corrosion and deterioration of these parts. The minor cost of the pilot fuel consumption is trivial compared to early deterioration and replacement costs of a fireplace. There have also been reports of units with intermittent electronic ignition devices failing to properly and safely ignite in very cold weather. This appears to occur primarily in Direct Vent type appliances due to circulation of extremely cold air through the appliance and failure to establish adequate venting draft when the appliance ignition is attempted. This has not been an issue with units that have standing pilots.

All units with standing pilots can be turned off completely by the user at any time. Most units have a convenient and simple to use pilot ignition system so the user is in complete control of whether or not the unit uses pilot gas when not being used. Certainly consumers who do not wish to spend the estimated $94/yr on pilot gas can simply turn the pilot off over the summer months or whenever they're not using the unit. Using the proponent's calculations, $61.92 of the supposed $94 cost would be avoided by simply turning the gas valve off during the 215 days when the appliance is not in use.

The proposal, if accepted would have the unintended consequence of encouraging sales of many more "manually ignited" gas-log decorative appliances. These appliances, listed per ANSI Z21.84, are allowed by the current codes (IRC and IFGC) and the proposed change would eliminate many competitive products that use standing pilots which substantially reduce the risks of personal injury and asphyxiation that are associated historically with manually lighted gas appliances.

Finally, gas fireplace heaters are required to meet US DOE minimum Annual Fuel Utilization Efficiency (AFUE) requirements which account for the gas consumed by a standing pilot. Code requirements should not eliminate a class of products that meet Federal Energy Efficiency regulations from installation on the grounds that a specific feature is not sufficiently energy efficient. The proposal would, for example, allow a Fireplace Heater with an intermittent ignition and an AFUE of 65% while disallowing a similar appliance with a standing pilot and an AFUE of 70%. This would certainly not result in fuel savings or lower operating costs.

(Patrick A. McLaughlin) The Air-Conditioning, Heating and Refrigeration Institute (AHRI) is the trade association representing more than 300 manufacturers of air conditioning, heating and commercial refrigeration equipment. Their product categories include many types of vented and unvented gas residential heating appliances. This proposed change should be disapproved for two key reasons. First, the U.S. Department of Energy regulation 10 CFR 430.32(i) regarding energy efficiency of fireplace direct heating equipment, developed as a result of the federal National Appliance Energy Conservation Act (NAECA), preempts some of the equipment covered by the code proposal. Second, unvented gas appliances are required by the national product standard, ANSI Z21.11.2, to have a oxygen depletion sensor (ODS), which is the standing pilot, as an important safety feature. Consumer safety should take precedence over modest energy savings, particularly when unvented gas-fired fireplace appliances with an ODS are energy efficient heating products.

(Roger Purinton) Jøtul North America expresses the same concerns as many other experts in the hearth industry that the banning of standing pilot technology to improve energy efficiency could have significant unintended consequences regarding product safety. A proposal to eliminate the use of standing pilots should be very carefully considered relative to other significant aspects unique to hearth products. Certainly the issue of energy conservation is very important, however, considerations of product safety should be of uppermost concern.

The most serious of those concerns is that with the absence of a pilot, gas could be allowed to accumulate in a combustion chamber and in turn result in increased possibility of serious delayed ignition potential. A primary function of a standing pilot is to prevent such conditions of gas accumulation, a condition that is not likely to happen in appliances such as kitchen range tops or other products where significant accumulation can not occur.

Another well recognized aspect of standing pilots is the promotion of product longevity by way of minimizing potentially corrosive condensation which could be detrimental to the long term integrity of the combustion chamber. A standing pilot provides a warmed firebox which prevents the development of condensation that can occur with cold fireboxes each time the appliances main burner is activated. Frequent and repeated exposure to condensation is a concern for product durability and integrity which is an important aspect of insuring product safety.

A continued objective of assuring the highest level of product safety should be of paramount concern regarding products that are typically operated in a homes primary living space in proximity to the occupants. Standing pilots have a clearly demonstrated history of providing that level of safety and durability for hearth type products. A comparable level does not appear achievable for hearth products by way of other available recognized technology.

(James Ranfone) The proponent overstated the expected savings that may result from the elimination of standing pilot lights while ignoring the negative impacts such a ban would create. The IRC committee recognized the weakness of the proposed change and disapproved the same code change submitted to the IRC for the following reason: *"The committee was concerned that, in some cases, pilots are safety devices, and therefore the proposal would severely hurt some product manufacturers. In addition, this represents minimal savings."*

1. Overstating of Savings: The proponent based his calculated savings on a full year of operation. However, homeowners typically shut down the standing pilot on fireplace appliances or shut off the gas valve during the time of year when the appliance is unlikely to be operated. Therefore, most of the year the pilot would not be burning.
2. Bans vent free room heaters: The standing pilot on a vent-free room heater, which are often designed for fireplaces, is part of their oxygen depletion safety (ODS) system. There is no practical way to design a vent free room heater without a standing pilot. Therefore the proposal would ban vent free heaters designed for fireplace installation. No technical justification was provided for banning a listed appliance that has an outstanding life safety record.

Fails to account for environmental impact of continued wood burning: Gas logs are often installed in existing or new fireplaces as a substitute for burning wood. The ban on pilot equipped gas logs would reduce their installation rate due to significantly higher costs. Electrically equipped ignition systems for gas logs would add to their cost and in addition there are increased installation costs associated with supplying electrical connections inside or near the fireplace. These increased costs are likely to result in fewer gas logs being installed and the continued use of wood. The proponent has not accounted for the environmental impact of the number of fireplaces that would not be converted to gas and if their wood emissions would be offset by the pilot light ban.

(Thomas Stroud) The proposal to ban the use of continuous (standing) pilots on gas fired fireplaces should be disapproved for the following reasons:

- In supplemental heating situations an appliance with a standing pilot does not require electric power to operate and is therefore capable of providing safe heat during extended power outages.
- In the case of unvented room heaters, an Oxygen Depletion Sensor (ODS) is required; this device is a specialized form of standing pilot. Thus, this code change could have the effect of banning all unvented room heaters even though these products are, by DOE's admission, nearly 100% efficient. No technical justification has been provided for banning a listed appliance that has an excellent safety record.
- For appliances designed with a standing pilot, they have also long been proven to be a very reliable safety device, particularly in direct vent hearth systems.
    - Pilot lights protect sealed combustion direct vent fireplaces from accumulation of gas, trace leakage and the resulting delayed ignition explosions. This is of particular concern when dealing with fireplaces that have glass fronts, as explosive ignitions resulting from slow accumulation of gas in the appliance can cause glass breakage and personal injury.
    - As of this writing there have been nine explosive events in Canada. These explosive events took place in Ontario, Canada, where standing pilots were slated for elimination. The Technical Standards and Safety Authority (TSSA, the relevant safety authority in Ontario) has recently raised considerable safety concerns about fireplaces without standing pilots. They cited these recent examples of glass blow out which they attribute to start up issues caused by a cold firebox. There has been at least one serious injury.
    - The standing pilot is important in cold climates in ensuring that the "cold air plug" does not reduce the ability to draft immediately, a situation that can also cause delayed ignition.
- Standing pilots also help to maintain the temperature of the appliance at somewhat above ambient temperature and helps prevent condensation within the appliance and venting system. Condensation prevention reduces corrosion and deterioration of these parts. The minor cost savings of eliminating the gas utilized by the pilot will be seen as trivial compared to the deterioration of the equipment and maintenance costs created by their elimination.
- Adding a small amount of heat into the firebox is beneficial in very cold climates where condensation can result in frost forming on glass front of the direct vent fireplace.
- Standing pilots can be turned off during the seasons when not in use. Most manufacturers recommend turning off the pilot and provide instructions of how to do so in their use manuals. However, HBA contests the gas savings listed by the proponent because of the inflated gas costs. Whatever numbers are used, turning off the pilot light during unused seasons would save up to two thirds of those costs.
- These "fireplace systems" are all covered by ANSI/CSA safety standards. By eliminating the option of using standing pilots, many products will have to go through expensive re-testing and re-designing, because the standing pilot is so integral to their use.
- The IRC-Energy voted to reject this proposal based on safety concerns. The TSSA which has raised concerns following the nine incidents that they are aware of in Canada regarding standing pilot lights and Natural Resources Canada (NRCan) has recently acknowledged that standing pilots may have legitimate uses which deserve further study.

These safety considerations plus those listed above lead HPBA to recommend for disapproval of this proposal.

(Bruce Swiecicki) The proposal to ban the use of standing pilot safety controls on gas fired fireplaces should be disapproved for several reasons. First, gas fireplaces are not similar to pool heaters or kitchen ranges. They are installed in living areas and frequently have large glass doors. They are often used for supplemental or emergency heating. Units with standing pilots do not require electric power to operate and are therefore capable of providing heating during extended power outages. They only require a gas line to be installed and thus avoid the cost of additional electrical circuit installation.

The term "fireplace systems" in the proposal is overly broad. This could be interpreted to include virtually any product that operates on gas fuel and has the aesthetic quality of a visible flame. This would include "Vented Gas Fireplace Heaters", "Vented Decorative Gas Fireplaces", "Decorative Gas Appliances for Installation in Solid-Fuel Burning Fireplaces" and "Unvented Gas-Fired Room Heaters". All of these appliance types are covered by ANSI Safety Standards specified in the codes and all are required to have proven gas ignition safety controls which include standing pilots. In the case of Unvented Room Heaters, an Oxygen Depletion Sensor (ODS) is required and this device is a specialized form of a standing pilot. Thus, the code change could have the effect of banning unvented room heaters even though these products are, by definition, nearly 100% energy efficient.

All units with standing pilots can be turned off completely by the user at any time. Most units have a convenient and simple to use pilot ignition system so the user is in complete control of whether or not the unit uses pilot gas when not being used. Certainly consumers who do not wish to spend the estimated $94/yr on pilot gas can simply turn the pilot off over the summer months or whenever they're not using the unit. Using the proponent's calculations, $61.92 of the supposed $94 cost would be avoided by simply turning the gas valve off during the 215 days when the appliance is not in use.

Additionally, gas fireplace heaters are required to meet DOE minimum Annual Fuel Utilization Efficiency (AFUE) requirements which account for the gas consumed by a standing pilot. Code requirements should not eliminate a class of products that meet Federal Energy Efficiency regulations from installation on the grounds that a specific feature is not sufficiently energy efficient. The proposal would, for example, allow a Fireplace Heater with an intermittent ignition and an AFUE of 65% while disallowing a similar appliance with a standing pilot and an AFUE of 70%. This would certainly not result in fuel savings or lower operating costs.

Final Action: AS AM AMPC____ D

EC125-09/10-PART II
N1103.9 (New)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

Add new text as follows:

N1103.9 Fireplace systems. Fireplace systems shall not have continuously burning pilot lights.

Reason: This language is consistent with the ban on continuously burning pilot lights for pool heaters currently in the *IECC*. Under a recent US Department of Energy rulemaking, residential gas cooking equipment will also not be allowed to have continuously burning pilot lights.

According to the Hearth, Patio, and Barbecue Association, between 1.0 and 2.1 million gas fireplace / hearth systems are shipped to North America every year (about 54 to 69% of total hearth shipments. See http://www.hpba.org/index.php?id=238 for more details). Many of these units are shipped to new homes with pilot lights that are only capable of burning continuously, ranging from 800 to 1,200 Btu's per hour. For a fireplace that has a pilot light using 1,000 Btu/hr, and is in "standby" mode for 8000 hours per year (fireplace is used 5 hours per day for 150 days of the year), the pilot light uses 8 million Btu's, or 80 therms. At a national average cost of $1.20 per therm, the cost to a typical consumer is $96 per year.

As a reference point, according to AGA Gas Facts 2007, a typical gas range uses about 55 therms per year, and a typical clothes dryer uses about 50 therms per year (Table 10-1, page 78). In fact, according to the AGA publication, in the Pacific region of the US, residential natural gas fireplaces use almost as much energy (20.8 Mcf) as residential natural gas water heaters (21.3 Mcf).

Significant energy savings are available with current technology. With advanced controls (electronic spark ignition, for example), the standby energy losses are eliminated, and the average consumer saves at least $96, based on the example shown.

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

ICCFILENAME: PRINDLE-EC-26-403.10-N1103.9

Public Hearing Results

PART II – IRC

Committee Action: **Disapproved**

Committee Reason: The committee was concerned that, in some cases, pilots are safety devices, and therefore the proposal would severely hurt some product manufacturers. In addition, this represents minimal savings.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC and Craig Conner, Building Quality, requests Approval as Submitted.

Commenter's Reason: The best way to align the codes would be to approve RE4. The changes to the IRC are not needed if RE4 aligns the codes.

Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC13, EC 16 and EC17.

We agree with the IECC Committee's reasoning that this product is readily available and the requirement is not hard to comply with. Standing pilot lights are a waste of energy. We would recommend Approval as Submitted for EC125 Part II to be consistent with Part I.

Public Comment 2:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1103.9 Fireplace systems. Fireplace systems shall not have continuously burning pilot lights.

Exception: Fireplace systems regulated by the U.S. Department of Energy.

Commenter's Reason: *EC125 should be approved as modified by this public comment.*
Although EC125 was recommended for approved as submitted by the IECC Code Development Committee, a concern was raised at the hearing that fireplace systems regulated by the U.S. Department of Energy would be preempted by federal law. This public comment adds an exception that will alleviate any preemption issues that may arise from adding requirements to DOE-regulated equipment.

Final Action: AS AM AMPC____ D

EC126-09/10-PART I

202 (New), 403.11 (New), Table 405.5.2(1)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART I – IECC

1. Revise definition as follows:

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. Such systems include equipment referred to as an "energy recovery ventilator" (ERV) or as a "heat recovery ventilator" (HRV).

2. Add new definition as follows:

SPECIFIC LEAKAGE AREA (SLA). The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with section 5.1 of ASHRAE 119 and where L and CFA are in the same units.

3. Add new text as follows:

403.11 *Energy recovery ventilation system* and air leakage supplemental requirements. The building shall meet the following the requirements:

1. An *energy recovery ventilation system* shall be installed. For warm humid counties as identified in Table 301.1, a dehumidifier with a built in humidistat shall be installed in addition to the *energy recovery ventilation system*.
2. Building air leakage shall be tested in accordance with the procedure prescribed in Section 402.4.2.1, except that the air leakage shall not exceed 0.00015 *specific leakage area (SLA)* for all buildings except multifamily, which shall not exceed 0.00018 *specific leakage area (SLA),* when tested with a blower door at a pressure of 33.5 psf (50 Pa) by an *approved* party independent of the builder and any contractors involved in any aspect of sealing the building.

   Exceptions:

   1. Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20% and meets or exceeds 12.5 EER.
   2. Buildings located in climate zones 3, 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15% and cooling equipment that meets or exceeds 12.5 EER.
   3. Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20%.
   4. In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not commercially available, the equipment with the highest rated efficiency commercially available can be substituted, when *approved* by the *code official*,
   5. As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.

4. Revise table as follows:

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	*Specific leakage area (SLA)*[d] = 0.00015~~36~~ ~~assuming no energy recovery.~~ with a 70% efficient *energy recovery ventilation system*. Exceptions: 1. For multifamily buildings, the specific leakage area shall be 0.00018 with a 70% efficient *energy recovery ventilation system*. 2. For buildings subject to the exceptions in section 403.11, SLA = 0.00030, assuming no energy recovery.	~~For residences that are not tested, the same as the standard reference design.~~ *Specific Leakage Area (SLA)* = the tested value for the proposed home and the tested value shall be in determined accordance with the methodology set out in section 402.4.2.1 and the ASHRAE 119, Section 5.1 and the SLA shall be: 1. For residences without mechanical ventilation ~~that are tested in accordance with ASHRAE 119, Section 5.1,~~ the measured air exchange rate[e] but not less than 0.35 ACH. 2. For residences with mechanical ventilation that is not an *energy recovery ventilation system* ~~that are tested in accordance with ASHRAE 119, Section 5.1,~~ the measured air exchange rate[e] combined with the mechanical ventilation rate, [f] which shall not be less than 0.01 x *CFA* + 7.5 x (N_{br} + 1) where: *CFA* = conditioned floor area N_{br} = number of bedrooms 3. For residences with *energy recovery ventilation systems*, the efficiency of the energy or heat recovery ventilation system shall be as proposed.

~~d. Where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:~~
~~SLA = L/CFA~~
~~where L and CFA are in the same units.~~

(Portions of table and footnotes not shown remain unchanged)

Reason: There is significant energy savings potential in homes through tested air leakage improvements with energy recovery ventilation equipment or though having higher efficiency equipment. This proposal creates a trade-up opportunity, where a home can achieve significant savings through either the primary requirements or the exceptions. This proposal also makes necessary changes to Table 405.4.2(1) of the IECC to incorporate the effects of this proposal into the Simulated Performance Alternative in Section 405.

For the primary requirements, this proposal achieves significant savings from tested air leakage improvements with energy recovery equipment. These base requirements achieve approximately 12-17% estimated heating and cooling energy savings or approximately 5 to 12% purchased energy savings (including appliances and lighting) depending on the location and home specifications.

One of the key criteria in the primary requirements is to install an energy recovery ventilation system (either ERV or HRV). This is critical for achieving energy savings from a tight home. Without the energy recovery ventilation system, no home or program can claim energy savings credit for substantially tight homes. Therefore, by tightening the house to levels that many houses today are already tightening them (0.00015), minimal to no savings are achieved depending on the location. However, by installing the energy recovery ventilator energy savings between $100-300 per year are achieved depending on the climate. The most savings are achieved in the coldest climates due to the extreme temperature difference between the inside and outside temperatures.

The exception has reasonable and sensible equipment requirements that can achieve approximately 10-16% heating and cooling energy savings or approximately 5-11% purchased energy savings depending on location and home specifications. Example specifications for the exemption include:

>15.6 SEER and 12.5 EER AC in Climate Zone 1 & 2
- with available equipment up to 23 SEER
- includes 46,375 records from AHRI directory of air conditioning equipment available

>14.95 SEER and 12.5 EER AC in Climate Zone 3, 4 and 5
- with available equipment up to 23 SEER
- includes 101,899 records from AHRI directory of air conditioning equipment available

> 89.7 AFUE in Climate Zone 3, 4 and 5
- with available equipment up to 96+ AFUE
- includes 5,100 records from AHRI directory of furnace equipment available

> 93.6 AFUE in Climate Zone 6, 7 and 8

- with available equipment up to 96+ AFUE
- includes 1,339 records from AHRI directory of furnace equipment available

> 8.86 HSPF in Climate Zone 3, 4 and 5

- with available equipment up to 11 HSPF
- includes 27,310 records from AHRI directory of heat pump equipment available

> 9.24 HSPF in Climate Zone 6, 7 and 8

- with available equipment up to 11 HSPF
- includes 9,051 records from AHRI directory of heat pump equipment available

In addition to having the improved efficiency requirement beyond federal minimum standards, this proposal also has improved EER rating in the exception that will ensure higher performance in peak temperature hours. Per ACEEE, for utilities, reducing peak demand is worth somewhere in the range of $1000/kW. That is an estimate of the costs avoided by not building new peak generation, plus the required reinforcements of transmission and distribution. In many cases, capacity constraints for the foreseeable future make avoiding peak demand even more valuable than saving energy. For a 3-ton central air conditioner the difference between EER 11.5 and EER 12 is about 0.13 kW on a 95ºF day. This difference is much of the justification for rebates in CA, for example, since by itself a 0.13 kW peak reduction is worth roughly $130. *(source: ACEEE)*

The exception that allows for ground source heat pumps (GSHP) with efficiency greater than or equal to 2.8 COP to be installed in climates 3 through 8, is based on DOE recommendations, while FEMP recommends GSHP efficiency levels of 3.3 COP of higher. It is also important to point out that maximum efficiency for GSHP are closer to 5 COP.
Source: http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12670
Source: http://www1.eere.energy.gov/femp/procurement/eep_groundsource_heatpumps.html

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

ICCFILENAME: PRINDLE-EC-27-202-403.11-R202-N1103.10

Public Hearing Results

PART I – IECC

Committee Action: **Disapproved**

Committee Reason: The proposal would provide a conflict with EC13. The energy recovery ventilator would not be cost effective in cold climates.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Modified by this Public Comment.

Modify the proposal as follows:

SECTION 202
GENERAL DEFINITIONS

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. Such systems include equipment referred to as an “energy recovery ventilator” (ERV) or as a “heat recovery ventilator” (HRV).

~~**SPECIFIC LEAKAGE AREA (SLA).** The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with section 5.1 of ASHRAE 119 and where L and CFA are in the same units.~~

403.11 ~~***Energy recovery ventilation system*** **and air leakage supplemental requirements**~~ **Thermal distribution system efficiency.** ~~The building shall meet the following requirements:~~ The entire thermal distribution system, including all ducts and air handlers, shall be located entirely within the conditioned space.

Exception: Buildings that meet all of the requirements in one of the following three exceptions:

1. An *energy recovery ventilation system,* that includes either an energy recovery ventilator or heat recovery ventilator, shall be installed. For warm humid counties as identified in table 301.1, a dehumidifier with a built in humidistat shall be installed in addition to the *energy recovery ventilation system*. ~~2.~~ Building air leakage shall be tested in accordance with the procedure prescribed in

Section 402.4.1.2.1,. except that the The air leakage shall not exceed three air changes per hour (ACH50) 0.00015 *specific leakage area (SLA)* for all buildings except multifamily, which shall not exceed four air changes per hour (ACH50) 0.00018 *specific leakage area (SLA),* when tested with a blower door at a pressure of 33.5 psf 0.2 inches w.g. (50 Pa) by an *approved* party independent of the builder and any contractors involved in any aspect of sealing the building.

2. A hydronic thermal distribution system, as defined in the notes to Table 405.5.2(2), shall be installed for space heating and cooling systems.
3. A ductless thermal distribution system, as defined in the notes to Table 405.5.2(2), shall be installed for space heating and cooling systems.

Exceptions:

1. Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20% and meets or exceeds 12.5 EER.
2. Buildings located in climate zones 3 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15% and cooling equipment that meets or exceeds 12.5 EER.
3. Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20%.
4. In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not commercially available, the equipment with the highest rated efficiency commercially available can be substituted, when *approved* by the *code official*.
5. As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	*Specific leakage area (SLA)* = 0.00015 with a 70% efficient *energy recovery ventilation system*. Air leakage rate of 5 air changes per hour in zones 1 through 8 at a pressure of 0.2 inches w.g., (50 Pa). The mechanical ventilation rate shall be in addition to the air leakage rate and the same as in the proposed design, but no greater than 0.01 x CFA +7.5 x (Nbr + 1) where: *CFA* = conditioned floor area N_{br} = number of bedrooms Energy recovery shall not be assumed for mechanical ventilation. Exceptions: 1. For multifamily buildings, the specific air leakage area shall be 7 ACH50 assuming no energy recovery when tested with a blower door at a pressure of 0.2 inches w.g. (50 Pa) 0.00018 with a 70% efficient *energy recovery ventilation system*. 2. For buildings subject to the exceptions in section 403.11, SLA = 0.00030, assuming no energy recovery.	The measured air exchange rate as determined through testing in accordance with section 402.4.1.2. The mechanical ventilation rate shall be in addition to the air leakage rate and shall be as proposed. *Specific Leakage Area (SLA)* = the tested value for the proposed home and the tested value shall be in determined accordance with the methodology set out in section 402.4.2.1 and the ASHRAE 119, Section 5.1 and the SLA shall be: 1. For residences without mechanical ventilation the measured air exchange rate[e] but not less than 0.35 ACH. 2. For residences with mechanical ventilation that is not an *energy recovery ventilation system* the measured air exchange rate[e] combined with the mechanical ventilation rate, *f* which shall not be less than 0.01 x *CFA* + 7.5 x (N_{br} + 1) where: *CFA* = conditioned floor area N_{br} = number of bedrooms 3. For residences with *energy recovery ventilation systems*, the efficiency of the energy or heat recovery ventilation system shall be as proposed.
Thermal distribution systems	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. Duct insulation: from Section 403.2.1 *For tested duct systems, the leakage rate shall be the applicable maximum rate from Section 403.2.2.*	As tested or as specified in Table 405.5.2 (2) if not tested The air leakage rate or DSE shall be as tested in accordance with Section 403.2.2. Duct insulation shall be as proposed. Exception: Proposed distribution systems that qualify for default values under Table 405.5.2 may use the DSE specified in Table 405.5.2(2) in lieu of tested air leakage values. Forced air systems located entirely in conditioned space, may use the default value only when ducts are also tested and meet the maximum value set forth in the Exception to 403.2.2. and are insulated as required in Section 403.2.1.

~~d. Where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:~~
~~SLA = L/CFA~~
~~where L and CFA are in the same units.~~

Commenter's Reason: *EC126 should be approved as modified by this public comment.*

Among the individual (non-package) proposals being considered, this proposal, if approved as modified, is a big energy saver – from either improved thermal distribution systems or tested air leakage improvements with energy recovery equipment.

The modifications in this public comment will specifically require ducts and air handlers in conditioned space (as DOE's original EC13 does). As an Exception (alternative), other more efficient distribution systems, like hydronic and ductless (already included and defined in the code), will be permitted. And for those who do not want to redesign and construct improved distribution/duct systems, there will be the option to install either an ERV or HRV energy recovery ventilation system.

The effect of these modifications will also be to create more consistency with EC13, while avoiding any federal preemption claims related to improved mechanical equipment. This proposal also removes the term specific leakage area and uses air changes per hour (ACH) for the air leakage requirements, as in EC13. To address the comment from the IECC committee, the modification alters the exceptions to remove potentially confusing language.

The resulting efficiency (and cost savings) are significant:

(1) With the baseline requirement of ducts in the conditioned space, most of the heating and cooling energy will make it to the conditioned space, with a default distribution efficiency of 88%.
(2) With ductless thermal distribution systems, there are no distribution system losses through ducts, with a default distribution efficiency of 100%.
(3) With hydronic thermal distribution systems, there are minimal distribution system losses, with a default distribution efficiency of 95% when the system is located in unconditioned space and 100% when it is within conditioned space.
(4) With the energy recovery equipment, this proposal achieves approximately 5 to 12% purchased energy savings (including heating, cooling, hot water, appliance and lighting energy use) depending on specific house and location. This translates to energy savings that range from $100 to $300 per year.

Each of these four options will save significant energy compared to the current baseline in the 2009 IECC and IRC.

Final Action: AS AM AMPC____ D

EC126—PART II-09/10
R202 (New), N1103.10 (New)

Proposed Change as Submitted

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

PART II – IRC BUILDING/ENERGY

1. Add new definitions as follows:

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. Such systems include equipment referred to as an "energy recovery ventilator" (ERV) or as a "heat recovery ventilator" (HRV).

SPECIFIC LEAKAGE AREA (SLA). The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where L and CFA are in the same units.

2. Add new text as follows:

N1103.10 *Energy recovery ventilation system* and air leakage supplemental requirements. The building shall meet the following the requirements:

1. An *energy recovery ventilation system* shall be installed. For warm humid counties as identified in table N1101.2, a dehumidifier with a built in humidistat shall be installed in addition to the *energy recovery ventilation system*.
2. Building air leakage shall be tested in accordance with the procedure prescribed in Section N1102.4.2.1, except that the air leakage shall not exceed 0.00015 *specific leakage area (SLA)* for all buildings except multifamily, which shall not exceed 0.00018 *specific leakage area (SLA),* when tested with a blower door at a pressure of 33.5 psf (50 Pa) by an *approved* party independent of the builder and any contractors involved in any aspect of sealing the building.

   Exceptions:

   1. Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20 percent and meets or exceeds 12.5 EER.
   2. Buildings located in climate zones 3, 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15 percent and cooling equipment that meets or exceeds 12.5 EER.
   3. Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20 percent.
   4. In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not commercially available, the equipment with the highest rated efficiency commercially available can be substituted, when *approved* by the *building official*,
   5. As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.

Reason: There is significant energy savings potential in homes through tested air leakage improvements with energy recovery ventilation equipment or though having higher efficiency equipment. This proposal creates a trade-up opportunity, where a home can achieve significant savings through either the primary requirements or the exceptions. This proposal also makes necessary changes to Table 405.4.2(1) of the IECC to incorporate the effects of this proposal into the Simulated Performance Alternative in Section 405.

For the primary requirements, this proposal achieves significant savings from tested air leakage improvements with energy recovery equipment. These base requirements achieve approximately 12-17% estimated heating and cooling energy savings or approximately 5 to 12% purchased energy savings (including appliances and lighting) depending on the location and home specifications.

One of the key criteria in the primary requirements is to install an energy recovery ventilation system (either ERV or HRV). This is critical for achieving energy savings from a tight home. Without the energy recovery ventilation system, no home or program can claim energy savings credit for substantially tight homes. Therefore, by tightening the house to levels that many houses today are already tightening them (0.00015), minimal to no savings are achieved depending on the location. However, by installing the energy recovery ventilator energy savings between $100-300 per year are achieved depending on the climate. The most savings are achieved in the coldest climates due to the extreme temperature difference between the inside and outside temperatures.

The exception has reasonable and sensible equipment requirements that can achieve approximately 10-16% heating and cooling energy savings or approximately 5-11% purchased energy savings depending on location and home specifications. Example specifications for the exemption include:

>15.6 SEER and 12.5 EER AC in Climate Zone 1 & 2

- with available equipment up to 23 SEER
- includes 46,375 records from AHRI directory of air conditioning equipment available

>14.95 SEER and 12.5 EER AC in Climate Zone 3, 4 and 5

- with available equipment up to 23 SEER
- includes 101,899 records from AHRI directory of air conditioning equipment available

> 89.7 AFUE in Climate Zone 3, 4 and 5

- with available equipment up to 96+ AFUE
- includes 5,100 records from AHRI directory of furnace equipment available

> 93.6 AFUE in Climate Zone 6, 7 and 8

- with available equipment up to 96+ AFUE
- includes 1,339 records from AHRI directory of furnace equipment available

> 8.86 HSPF in Climate Zone 3, 4 and 5

- with available equipment up to 11 HSPF
- includes 27,310 records from AHRI directory of heat pump equipment available

> 9.24 HSPF in Climate Zone 6, 7 and 8

- with available equipment up to 11 HSPF
- includes 9,051 records from AHRI directory of heat pump equipment available

In addition to having the improved efficiency requirement beyond federal minimum standards, this proposal also has improved EER rating in the exception that will ensure higher performance in peak temperature hours. Per ACEEE, for utilities, reducing peak demand is worth somewhere in the range of $1000/kW. That is an estimate of the costs avoided by not building new peak generation, plus the required reinforcements of transmission and distribution. In many cases, capacity constraints for the foreseeable future make avoiding peak demand even more valuable than saving energy. For a 3-ton central air conditioner the difference between EER 11.5 and EER 12 is about 0.13 kW on a 95ºF day. This difference is much of the justification for rebates in CA, for example, since by itself a 0.13 kW peak reduction is worth roughly $130. *(source: ACEEE)*

The exception that allows for ground source heat pumps (GSHP) with efficiency greater than or equal to 2.8 COP to be installed in climates 3 through 8, is based on DOE recommendations, while FEMP recommends GSHP efficiency levels of 3.3 COP of higher. It is also important to point out that maximum efficiency for GSHP are closer to 5 COP.
Source: http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12670
Source: http://www1.eere.energy.gov/femp/procurement/eep_groundsource_heatpumps.html

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

ICCFILENAME: PRINDLE-EC-27-202-403.11-R202-N1103.10

Public Hearing Results

PART II – IRC

Committee Action: Disapproved

Committee Reason: The structure of the code would be confusing, given that there are exceptions to other exceptions. The reference to specific leakage area is confusing, as it is not an accepted term in the IECC vernacular.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Modified by this Public Comment.

Modify the proposal as follows:

SECTION R202
GENERAL DEFINITIONS

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying the air to a space, either directly or as part of an HVAC system. Such systems include equipment referred to as an "energy recovery ventilator" (ERV) or as a "heat recovery ventilator" (HRV).

~~**SPECIFIC LEAKAGE AREA (SLA).** The air leakage area (L) per conditioned floor area (CFA) of a home (L/CFA), where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where L and CFA are in the same units.~~

N1103.10 ~~***Energy recovery ventilation system*** **and air leakage supplemental requirements**~~ <u>**Thermal distribution system efficiency**</u>**.** ~~The building shall meet the following requirements:~~ <u>The entire thermal distribution system, including all ducts and air handlers, shall be located entirely within the conditioned space.</u>

<u>**Exception:** Buildings that meet all of the requirements in one of the following three exceptions:</u>

1. An *energy recovery ventilation system,* <u>that includes either an energy recovery ventilator or heat recovery ventilator,</u> shall be installed. For warm humid counties as identified in table N1101.2, a dehumidifier with a built in humidistat shall be installed in addition to the *energy recovery ventilation system*. ~~2.~~ Building air leakage shall be tested in accordance with the procedure prescribed in Section N1102.4.<u>1.2</u>~~.1,~~<u>.</u> ~~except that the~~ <u>The</u> air leakage shall not exceed <u>three air changes per hour (ACH50)</u> ~~0.00015 *specific leakage area (SLA)*~~ for all buildings except multifamily, which shall not exceed <u>four air changes per hour (ACH50)</u> ~~0.00018 *specific leakage area (SLA)*~~, when tested with a blower door at a pressure of ~~33.5 psf~~ <u>0.2 inches w.g.</u> (50 Pa) by an *approved* party independent of the builder and any contractors involved in any aspect of sealing the building.
2. <u>A hydronic thermal distribution system, as defined in the notes to Table 405.5.2(2) of the IECC, shall be installed for space heating and cooling systems.</u>
3. <u>A ductless thermal distribution system, as defined in the notes to Table 405.5.2(2) of the IECC, shall be installed for space heating and cooling systems.</u>

~~**Exceptions:**~~

1. ~~Buildings located in climate zones 1 or 2 with installed cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20 percent and meets or exceeds 12.5 EER~~.
2. ~~Buildings located in climate zones 3 4 or 5 with installed heating and cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15 percent and cooling equipment that meets or exceeds 12.5 EER.~~
3. ~~Buildings located in climate zones 6, 7 or 8 with installed heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 20 percent~~.
4. ~~In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not commercially available, the equipment with the highest rated efficiency commercially available can be substituted, when *approved*~~ by the ~~*building official*,~~
5. ~~As an alternative to the heating equipment specified in Exceptions 2 and 3 above, a ground source heat pump with an efficiency of greater than or equal to 2.8 COP and 13 EER may be installed.~~

Commenter's Reason: *EC126 should be approved as modified by this public comment.*

Among the individual (non-package) proposals being considered, this proposal, if approved as modified, is a big energy saver – from either improved thermal distribution systems or tested air leakage improvements with energy recovery equipment.

The modifications in this public comment will specifically require ducts and air handlers in conditioned space (as DOE's original EC13 does). As an Exception (alternative), other more efficient distribution systems, like hydronic and ductless (already included and defined in the code), will be permitted. And for those who do not want to redesign and construct improved distribution/duct systems, there will be the option to install either an ERV or HRV energy recovery ventilation system.

The effect of these modifications will also be to create more consistency with EC13, while avoiding any federal preemption claims related to improved mechanical equipment. This proposal also removes the term specific leakage area and uses air changes per hour (ACH) for the air leakage requirements, as in EC13. To address the comment from the IECC committee, the modification alters the exceptions to remove potentially confusing language.

The resulting efficiency (and cost savings) are significant:

(1) With the baseline requirement of ducts in the conditioned space, most of the heating and cooling energy will make it to the conditioned space, with a default distribution efficiency of 88%.
(2) With ductless thermal distribution systems, there are no distribution system losses through ducts, with a default distribution efficiency of 100%.
(3) With hydronic thermal distribution systems, there are minimal distribution system losses, with a default distribution efficiency of 95% when the system is located in unconditioned space and 100% when it is within conditioned space.
(4) With the energy recovery equipment, this proposal achieves approximately 5 to 12% purchased energy savings (including heating, cooling, hot water, appliance and lighting energy use) depending on specific house and location. This translates to energy savings that range from $100 to $300 per year.

Each of these four options will save significant energy compared to the current baseline in the 2009 IECC and IRC.

Final Action: AS AM AMPC____ D

EC129-09/10-PART I
404.1

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART I – IECC

Revise as follows:

404.1 Lighting equipment (Prescriptive). A minimum of ~~50~~ seventy-five percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps or a minimum of seventy-five percent of the permanently installed lighting fixtures shall contain only high efficacy lamps.

Exception: Low-voltage lighting.

Reason: As reported from the Partnership for Advancing Technology in Housing program high efficacy lamps (e.g., CFL's) are up to four times as efficient and last up to 10 times as long as incandescent bulbs. A 22-watt CFL has about the same light output as a 100-watt incandescent. CFL's use 50 to 80 percent less energy than incandescent bulbs. Standard incandescent bulbs have an average lifetime of 750 to 2500 hours, while CFLs last from 6,000 to 10,000 hours. Although initially more expensive, you save money in the long run because CFL's use 1/3 the electricity and last up to 10 times as long as incandescent bulbs. A single 18-watt CFL used in place of a 75-watt incandescent will save about 570 kWh over its lifetime. At 8 cents per kWh, that equates to a $45 savings for one bulb over its lifetime. Newer CFL's give a warm, inviting light instead of the "cool white" light of older fluorescents. These were reasons presented during the last code cycle for approving this requirement for 50% CFL's. The intent of this proposal is to expand the high-efficacy requirement to a larger fraction of the home's lighting, while giving additional flexibility to the builder by allowing the required high-efficacy percentage to be based on either a count of lamps or a count of fixtures.

Cost Impact: The code change proposal will increase the cost of construction to the extent that incandescent lamps are replaced with higher-cost high-efficacy lamps. However, federal law will greatly restrict the availability of incandescent lamps a short time after this code goes into effect; thereafter, this code will not increase the cost of construction.

ICCFILENAME: MAJETTE-EC-72-404.1-IRC R202-N1104.1

Public Hearing Results

PART I – IECC

Committee Action: **Approved as Submitted**

Committee Reason: The proposed change in percentage of high efficiency lamps is consistent with the provisions of EC13.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Alex Boesenberg, National Electrical Manufacturers Association (NEMA), representing NEMA, ASE, ACEEE, PNL, ICFI, NAIMA and EEI requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

404.1 Lighting equipment (~~Prescriptive~~). ~~A minimum of seventy-five percent~~ All of the lamps in permanently installed lighting fixtures shall be high efficacy lamps ~~or a minimum of seventy-five percent of the permanently installed lighting fixtures shall contain only high efficacy lamps~~ .

Exception (Interior): ~~Low-voltage lighting~~ . Up to 50% of the lamps can be other than high-efficacy lamps provided that they are controlled by at least one of the following control devices: solid-state dimmer, electronic time switch, vacancy/motion sensor, or centralized lighting control system that has the ability to schedule the lights off automatically.

Exception (Exterior): Up to 100% of the lamps can be other than high-efficacy lamps providing that they are controlled by at least one of the following control devices capable of turning off exterior lighting when sufficient daylight is available or when the lighting is not required during nighttime hours:

a. a combination of a photosensor and an astronomic time switch, or
b. a combination of a photosensor and occupancy sensor, or
c. an astronomic time switch
d. a centralized lighting control system that has the ability to schedule lights off automatically

Commenter's Reason: This comment on proposal encourages good lighting practice that is much more likely to result in occupant acceptance, and therefore will remain unchanged after the inspection. When consumers have no guidance about good lighting practices, and misapply compact fluorescent lamps (note: the only widely available screw-base lamp design which meets the IECC definition of "high-efficacy"), one of two things typically happens: (1) the CFLs are removed by the consumer and incandescent lights are installed; or (2) the CFLs are left on for very long periods of time to avoid having to deal with the long warm-up time during which light output is significantly reduced.

This comment on proposal has the additional advantage that the requirement to use lighting controls to operate all low efficacy (non-high-efficacy) lighting results in higher energy savings, since both dimmers and occupancy sensors save energy compared to operating the lights on a switch.

Final Action: AS AM AMPC____ D

EC129-09/10-PART II
IRC R202 (New), N1104.1

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

PART II – IRC BUILDING/ENERGY

1. Add new definition as follows:

LOW-VOLTAGE LIGHTING. Lighting equipment powered through a transformer such as a cable conductor, a rail conductor and track lighting.

2. Revise as follows:

N1104.1 Lighting equipment. A minimum of ~~50~~ seventy-five percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps or a minimum of seventy-five percent of the permanently installed lighting fixtures shall contain only high efficacy lamps.

Exception: Low-voltage lighting.

Reason: As reported from the Partnership for Advancing Technology in Housing program high efficacy lamps (e.g., CFL's) are up to four times as efficient and last up to 10 times as long as incandescent bulbs. A 22-watt CFL has about the same light output as a 100-watt incandescent. CFL's use 50 to 80 percent less energy than incandescent bulbs. Standard incandescent bulbs have an average lifetime of 750 to 2500 hours, while CFLs last from 6,000 to 10,000 hours. Although initially more expensive, you save money in the long run because CFL's use 1/3 the electricity and last up to 10 times as long as incandescent bulbs. A single 18-watt CFL used in place of a 75-watt incandescent will save about 570 kWh over its lifetime. At 8 cents per kWh, that equates to a $45 savings for one bulb over its lifetime. Newer CFL's give a warm, inviting light instead of the "cool white" light of older fluorescents. These were reasons presented during the last code cycle for approving this requirement for 50% CFL's. The intent of this proposal is to expand the high-efficacy requirement to a larger fraction of the home's lighting, while giving additional flexibility to the builder by allowing the required high-efficacy percentage to be based on either a count of lamps or a count of fixtures.

Cost Impact: The code change proposal will increase the cost of construction to the extent that incandescent lamps are replaced with higher-cost high-efficacy lamps. However, federal law will greatly restrict the availability of incandescent lamps a short time after this code goes into effect; thereafter, this code will not increase the cost of construction.

ICCFILENAME: MAJETTE-EC-72-404.1-IRC R202-N1104.1

Public Hearing Results

PART II - IRC
Committee Action: **Approved as Submitted**

Committee Reason: This is a reasonable step toward energy savings.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Alex Boesenberg, National Electrical Manufacturers Association (NEMA), representing NEMA, ASE, ACEE, PNL, ICFI, NAIMA and EEI requests Approval as Modified by this Public Comment.

N1104.1 Lighting equipment. ~~A minimum of seventy-five percent~~ All of the lamps in permanently installed lighting fixtures shall be high efficacy lamps ~~or a minimum of seventy-five percent of the permanently installed lighting fixtures shall contain only high efficacy lamps~~.

Exception: ~~Low-voltage lighting~~ . Up to 50% of the lamps can be other than high-efficacy lamps provided that they are controlled by at least one of the following control devices: solid-state dimmer, electronic time switch, vacancy/motion sensor, or centralized lighting control system that has the ability to schedule the lights off automatically.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: This comment on proposal encourages good lighting practice that is much more likely to result in occupant acceptance, and therefore will remain unchanged after the inspection. When consumers have no guidance about good lighting practices, and misapply compact fluorescent lamps (note: the only widely available screw-base lamp design which meets the IECC definition of "high-efficacy"), one of two things typically happens: (1) the CFLs are removed by the consumer and incandescent lights are installed; or (2) the CFLs are left on for very long periods of time to avoid having to deal with the long warm-up time during which light output is significantly reduced.

This comment on proposal has the additional advantage that the requirement to use lighting controls to operate all low efficacy (non-high-efficacy) lighting results in higher energy savings, since both dimmers and occupancy sensors save energy compared to operating the lights on a switch.

Final Action: AS AM AMPC____ D

EC131-09/10-PART I

202 (New), 403.5, 404 (New), Table 405.5.2(1), Chapter 6

Proposed Change as Submitted

Proponent: Craig Conner, Building Quality, representing self

PART I – IECC

1. Add new definitions as follows:

DESUPERHEATER/WATER HEATER. A factory-made assembly of elements by which the flows of refrigerant vapor and water are maintained in such heat transfer relationship that the refrigerant vapor is desuper-heated and the water is heated. A water circulating pump may be included as part of the assembly.

FURNACE ELECTRICITY RATIO. The ratio of furnace electricity use to total furnace energy computed as ratio = $(3.412*E_{AE})/(1000*E_F + 3.412*E_{AE})$, where E_{AE} (average annual auxiliary electrical consumption) and E_F (average annual fuel energy consumption) are defined in Appendix N to subpart B of part 430 of title 10 of the Code of Federal Regulations and E_F is expressed in millions of Btus per year.

2. Revise as follows:

403.5 Mechanical ventilation (Mandatory). The building shall be provided with ventilation that meets the requirements of Section M1507 of the *International Residential Code* 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.

All combustion equipment in new residences in Climate Zones 3 to 8 shall be direct vent or sealed combustion.

> **Exceptions:** Stoves and ovens in kitchens with vents fireplaces that meet the applicable requirements of Section 402.

3. Add new text and tables as follows:

404. Equipment efficiency.

404.1 Heating equipment. New and replacement furnaces, boilers and heat pumps shall be a minimum of the efficiencies in Table 404.1.

> **Exception:** Replacement of non-condensing furnaces.

Ground source heat pumps shall have a least the efficiency in Table 503.2.3(2). All-electric heated buildings in Climate Zones 3 through 8 shall utilize either an air-source or ground source heat pump.

TABLE 404.1
MINIMUM HEATING EQUIPMENT EFFICIENCY

ZONE	1 & 2	3 & 4	5 to 8
Gas furnace[a]	NR	90 AFUE	92 AFUE
Gas and oil boiler, oil furnace[a]	NR	85 AFUE	
Air source heat pump	NR	8.5 HSPF	

a. Furnaces in Climate Zones 3 through 8 shall have a furnace electricity ratio not greater than 2%.

404.2 Cooling equipment. New and replacement vapor compression air conditioners shall be a minimum of the efficiencies in Table 404.2. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2).

TABLE 404.2
MINIMUM COOLING EQUIPMENT EFFICIENCY

Zone	1 & 2	3 & 4	5 & 6	7 & 8
Air conditioner and Air source heat pump	SEER 16 EER 13	SEER 15 EER 12.5	SEER 14 EER 12.0	NR
Room air conditioner	11 EER < 20,000 Btu/hr 10 EER >= 20,000 Btu/hr			NR

404.3 Water heating. New and replacement gas water heaters shall be a minimum of 0.62 EF. New and replacement electric water heaters shall be a minimum of 0.95 EF.
Water heating in new homes shall include at least one of the following:

1. Desuperheater on a vapor compression air conditioner, heat pump, or ground source heat pump. The desuperheater shall be tested and listed in accordance with ARI 470 and connected to the hot water storage tank.
2. Electric water heater with a minimum of 2.0 EF.
3. Solar water heating system having a minimum Solar Fraction of 0.30 when tested in accordance with OG-300.
4. Gas water heater with a minimum of 0.80 EF.
5. Water heating provided by a ground source heat pump.
6. Tankless coil with a boiler with a minimum of 85 AFUE.

4. Revise as follows:

SECTION ~~405~~ 406
SIMULATED PERFORMANCE ALTERNATIVE
(Performance)

TABLE ~~405.5.2(1)~~ 406.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems[~~g,~~ h, i]	~~As Proposed~~ Fuel type: same as proposed design Efficiencies as specified by Section 404.1: Electric: air-source heat pump Nonelectric furnaces: natural gas furnace Nonelectric boilers: natural gas boiler Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	~~As proposed~~ As proposed As proposed As proposed
Cooling systems[~~g, i~~h, j]	~~As Proposed~~ Fuel type: Electric Efficiencies as specified by Section 404.2: Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	~~As Proposed~~ As proposed As proposed As proposed
Service Water Heating[~~g, i, j,~~ h, k]	~~As Proposed~~ Fuel type: same as proposed design for non-solar water heating. Where proposed design includes solar water heating, the standard reference shall include the equivalent capacity with fuel type same as the non-solar water heating. Efficiencies as specified by Section 404.3: Use: gal/day=30 + (10 x N_{br}) ~~Same as proposed design~~	~~As Proposed~~ As proposed As proposed Same as standard reference ~~Use: gal/day=30 + (10 x N_{br})~~

(Portions of table and footnotes not shown remain unchanged)

5. Add new standards to Chapter 6 as follows:

AHRI
470-06 Performance Rating of Desuperheater/Water Heaters

Reason: Energy efficient buildings need high efficiency equipment. Inevitably the least costly and most effective designs for high efficiency buildings will include high efficiency heating, cooling, and water heating equipment, as well as insulation, air tightness, efficient windows, efficient lighting, etc. Many of the envelope measures are reaching a point of diminishing returns. The biggest group of remaining cost-effective opportunities that are in energy efficient equipment.

Historically Federal law (National Appliance Energy Conservation Act and others) has preempted any ability to specify higher efficiency for most equipment in the building codes. This change presumes the Federal restriction has been lifted as is currently proposed in congressional legislation.

Equipment efficiency affects existing residences too. Because equipment is replaced in existing residences, specifying high efficiency equipment achieves a much higher level of energy savings both on a per residence basis and in aggregate nationally. Although replacement equipment doesn't usually involve a permit, a jurisdiction's requirement that replacement equipment have a specific level of efficiency is likely to be met by those supply and installing replacement equipment.

For heating and cooling this proposal sets levels based on the Consortium for Energy Efficiency (CEE) and Energy Star. CEE and Energy Star levels of efficiency result from substantial discussion and process. Energy Star is the best-known name in energy efficiency. CEE is a collaborative effort of utilities, environmental groups, and industry. CEE establishes energy efficiency "Tiers" after examining what is practical and available.

Equipment manufacturers do not want a patchwork of varying equipment requirements. Manufacturers legitimately desire large areas of uniform requirements. Large areas of uniform requirements are created by having multiple climate zones require the same equipment efficiency. Specifying large areas with a uniform equipment requirement results in lower cost equipment efficiency because the economics of scale in manufacturing and distributing mean lower cost efficiency is available due to large-scale production.

This change proposes a minimum gas furnace efficiency of 92 AFUE (CEE Tier II) in the northern zones and a minimum 90 AFUE (CEE Tier I, Energy Star) in zones 3 and 4.

In 2006 DOE completed an analysis of furnace efficiency options as part of a furnace rulemaking[1]. DOE's analysis determined that the higher AFUE furnaces were the most cost-effective in the mid/northern US and in new homes. Unfortunately DOE did not have the authority to set separate standards in the north or for new homes, and choose a disappointing 80 AFUE for most furnaces. Since the DOE furnace rule making natural gas prices have increased well beyond projections and the incremental cost of higher efficiency furnaces has decreased. The trends towards more expensive fuel and lower cost efficient equipment combine to make equipment efficiency more cost-effective. These same long-term trends towards higher fuel costs and lower incremental costs for efficient equipment also makes cooling and water heating efficiency more cost effective.

Condensing furnaces (90 AFUE and up) and non-condensing furnaces use significantly different venting. Condensing furnaces typically use a short horizontal plastic pipe, while non-condensing furnaces need a chimney. In new construction condensing furnaces are actually cheaper to vent than non-condensing furnaces. DOE estimated that in new homes the less expensive condensing furnace venting saves $138 (TSD, page 6-34, Table 6.5.7)[1].

The increased costs of a 90 AFUE furnace are between $500 and $1000[2,3]. After taking credit for reduced venting costs, a typical cost might be $700 to $800. The incremental cost of going from 90 to 92 AFUE is harder to estimate, but probably small since much of the equipment around 90 AFUE is actually closer to 92 AFUE.

Replacement of non-condensing furnaces with condensing furnaces can be significantly more expensive due to the need for an expensive chimney modification. Therefore, this proposal allows existing non-condensing furnaces to be replaced by non-condensing furnaces.

Gas-fired boilers requirements are set based on the Energy Star and CEE level of 85 AFUE. Oil furnaces are based on the Energy Star level of 85 AFUE. Currently there are not sufficient condensing gas boilers and oil heaters in the market to set the requirement above 85 AFUE.

This proposed change requires efficient fossil-fuel furnace fans. The fan blower motor accounts for most of fossil-fuel furnace electricity consumption, in some cases being the largest consumer of electricity in the household. Currently, no minimum efficiency requirement exists for furnace electricity use. The "furnace electricity ratio" specified in this proposal is based solely on efficiency information already provided by the manufacturers[4].

A simple payback for an efficient furnace fan motor can be estimated. Most furnace blowers use a permanent split capacitor (PSC) motor. The efficiency level proposed here is likely to be achieved using a brushless permanent magnet (BPM) motor also called an electronically commutated motor (ECM). Many furnaces with these efficient fans are available in the market today. A simple payback can be estimated from DOE's recent furnace rulemaking[1]. DOE estimated an annual energy savings of about 215 kwh per year (DOE TSD page 8.5-6), or about $21.5 per year for a BPM at $0.10/kwh. DOE estimated the cost of the new fan at about $213 (TSD page 6.4-2), perhaps decreasing by about 78% (TSD page 8.5-2) to about $166 by 2012 for a mature market costs. The simple payback would be about 8 years in a mature market. Estimated savings from other studies have been higher, as cited below[5]. Based on the cited estimates of savings the simple payback would be 3 to 8 years.

For cooling this change proposes CEE Tier III for zones 1 and 2, Tier II for zones 3 and 4, and Tier I for zones 5 and 6. The cost of a higher SEER varies, but is dropping. Some give the incremental cost of a SEER 16 as small as $500 for 13 to 16[6], although most prices would probably be closer to $1000 plus.

An EER (energy efficiency ratio) requirement is also proposed for cooling. EER is a term already used in chapter 5. The EER is a better indicator of performance in high temperatures that lead to utility peak loads. Specifying both a SEER and EER leads to equipment that performs well both seasonally and during peak loads.

Significantly increased water heating equipment efficiency is available. DOE's recent analysis of water heater options for Energy Star[7] yields favorable paybacks for many of these options. The base requirements for any new or existing water heating system have very favorable paybacks according to the DOE analysis[7]. The 0.62 gas water heater has an estimated cost increase of $70 with a payback of about 2.5 years. The 0.95 electric water heater has an estimated $50 cost with a payback of about 2 years. These two, the gas EF of 0.62 and electric EF of at least 0.95 are minimum for replacement of existing systems. For new homes one of the list of options is required. It is important that at least one of the options be cost-effective. The increased cost of the heat pump water heater is significant ($850) but the estimated payback is a quick 3 years. The gas 0.80 EF is achievable with a couple of options, a thankless water heater is the most common with an estimated cost increase of about $1100 and a payback of perhaps 10 years. The much less common condensing gas water heater was estimated at about $700 with a payback of about 7 years. Currently many major water heater manufacturers are introducing multiple new products, which will likely lower these prices and make efficient water heaters more available and more cost-effective.

Discussions with a water heater manufacturer indicated a strong request for requirements that were uniform nationally. Although the performance of some water heating options will vary with climate, these are uniform.

When the Federal restriction on equipment efficiency in the IECC is lifted, increased energy efficiency proposed here becomes the single largest source of energy efficiency available in the codes.

Notes:

1. U.S. DOE Federal Register Notice dated October 6, 2006. *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnaces and Boilers; Proposed Rule*, and its technical support document available at: http://www.eere.energy.gov/buildings/appliance_standards/residential/furnaces_boilers_1113_r.html
2. http://coolheatmechanical.com/tipsandinfo_biting_90_afue_bullet.shtml
3. http://www.greenhousing.umn.edu/factsheets/comp_heating.pdf
4. Consumers' Directory of Certified Efficiency Ratings. Gas Appliance Manufacture's Association.. http://www.gamanet.org/gama/inforesources.nsf/vContentEntries/Furnace+electrical+efficiency?OpenDocument
5. BPM Motors in Residential Gas Furnaces: What are the Savings? *James Lutz, Victor Franco, Alex Elko, and Gabrielle Wong-Parodi. Lawrence Berkeley National Laboratory, Berkeley, California.* LBNL-59866
6. http://www.consumersearch.com/central-air-conditioners/central-ac-pricing
7. ENERGY STAR Residential Water Heaters: Final Criteria Analysis, April 1 2008. http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/WaterHeaterAnalysis_Final.pdf

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

Analysis: A review of the standard(s) proposed for inclusion in the code, AHRI 470-06 and SRCC OG-300, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: CONNER-EC-7-202-404.1-3 - R202-N1104.1-3.DOC

Public Hearing Results

Note: The following analysis was not in the Code Change Proposal book but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf:

Analysis: Review of the proposed new standard AHRI 470-06 indicated that, in the opinion of ICC staff, the standard did comply with ICC standards criteria.

PART I – IECC

Committee Action: **Disapproved**

Committee Reason: Bans unvented gas heating appliances in northern climates. In addition the proposal would be in violation of Federal law by specifying higher efficiency appliances in building codes.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment 1:

Craig Conner, Building Quality, representing himself requests Approval as Submitted.

Commenter's Reason: Increased equipment efficiency is probably the largest remaining source of residential energy savings. However, Federal law preempts state and local jurisdictions from increasing the equipment efficiency required by the building code. This comment is provided on the chance that the Federal preemption might be removed in upcoming legislation.

Public Comment 2:

Joe Rothschiller, representing Steffes Corporation requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

404.1 Heating equipment. In climate zones 3 and 4 gas furnace AFUE shall be at least *90.* In climate zones 5 through 8, gas furnace AFUE shall be at least 92. In climate zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In climate zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). ~~All electric heated buildings shall utilize either an air source or ground source heat pump.~~ <u>In the event the heating or cooling equipment specified in the exception applicable to a particular climate zone above is not available in the market or is not able to be installed for economic reasons, the equipment with the highest rated efficiency that is commercially available can be substituted, when *approved* by the *code official.*</u>

Commenter's Reason: This proposal restricts the use of electric resistance heating as an option for primary heating. In many areas of the country, electric resistance heating is the most economical choice of heating, especially in rural America. Electric heat technologies (have and are) advancing quickly and with the insurgence of renewable energy into the Electric Grid, electric heat technologies (smart heating) will play a major part in utilizing this carbon free resource. In addition, many utilities *offer* off-peak electric rates to encourage consumers to help them lower their system peak/demand. Some consumers are using off-peak electric heating systems to totally remove their heating load from the utilities peak and thus improving a utilities load factor and efficiency.

This code change also ignores site generated sources of electricity which can be used for heating. The Government and DOE are asking utilities and consumer to invest in renewable power sources, which contradicts the intent of this proposal. We are not clear why a building code is trying to address the "supply of energy" to a site. Electric resistance heat is *100%* efficient at the site and no electric heating system should be excluded from consideration, especially if it is the best option.

We are asking for this modification to allow the most economical and efficient heating technologies to be considered and not to exclude electric resistance.

Public Comment 3:

Joe Rothschiller, representing Steffes Corporation requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

404.1 Heating equipment. In climate zones 3 and 4 gas furnace AFUE shall be at least 90. In climate zones 5 through 8, gas furnace AFUE shall be at least 92. In climate zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In climate zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). All-electric heated buildings shall utilize either an air-source or ground source heat pump or an off-peak electric thermal storage heating system.

Commenter's Reason: Electric heat technologies (have and are) advancing quickly and with the insurgence of renewable energy into the Electric Grid, electric heat technologies (smart heating) will play a major part in utilizing this carbon free resource. In addition, many utilities offer off-peak electric rates to encourage consumers to help them lower their system peak/demand. Some consumers are using off-peak electric thermal storage heating systems to totally remove their heating load from the utilities peak and thus improving a utilities load factor and efficiency.

Why exempt Off-peak Heating Systems:

At the heart of the electric system in this country, is the need to balance supply and demand on a moment to moment basis. Electric technologies, especially off-peak electric thermal storage (ETS) can provide significant energy, economic and environmental benefits. ***We are asking for an Exemption for Off-peak Electric Thermal Storage systems.***

Electric energy storage is poised to become an important element of the electricity grid and Market place of the future. Storage has unique features and characteristics that make it useful for significant existing and emerging electric-utility-related opportunities and challenges. (Source; SANDIA *REPORT, SAND2010-0815, Unlimited Release, Printed February 2010, Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, A Study for the DOE Energy Storage Systems Program)*

Electric Thermal Storage (ETS): ETS is a heating technology whereby renewable or off peak electricity is stored as heat in a dense ceramic brick core, for use when needed - 24 hours a day. For the U.S. to capitalize on its investment in renewable energy development and the smart grid, significant amounts of electric storage is needed. ETS is a low cost tool that can provide measurable portion of this storage.

A. Consumer Benefits (Residential. Commercial and Industrial)

- i. Uses off-peak, demand free electric rates to lower consumer's heating cost by as much as 70%
- ii. Safe, clean, quiet and provides superior comfort
- iii. Stores off-peak and/or GREEN POWER and acts as a Smart grid heater
- iv. Acts as a *"thermal battery"* for electricity storage
- v. Renewable power integration with smart grid control
  1. Better grid reliability and valued demand response and reduced emissions control capabilities
  2. Significant amounts of renewable (wind) energy are curtailed or wasted at night, during heating months, that ETS systems could be storing for productive use. Thus, providing a very low or carbon free footprint for home heating.
- vi. Off-peak /TOU pricing - dynamic pricing is here and expanding quickly in most states. ETS heating equipment allows consumers to take advantage of using low cost, off-peak electric rates to heat their home.
- vii. With off-peak, demand free electric rates, smart controls and ETS heating can provide consumers with the lowest cost heating option on the market vs natural gas, propane, fuel oil, etc.
- *viii.* Greater Efficiency with Heat pumps - ETS combined with an air to air heat pump provides greater energy efficiency than a standard air to air heat pump. ETS/ASHP systems operate down to much lower outside temperatures, which provides greater efficiency without sacrificing comfort, and does all of this using renewable or off-peak energy. *See additional explanation of efficiency gains at the end of this document.*

B. Power Company and Smart Grid benefits - almost 10 GWH of ETS is installed in the United States providing load management and renewable integration benefits to hundreds of utilities.

- i. Used as a demand side management tool since 1970
  1. Load shaping
  2. Load shifting
- ii. ETS can be used as a tool for up/down regulation for utilities" frequency control"; which can bring a whole new dimension to conservation and efficiency in the industry.
- iii. Ancillary Services - electric storage provides Regulation and Spinning Reserve benefits. Doing regulation with a non fuel consuming resource, like ETS, can yield a 70% carbon emissions reduction.
- iv. Power generation, transmission and distribution efficiency - The use of storage improves system efficiency for the generation, transmission and distribution of power by reducing peak power consumption and allowing more consistent and predictable system operation.
- v. Improves system reliability and power quality
- vi. Instantaneous demand response tool
- vii. A proven 20+ year life cycle as a thermal battery
- viii. Operates in conjunction with smart meters, TOU or TOO meters and Green Power smart controls.
- ix. ETS units can store up to 960 kWh of energy from renewable sources, such as wind and solar, and can do this quickly when wind gusts exists.
- x. Cheapest form of electric storage readily available on the market. See table below:

	Cost	
Technolgy	**(/kW·h)**	**(/kW)**
Electric Thermal Storage+	\$30 – 60	\$100 - \$200
CAWS (above ground)	\$200 - \$250	\$700 - \$800

ZnBr Flow Cell	$280 - $450	$425 - $1300
Pb-Acid Battery	$330 - $480	$420 - $660
NaS Battery	$350 - $400	$450 - 550
Flywheel	$1340 - $1570	$3360 - $3920

Source: EPRI2009 energy storage technology cost estimates
[t]Source: Steffes Corp.

Additional comments taken from the Department of Energy website:

Electric Thermal Storage
Some electric utilities structure their rates in a way similar to telephone companies and charge more for electricity during the day and less at night. They do this in an attempt to reduce their **"peak" demand.**
If you are a customer of such a utility, you may be able to benefit from a heating system that stores electric heat during nighttime hours when rates are lower. This is called an electric thermal storage heater, and while it does not save energy, it can save you money because you can take advantage of these lower rates. DOE website: http://www.energysavers.gov/yourhome/space heating cooling/index.cfm/mytopic=12520
****

Explanation of Greater Efficiency Gains with ETS combined with Air Source Heat Pumps:
Air Source Heat Pumps (ASHP) are known for providing very efficient, low cost heating and cooling. However, during colder outdoor temperatures, associated with colder climates, traditional heat pumps often times do not deliver acceptable comfort. Using ETS as the resistance supplemental heat, you can assure good comfort, while optimizing the heat pump's efficiency. By using ETS vs an electric resistance plenum heater as the supplemental heat source, the ETS stored heat provides comfort modulation 24 hours a day and does it with off-peak energy, which lowers the operating cost to the consumer.

Final Action: AS AM AMPC____ D

EC131-09/10-PART II
R202 (New), N1103.5, N1104 (New), Chapter 44 (New)

Proposed Change as Submitted

Proponent: Craig Conner, Building Quality, representing self

PART II – IRC ENERGY

1. Add new definitions as follows:

DESUPERHEATER/WATER HEATER. A factory-made assembly of elements by which the flows of refrigerant vapor and water are maintained in such heat transfer relationship that the refrigerant vapor is desuper-heated and the water is heated. A water circulating pump may be included as part of the assembly.

FURNACE ELECTRICITY RATIO. The ratio of furnace electricity use to total furnace energy computed as ratio = $(3.412*E_{AE})/(1000*E_F + 3.412*E_{AE})$, where E_{AE} (average annual auxiliary electrical consumption) and E_F (average annual fuel energy consumption) are defined in Appendix N to subpart B of part 430 of title 10 of the Code of Federal Regulations and E_F is expressed in millions of Btus per year.

2. Revise as follows:

N1103.5 Mechanical ventilation. The building shall be provided with ventilation that meets the requirements of Section M1507 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.

All combustion equipment in new residences in Climate Zones 3 through 8 shall be direct vent or sealed combustion.

> **Exceptions:** Stoves and ovens in kitchens with vents fireplaces that meet the applicable requirements of Section 402.

3. Add new text and tables as follows:

N1104. Equipment efficiency.

N1104.1 Heating equipment. New and replacement furnaces, boilers and heat pumps shall have at least the efficiencies in Table N1104.1.

> **Exception:** Replacements for non-condensing furnaces.

Ground source heat pumps shall have a least the efficiency in IECC Table 503.2.3(2). All-electric heated buildings in Climate Zones 3 through 8 shall utilize either an air-source or ground source heat pump.

TABLE N1104.1
MINIMUM HEATING EQUIPMENT EFFICIENCY

ZONE	1 & 2	3 & 4	5 to 8
Gas furnace[a]	NR	90 AFUE	92 AFUE
Gas and oil boiler, oil furnace[a]	NR	85 AFUE	
Air source heat pump	NR	8.5 HSPF	

a. Furnaces in zones 3 to 8 shall have a furnace electricity ratio not greater than 2%.

N1104.2 Cooling equipment. New and replacement vapor compression air conditioners shall a minimum of the efficiencies in Table N1104.2. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2) of the *International Energy Conservation Code*.

TABLE N1104.2
MINIMUM COOLING EQUIPMENT EFFICIENCY

ZONE	1 & 2	3 & 4	5 & 6	7 & 8
Air conditioner and Air source heat pump	SEER 16 EER 13	SEER 15 EER 12.5	SEER 14 EER 12.0	NR
Room air conditioner	11 EER < 20,000 Btu/hr 10 EER >= 20,000 Btu/hr			NR

N1104.3 Water heating. New and replacement gas water heaters shall be a minimum of 0.62 EF. New and replacement electric water heaters shall be a minimum of 0.95 EF.

Water heating in new homes shall include at least one of the following:

1. Desuperheater on a vapor compression air conditioner, heat pump, or ground source heat pump. The desuperheater shall be tested and listed in accordance with ARI 470 and connected to the hot water storage tank.
2. Electric water heater with a minimum of a 2.0 EF.
3. Solar water heating system with a minimum Solar Fraction of 0.30 when tested in accordance with OG-300.
4. Gas water heater with a minimum of 0.80 EF.
5. Water heating provided by a ground source heat pump.
6. Tankless coil with a boiler with a minimum of 85 AFUE.

4. Add new standards to Chapter 44 as follows:

AHRI
470-06 Performance Rating of Desuperheater/Water Heaters

SRCC
OG-300 Operating Guidelines and Minimum Standards for Certifying Solar Water Heating Systems

Reason: Energy efficient buildings need high efficiency equipment. Inevitably the least costly and most effective designs for high efficiency buildings will include high efficiency heating, cooling, and water heating equipment, as well as insulation, air tightness, efficient windows, efficient lighting, etc. Many of the envelope measures are reaching a point of diminishing returns. The biggest group of remaining cost-effective opportunities that are in energy efficient equipment.

Historically Federal law (National Appliance Energy Conservation Act and others) has preempted any ability to specify higher efficiency for most equipment in the building codes. This change presumes the Federal restriction has been lifted as is currently proposed in congressional legislation.

Equipment efficiency affects existing residences too. Because equipment is replaced in existing residences, specifying high efficiency equipment achieves a much higher level of energy savings both on a per residence basis and in aggregate nationally. Although replacement equipment doesn't usually involve a permit, a jurisdiction's requirement that replacement equipment have a specific level of efficiency is likely to be met by those supply and installing replacement equipment.

For heating and cooling this proposal sets levels based on the Consortium for Energy Efficiency (CEE) and Energy Star. CEE and Energy Star levels of efficiency result from substantial discussion and process. Energy Star is the best-known name in energy efficiency. CEE is a collaborative effort of utilities, environmental groups, and industry. CEE establishes energy efficiency "Tiers" after examining what is practical and available.

Equipment manufacturers do not want a patchwork of varying equipment requirements. Manufacturers legitimately desire large areas of uniform requirements. Large areas of uniform requirements are created by having multiple climate zones require the same equipment efficiency. Specifying large areas with a uniform equipment requirement results in lower cost equipment efficiency because the economics of scale in manufacturing and distributing mean lower cost efficiency is available due to large-scale production.

This change proposes a minimum gas furnace efficiency of 92 AFUE (CEE Tier II) in the northern zones and a minimum 90 AFUE (CEE Tier I, Energy Star) in zones 3 and 4.

In 2006 DOE completed an analysis of furnace efficiency options as part of a furnace rulemaking[1]. DOE's analysis determined that the higher AFUE furnaces were the most cost-effective in the mid/northern US and in new homes. Unfortunately DOE did not have the authority to set separate standards in the north or for new homes, and choose a disappointing 80 AFUE for most furnaces. Since the DOE furnace rule making natural gas prices have increased well beyond projections and the incremental cost of higher efficiency furnaces has decreased. The trends towards more expensive fuel and lower cost efficient equipment combine to make equipment efficiency more cost-effective. These same long-term trends towards higher fuel costs and lower incremental costs for efficient equipment also makes cooling and water heating efficiency more cost effective.

Condensing furnaces (90 AFUE and up) and non-condensing furnaces use significantly different venting. Condensing furnaces typically use a short horizontal plastic pipe, while non-condensing furnaces need a chimney. In new construction condensing furnaces are actually cheaper to vent than non-condensing furnaces. DOE estimated that in new homes the less expensive condensing furnace venting saves $138 (TSD, page 6-34, Table 6.5.7)[1].

The increased costs of a 90 AFUE furnace are between $500 and $1000[2,3]. After taking credit for reduced venting costs, a typical cost might be $700 to $800. The incremental cost of going from 90 to 92 AFUE is harder to estimate, but probably small since much of the equipment around 90 AFUE is actually closer to 92 AFUE.

Replacement of non-condensing furnaces with condensing furnaces can be significantly more expensive due to the need for an expensive chimney modification. Therefore, this proposal allows existing non-condensing furnaces to be replaced by non-condensing furnaces.

Gas-fired boilers requirements are set based on the Energy Star and CEE level of 85 AFUE. Oil furnaces are based on the Energy Star level of

85 AFUE. Currently there are not sufficient condensing gas boilers and oil heaters in the market to set the requirement above 85 AFUE.

This proposed change requires efficient fossil-fuel furnace fans. The fan blower motor accounts for most of fossil-fuel furnace electricity consumption, in some cases being the largest consumer of electricity in the household. Currently, no minimum efficiency requirement exists for furnace electricity use. The "furnace electricity ratio" specified in this proposal is based solely on efficiency information already provided by the manufacturers[4].

A simple payback for an efficient furnace fan motor can be estimated. Most furnace blowers use a permanent split capacitor (PSC) motor. The efficiency level proposed here is likely to be achieved using a brushless permanent magnet (BPM) motor also called an electronically commutated motor (ECM). Many furnaces with these efficient fans are available in the market today. A simple payback can be estimated from DOE's recent furnace rulemaking[1]. DOE estimated an annual energy savings of about 215 kwh per year (DOE TSD page 8.5-6), or about $21.5 per year for a BPM at $0.10/kwh. DOE estimated the cost of the new fan at about $213 (TSD page 6.4-2), perhaps decreasing by about 78% (TSD page 8.5-2) to about $166 by 2012 for a mature market costs. The simple payback would be about 8 years in a mature market. Estimated savings from other studies have been higher, as cited below[5]. Based on the cited estimates of savings the simple payback would be 3 to 8 years.

For cooling this change proposes CEE Tier III for zones 1 and 2, Tier II for zones 3 and 4, and Tier I for zones 5 and 6. The cost of a higher SEER varies, but is dropping. Some give the incremental cost of a SEER 16 as small as $500 for 13 to 16[6], although most prices would probably be closer to $1000 plus.

An EER (energy efficiency ratio) requirement is also proposed for cooling. EER is a term already used in chapter 5. The EER is a better indicator of performance in high temperatures that lead to utility peak loads. Specifying both a SEER and EER leads to equipment that performs well both seasonally and during peak loads.

Significantly increased water heating equipment efficiency is available. DOE's recent analysis of water heater options for Energy Star[7] yields favorable paybacks for many of these options. The base requirements for any new or existing water heating system have very favorable paybacks according to the DOE analysis[7]. The 0.62 gas water heater has an estimated cost increase of $70 with a payback of about 2.5 years. The 0.95 electric water heater has an estimated $50 cost with a payback of about 2 years. These two, the gas EF of 0.62 and electric EF of at least 0.95 are minimum for replacement of existing systems. For new homes one of the list of options is required. It is important that at least one of the options be cost-effective. The increased cost of the heat pump water heater is significant ($850) but the estimated payback is a quick 3 years. The gas 0.80 EF is achievable with a couple of options, a thankless water heater is the most common with an estimated cost increase of about $1100 and a payback of perhaps 10 years. The much less common condensing gas water heater was estimated at about $700 with a payback of about 7 years. Currently many major water heater manufacturers are introducing multiple new products, which will likely lower these prices and make efficient water heaters more available and more cost-effective.

Discussions with a water heater manufacturer indicated a strong request for requirements that were uniform nationally. Although the performance of some water heating options will vary with climate, these are uniform.

When the Federal restriction on equipment efficiency in the IECC is lifted, increased energy efficiency proposed here becomes the single largest source of energy efficiency available in the codes.

Notes:

1. U.S. DOE Federal Register Notice dated October 6, 2006. *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnaces and Boilers; Proposed Rule*, and its technical support document available at: http://www.eere.energy.gov/buildings/appliance_standards/residential/furnaces_boilers_1113_r.html
2. http://coolheatmechanical.com/tipsandinfo_biting_90_afue_bullet.shtml
3. http://www.greenhousing.umn.edu/factsheets/comp_heating.pdf
4. Consumers' Directory of Certified Efficiency Ratings. Gas Appliance Manufacture's Association.. http://www.gamanet.org/gama/inforesources.nsf/vContentEntries/Furnace+electrical+efficiency?OpenDocument
5. BPM Motors in Residential Gas Furnaces: What are the Savings? *James Lutz, Victor Franco, Alex Elko, and Gabrielle Wong-Parodi. Lawrence Berkeley National Laboratory, Berkeley, California.* LBNL-59866
6. http://www.consumersearch.com/central-air-conditioners/central-ac-pricing
7. ENERGY STAR Residential Water Heaters: Final Criteria Analysis, April 1 2008. http://www.energystar.gov/ia/partners/prod_development/new_specs/downloads/water_heaters/WaterHeaterAnalysis_Final.pdf

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

Analysis: A review of the standard(s) proposed for inclusion in the code, AHRI 470-06 and SRCC OG-300, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: CONNER-EC-7-202-404.1-3 - R202-N1104.1-3.DOC

Public Hearing Results

Note: The following analysis was not in the Code Change Proposal book but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf:

Analysis: Review of the proposed new standard AHRI 470-06 indicated that, in the opinion of ICC staff, the standard did comply with ICC standards criteria.

PART II – IRC

Committee Action: Disapproved

Committee Reason: Proponent requested disapproval based on Federal laws that have not yet changed as given in the proponent's reason statement.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Craig Conner, Building Quality, representing self requests Approval as Submitted.

Commenter's Reason: Increased equipment efficiency is probably the largest remaining source of residential energy savings. However, Federal law preempts state and local jurisdictions from increasing the equipment efficiency required by the building code. This comment is provided on the chance that the Federal preemption might be removed in upcoming legislation.

Public Comment 2:

Joe Rothschiller, representing Steffes Corporation requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1104.1 Heating equipment. In climate zones 3 and 4 gas furnace AFUE shall be at least 90. In climate zones 5 through 8, gas furnace AFUE shall be at least 92. In climate zones 3 through 8, gas boiler, oil boiler, or oil furnace AFUE shall be at least 85. In climate zones 3 through 8, heat pump HSPF shall be at least 8.5. Ground source heat pumps shall have a minimum efficiency as specified in Table 503.2.3(2). All-electric heated buildings shall utilize either an air-source or ground source heat pump <u>or an off-peak electric thermal storage heating system.</u>

Commenter's Reason: Electric heat technologies (have and are) advancing quickly and with the insurgence of renewable energy into the Electric Grid, electric heat technologies (smart heating) will play a major part in utilizing this carbon free resource. In addition, many utilities offer off-peak electric rates to encourage consumers to help them lower their system peak/demand. Some consumers are using off-peak electric thermal storage heating systems to totally remove their heating load from the utilities peak and thus improving a utilities load factor and efficiency.

<u>**Why exempt Off-peak Heating Systems:**</u>

At the heart of the electric system in this country, is the need to balance supply and demand on a moment to moment basis. Electric technologies, especially off-peak electric thermal storage (ETS) can provide significant energy, economic and environmental benefits. <u>***We are asking for an Exemption for Off-peak Electric Thermal Storage systems.***</u>

Electric energy storage is poised to become an important element of the electricity grid and Market place of the future. Storage has unique features and characteristics that make it useful for significant existing and emerging electric-utility-related opportunities and challenges. (Source; SANDIA <u>*REPORT, SAND2010-0815, Unlimited Release, Printed February 2010, Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, A Study for the DOE Energy Storage Systems Program*</u>)

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<u>**A. Consumer Benefits (Residential. Commercial and Industrial)**</u>

- i. Uses off-peak, demand free electric rates to lower consumer's heating cost by as much as 70%
- ii. Safe, clean, quiet and provides superior comfort
- iii. Stores off-peak and/or GREEN POWER and acts as a Smart grid heater
- iv. Acts as a *"thermal battery"* for electricity storage
- v. Renewable power integration with smart grid control
  1. Better grid reliability and valued demand response and reduced emissions control capabilities
  2. Significant amounts of renewable (wind) energy are curtailed or wasted at night, during heating months, that ETS systems could be storing for productive use. Thus, providing a very low or carbon free footprint for home heating.
- vi. Off-peak /TOU pricing - dynamic pricing is here and expanding quickly in most states. ETS heating equipment allows consumers to take advantage of using low cost, off-peak electric rates to heat their home.
- vii. With off-peak, demand free electric rates, smart controls and ETS heating can provide consumers with the lowest cost heating option on the market vs natural gas, propane, fuel oil, etc.
- *viii.* <u>Greater Efficiency with Heat pumps</u> - ETS combined with an air to air heat pump provides greater energy efficiency than a standard air to air heat pump. ETS/ASHP systems operate down to much lower outside temperatures, which provides greater efficiency without sacrificing comfort, and does all of this using renewable or off-peak energy. *See additional explanation of efficiency gains at the end of this document.*

<u>**B. Power Company and Smart Grid benefits**</u> - almost 10 GWH of ETS is installed in the United States providing load management and renewable integration benefits to hundreds of utilities.

- i. Used as a demand side management tool since 1970
  1. Load shaping
  2. Load shifting
- ii. ETS can be used as a tool for up/down regulation for utilities" frequency control"; which can bring a whole new dimension to conservation and efficiency in the industry.
- iii. Ancillary Services - electric storage provides Regulation and Spinning Reserve benefits. Doing regulation with a non fuel consuming resource, like ETS, can yield a 70% carbon emissions reduction.
- iv. Power generation, transmission and distribution efficiency - The use of storage improves system efficiency for the generation, transmission and distribution of power by reducing peak power consumption and allowing more consistent and predictable system operation.
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viii. Operates in conjunction with smart meters, TOU or TOO meters and Green Power smart controls.
ix. ETS units can store up to 960 kWh of energy from renewable sources, such as wind and solar, and can do this quickly when wind gusts exists.
x. Cheapest form of electric storage readily available on the market. See table below:

	Cost	
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Source: EPRI2009 energy storage technology cost estimates
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Additional comments taken from the Department of Energy website:

Electric Thermal Storage
Some electric utilities structure their rates in a way similar to telephone companies and charge more for electricity during the day and less at night. They do this in an attempt to reduce their **"peak" demand.**
If you are a customer of such a utility, you may be able to benefit from a heating system that stores electric heat during nighttime hours when rates are lower. This is called an electric thermal storage heater, and while it does not save energy, it can save you money because you can take advantage of these lower rates. DOE website: http://www.energysavers.gov/yourhome/space heating cooling/index.cfm/mytopic=12520
****
Explanation of Greater Efficiency Gains with ETS combined with Air Source Heat Pumps:
Air Source Heat Pumps (ASHP) are known for providing very efficient, low cost heating and cooling. However, during colder outdoor temperatures, associated with colder climates, traditional heat pumps often times do not deliver acceptable comfort. Using ETS as the resistance supplemental heat, you can assure good comfort, while optimizing the heat pump's efficiency. By using ETS vs an electric resistance plenum heater as the supplemental heat source, the ETS stored heat provides comfort modulation 24 hours a day and does it with off-peak energy, which lowers the operating cost to the consumer.

Final Action: AS AM AMPC____ D

EC132-09/10

405, 405.1, 405.1.1 (New), Table 405.5.2(1)

Proposed Change as Submitted

Proponent: Craig Conner, Building Quality, representing self

Revise as follows:

SECTION 405
SIMULATED PERFORMANCE ALTERNATIVE

405.1 Scope. This section establishes criteria for compliance using simulated energy performance analysis. Such analysis shall include heating, cooling, and service water heating energy only.

405.1.1 Performance level. Compliance with this section shall require the Proposed Design to be 10% more efficient than the Standard Reference Design.

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems[~~g,~~ h, i]	~~As Proposed~~ Fuel type: same as proposed design Efficiencies: Electric: air-source heat pump with prevailing federal minimum efficiency Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	~~As proposed~~ As proposed As proposed As proposed
Cooling systems[~~g, i~~h, j]	~~As Proposed~~ Fuel type: Electric Efficiency: in accordance with prevailing federal minimum standards Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	~~As Proposed~~ As proposed As proposed As proposed
Service Water Heating[~~g, i, j,~~ h, k]	~~As Proposed~~ Fuel type: same as proposed design for non-solar water heating. Where proposed design includes solar water heating, the standard reference shall include the equivalent capacity with fuel type same as the non-solar water heating. Efficiency: in accordance with prevailing federal minimum standards Use: gal/day=30 + (10 x N_{br}) ~~Same as proposed design~~	~~As Proposed~~ As proposed As proposed Same as standard reference ~~Use: gal/day=30 + (10 x N_{br})~~

(No changes to portions of table and footnotes not shown.)

Reason: Energy efficient buildings need high efficiency equipment as one way to get efficiency. Changes in the last code cycle removed credit for high efficiency equipment from the performance approach. This change restores credit for high efficiency equipment.

The argument for not recognizing equipment efficiency in a performance calculation is that heating, cooling and water heating equipment does not last as long as envelop efficiency measures (insulation, air tightness, windows). Further, the relatively short-lived equipment may be used as a trade off to downgrade the envelope. The argument concludes that when the equipment wears out it may be replaced with less efficient equipment, leaving both inefficient equipment and inefficient envelopes. The argument apparently presumes the next generation of energy efficient buildings must choose either high efficiency envelopes or high efficiency equipment.

I say "no" to the argument above. More efficient and affordable buildings need high efficiency in both envelopes and equipment; therefore, the code should recognize both. Getting 30% more efficient than the 2006 IECC, the goal of many in this code cycle, is made more difficult and costly without equipment. Getting 50% more efficient (as in some draft Federal laws) is nearly impossible without high efficiency equipment.

This code cycle many will propose options for increased building efficiency that rely in part on higher equipment efficiency to get to the 30% increased efficiency goal. Ignoring equipment efficiency means those new options in the IECC would fail to comply under the IECC's own performance path, often fail by large margins.

Perhaps most important, not recognizing high efficiency equipment means treating some outstanding equipment choices as no better than minimum efficiency equipment. The code would treat a 95 AFUE condensing gas furnace as no better than a 78 AFUE furnace? A ground source heat pump is the same as an electric resistance heater? A 17 SEER air conditioner is treated the same as a 13 SEER air conditioner? Solar water heating is no better than the least efficient gas or electric water heater that can be purchased? A heat pump water heater has no advantage over an electric resistance water heater? The code needs to encourage efficient equipment by including it in the performance calculation.

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: CONNER-EC-16-405.DOC

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: See EC140.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Craig Conner, Building Quality, representing self requests Approval as Submitted.

Commenter's Reason: One of the arguments against a performance calculation is that the code user will simply use the performance calculation to take advantage of efficiency that was going to be used in one building component-— perhaps windows that exceed the code, excess insulation beyond the prescriptive requirements, or higher efficiency equipment—and use that to lower efficiency in some other aspect of the building. This ratchets up the efficiency required in the performance section by 10% to account for common levels of exceeding the code, sometimes called "free riders". This also restores the equipment efficiency back to the calculation, as a legitimate source of energy efficiency in a new residence.

Final Action: AS AM AMPC____ D

EC133-09/10
405.3, Table 405.3 (New)

Proposed Change as Submitted

Proponent: Ken Nittler, PE, Enercomp, Inc.

1. Revise as follows:

405.3 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 Price and Expenditure Report*. *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.~~ using the source energy factors specified in Table 405.3.

2. Add new table as follows:

TABLE 405.3
SOURCE ENERGY FACTORS FOR ENERGY DELIVERED TO BUILDINGS

ENERGY SOURCE	SOURCE ENERGY FACTOR
Electricity	3.365
Natural Gas	1.092
Fuel Oil/Kerosene	1.158
Gasoline	1.187
LPG	1.151

Reason: This revision updates the values introduced during the last code cycle to cover more energy sources and to be consistent with the values used in the *Building America Research Benchmark*, Updated December 19, 2008.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: NITTLER-EC-1-T. 405.3

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: The code change will provide better data regarding relative cost of different fuel sources, which will lead to more accurate application of energy conservation requirements.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Steve Rosenstock, representing Edison Electric Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

405.3 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 Price and Expenditure Report*. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

Exception: The energy use based on ~~source~~ marginal resource energy expressed in Btu or Btu per square foot of conditioned floor area shall be permitted to be substituted for the energy cost, using the ~~source~~ marginal resource energy factors specified in Table 405.3.

TABLE 405.3
~~SOURCE~~ MARGINAL RESOURCE ENERGY FACTORS FOR ENERGY DELIVERED TO BUILDINGS

ENERGY SOURCE	~~SOURCE~~ MARGINAL RESOURCE ENERGY FACTOR
Electricity	~~3.365~~ 0.0
Natural Gas	~~1.092~~ > 100
Fuel Oil / Kerosene	~~1.158~~ > 100
Gasoline	~~1.187~~ > 100
LPG	~~1.151~~ > 100

Commenter's Reason: This modification should be accepted for the following reasons:

-There is significant disagreement as to what the "source energy" estimated factors for the same energy source are among different entities. In recent publications from the following 5 entities:

1) American Gas Association EA 2009-3 "A Comparison of Energy Use, Operating Costs, and Carbon Dioxide Emissions of Home Appliances" (October 2009)
2) National Propane Gas Association "Proposal to the IGBC" letter (November 2009)
3) National Renewable Energy Laboratory NREL/TP-550-47246 "Building America Research Benchmark Definition" (January 2010)
4) Environmental Protection Agency "Energy Star Performance Ratings Methodology for Incorporating Source Energy Use" (August 2009)
5) Gas Technology Institute proposals for Chapter 6 of the IGCC (2009/2010)

The differences are significant, and by orders of magnitude in some cases. For example, under the GTI proposal, regional estimated values would be used for electricity, ranging from 1.84 to 3.69. AGA shows a national estimated value for electricity, but breaks down its analysis by power plant fuel type (with estimates ranging from 2.01 to 3.77).

For fuel oil and propane, EPA uses a factor of 1.01 while NREL uses estimated values of 1.158 and 1.151.

A review of the five papers will show different "source" estimates for every energy type shown in the table.

Since there is so much disagreement among different parties, this modification provides a much better solution: use marginal resource factors based on current policies and actions.

For electricity, there are 30 states with Renewable Portfolio Standards and 7 states with renewable electricity goals that utilities have pledged to meet. In the US in 2009, over 9,900 MW of wind turbines were installed, making it the "marginal resource" most often used for electricity. Since no natural resources are lost with wind power, the marginal resource factor for electric end-uses is 0.0.

For fossil fuels, there is no information about the energy used for hydraulic fracturing (energy to move water/steam, sand, and to create and move all of the chemicals used). There is information about the energy losses associated with one of the largest producers of oil and natural gas (Deepwater Horizon) during May-June, 2010, when little or no oil and natural gas was recovered or sent to homes and/or refineries. In fact, according to the following information:

http://cbs2chicago.com/national/gulf.oil.spill.2.1759321.html "Methane From Gulf Oil Gusher Poses Serious Threat" June 18, 2010.

Story quote: "A BP spokesman said the company was burning about 30 million cubic feet of natural gas daily from the source of the leak, adding up to about 450 million cubic feet since the containment effort started 15 days ago. That's enough gas to heat about 450,000 homes for four days."

Therefore, the marginal resource factor for these fossil fuels is well over 100, if not infinity.

Public Comment 2:

Kristyn Clayton, Green House Effects, representing North American Electrical Heating Industry Coalition, and Alex Hofmann, representing American Public Power Association requests Disapproval.

Commenter's Reason: (Kristyn Clayton): The definition and increase of the "Energy Source Factor" is beyond the scope of this code. Energy Source Factors are used to predict the overall impact of source generation on the global environment and are not relevant when comparing a building's performance when selecting Heating/Cooling equipment.

Furthermore, the proponents of this proposal selected a value for the energy source factor that vary from calculation to calculation, and organization to organization. This code should only specify a source for this data, and not the actual data, and as such the original Section 405.3 should also be considered outside the scope of this code. With the addition of the Table, there are then two referenced sources to obtain this data from which is confusing and selecting this data is outside the scope of a building official's duties.

According to the document produced by the National Renewable Energy Laboratory "Source Energy and Emission Factors for Energy Use in Buildings" by M. Deru and P. Torcellini, NREL/TP-550-38617, Revised June 2007**:**

People measure and analyze the energy performance of buildings for many reasons. Comparisons of energy use may be made between nations, regions, individual buildings, or systems within a building. Policy makers, owners, designers, operators, raters, and researchers use energy performance data. Many tools (or approaches) have been developed to analyze energy performance in different ways, at different levels of effort and precision, and at different stages in the life of a building. Each tool quantifies the building energy performance to fit the users' needs. However, methods and metrics are often inconsistent with each other. In addition, performance numbers may be misrepresented or misused to predict energy savings beyond the accuracy of the numbers.

The Performance Metrics Project is a U.S. Department of Energy commercial buildings research activity whose goal is to standardize the measurement and characterization of building energy performance. Its main products are clearly defined energy performance metrics and standard procedures for determining the performance metrics; its intents are to define common language and to create standards that produce consistent results independently of the user. Therefore, the terms and techniques are clearly defined with little room for interpretation. The more opportunity there is for interpretation, the higher the probability for disparity and "gaming" of the results. These procedures focus on reporting absolute numbers and not on comparisons of energy performance. Benchmarks are included only where well-established values apply. However, benchmarking of results by others can be improved by using the clearly defined absolute metrics determined by these procedures.

This document supports the other measurement procedures and all building energy-monitoring projects by providing methods to calculate the source energy and emissions from the energy measured at the building. Energy and emission factors typically account for the conversion inefficiencies at the power plant and the transmission and distribution losses from the power plant to the building. The energy and emission factors provided here also include the precombustion effects, which are the energy and emissions associated with extracting, processing, and delivering the primary fuels to the point of conversion in the electrical power plants or directly in the buildings. Source energy factors for electricity are provided for the total fossil fuel, total nonrenewable energy, and total energy. The breakdown of the energy used to generate electricity is provided on the national level, interconnection level, and state level.

(Alex Hofmann): The use of source energy factors should be disapproved for the following reasons:
There is significant disagreement as to what the "source energy" estimated factors for the same energy source are among different entities. In recent publications from the following 5 entities:

1) American Gas Association EA 2009-3 "A Comparison of Energy Use, Operating Costs, and Carbon Dioxide Emissions of Home Appliances" (October 2009)
2) National Propane Gas Association "Proposal to the IGBC" letter (November 2009)
3) National Renewable Energy Laboratory NREL/TP-550-47246 "Building America Research Benchmark Definition" (January 2010)
4) Environmental Protection Agency "Energy Star Performance Ratings Methodology for Incorporating Source Energy Use" (August 2009)
5) Gas Technology Institute proposals for Chapter 6 of the IGCC (2009/2010).

The differences are significant, and by orders of magnitude in some cases. For example, under the GTI proposal, regional estimated values would be used for electricity, ranging from 1.84 to 3.69. AGA shows a national estimated value for electricity, but breaks down its analysis by power plant fuel type (with estimates ranging from 2.01 to 3.77).

For fuel oil and propane, EPA uses a factor of 1.01 while NREL uses estimated values of 1.158 and 1.151.
A review of the five papers shows different "source" estimates for every energy type shown in the table.

There is significant disagreement among different experts as to the relative factor applied for different sources. This modification provides a much better solution: do NOT use source energy calculations.

In many cases, the data to set a scope of analysis and make a valid calculation of source energy does not exist. Making an invalid calculation based on source energy and would be harmful to the spirit and intent of the code.

Final Action: AS AM AMPC____ D

EC134-09/10
405.3, 506.3

Proposed Change as Submitted

Proponent: James Ranfone, representing the American Gas Association

Revise as follows:

405.3 Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have an annual source energy ~~cost~~ use that is less than or equal to the annual source energy ~~cost~~ use 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.~~

> ~~**Exception:** The energy use based on~~ Source energy use shall be 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.
>
> **Exception**: Emissions of carbon dioxide equivalents (CO_2e) used in lieu of source energy use, taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's Annual Energy Outlook.

506.3 Performance-based compliance. Compliance based total building performance requires that a proposed building (proposed design) be shown to have an annual source energy ~~cost~~ use that is less than or equal to the annual source energy ~~cost~~ use 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.~~ Nondepletable energy collected off site shall be treated and ~~priced~~ calculated the same as purchased energy. Energy from nondepletable energy sources collected on site shall be omitted from the annual source energy ~~cost~~ use of the proposed design. Source energy use shall be expressed in Btu or Btu per square foot of conditioned floor area. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.

> **Exception:** ~~Jurisdictions that require site energy (1 kWh=3413 Btu) rather than energy cost as the metric of comparison.~~ Emissions of carbon dioxide equivalents (CO_2e) used in lieu of source energy use, taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's Annual Energy Outlook.

Reason: Only through source (full fuel cycle) energy measurements can the IECC accurately gauge a building's total energy footprint. Source energy is fully defined and justified within U. S. Environmental Protection Agency (EPA) procedures for assessing energy and carbon footprints of commercial buildings under its Energy Star performance path rating methodology. The best method to gauge a building's global warming impact is through source energy emissions of CO_2 and CO_2 equivalents (CO_2e). The proposed changes include both methods. Energy cost does not reflect source energy consumption or CO2 and, further, is misleading in that energy cost for electricity and other fuels often vary widely by region and season. Therefore, energy cost is not capable of truly reflecting a building's energy or global warming impact. Energy cost has served as a useful tool for many years, but the new reality demands that the IECC and other energy conservation and environmental programs move toward the use of total energy or CO_2 emissions to measure energy & emission reductions. The IECC is the nation's premier energy code and must take the lead.
As required by Section 1802 of the Energy Policy Act of 2005, the National Academy of Sciences (NAS) issued their report "Review of Site (Point-of-Use) and Full-Fuel-Cycle Measurement Approaches to DOE/EERE Building Appliance Energy-Efficiency Standards." **This free report in PDF was downloaded from: http://www.nap.edu/catalog/12670.html** . The report recommends DOE to "consider moving over time toward the use of full-fuel-cycle measure of energy consumption for assessment of national and environmental impacts." The report found that using that metric would provide the public with more comprehensive information about the impacts of energy consumption on the environment, the economy, and other national concerns. DOE/EERE's current use of site energy consumption does not account for the total consumption of energy when more than one fuel is used in an appliance or when more than one fuel can be used for the same application. For these appliances, measuring full-fuel-cycle energy consumption would provide a more complete picture of energy used, allowing comparison across many different appliances as well as an improved assessment of impacts such as effects on energy security and the environment.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: RANFONE-EC-1-405.3-506.3

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The use of carbon emissions as a basis for comparison of energy conservation in the performance path needs detailed study before it can be incorporated into this code. While this seems to be a logical approach, there needs to be a determination that using this option will truly be coordinated with

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

James Ranfone, American Gas Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

405.3 Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have an annual source energy-use that is less than or equal to the annual source energy-use of the standard reference design. Source energy use shall be expressed in Btu or Btu per square foot of conditioned floor area. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.

> **Exception**: Emissions of carbon dioxide equivalents (CO_2e) used in lieu of source energy use, taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's Annual Energy Outlook.

506.3 Performance-based compliance. Compliance based total building performance requires that a proposed building (proposed design) be shown to have an annual source energy use that is less than or equal to the annual source energy-use of the standard reference design. Nondepletable energy collected off site shall be treated and calculated the same as purchased energy. Energy from nondepletable energy sources collected on site shall be omitted from the annual source energy use of the proposed design. Source energy use shall be expressed in Btu or Btu per square foot of conditioned floor area. The source energy multiplier for electricity shall be ~~3.16. The source energy multiplier for fuels other than electricity shall be 1.1~~ in accordance with Table 405.3.

> **Exception:** Emissions of carbon dioxide equivalents (CO_2e) used in lieu of source energy use, taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's Annual Energy Outlook.

Commenter's Reason: The committee agreed that the approach had merit but required additional review before the IECC should accept this approach. Since then, the IgCC committee reviewed a similar approach and have approved a IgCC public draft that will include both site based and emission based factors. Their decision to move forward is based on U.S. EPA's energy and emission conversion factors.

The amended proposal includes a reference to table 405.3 that was approved by the IECC Committee which will contain the appropriate energy conversion factors.

Public Comment 2:

Robert Beauregard, American Public Gas Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

405.3 Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have an annual source energy-use that is less than or equal to the annual source energy-use of the standard reference design. Source energy use shall be expressed in Btu or Btu per square foot of conditioned floor area. The source energy multiplier ~~for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1~~ shall be in accordance with Table 405.3.

> **Exception**: Emissions of carbon dioxide equivalents (CO_2e) used in lieu of source energy use, taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's Annual Energy Outlook.

506.3 Performance-based compliance. Compliance based total building performance requires that a proposed building (proposed design) be shown to have an annual source energy-use that is less than or equal to the annual source energy-use of the standard reference design. Nondepletable energy collected off site shall be treated and calculated the same as purchased energy. Energy from nondepletable energy sources collected on site shall be omitted from the annual source energy use of the proposed design. Source energy use shall be expressed in Btu or Btu per square foot of conditioned floor area. The source energy multiplier ~~for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1~~ shall be in accordance with Table 405.3.

Exception: Emissions of carbon dioxide equivalents (CO_2e) used in lieu of source energy use, taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's Annual Energy Outlook.

Commenter's Reason: Two modifications are added to the original proposal in sections 405.3 and 506.3 that reference Table 405.3 for source energy multipliers which were accepted by the IECC Committee in proposal EC133.

On June 8, 2010, the U.S. Department of Energy (DOE) issued a Request for Information (RFI) inviting comments to assist in developing a voluntary National Energy Rating Program for Homes. The new rating program is intended to provide consumers with consistent and reliable information about the energy performance of their homes and encourage them to invest in cost-effective energy improvements. The RFI gives source energy top-billing in the home rating approaches DOE is considering. DOE states (page 6) "…this metric would need to provide consumers with information as to the total energy use of the home and the potential for improvement. DOE believes that a source energy metric would allow consumers to more equitably consider all fuel types. Furthermore, depending on the conversion factors used, as well as how renewable energy is counted, source energy can more effectively reflect the environmental consequences of energy generation, transmission, and use. For these reasons, the Department plans to use source energy as the basic metric for the program. This would ensure that the information provided for homes that use both gas and electric energy will reflect the energy consumption of these fuels using an apples-to-apples approach and reflect a more complete picture of the energy use of the home. While the use of source energy, relative to site energy, requires the use of a conversion factor to convert site electricity use to a source equivalent, the Department believes this can be accomplished in a manner that is credible and transparent for the consumer as well as easy to implement and oversee. The source energy associated with the use of electricity can either be determined on a regional or national basis. The benefit of using a national conversion factor for source energy is that it is easier to implement and allows the easy comparison of energy performance for homes across the nation. Regional source conversion factors, however, more accurately depict the actual energy use of the home and are also readily available."

The IECC can only accurately weigh a building's total energy footprint using source (full fuel cycle) energy measurements. The U.S Environmental Protection Agency already recognizes that fact in its procedures for assessing energy and carbon footprints of commercial buildings under its Energy Star performance path rating methodology. The only method to gauge a building's global warming impact is through source energy emissions of CO_2 and CO_2 equivalents (CO_2e). The proposed changes include both methods. Energy cost does not reflect source energy consumption or CO2 and, further, is misleading in that energy cost for electricity and other fuels often vary widely by region and season. Therefore, energy cost is not capable of truly reflecting a building's energy or global warming impact.

Final Action: AS AM AMPC____ D

EC135-09/10
405.3

Proposed Change as Submitted

Proponent: Steve Rosenstock, representing Edison Electric Institute (EEI)

Revise as follows:

405.3 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 Price and Expenditure Report*. *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 But 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.~~

Exceptions:

1. Jurisdictions that require site energy (1 kWh = 3,413 Btu) rather than energy cost as the metric of comparison.
2. Jurisdictions that use both site energy and source energy estimates as the metrics of comparison. All source energy estimates shall be reviewed by independent third parties for technical accuracy and to ensure market and fuel neutrality.

Reason: This revision will provide more options for code officials and provide builders transparency about why certain building design options do not meet energy efficiency codes when using source energy.

Cost Impact: Increased due to third party verification of source energy methodology and numerical estimates.

ICCFILENAME: ROSENSTOCK-EC-1-405.3

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Site energy was removed from the code as an option in the 2007/2008 Code Change Cycle because it does not provide a meaningful comparison when more than one fuel source is used in a building. The committee does not want to re-introduce site energy into the code for the same reasons it was removed.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Steve Rosenstock, representing Edison Electric Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

405.3 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 Price and Expenditure Report*. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

Exceptions:

1. Jurisidictions that require site energy (1 kWh = 3,413 Btu) rather than energy cost as the metric of comparison.

2. ~~Jurisdictions that use both site energy and source energy estimates as the metrics of comparison. All source energy estimates shall be reviewed by independent third parties for technical accuracy and to ensure market and fuel neutrality.~~

Commenter's Reason: This modification should be accepted for the following reasons:

This revision will change the code back to the more correct 2006 IECC. It is a fact that site energy was used with no problems for code officials.

Site energy can be tested, measured, and verified by code officials and/or independent 3rd parties (such as utilities that offer energy efficiency and new construction programs).

Source energy values can only be estimated, and will vary by state, region, season, and time of day. With source energy, it is too easy to "game the system" to create market disparities, which will hurt the goal of building energy efficiency.

For example, in areas that are primarily served by hydroelectric and/pr renewable power plants, a more accurate estimated source energy multiplier would be 0.0. Using a value of 3.16 in these areas overstates the estimated source energy usage by a factor of infinity. Because source energy estimates can vary by orders of magnitude of over 100%, with standard deviations having similar ranges, it is a better code policy to use a metric that can be measured and verified, such as site energy.

Public Comment 2:

Chuck Foster, Foster and Jamison, representing himself, and Alex Hofmann, representing American Public Power Association requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

405.3 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 Price and Expenditure Report. Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

Exceptions:

1. Jurisdictions that require site energy (1 kWh = 3,413 Btu) rather than energy cost as the metric of comparison.
2. Jurisdictions that use both site energy and source energy estimates as the metrics of comparison

Commenter's Reason: (Chuck Foster) This modification will provide maximum flexibility for the code officials. They can use energy cost, or they can use site energy, or they can use a combination of site energy and source energy estimates. Code officials used site energy in the past (through the 2006 IECC), and will not have a problem in using the metric.

Site energy can be tested, measured, and verified by code officials and/or independent 3rd parties (such as utilities that offer energy efficiency and new construction programs).

Since source energy values can only be estimated and will vary by state, region, season, and time of day, it will be essential to combine such estimates with site energy values that are based in reality. With source energy as a stand- alone "metric", it is too easy to "game the system" to create market disparities, which will hurt the goal of building energy efficiency. Moreover, the process of estimating source energy always begins with a calculation of site energy. Finally, the use of source energy in the aggregate fails to recognize the diverse array of energy sources available to use in the generation of electricity, including wind, nuclear, hydro, gas, coal, biomass, solar and other sources.

For example, in areas that are primarily served by hydroelectric and/or renewable power plants, a more accurate estimated source energy multiplier would be 0.0. Using a value of 3.16 in these areas overstates the estimated source energy usage by a factor of infinity. Because source energy estimates can vary by orders of magnitude of over 100%, with standard deviations having similar ranges, it is a better code policy to use a metric that can be measured and verified, such as site energy.

(Alex Hofmann) This modification will maximize flexibility for code officials. Officials can use energy cost, or site energy, or a combination of site energy and source energy estimates. Site energy has been used successfully by code officials through the 2006 IECC.

Site energy can be tested, measured, and verified by code officials and/or independent 3"' parties (such as utilities that offer energy efficiency and new construction programs).

Calculated source energy values will vary by scope of analysis. Further, through the process of setting scope of analysis, two code officials in the same area could end up with largely different estimates for source energy. This would complicate the energy efficiency decision making process for residents and consumers. Beyond scope, source energy literally varies in composition by state, region, season and time of day. As such, it will be essential to, at least, combine source energy estimates with site energy values that are valid and verifiable. Since source energy values can only be loosely estimated based on a variable scope of estimation and large volumes of data, it is an inefficient and time consuming calculation for code officials to perform and will hurt the overall long-term goal of energy efficiency.

To exemplify vocational differences in electric source energy, it is important to note that areas that are primarily served by hydroelectric and/or renewable power plants would be best represented using a multiplier near or at 0.0. Using a value of 3.16 in these areas overstates the estimated source energy usage by many orders of magnitude. By using a metric that can be measured and verified, such as site energy, code, officials would be acting in 'the best interest of the spirit of the code.

Final Action: AS AM AMPC____ D

EC137-09/10
Table 405.5.2(1)

Proposed Change as Submitted

Proponent: James Larsen, representing the Cardinal Glass Industries

Revise table as follows:

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Glazing[a]	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. Orientation: equally distributed to four cardinal compass orientations (N, E, S & W). *U*-factor: from Table 402.1.3 SHGC: From Table 402.1.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used. Interior shade fraction: 0.92-(0.21*SHGC for the standard reference design) ~~Summer (all hours when cooling is required) = 0.70~~ ~~Winter (all hours when heating is required) = 0.85[c]~~ External shading: none	As proposed As proposed As proposed As proposed 0.92-(0.21*SHGC as proposed) ~~Same as standard reference design~~ As proposed

a. and b. (No change to current text)

~~c. For fenestrations facing within 15 degrees (0.26 rad) of true south that are directly coupled to thermal storage mass, the winter interior shade fraction shall be permitted to be increased to 0.95 in the proposed design.~~

d. through k. (No change to current text)

Reason: The "Interior shade fraction" in the *IECC*'s section 405 performance compliance path is used in simulating the performance of the building as a multiplier to reduce effective SHGC and its impact on the conditioned space. This approach is intended to simulate the effects of interior shades on solar heat gain transmitted through the glazing. As a result, this multiplier is important because it can affect the choice of appropriate fenestration.

The current specifications for the Standard Reference Design and the Proposed Design incorrectly treat interior shade fraction as a constant without regard to the type of shade or the type of the glass. Recently completed research shows that it is not a constant. This proposal is intended to correct this issue by providing a simplified equation for determining interior shading fraction depending on the SHGC of the glazed fenestration product (this equation is based on the assumption of a specific type of interior shade, recognizing that the code has no control over the type of shade ultimately employed). This proposal also incorporates the assumption that shades are closed 50% of the time throughout the entire year, rather than assuming twice the shade usage in the summer than the winter. This proposal would allow the performance path to provide a more precise treatment of shade fraction depending on the SHGC of the glazing product.

ASHRAE recently completed a research project - 1311 RP – and published a 95 page final report on the effects of various shading devices on the building loads resulting from solar heat gain; specifically, Wright, J., et.al., *Improved Cooling Load Calculations for Fenestration with Shading Devices* (dated January 14, 2009). This report publishes tables of modifiers for 56 glass products and 34 types of interior shading devices.

Shade combinations studied in the report included:

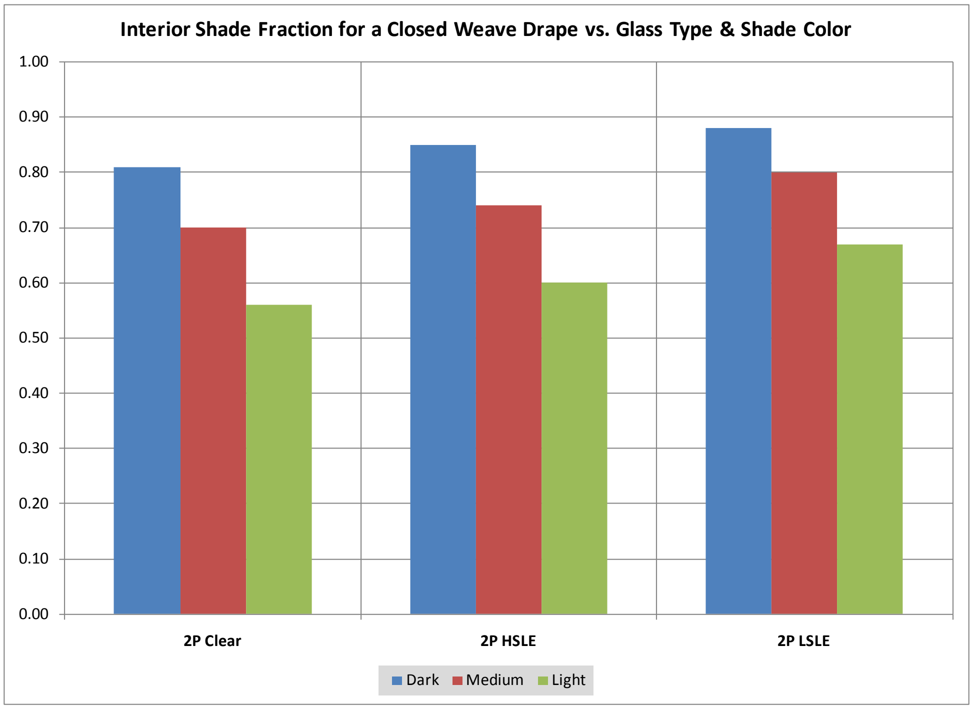
- Louvered Shades
  - 3 colors (dark, medium, light)
  - 5 positions (rotated from closed down to open to closed up)
- Fabric Drapes
  - 3 colors
  - 4 weave densities (closed, semi-open, open, sheer)
- Roller Shades
  - 3 colors
  - 2 density (opaque, translucent)
- Insect Screen (1)

According to the report, the shading values vary remarkably depending on the type of shade and the type of glass. In fact, one could reasonably conclude that it is impossible to set any meaningful shade fraction without reference to a specific shade and a specific window in each case. Reference to specific shades and window combinations in the code obviously would be complex at best, and would certainly be impractical, since the type of interior shades for each window is typically not controlled by the builder and would require a separate calculation for each window with a different shade. As a result, we are faced with two options – either eliminate interior shade fraction from the performance calculations, or make a simplifying assumption as to a standard shade. For this proposal, we have selected the latter course and propose to assume use of the most effective drape (from a shade fraction perspective), which is a light-colored tight-weave fabric drape.

A review and analysis of the data in the report does show, however, that for each shade type, as SHGC is reduced, the impact of the interior shade is also reduced. Intuitively this makes sense – as the glazing takes on the role of solar control, interior shades will have less impact on solar performance. In effect, what happens is that as the SHGC of the window decreases, more of the light energy that is reflected back to the window due to the interior shade is retained in the building (increasing cooling load and reducing heating load) – in other words, more light energy is trapped inside the conditioned space and prevented from retransmission to the outside by the lower SHGC. Since the builder does determine the SHGC of the window, at least this factor can be incorporated into the performance analysis. This impact is expressed in the [-0.21*SHGC] component of the proposed new shade fraction equation in Table 405.5.2(1).

The graphs below demonstrate how the interior shade fraction varies for the same light-colored, closed-weave drape with 3 common types of double glazing:

- Clear
- High Solar Gain Low-E (HSLE)
- Low Solar Gain Low-E LSLE)



The interior shade fractions shown in the graph above are for the drape fully closed all of the time and would need to be modified by an expected shade usage pattern. We are aware of no evidence as to typical actual usage patterns by homeowners. However, reverse engineering the current summer/winter interior shade fractions in Table 405.5.2(1) suggests that the *IECC* currently assumes that the homeowner's usage pattern would be shades closed 2/3 of the time in the summer and closed 1/3 of the time in the winter (this assumes the "legacy" values were derived with clear glass and light colored tight weave drape). We do not believe that this is a valid assumption without data. As a result, the proposed 0.92/0.21 coefficients were calculated for the proposed interior shade fraction equation assuming a 50% drape closure year round. In other words, it assumes that the home owner is just as likely to open the drape as close it throughout the entire year.

Should the committee feel a different usage pattern is appropriate, for either winter, or summer, or both, the table below shows coefficients as a function of shade closure over total daylight hours. The equation form is $\mathbf{C_1} - (\mathbf{C_2}*\text{SHGC})$.

Closure	C_1	C_2
25%	0.96	0.10
33%	0.95	0.14
50%	**0.92**	**0.21**
67%	0.89	0.28
75%	0.88	0.31
100%	0.84	0.42

The proposed equation was developed and these coefficient values were calculated based on the data from the report.

It is also important to ensure that the Proposed Design properly reflects the shade fraction as a result of the SHGC of the actual product used in the Proposed Design (that is, as proposed), rather than simply repeating the shade fraction based on the SHGC from the Standard Reference Design. As a result, we propose to incorporate the same equation in the Proposed Design, but using the actual product SHGC in lieu of the SHGC in the Standard Reference Design.

This proposal should be adopted to reflect more accurately the effects of the glazing SHGC on the interior shade fraction.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: LARSEN-EC-1-T. 405.5.2(1)

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: The proponent provided compelling data that showed that the impact of shade on the SHGC of the fenestration is dependent on the type of glazing used. Therefore, this code change makes sense in relating the two.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc & AGC Flat Glass North America, Inc., requests Disapproval.

Commenter's Reason: EC137 should be disapproved because it makes application of the code far more complicated than necessary with no measurable, corresponding benefit.

The code currently provides reasonable and easy to use fractions for shading in the standard reference design. It then applies those same fractions to the proposed design. With no evaluation as to what measurable benefit would accrue, EC137 proposes replacing those simple fractions with an obscure and difficult to apply formula. This is another case of changing the code for the sake of change and making the code far more complex than necessary, for no measurable or discernible benefit.

Final Action voters are urged to disapprove EC137 to remind those submitting code change proposals to do so only when some measurable and tangible benefit can be realized to justify the time and costs associated with requiring building code officials to learn an endless stream of new code provisions of increasing complexity in every development cycle.

We encourage Final Action voters to vote against the standing motion to adopt EC137 as submitted in order to vote in favor of a motion to disapprove EC137.

Final Action: AS AM AMPC____ D

EC140-09/10
Table 405.5.2(1)

Proposed Change as Submitted

Proponent: Mark Nowak, representing Steel Framing Alliance

Revise table as follows:

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Building Component	Standard Reference Design	Proposed Design
Heating Systems [g, h]	~~As proposed~~ ~~Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*~~ Fuel Type: same as proposed Design Efficiencies: Electric: Air-source heat pump with prevailing federal minimum efficiency Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency Nonelectric boilers: natural gas boiler efficiency Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	~~As Proposed~~ As Proposed Same as standard reference [l] Same as standard reference [l] Same as standard reference [l] As Proposed
Cooling Systems [g, i]	~~As proposed~~ ~~Capacity: sized in accordance with Section M1401.3 of the International Residential Code~~ Fuel type: Electric Efficiency: in accordance with prevailing federal minimum standards Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	~~As Proposed~~ As Proposed Same as standard reference [l] As Proposed
Service Water Heating [g, i, j, k]	~~As proposed~~ ~~Use: same as proposed design~~ Fuel type: same as proposed design Efficiency: in accordance with prevailing federal minimum standards Use: same as proposed design	~~As proposed~~ ~~gal/day = 30 + (10 x N_{br})~~ As Proposed Same as standard reference [l] As proposed gal/day = 30 + (10 x N_{br})

l. Proposed design shall be as proposed when the building meets minimum wall cavity insulation requirements in Section 402 or when providing a thermally equivalent wall assembly to the same.

(Portions of table and footnotes not shown remain unchanged)

Reason: The purpose of the performance path is to provide flexibility for builders as they comply with code. However, this flexibility is severely limited if increases in mechanical efficiency are not taken into account in performance path compliance. Currently the code creates a disincentive for builders to use any heating, cooling or water heating system other than code minimum, making the performance path essentially unusable.

This proposal reintroduces heating, cooling, and water heating efficiency into the performance path, offering more flexibility for code compliance, while encouraging builders to use higher than minimum efficiency mechanical equipment. It fills a hole in the 2009 IECC, which has no method to encourage energy savings through mechanical equipment.

Concerns have been raised about the ability to trade off mechanical equipment efficiency against wall cavity insulation because wall cavity insulation is difficult and expensive to access during a home renovation. Therefore increases to cavity insulation are less practical for home owners than other energy saving measures. This proposal limits mechanical tradeoffs to situations in which the builder meets the minimum cavity insulation requirement (or equivalent assembly). Therefore, builders can use heating, cooling, and water heating equipment efficiency in their performance path compliance, but only if they meet the minimum cavity insulation requirements in Section 402.

This change will increase flexibility and increase the use of high efficiency heating, cooling, and water heating equipment, while maintaining reasonable limits on wall insulation requirements.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: NOWAK-EC-2-T. 405.5.2(1)

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This proposed change could possibly reduce the energy conservation levels using the performance path. High efficiency appliances are the norm. Therefore, to take a credit for these in the performance path as an improvement would lower the bar of the standard design.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Thomas D. Culp, Birch Point Consulting, representing The Glazing Industry Code Committee and the Aluminum Extruders Council, requests Approval as Modified by this Public Comment.

Modify the proposal as follows

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Heating systems[~~g,~~ h, i]	As proposed ~~Fuel type: same as proposed design~~ ~~Efficiencies:~~ ~~Electric: air-source heat pump with prevailing federal minimum efficiency~~ ~~Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency~~ ~~Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency~~ Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed ~~As proposed~~ ~~Same as standard reference [i]~~ ~~Same as standard reference [i]~~ ~~Same as standard reference [i]~~ As proposed
Cooling systems[~~g, i~~ h, j]	As proposed ~~Fuel type: Electric~~ ~~Efficiency: in accordance with prevailing federal minimum standards~~ Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed ~~As proposed~~ ~~Same as standard reference [i]~~ As proposed
Service water heating[~~g, i, j,~~ k]	As proposed ~~Fuel type: same as proposed design~~ ~~Efficiency: in accordance with prevailing Federal minimum standards~~ Use: same as proposed design	As proposed ~~As proposed~~ ~~Same as standard reference [i]~~ As proposed gal/day = 30 + (10 x N_{br})

h. For a proposed design with multiple heating~~,~~ or 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.

i. For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design. For electric heating systems without a heat pump, the prevailing federal minimum efficiency air-source heat pump shall be used for the standard reference design. Where the minimum wall cavity insulation requirements in Section 402 are met, the standard reference design shall use the prevailing federal minimum efficiency air-source heat pump for electric heating systems, prevailing federal minimum efficiency natural gas furnace for nonelectric furnaces, and prevailing federal minimum efficiency natural gas boiler for nonelectric boilers.

j. For a proposed design home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design. Where the minimum wall cavity insulation requirements in Section 402 are met, the standard reference design shall use an electric air conditioner with the prevailing federal minimum efficiency.

k. For a proposed design with a non-storage-type water heater, a 40-gallon storage-type water heater with the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For the case of a proposed design without a proposed water heater, a 40-gallon storage-type water heater with 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. Where proposed design includes solar water heating, the standard reference shall include the equivalent capacity with fuel type same as the non-solar water heating. Where the minimum wall cavity insulation requirements in Section 402 are met, the standard reference design shall use the prevailing federal minimum efficiency for the same fuel as the proposed design.

~~l. Proposed design shall be as proposed when the building meets minimum wall cavity insulation requirements in Section 402 or when providing a thermally equivalent wall assembly to the same.~~

(Portions of table not shown remain unchanged)

Commenter's Reason: Encouraging better HVAC equipment efficiency is essential to improving the overall energy performance of buildings. However, the 2009 IECC removed all credit in the performance path for installing higher efficiency equipment. This was a significant mistake. We cannot move to high performance buildings by relying only on the building envelope – that is like telling the auto industry to improve the miles-per-gallon of a car, but don't touch the engine! It simply makes no sense to ignore one of the most important aspects controlling the overall energy efficiency of a building, and violates the whole premise of the performance path.

Additionally, there are technical flaws. The current language treats a 96 AFUE condensing furnace the same as an 80 AFUE furnace. Solar water heating the same as the worst efficient water heater on the market. A ground-sourced heat pump the same as electrical resistance heating. This makes no sense, and causes unintended consequences. For example, there is now absolutely no incentive to install a SEER 16 air conditioner, so the net effect would be that only the federal minimum (SEER 13) would be installed.

One of the main arguments for this approach has been that equipment efficiency should not be traded-off for wall insulation, as it may be more difficult and costly to upgrade a wall in the future. If that is the concern, EC140 would restore the incentive to use high efficiency equipment, but only in cases where the wall cavity insulation requirements are already met. This proposed modification takes the same concept as the original EC140, but reformatted such that the main table is restored to its current format, and the ability to use higher equipment only when the wall cavity insulation requirements are met is delegated to the footnotes. At the same time, the wording is clarified, and editorial mistakes in the current code related to footnote references are corrected.

Providing an incentive to install high performance equipment is fundamental to a strong and usable energy code. We ask that you vote against the initial motion for disapproval, followed by a vote to approve EC140 as modified by this public comment.

Public Comment:

Joe Nebbia and Mike Moore, Newport Ventures, representing Steel Framing Alliance, request Approval as Modified by this Public Comment.

Modify the proposal as follows

Table 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating Systems [g, h]	Fuel Type: same as proposed	As Proposed
	Efficiencies:	
	Electric: air-source heat pump with prevailing federal minimum efficiency	Same as standard reference [l]
	Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency	Same as standard reference [l]
	Nonelectric boilers: natural gas boiler efficiency	Same as standard reference [l]
	Capacity: sized in accordance with ~~Section M1401.3 of the International Residential Code~~ ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.	As Proposed
Cooling Systems [g, i]	Fuel type: Electric	As Proposed
	Efficiency: in accordance with prevailing federal minimum standards	Same as standard reference [l]
	Capacity: sized in accordance with ~~Section M1401.3 of the International Residential Code~~ ACCA Manual S based on building loads calculated in accordance with ACCA Manual J or other approved heating and cooling calculation methodologies.	As Proposed
Service Water Heating [g, i, j, k]	Fuel type: same as proposed design	As Proposed
	Efficiency: in accordance with prevailing federal minimum	Same as standard reference [l]

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	standards Use: same as proposed design	gal/day = 30 + (10 x N_{br})

l. Proposed design shall be as proposed when the building's exterior walls comply with one of the following: ~~meets minimum wall cavity insulation requirements in Section 402 or when providing a thermally equivalent wall assembly to the same.~~

1. Framed walls with minimum R-13 cavity insulation in climate zones 1-5 or minimum R-20 cavity insulation in climate zones 6-8;
2. Masonry walls with minimum insulation of R-3 in climate zones 1-3, R-5 in climate zone 4, R-10 in climate zone 5, or R-15 in climate zones 6-8; or
3. Any wall assembly that satisfies the U-factor requirements of Table 402.1.3.

Commenter's Reason: *Background*
As the focus of the IECC continues to require higher levels of energy performance, the importance of the simulated performance path has increased. Because the prescriptive path continues to become more and more restrictive, more builders will need to use the performance path to ensure that they can meet the desired energy savings targets in the most cost effective manner. Since 2009, when the ability to credit high efficiency mechanical equipment was removed, the simulated performance path has been practically unusable. This comment re-inserts mechanical efficiency within the performance path, increases flexibility and cost-effective design options, provides an incentive for innovation and specification of high efficiency equipment, and encourages whole-building energy efficient design.

Changes proposed in this comment
This comment addresses several criticisms raised in the first hearings by the committee and opponents. It now includes mass walls so that all wall categories are covered. It also provides specific energy minimums and removes vague equivalency language. This comment still focuses on setting hard minimums for wall insulation because it tends to be a difficult and expensive efficiency item to retrofit.

Based on feedback from building code officials, we have also changed the language related to system capacity. Instead of referencing the IRC (as was done in the 2006 IECC Table), we have simply copied the reference text directly from the IRC (i.e. M1401.3) and inserted it here. This should simplify enforcement of this section.

Why these changes are needed
The argument for removing mechanical efficiency has largely focused on the perceived danger that a builder would put in a high efficiency HVAC system, and less insulation, only to have the HVAC system break and be replaced with a less efficient unit. This argument has multiple flaws.

- First, consumers don't tend to intentionally purchase goods that perform worse than the good that they previously purchased.
- Second, as related to heat pumps and air conditioners, equipment efficiency has historically increased over time, such that replacement units are likely to be of equal or greater efficiency than the initial unit. The result is that the whole-building performance required by the IECC is "locked-in" and achieved over the life of the building.
- Third, as related to furnaces, the type of venting initially installed is a major driver in determining what type of replacement equipment will be provided; so if a high efficiency furnace is initially installed, it is likely that future replacements will also be high efficiency.
- Fourth, the likelihood of a complete system failure and replacement in the initial years of the equipment's life is small. More likely, for the few cases where major replacements are necessary, it will typically require component replacement with compatible components and not whole system replacement.

Removing mechanical system efficiencies from the performance path has also created product bias in the code. Windows, for example, will likely need to be replaced before insulation. However, window tradeoffs are still allowed in both the performance path and the UA tradeoff approach. In fact, windows may have to be replaced as frequently as HVAC equipment.

This comment provides a compromise position that encourages whole-house, energy efficient design while ensuring that builders do not neglect the building envelope. It also removes product bias in the code, and shifts the focus of the performance path back to cost-effective results, not mandated materials.

Final Action: AS AM AMPC____ D

EC141-09/10
Table 405.5.2(1)

Proposed Change as Submitted

Proponent: Ken Sagan, representing National Association of Home Builders (NAHB)

Revise table as follows:

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems[g, h],	~~As proposed~~ Fuel type: same as proposed design Efficiencies: Electric: air-source heat pump with prevailing federal minimum efficiency Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed As proposed As proposed
Cooling system[g, i],	~~As proposed~~ Fuel type: Electric Efficiency: in accordance with prevailing federal minimum standards Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed As proposed As proposed
Service Water Heating[g, i, j, k]	~~As proposed~~ Fuel type: same as proposed design Efficiency: in accordance with prevailing Federal minimum standards Use: gal/day = 30 + 10 × *Nbr* Tank temperature: 120°F ~~Use: same as proposed design~~	As proposed As proposed Same as standard reference Same as standard reference ~~gal/day = 30 + 10 × *Nbr*~~

(Portions of table and footnotes not shown remain unchanged)

Reason: The purpose of this proposal is to retain the original equipment trade-off provisions from the 2006 *International Energy Conservation Code* (IECC) for the heating systems, cooling systems, and service water heating. By retaining these, builders have an opportunity to optimize a code-compliant house design by using energy efficient equipment.

Eliminating the ability to use equipment efficiency as a means to achieve whole-house energy conservation will discourage the use of higher efficiency equipment. Quite often, the use of this high efficiency equipment provides a more cost effective solution to achieve code compliance. Eliminating this ability discourages the concept of the “house as a system” approach which is a cornerstone of many state energy programs and the Federal Energy Star Program. In fact, without this proposal the current practice for constructing an Energy Star home in certain jurisdictions would be disallowed.

Significant improvements in the efficiency of HVAC and water heating equipment have been made in the last 20 years. With the increased emphasis on new and improved technologies, this trend will continue and will result in even higher energy savings in future years. Eliminating the ability to recognize the value of these technologies in the marketplace will prove detrimental to all builders and ultimately the homeowners.

By inserting the equipment trade-off tables, this amendment provides a reasonable cost-effective solution to achieve compliance.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: SAGAN-EC-9-T. 405.5.2(1)

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: For the same reasons that the committee disapproved EC140.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Don Surrena, representing National Association of Home Builders (NAHB) requests Approval as Submitted.

Commenter's Reason: Equipment efficiencies have long been part of the energy code. This proposal reinstates the language from the 2006 *International Energy Conservation Code*. Having the ability to create an equally efficient house using efficient equipment allows the builders to optimize the efficiency design of the home by using "innovative approaches and techniques to achieve the effective use of energy" as stated in the Intent section of the 2009 IECC. The removal of energy neutral equipment tradeoffs limits consumer choice and raises the cost of housing.

Final Action: AS AM AMPC____ D

EC142-09/10
202

Proposed Change as Submitted

Table 405.5.2(1)

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

Revise as follows:

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
~~Doors~~	~~Area: 40 ft²~~ ~~Orientation: North~~ ~~*U*-Factor: same as fenestration from Table 402.1.3~~	~~As proposed~~ ~~As proposed~~ ~~As proposed~~
~~Glazing[a]~~ Fenestration	Total area[b] = (a) The proposed ~~glazing~~fenestration area; where the proposed ~~glazing~~fenestration area is less than 15% of the conditioned floor area (b) 15% of the conditioned floor area; where the proposed ~~glazing~~fenestration area is 15% or more of the conditioned floor area	As proposed
	Opaque Door: opaque door (SHGC = 0) as proposed up to 40 ft² shall be included in proposed total fenestration area and oriented the same as in the proposed design	As proposed
	Orientation: all fenestration other than the opaque door equally distributed to four cardinal compass orientations (N, E, S & W)	As proposed
	U-Factor: from Table 402.1.3 SHGC: from Table 402.1.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed As proposed
	Interior shade fraction: Summer (all hours when cooling is required) = 0.70 Winter (all hours when heating is required) = 0.85[c]	Same as 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% 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.~~

(Portions of table and footnotes not shown remain unchanged)

Reason: The IECC defines fenestration (Section 202) to include all windows, skylights and doors, whether glazed or opaque. Yet, table 404.5.2(1), treats "doors" a separate component. It is unclear how glazed and un-glazed doors are supposed to be treated under this approach (e.g., are glazed doors included in doors or glazing?). This proposal simplifies and tightens the performance path by including all fenestration—doors, vertical glazing, and skylights—in a single calculation. In order to do so, the proposal replaces the two terms "doors" and "glazing" with "fenestration," and sets an SHGC in the standard reference design for both glazed and opaque doors.

This simplification will strengthen the code by ensuring that all fenestration is properly accounted for in the proposed design. The result will also be an increase in efficiency and energy savings, since it eliminates a separate assumption of 40 square feet of opaque doors in the standard reference design, instead including such doors in fenestration area, like all other fenestration.

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: PRINDLE-EC-30-T. 405.5.2(1)

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason:. This is an unnecessary complication to the determination of the requirements that will yield very little difference in stringency.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute requests Approval as Submitted.

Commenter's Reason: *EC142 should be approved as submitted.*

As explained in the original reason statement, this proposal corrects an inconsistency in the IECC, will eliminate potential confusion and will result in energy savings. The proposal correctly recognizes that doors are part of fenestration and should not be set out as a separate building component. This change will result in an increase in efficiency and energy savings for buildings complying under the performance path, since it eliminates a separate assumption of 40 square feet of opaque doors in the standard reference design in addition to fenestration equal to up to 15% of conditioned floor area. Forty square feet of doors amounts to an additional 2% fenestration area for a 2000 square foot home. The performance path is only as accurate as its fundamental assumptions – using 15% overall fenestration area (including doors) is a more reasonable approach.

Final Action: AS AM AMPC____ D

EC145-09/10
Table 405.5.2(1)

<u>Proposed Change as Submitted</u>

Proponent: Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steve Rosenstock, Edison Electric Institute; Brian Dean, ICF International

Revise as follows:

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Glazing [a]	Total area [b] = (a) The proposed glazing area; where the 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 Orientation: equally distributed to four cardinal compass orientations (N,E,S, & W) U-factor: from Table 402.1.3 SHGC: From Table 402.1.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used Interior shade fraction: Summer (all hours when cooling is required) = ~~0.70~~ <u>0.90</u> Winter (all hours when heating is required) = ~~0.85~~ <u>0.90</u> [c] Exterior shading: none	As proposed As proposed As proposed As proposed Same as standard reference design As proposed

(Portions of table and footnotes not shown remain unchanged)

Reason: This proposal corrects a long-term flaw in the performance path – an unfounded assumption that interior shades are consistently used twice as much in the summer as in the winter – by setting the interior shade fraction at the same 0.90 level for both summer and winter. Another option would be to eliminate interior shading altogether, just as the performance path already assumes no exterior shading. Either approach would allow for the energy efficiency improvements of the home to be treated consistently throughout the year without impact from occupant behavior between seasons. Because there is no valid evidence as to actual, consistent human behavior in using shades, and indeed shade use is ultimately up to each individual occupant, we propose to treat all seasons equally.

The benefits of reducing solar heat gain for homes is well-known. However, it is not so well known that the code-assumed interior shading values reduce the perceived benefits of shading windows or reducing the SHGC of windows.

This proposal makes the performance path more accurate by establishing an equal interior shade fraction in all seasons. The current standard reference design assumes a 30% reduction in the benefit of reducing solar heat gain in the hottest time of the year when the solar heat gain reduction is most important to reducing the electric grid overload during peak hours. By contrast, the standard reference design assumes only 15% is blocked in the winter. These numbers are not supported by objective data or any studies, and the imbalance between the shading fractions creates inaccuracies in modeling programs. Because the performance path assumes that interior shading is used twice as much in the summer as in the winter, the equation shows higher relative energy use in the heating months than in the cooling months. In the performance path calculation, this translates to an artificially inflated heating budget and a bias in favor of measures used to reduce heating energy. This assumption is similar to assuming that heating equipment will operate 30% more efficiently due to occupant behavior. It is not accurate and promotes less efficiency. The assumption also makes no climate zone-specific distinctions, but rather assumes that shading tendencies are static nationally. The result is that the performance path may favor compliance measures that reduce heating energy over measures that reduce cooling energy, even in cooling-dominated climates.

Because there is no data to support the currently unbalanced assumptions of interior shading fractions, this proposal neutralizes the assumptions in the standard reference design at a uniform, conservative level. It assumes that a typical occupant will not radically alter behavior with regards to interior shade operation by season. It also makes the conservative assumption that the majority of windows will not have shades drawn during daytime hours to block solar radiation. As a result, the purchased energy estimated using the performance approach will be more accurate and representative of an actual residential building.

Although it can be argued that a conscientious building occupant may reduce heating or cooling loads by operating shades to minimize sunlight during the summer and maximize sunlight during winter, there is no data to suggest that occupants actually engage in these practices for the purpose of saving energy. There are many reasons why shades are operated throughout the year, and almost all of them have nothing to do with energy use.

The *2005 ASHRAE Handbook of Fundamentals* outlines a number of variables affecting user-operated shading devices, each of which may have significant impacts on the effectiveness of the devices:

Shading devices vary in their operational effectiveness. Some devices, such as overhangs, light shelves, and tinted glazings, do not require operation, have long life expectancies, and do not degrade significantly over their effective life. **Other types of shading devices, especially**

operable interior shades, may have reduced effectiveness because of less than optimal operation and degradation of effectiveness over time. It is important to evaluate operational effectiveness when considering the actual heat rejection potential of shading devices.

Handbook, at 31.54, emphasis added. The *Handbook* lists six reasons why shades are more or less effectively operated, and only one of them (radiant energy protection) has anything to do with energy use or changing seasons: Radiant Energy Protection, Outward Vision, Privacy, Brightness Control, View Modification, and Sound Control. *See Handbook* at 31.54-55.

In reality, a home's occupant will operate shades for any number of these reasons, without thinking of the potential negative energy impacts. For example, interior shades should be operated to reflect radiant energy during the hottest months of the year. However, in northern climates, because glass temperatures during winter months can drop below room temperature, it is common practice to use shades *more often* during the winter months for the perceived insulating benefits. In addition, direct sunlight or reflected light can make occupants uncomfortable, leading to more shade usage (even in winter months).

Windows are often installed for a view of particular external geographical features, such as landscape or city views. A beautiful view or day-lighting interest may induce an occupant to leave shades open year-round. In other cases, because of a home's proximity to other homes, certain windows may be shaded year-round for privacy concerns. Users may also install heavy draperies to reduce road noise or other sounds.

Every building will have unique shading characteristics based on the climate zone, shade type, window type, orientation, exterior shading, and most importantly, the occupant's priorities. Because there is no reliable data to support the current bias in the performance path, the shading fraction should be neutralized so that heating and cooling measures will be treated similarly. Moreover, given the lack of data as to actual operation, the safer assumption is that shades are largely left open (justifying a higher fraction); after all, it is reasonable to assume that the average person buys windows for views and light. This proposal sets the assumption at a conservative 0.90, which means that the shades are blocking 10% of the solar heat gain annually. Another sensible option is to assume no interior shading, just as the standard reference design assumes no exterior shading.

Cost Impact: The code change proposal will not increase the cost of construction. This change is not intended to affect the overall stringency of the code.

ICCFILENAME: PRINDLE-EC-33-T. 405.5.2(1)

Public Hearing Results

Committee Action: Disapproved

Committee Reason: The committee dealt with this issue in their action on EC137.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Bill Prindle, ICF International, representing the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute request Approval as Submitted.

Commenter's Reason: The problem addressed by this proposal is also addressed by EC137, which was recommended for approval as submitted by the IECC Committee. Proponents prefer the solution in EC137; as a result, if EC137 is approved, proponents will withdraw EC145. However, in the event EC137 is disapproved, this proposal should be approved as submitted for the reasons set forth in the original proponents' reason statement.

Final Action: AS AM AMPC____ D

EC147-09/10

202, 101.2, Chapter 5

Proposed Change as Submitted

Proponent: David C. Hewitt, New Buildings Institute, John Loyer, American Institute of Architects, Ronald Majette, representing US Department of Energy

1. Revise as follows:

101.2 Scope. This code applies to *residential* and *commercial buildings* and the building site and associated systems and equipment.

2. Revise Section 202 as follows:

BUILDING. Any structure used or intended for supporting or sheltering any use or occupancy, including any mechanical systems, service water heating systems and electric power and lighting systems located on the building site and supporting the building.

BUILDING COMMISSIONING. A process that verifies and documents that the selected building systems have been designed, installed, and function according to the owner's project requirements and construction documents, and to minimum code requirements.

BUILDING SITE. A contiguous area of land that is under the ownership or control of one entity.

BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floor, roof, and any other building element that encloses *conditioned space*. ~~This boundary also includes the boundary between *conditioned space* and any exempt or unconditioned space~~ or provides a boundary between *conditioned space* and exempt or unconditioned space.

CONTINUOUS AIR BARRIER. A combination of materials and assemblies that restrict or prevent the passage of air through the building thermal envelope.

FENESTRATION PRODUCT, FIELD-FABRICATED is a fenestration product including an exterior glass door whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut, or otherwise formed with the specific intention of being used to fabricate a fenestration product or exterior door. Field fabricated does not include site-built fenestration with a label certificate or products required to have temporary or permanent labels.

FENESTRATION PRODUCT, SITE-BUILT is fenestration designed to be field-glazed or field assembled units using specific factory cut or otherwise factory formed framing and glazing units. Examples of site-built fenestration include storefront systems, curtain walls, and atrium roof systems.

FURNACE ELECTRICITY RATIO. The ratio of furnace electricity use to total furnace energy computed as ratio = $(3.412 * E_{AE})/(1000 * E_F + 3.412 * E_{AE})$, where E_{AE} (average annual auxiliary electrical consumption) and E_F (average annual fuel energy consumption) are defined in Appendix N to subpart B of part 430 of title 10 of the Code of Federal Regulations and E_F is expressed in millions of Btu's per year.

ON-SITE RENEWABLE ENERGY. Energy derived from solar radiation, wind, waves, tides, landfill gas, biomass, or the internal heat of the earth. The energy system providing on-site renewable energy shall be located on or adjacent to the project site.

3. Revise as follows:

501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. ~~These commercial buildings shall meet either requirements of ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*, or the requirements contained in this chapter.~~

4. Revise as follows:

501.2 Application. The *commercial building* project shall comply with the requirements in Sections 502 ~~(Building envelope requirements),~~ 503 ~~(Building mechanical systems)~~, 504~~(Service water heating)~~, 505 ~~(Electrical power and lighting systems)~~ in its entirety, and one of the additional options as presented in Section 506. As an alternative the *commercial building* project shall exceed by at least 25% ~~comply with~~ the requirements of ASHRAE/IESNA Standard 90.1, Energy Standard for Buildings Except for Low Rise Residential Buildings, Appendix G in its entirety.

Exceptions:

1. Buildings conforming to Section 507, provided Sections 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied. Building energy cost shall be equal to or less than 75% of the standard reference design building.
2. Additions, alterations and repairs shall comply with the applicable requirements in Sections 502, 503, 504, and 505 only or with ASHRAE/IESNA 90.1.

5. Revise as follows:

502.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table 502.2(1), based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

Exception: Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U*-factor is equivalent to the same assembly with the *R*-value specified in Table 502.2(1).

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

6. Add new text as follows:

502.2.1.1 Roof solar reflectance and thermal emittance. Roofs in climate zones 1 to 3 not over ventilated attics or not over cooled spaces shall have a minimum three-year aged - solar reflective index (SRI) of 64 when determined in accordance with the SRI method in ASTM E1980 using a convection coefficient of ($12W/m^{2} \cdot K$) or a minimum three-year-aged solar reflectance of 0.55 when tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 and a minimum three-year-aged thermal emittance of at least 0.75 when testing in accordance with ASTM C1371 or ASTM E408.

Exceptions:

1. Ballasted roofs with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or 23 lbs/ft2 pavers (117 kg/m2).
2. Roofs, where a minimum of 75% of the roof area is shaded during the peak sun angle on June 21st by permanent features of the building and/or is covered by off-set photovoltaic arrays, building-integrated photovoltaic arrays, or solar water collectors.
3. Metal building roofs or asphaltic membranes in climate zone 3.

7. Revise as follows:

502.2.6 Slabs on grade. The minimum thermal resistance (*R*-value) of the insulation around the perimeter of unheated or heated slab-on-grade floors shall be as specified in Table 502.2(1). The insulation shall be placed on the outside of the foundation or on the inside of ~~a~~ the foundation wall. The insulation shall extend downward from the top of the slab for a minimum distance as shown in the table or to the top of the footing, whichever is less, or downward to at least the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Where extending outside of the foundation the insulation shall be covered by pavement or by soil a minimum of 10 in. thick. For the purposes of this section a slab on grade floor is a slab floor that is in contact with the ground and that is either above grade or less than or equal to 24 in. below the final elevation of the nearest exterior grade.

8. Revise Table as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration (~~40~~ 30% maximum of above-grade wall)								
U-factor								

(Portions of Table not shown, remain unchanged)

9. Delete and substitute as follows:

~~**502.4.1 Window and door assemblies.** The air leakage of window and sliding or swinging door assemblies that are part of the building envelope shall be determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, or NFRC 400 by an accredited, independent laboratory, and *labeled* and certified by the manufacturer and shall not exceed the values in Section 402.4.2.~~

> ~~**Exception:** Site-constructed windows and doors that are weatherstripped or sealed in accordance with Section 502.4.3.~~

~~**502.4.2 Curtain wall, storefront glazing and commercial entrance doors.** Curtain wall, *storefront* glazing and commercial- glazed swinging entrance doors and revolving doors shall be tested for air leakage at 1.57 pounds per square foot (psf) (75 Pa) in accordance with ASTM E 283. For curtain walls and *storefront* glazing, the maximum air leakage rate shall be 0.3 cubic foot per minute per square foot (cfm/ft^2) (5.5 m^3/h × m^2) of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage rate shall be 1.00 cfm/ft^2 (18.3 m^3/h × m^2) of door area when tested in accordance with ASTM E 283.~~

~~**502.4.3 Sealing of the building envelope.** Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.~~

502.4.1 Air Barriers. The building envelope shall be designed and constructed with a continuous air barrier that complies with Section 502.4.1.1 and 502.4.1.2 to control air leakage into, or out of, the conditioned space. Construction documents shall identify the air barrier components for each assembly, including detailing joints, interconnections and sealing of penetrations. The opaque building envelope air barrier shall be located on the inside or, outside of, or be integral with the building envelope; or any combination thereof.

> **Exception:** Buildings in climate Zones 1, 2 and 3.

502.4.1.1 The *continuous air barrier* shall have the following characteristics:

1. It shall be continuous throughout the envelope (at the lowest *floor*, exterior *walls*, and ceiling or *roof*). Air barrier joints and seams shall be sealed; including sealing transitions in planes and changes in materials. Air barrier penetrations shall be sealed.
2. The air barrier component of each assembly shall be joined and sealed in a flexible manner to the air barrier component of adjacent assemblies. The joints and seals shall allow for the relative movement of the assemblies and materials without damage to the air seal.
3. The air barrier shall be installed in accordance with the *manufacturer's* instructions in a manner that achieves the performance requirements.
4. Where lighting *fixtures* with ventilation holes or other similar objects are to be installed in such a way as to penetrate the *continuous air barrier*, provisions shall be made to maintain the integrity of the *continuous air barrier*.

> **Exception:** Buildings that comply with Section 502.4.1.2(3) below are not required to comply with either 1 or 4.

502.4.1.2 Air barrier compliance options. A continuous air barrier for the opaque building envelope shall meet the requirements of at least one of the compliance options in Section 502.4.1.2.1, 502.4.1.2.2, or 502.4.1.2.3

502.4.1.2.1 Materials. Individual materials shall have an air permeability not to exceed 0.02 L/s·m^2 under a pressure differential of 75 Pa (0.004 cfm/ft^2 under a pressure differential of 0.3 in. water (1.57 lb/ft^2)) when tested in accordance with ASTM E2178. The following materials comply with this requirement when all joints are sealed:

1. Plywood - minimum 3/8 in (10 mm)
2. Oriented strand board - minimum 3/8 in (10 mm)
3. Extruded polystyrene insulation board - minimum 3/4 in (19 mm)
4. Foil-back urethane insulation board - minimum 3/4 in (19 mm)
5. Closed cell spray foam meeting air permeability requirement
6. Open cell spray foam meeting air permeability requirement
7. Weather resistant barrier meeting air permeability requirement
8. Exterior or interior gypsum board - minimum 1/2 in (12 mm)
9. Cement board - minimum 1/2 in (12 mm)
10. Built up roofing membrane
11. Modified bituminous roof membrane
12. Fully adhered single-ply roof membrane
13. A Portland cement/sand parge, or gypsum plaster minimum 5/8 in (16 mm) thick
14. Cast-in-place and precast concrete.
15. Fully grouted concrete block masonry.
16. Sheet steel or aluminum

502.4.1.2.2 Assemblies. Assemblies of materials and components shall have an average air leakage not to exceed 0.2 L/s·m2 @ 75 Pa (0.04 cfm/ft2 under a pressure differential of 0.3" w.g. (1.57psf)) when tested in accordance with ASTM E2357 or ASTM E1677. The following assemblies comply with this requirement when all joints are sealed and every characteristic in Section 502.4.4.1.1 is met:,

1. Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;
2. A Portland cement/sand parge, stucco or plaster minimum 1/2 in (12 mm) thick.

502.4.1.2.3 Building Test. The completed building shall be tested and the air leakage rate of the *building envelope* shall not exceed 2.0 L/s·m^2 @ 75 Pa (0.40 cfm/ft^2 at a pressure differential of 0.3" w.g. (1.57 psf)) in accordance with ASTM E779 or an equivalent method approved by the code official.

502.4.2 Air Barrier Penetrations. All penetrations of the air barrier and paths of air infiltration / exfiltration shall be made air tight and shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seals shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

502.4.3 Fenestration and doors. The air leakage of fenestration assemblies and doors shall meet the provisions of Table 502.4.3. Testing shall be performed in accordance with the applicable reference test standard by an accredited and independent testing laboratory and all fenestration assemblies *listed* and *labeled*.

Exception: Site built fenestration assemblies that are sealed in accordance with Section 502.4.1.

10. Add new Table as follows:

Table 502.4.3
Maximum Air Infiltration Rate for Fenestration Assemblies

Fenestration Assembly	Maximum Rate
Windows	0.20 [a]
Sliding Doors	0.20 [a]
Swinging Doors	0.20 [a]
Skylights	0.20 [a]
Curtain Walls	0.06 [b]
Storefront Glazing	0.06 [b]
Commercial Glazed Swinging Entrance Doors	1.00 [c]
Revolving Doors	1.00 [c]
Rolling doors	1.00 [c]

a. cfm per square foot of fenestration or door area when tested in accordance with NFRC 400 or AAMA/WDMA/CSA101/I.S.2/A440 at 1.57 psf (75 Pa). Alternatively the maximum rate is permitted to be 0.3 cfm per square foot of fenestration or door area when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf (300 Pa)
b. cfm per square foot of fenestration area when tested in accordance with NFRC 400 or ASTM E283 at 1.57 psf (75 Pa)
c. cfm per square foot of fenestration or door area when tested in accordance with NFRC 400, AAMA/WDMA/CSA101/I.S.2/A440, or ASTM E283 at 1.57 psf (75 Pa)

11. Add new text as follows:

502.4.4 Doors and Access Openings to Shafts, Chutes, Stairwells, and Elevator Lobbies. These doors and access openings shall either meet the requirements of 502.4.3 or shall be equipped with weather seals.

> **Exception:** Weatherseals on elevator lobby doors are not required when a smoke control system is installed.

12. Revise Section 502.4.5 as follows:

502.4.5 Outdoor air intakes and exhaust openings. Stair and elevator shaft vents and other outdoor air intakes and exhaust openings ~~integral to the building envelope shall be equipped with not less than a Class I motorized dampers, leakage- rated damper with a maximum leakage rate of 4 cfm per square foot (6.8 L/s · C m2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D~~ shall be provided with dampers in accordance with Sections 502.4.5.1 and 502.4.5.2.

Dampers shall be installed with controls so that they are capable of automatically opening upon:

1. The activation of any fire alarm initiating device of the building's fire alarm system;
2. The interruption of power to the damper.

502.4.5.1 Stair and shaft vents. Stair and shaft vents shall be provided with Class IA motorized dampers with a maximum leakage rate of 3 cfm per square foot (5.1 L/s · C m2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.

502.4.5.2 Outdoor air intakes and exhausts. *Outdoor air* supply and exhaust openings shall be provided with Class IA motorized dampers with a maximum leakage rate of 3 cfm per square foot (5.1 L/s · C m2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.

> **Exception:** Gravity (nonmotorized) dampers having a maximum leakage rate of 20 cfm per square foot (34 L/s · C m2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D are permitted to be used ~~in buildings less than three stories in height above grade~~ where the design *outdoor air* intake or exhaust capacity does not exceed 300 cfm.

13. Revise Section 502.4.8 as follows:

502.4.8 Recessed lighting. Recessed luminaires installed in the *building thermal envelope* shall be sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires shall be IC-rated and labeled as having an air leakage rate or no more 2.0 cfm (0.944 L/s) ~~meeting ASTM E 283~~ when tested in accordance with ASTM E 283 at a 1.57 psf (75 Pa) pressure differential ~~with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity~~. All recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

14. Revise as follows:

503.2.1 Calculation of heating and cooling loads. Design loads shall be determined in accordance with the procedures described in the ASHRAE/ACCA Standard 183. The design loads shall account for the building envelope, lighting, ventilation and occupancy loads based on the project design. Heating and cooling loads shall be adjusted to account for load reductions that are achieved when energy recovery systems are utilized in the HVAC system in accordance with the ASHRAE *HVAC Systems and Equipment Handbook*. Alternatively, design loads shall be determined by an *approved* equivalent computation procedure, using the design parameters specified in Chapter 3.

15. Revise as follows:

503.2.2 Equipment and system sizing. ~~Equipment and system sizing.~~ The output capacity of ~~H~~heating and cooling equipment and systems ~~capacity~~ shall not exceed the loads calculated in accordance with Section 503.2.1. A single piece of equipment providing both heating and cooling must satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.

16. Add new text as follows:

503.2.4.3.3 Automatic start capabilities. Controls designed to automatically adjust the start time of an HVAC system each day to allow for automatically brining the space to desired occupied temperature levels immediately before scheduled occupancy shall be provided on each system.

17. Revise as follows:

503.2.5.1 Demand controlled ventilation. Demand control ventilation (DCV) is required for spaces larger than 500 ft^2 (50m^2) and with an average occupant load of ~~40~~ 25 people per 1000 ft^2(93 m^2) of floor area (as established in Table 403.3 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; or
3. A design outdoor airflow greater than 3,000 cfm (1400 L/s).

Exceptions:

1. Systems with energy recovery complying with Section 503.2.6.
2. Multiple-zone systems without direct digital control of individual zones communicating with a central control panel.
3. System with a design outdoor airflow less than 1,200 cfm (600 L/s).
4. Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1,200 cfm (600 L/s).
5. Building spaces where the primary ventilation needs are for process loads.

18. Revise Section 503.2.6 as follows:

503.2.6 Energy recovery ventilation systems. ~~Individual fan systems that have both a design supply air capacity of 5,000 cfm (2.36 m^3/s) or greater and a minimum outside air supply of 70 percent or greater of the design supply air quantity shall have an energy recovery system that provides a change in the enthalpy of the outdoor air supply of 50 percent or more of the difference between the outdoor air and return air at design conditions. Provision shall be made to bypass or control the energy recovery system to permit cooling with outdoor air where cooling with outdoor air is required.~~ Each fan system shall have an energy recovery system when the system's supply airflow rate exceeds the value listed in Table 503.2.6 based on the climate zone and percentage of *outdoor air* at design conditions. Required energy recovery systems shall have the capability to provide a change in the enthalpy of the *outdoor air* supply equal to at least 50% of the difference between the *outdoor air* and return air enthalpies at design conditions. Provision shall be made to bypass or control the energy recovery system to permit air economizer operation as required by Section 503.4

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 at least one of the following features:
   2.1. Variable-air-volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of design values.
   2.2. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (1.1°C) above room setpoint, cooled to no cooler than 3°F (1.7°C) below room setpoint, no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Systems serving spaces that are not cooled and are heated to less than 60°F (15.5°C).
4. Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.
5. ~~Heating systems in climates with less than 3,600 HDD.~~ Heating energy recovery in climate zones 1 and 2.
~~6. Cooling systems in climates with a 1-percent cooling design wet-bulb temperature less than 64_F (18_C).~~
6. Cooling energy recovery in climate zones 3c, 4c, 5b, 5c, 6b, 7, and 8.
7. Systems requiring dehumidification that employ series-style energy recovery coils wrapped around the cooling coil.

Table 503.2.6 Energy Recovery Requirement

Zone	% *Outdoor* air at full design airflow rate					
	≥30% and < 40%	≥40% and < 50%	≥50% and < 60%	≥60% and < 70%	≥70% and < 80%	≥80%
	Design Supply Fan airflow rate (cfm)					
3B, 3C, 4B, 4C, 5B	NR	NR	NR	NR	≥5000	≥5000
1B, 2B,5C	NR	NR	≥26000	≥12000	≥5000	≥4000
6B	≥11000	≥5500	≥4500	≥3500	≥2500	≥1500
1A, 2A, 3A, 4A, 5A, 6A	≥5500	≥4500	≥3500	≥2000	≥1000	>0
7,8	≥2500	≥1000	>0	>0	>0	>0

19. Delete and substitute as follows:

~~**503.2.9 HVAC system completion.** Prior to the issuance of a certificate of occupancy, the design professional shall provide evidence of system completion in accordance with Sections 503.2.9.1 through 503.2.9.3.~~

~~**503.2.9.1 Air system balancing.** Each supply air outlet and *zone* terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International Mechanical Code*. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 horsepower (hp) (7.4 kW) and larger.~~

~~**503.2.9.2 Hydronic system balancing.** Individual hydronic heating and cooling coils shall be equipped with means for balancing and pressure test connections.~~

~~**503.2.9.3 Manuals.** The construction documents shall require that an operating and maintenance manual be provided to the building owner by the mechanical contractor. The manual shall include, at least, the following:~~

1. ~~Equipment capacity (input and output) and required maintenance actions.~~
2. ~~Equipment operation and maintenance manuals.~~
3. ~~HVAC system control maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings, at control devices or, for digital control systems, in programming comments.~~
4. ~~A complete written narrative of how each system is intended to operate.~~

503.2.9 Mechanical systems commissioning and completion requirements. Mechanical systems commissioning and completion shall be in accordance with the provisions of Section 503.2.9.1 through 503.2.9.3.4.

503.2.9.1 System commissioning. The construction documents shall require commissioning and completion requirements in accordance with this section. The construction documents shall be permitted to refer to equipment specifications for further requirements. Copies of all documentation shall be given to the owner by the registered design professional. The building official may request commissioning documentation for review purposes. At the time of plan submittal, the *code official* shall be provided, by the permitee, a letter of intent to commission the building in accordance with this code.

503.2.9.1.1 Commissioning plan. A commissioning plan shall be prepared and shall include as a minimum the following items:

1. A detailed explanation of the building's project requirements for mechanical design,
2. A narrative describing the activities that will be accomplished during each phase of commissioning, including guidance on who accomplishes the activities and how they are completed,
3. Equipment and systems to be tested, including the extent of tests,
4. Functions to be tested (for example calibration, economizer control, etc.),
5. Conditions under which the test shall be performed (for example winter and summer design conditions, full outside air, etc.), and
6. Measurable criteria for acceptable performance.

503.2.9.1.2 Systems adjusting and balancing. All HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within 10% of design rates. Test and balance activities shall include as a minimum the following items:

1. Air systems balancing: Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the International Mechanical Code. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, Fan speed shall be adjusted to meet design flow conditions.

   Exception: Fans with fan motors of 1 hp or less.

2. Hydronic systems balancing: Individual hydronic heating and cooling coils shall be equipped with means for balancing and pressure test connections. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the ability to measure pressure across the pump, or test ports at each side of each pump.

   Exceptions:

   1. Pumps with pump motors of 5 hp or less.
   2. When throttling results in no greater than 5% of the nameplate horsepower draw above that required if the impeller were trimmed.

503.2.9.1.3 Functional performance testing. Equipment functional performance testing shall be in accordance with Section 503.2.9.1.3.1. Functional testing of HVAC controls shall be in accordance with Section 503.2.9.1.3.2.

503.2.9.1.3.1 Equipment functional performance testing. Equipment functional performance testing shall demonstrate the correct installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications. This demonstration is to prove the operation, function, and maintenance serviceability for each of the commissioned systems. Testing shall include all modes of operation, including:

1. All modes as described in the Sequence of Operation,
2. Redundant or automatic back-up mode,
3. Performance of alarms, and
4. Mode of operation upon a loss of power and restored power.

   Exception: Unitary or packaged HVAC equipment listed in Tables 503.2.3 (1) through (3) that do not require supply air economizers.

503.2.9.1.3.2 Controls functional performance testing. HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with approved plans and specifications.

503.2.9.1.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and provided to the building owner. The report shall be identified as “Preliminary Commissioning Report” and shall identify:

1. Itemization of deficiencies found during testing required by this section which have not been corrected at the time of report preparation and the anticipated date of correction.
2. Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.
3. Climatic conditions required for performance of the deferred tests, and the anticipated date of each deferred test.

503.2.9.2 Acceptance. Buildings, or portions thereof, required to comply with this section shall not be issued a final certificate of occupancy until such time that the *code official* has received a letter of transmittal from the building owner that states they have received the Preliminary Commissioning Report as required by Section 503.2.9.1.4. At the request of the code official, a copy of the Preliminary Commissioning Report shall be made available for review.

503.2.9.3 Completion requirements. The construction documents shall require that within 90 days of system acceptance by the *code official*, the documents described in Section 503.2.9 .3.1 and 503.2.9.3.2 shall be provided to the building owner or their designated representative by the mechanical contractor.

503.2.9.3.1 Drawings. Construction documents shall include as a minimum the location and performance data on each piece of equipment.

503.2.9.3.2 Manuals. An operating manual and a maintenance manual shall be in accordance with industry-accepted standards and shall include, at a minimum, the following:

1. Capacity (input and output) and required maintenance actions for each piece of equipment.
2. Operation and maintenance manuals for each piece of equipment.
3. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
4. Names and addresses of at least one service agency.
5. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.
6. A complete narrative of how each system is intended to operate, including ~~suggested~~ recommended setpoints.

503.2.9.3.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section 503.2.9.1.2

503.2.9.3.4 Final Commissioning Report. A complete report of test procedures and results identified as "Final Commissioning Report" shall include:

1. Results of all Functional Performance Tests.
2. Disposition of all deficiencies found during testing, including details of corrective measures used or proposed.
3. All Functional Performance Test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

   Exception: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

20. Revise as follows:

TABLE 503.2.10.1(1)
FAN POWER LIMITATION
(No change to Table)

where:

CFMS = The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute.
Hp = The maximum combined motor nameplate horsepower.
Bhp = The maximum combined fan brake horsepower.
A = Sum of [*PD* _ CFMD / 4131].

where:

PD = Each applicable pressure drop adjustment from Table 503.2.10.1(2) in. w.c.
CFM_D – The design airflow through each applicable device from Table 503.2.10.1(2) in cubic feet per minute.

21. Revise Section 503.3 as follows:

503.3 Simple HVAC systems and equipment (Prescriptive). This section applies to buildings served by unitary or packaged HVAC equipment listed in Tables 503.2.3(1) through 503.2.3(5), each serving one *zone* and controlled by a single thermostat in the zone served. It also applies to two-pipe heating systems serving one or more zones, where no cooling system is installed.

This section does not apply to fan systems serving multiple zones, nonunitary or nonpackaged HVAC equipment and systems or hydronic or steam heating and hydronic cooling equipment and distribution systems that provide cooling or cooling and heating which are covered by Section 503.4.

503.3.1 Economizers. Supply air economizers shall be provided on each cooling system as shown in Table 503.3.1(1).

Economizers shall be capable of providing 100-percent outdoor air, even if additional mechanical cooling is required to meet the cooling load of the building. Systems shall provide a means to relieve excess outdoor air during economizer operation to prevent over-pressurizing the building. The relief air outlet shall be located to avoid recirculation into the building. Where a single room or space is supplied by multiple air systems, the aggregate capacity of those systems shall be used in applying this requirement.

Exceptions:

1. Where the cooling equipment is covered by the minimum efficiency requirements of Table 503.2.3(1) or 503.2.3(2) and meets or exceeds the minimum cooling efficiency requirement (EER) by the percentages shown in Table 503.3.1(2).
2. Systems with air or evaporatively cooled condensers and which serve spaces with open case refrigeration or that require filtration equipment in order to meet the minimum ventilation requirements of Chapter 4 of the *International Mechanical Code*.

Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections 503.3.1.1 through 503.4.1.4.

Exceptions: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table 503.3.1(1).
2. Systems that require filtration equipment in order to meet the minimum ventilation requirements of Chapter 4 of the *International Mechanical Code.*
3. Where more than 25% of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F dew-point temperature to satisfy process needs.
4. Systems that include a condenser heat recovery system required by Section 503.4.6.
5. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table 503.3.1(1).
6. Systems that serve spaces whose sensible cooling load at design conditions, excluding transmission and infiltration loads, is less than or equal to transmission and infiltration losses at an outdoor temperature of 60°F.
7. Systems expected to operate less than 20 hours per week.
8. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
9. Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table 503.3.1(2).

TABLE 503.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B, 2A, 7, 8	No requirement
2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B	Economizers on all cooling systems ≥ 54,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.293 W.

a. The total capacity of all systems without economizers shall not exceed480,000 Btu/h per building, or 20 percent of its air economizer capacity, whichever is greater.

TABLE 503.3.1(2)
EQUIPMENT EFFICIENCY PERFORMANCE
EXCEPTION FOR ECONOMIZERS

CLIMATE ZONES	COOLING EQUIPMENT PERFORMANCE IMPROVEMENT (EER OR IPLV)
2B	10% Efficiency Improvement
3B	15% Efficiency Improvement
4B	20% Efficiency Improvement

~~**503.4.1 Economizers.** Supply air economizers shall be provided on each cooling system according to Table 503.3.1(1). Economizers shall be capable of operating at 100 percent outside air, even if additional mechanical cooling is required to meet the cooling load of the building.~~

~~**Exceptions:**~~

1. ~~Systems utilizing water economizers that are capable of cooling supply air by direct or indirect evaporation or both and providing 100 percent of the expected system cooling load at outside air temperatures of 50°F (10°C) dry bulb/45°F (7°C) wet bulb and below.~~
2. ~~Where the cooling equipment is covered by the minimum efficiency requirements of Table 503.2.3(1), 503.2.3(2), or 503.2.3(6) and meets or exceeds the minimum EER by the percentages shown in Table 503.3.1(2)~~
3. ~~Where the cooling equipment is covered by the minimum efficiency requirements of Table 503.2.3(7) and meets or exceeds the minimum integrated part load value (IPLV) by the percentages shown in Table 503.3.1(2).~~

503.3.1.1 Air Economizers. Air econimizers shall be designed in accordance with Sections 503.3.1.1.1 through 503.3.1.1.4**.**

503.3.1.1.1 Design Capacity. Air economizer systems shall be capable of modulating *outdoor air* and return air dampers to provide up to 100% of the design supply air quantity as *outdoor air* for cooling.

503.3.1.1.2 Control Signal. Economizer dampers shall be capable of being sequenced with the mechanical cooling equipment and shall not be controlled by only mixed air temperature.

Exception: The use of mixed air temperature limit control shall be permitted for systems controlled from space temperature (such as single-zone systems).

503.3.1.1.3 High-Limit Shutoff. All air economizers shall be capable of automatically reducing *outdoor air* intake to the design minimum *outdoor air* quantity when *outdoor air* intake will no longer reduce cooling energy usage. High-limit shutoff control types for specific climates shall be chosen from Table 503.3.1.1.3(1). High-limit shutoff control settings for these control types shall be those listed in Table 503.3.1.1.3(2).

TABLE 503.3.1.1.3(1)
HIGH-LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS

CLIMATE ZONES	ALLOWED CONTROL TYPES	PROHIBITED CONTROL TYPES
1b, 2b, 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, 8	Fixed dry bulb Differential dry bulb Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Fixed enthalpy
1a, 2a, 3a, 4a	Fixed dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Differential dry bulb
All other climates	Fixed dry bulb Differential dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	

a. Electronic enthalpy controllers are devices that use a combination of humidity and dry-bulb temperature in their switching algorithm.

TABLE 503.3.1.1.3(2)
HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS

DEVICE TYPE	CLIMATE	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHEN):	
		EQUATION	DESCRIPTION
Fixed dry bulb	1b, 2b, 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, 8,	T_{OA}>75°F	Outdoor air temperature exceeds 75°F
	5a, 6a, 7a	T_{OA}>70°F	Outdoor air temperature exceeds 70°F
	All other zones	T_{OA}>65°F	Outdoor air temperature exceeds 65°F
Differential dry bulb	1b, 2b, 3b, 3c, 4b, 4c, 5a, 5b, 5c, 6a, 6b, 7, 8	T_{OA}>T_{RA}	Outdoor air temperature exceeds return air temperature
Fixed enthalpy	All	h_{OA}> 28 Btu/lb[a]	Outdoor air enthalpy exceeds 28 Btu/lb of dry air[a]
Electronic Enthalpy	All	(T_{OA} , RH_{OA}) > A	Outdoor air temperature/RH exceeds the "A" setpoint curve[b]
Differential enthalpy	All	h_{OA}> h_{RA}	Outdoor air enthalpy exceeds return air enthalpy
Dew-point and dry bulb temperatures	All	DP_{OA}>55°F or T_{OA}>75°F	Outdoor air dry bulb exceeds 75°F or outside dew point exceeds 55°F (65 gr/lb)

a. At altitudes substantially different than sea level, the Fixed Enthalpy limit shall be set to the enthalpy value at 75°F and 50% relative humidity. As an example, at approximately 6000 ft elevation the fixed enthalpy limit is approximately 30.7 Btu/lb.
b. Setpoint "A" corresponds to a curve on the psychometric chart that goes through a point at approximately 75°F and 40% relative humidity and is nearly parallel to dry-bulb lines at low humidity levels and nearly parallel to enthalpy lines at high humidity levels.

503.3.1.1.4 Relief of Excess Outdoor Air. Systems shall provide a means to relieve excess *outdoor air* during air economizer operation to prevent over-pressurizing the building. The relief air outlet shall be located to avoid recirculation into the building.

22. Delete and substitute as follows:

~~**503.4.1 Economizers.** Supply air economizers shall be provided on each cooling system according to Table 503.3.1(1). Economizers shall be capable of operating at 100 percent outside air, even if additional mechanical cooling is required to meet the cooling load of the building~~.

~~**Exceptions:**~~

1. ~~Systems utilizing water economizers that are capable of cooling supply air by direct or indirect evaporation or both and providing 100 percent of the expected system cooling load at outside air temperatures of 50°F (10°C) dry bulb/45°F (7°C) wet bulb and below.~~
2. ~~Where the cooling equipment is covered by the minimum efficiency requirements of Table 503.2.3(1), 503.2.3(2), or 503.2.3(6) and meets or exceeds the minimum EER by the percentages shown in Table 503.3.1(2)~~
3. ~~Where the cooling equipment is covered by the minimum efficiency requirements of Table 503.2.3(7) and meets or exceeds the minimum integrated part load value (IPLV) by the percentages shown in Table 503.3.1(2).~~

503.4.1 Economizers. Economizer systems for complex HVAC Equipment shall be designed in accordance with Sections 503.4.1.1 through 503.4.1.4.

503.4.1.1 Design Capacity. Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100% of the expected system cooling load at *outdoor air* temperatures of 50°F dry bulb/45° wet bulb and below.

Exception: Systems in which a water economizer is used and where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb/ 45°F wet bulb must satisfy 100% of the expected system cooling load at 45°F dry bulb/40°F wet bulb.

503.4.1.2 Maximum Pressure Drop. Pre-cooling coils and water-to-water heat exchangers used as part of a water economizer system shall either have a water-side pressure drop of less than 15 ft of water or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling (non-economizer) mode.

503.4.1.3 Integrated Economizer Control. Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

Exceptions:

1. Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25% of the total system capacity.
2. Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h and use non-integrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.
3. Systems in climate zones 1A, 1B, 2A, 7, 8.

503.4.1.4 Economizer Heating System Impact. HVAC system design and economizer controls shall be such that economizer operation does not increase the building heating energy use during normal operation.

Exception: Economizers on VAV systems that cause zone level heating to increase due to a reduction in supply air temperature.

23. Revise as follows:

503.4.2 Variable air volume (VAV) fan control. Individual VAV fans with motors of ~~10~~ 7.5 horsepower (~~7.5~~ 5.6 kW) or greater shall be:

1. Driven by a mechanical or electrical variable speed drive;

2. Driven by a vane-axial fan with variable-pitch blades; or
~~2~~3. The fan ~~motor~~ shall have controls or devices that will result in fan motor demand of no more than 30 percent of their design wattage at 50 percent of design airflow when static pressure set point equals one-third of the total design static pressure, based on manufacturer's certified fan data.

Static pressure sensors used to control VAV fans shall be placed in a position such that the controller setpoint is no greater than one-third the total design fan static pressure, except for systems with direct digital control. If this results in the sensor being located downstream of major duct splits, multiple sensors shall be installed in each major branch to ensure the static pressure can be maintained in each branch.

For systems with direct digital control of individual *zone* boxes reporting to the central control panel, the static pressure set point shall be reset based on the *zone* requiring the most pressure, i.e., the set point is reset lower until one *zone* damper is nearly wide open.

24. Revise Section 505.1 as follows:

505.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications and minimum acceptable lighting equipment for exterior applications.

Lighting within dwelling units where ~~50~~ 75 percent or more of the permanently installed interior light fixtures are fitted with high-efficacy lamps or a minimum of 75 percent of the permanently installed lighting fixtures shall contain only high efficacy lamps.

Exception: Low-voltage lighting.

25. Revise Section 505.2 as follows:

505.2.1 Interior lighting controls. Each area enclosed by walls or floor-to-ceiling partitions shall have at least one manual control for the lighting serving that area. The required controls shall be located within the area served by the controls or be a remote switch that identifies the lights served and indicates their status.

Exceptions:

1. Areas designated as security or emergency areas that must be continuously lighted.
2. Lighting in stairways or corridors that are elements of the means of egress.

505.2.2 Additional controls. Each area that is required to have a manual control shall have additional controls that meet the requirements of Sections 505.2.2.1 and 505.2.2.2.

505.2.2.1 Light reduction controls. Each area that is required to have a manual control shall also allow the occupant to reduce the connected lighting load in a reasonably uniform illumination pattern by at least 50 percent. Lighting reduction shall be achieved by one of the following or other *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; or
4. Switching each luminaire or each lamp.

Exceptions:

1. Areas that have only one luminaire.
2. Areas that are controlled by an occupant-sensing device.
3. Corridors, storerooms, restrooms or public lobbies.
4. *Sleeping unit* (see Section 505.2.3).
5. Spaces that use less than 0.6 watts per square foot (6.5 W/m^2).
6. Daylight spaces complying with Section 505.2.2.2.3 Automatic Daylighting Controls

505.2.2.2 ~~505.2.2.3~~ Daylight Zone Control. Daylight zones shall be provided with individual controls which control the lights independent of general area lighting. Contiguous daylight zones adjacent to vertical fenestration are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e. north, east, south, west). Daylight zones under skylights more than 15 feet from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration.

Exception: Daylight spaces enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.

~~**505.2.2.2 Automatic lighting shutoff.** Buildings larger than 5,000 square feet (465m2) shall be equipped with an automatic control device to shut off lighting in those areas. This automatic control device shall function on either:~~

1. ~~A scheduled basis, using time-of-day, with an independent program schedule that controls the interior lighting in areas that do not exceed 25,000 square feet (2323 m2) and are not more than one floor; or~~
2. ~~An occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space; or~~
3. ~~A signal from another control or alarm system that indicates the area is unoccupied.~~

~~**Exception:** The following shall not require an automatic control device:~~

1. ~~*Sleeping unit* (see Section 505.2.3).~~
2. ~~Lighting in spaces where patient care is directly provided.~~
3. ~~Spaces where an automatic shutoff would endanger occupant safety or security.~~

~~**505.2.2.2.1 Occupant override.** Where an automatic time switch control device is installed to comply with Section 505.2.2.2, Item 1, it shall incorporate an override switching device that:~~

1. ~~Is readily *accessible*.~~
2. ~~Is located so that a person using the device can see the lights or the area controlled by that switch, or so that the area being lit is annunciated.~~
3. ~~Is manually operated.~~
4. ~~Allows the lighting to remain on for no more than 2 hours when an override is initiated.~~
5. ~~Controls an area not exceeding 5,000 square feet (465 m2).~~

~~**Exceptions:**~~

1. ~~In malls and arcades, auditoriums, single-tenant retail spaces, industrial facilities and arenas, where captive-key override is utilized, override time shall be permitted to exceed 2 hours.~~
2. ~~In malls and arcades, auditoriums, single-tenant retail spaces, industrial facilities and arenas, the area controlled shall not exceed 20,000 square feet (1860 m2).~~

~~**505.2.2.2.2 Holiday scheduling.** If an automatic time switch control device is installed in accordance with Section 505.2.2.2, Item 1, it shall incorporate an automatic holiday scheduling feature that turns off all loads for at least 24 hours, then resumes the normally scheduled operation.~~

~~**Exception:** Retail stores and associated malls, restaurants, grocery stores, places of religious worship and theaters.~~

~~**505.2.2.3 Daylight zone control.** Daylight zones, as defined by this code, shall be provided with individual controls that control the lights independent of general area lighting. Contiguous daylight zones adjacent to vertical fenestration are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e., north, east, south, west). Daylight zones under skylights more than 15 feet (4572 mm) from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration.~~

~~**Exception:** Daylight spaces enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.~~

505.2.2.3 Automatic lighting controls. All commercial buildings shall be equipped with automatic control devices to shut off lighting in compliance with one of the following automatic control technologies:

1. Section 505.2.2.3.1 Occupancy Sensors
2. Section 505.2.2.3.2 Time Clock Controls
3. Section 505.2.2.3.3 Automatic Daylighting Controls

Any lighting control required in Sections 505.2.2.3.1, 505.2.2.2.3.2 and 505.2.2.3.3 shall either be manual on or shall be controlled to automatically turn the lighting on to not more than 50% power unless otherwise provided in Sections 505.2.2.3.1, 505.2.3.2 or 505.2.2.3.3.

Exception: Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants.

505.2.2.3.1 Occupancy sensors. Occupancy sensors shall be installed in all classrooms, conference/meeting rooms, employee lunch and break rooms, private offices, restrooms, storage rooms and janitorial closets, and other spaces 300 sf. or less enclosed by ceiling height partitions. These automatic control devices shall be installed to automatically turn off lights within 30 minutes of all occupants leaving the space, except spaces with multi-scene control.

505.2.2.3.2 Time Clock Controls In areas not controlled by occupancy sensors, automatic time switch control devices shall be used. It shall incorporate an override switching device that:

1. Is readily accessible.
2. Is located so that a person using the device can see the lights or the area controlled by that switch, or so that the area being lit is annunciated.
3. Is manually operated.
4. Allows the lighting to remain on for no more than 2 hours when an override is initiated.
5. Controls an area not exceeding 5,000 square feet (465 m2).

Exceptions:

1. In malls and arcades, auditoriums, single-tenant retail spaces, industrial facilities and arenas, where captive-key override is utilized, override time may exceed 2 hours.
2. In malls and arcades, auditoriums, single-tenant retail spaces, industrial facilities and arenas, the area controlled may not exceed 20,000 square feet (1860 m2).

505.2.2.3.3 Automatic daylighting controls. Automatic controls installed in daylight zones shall control lights in the daylit areas separately from the non-daylit areas. Controls for calibration adjustments to the lighting control device shall be readily accessible to authorized personnel. Each daylight control zone shall not exceed 2,500 square feet. Automatic daylighting controls must incorporate an automatic shut-off ability based on time or occupancy in addition to lighting power reduction controls.

Controls will automatically reduce lighting power in response to available daylight by either one of the following methods:

1. Continuous dimming using dimming ballasts and daylight-sensing automatic controls that are capable of reducing the power of general lighting in the daylit zone continuously to less than 35% of rated power at maximum light output.
2. Stepped Dimming using multi-level switching and daylight-sensing controls that are capable of reducing lighting power automatically. The system should provide a minimum of two control channels per zone and be installed in a manner such that at least one control step shall reduce power of general lighting in the daylit zone by 30% to 50% of rated power and another control step that reduces lighting power by 65% to 100%. Stepped dimming control is not allowed in continuously occupied areas with ceiling heights of 14 feet or lower.

Exception: Daylight spaces enclosed by walls or ceiling height partitions and containing 2 or fewer luminaire are not required to have a separate switch for general area lighting.

505.2.3 Specific Application Controls. Specific application controls shall be provided for the following:

1. Display/Accent Lighting—display or accent lighting shall have a separate control device.
2. Case Lighting—lighting in cases used for display purposes shall have a separate control device.
3. Hotel and Motel Guest Room Lighting—hotel and motel guest rooms and guest suites shall have a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles.
4. Task Lighting—supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall-mounted control device

provided the control device is readily accessible and located so that the occupant can see the controlled lighting.

5. Non-visual Lighting—lighting for non-visual applications, such as plant growth and food warming, shall have a separate control device.
6. Demonstration Lighting—lighting equipment that is for sale or for demonstrations in lighting education shall have a separate control device.

Exceptions: Where LED lighting is used no additional control is required for items 1., 2. and 4.

505.2.4 Functional Testing. Controls for automatic lighting systems shall be tested prior to and as a condition for issuance of an approval under Section 104.8. Testing shall ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. The construction documents shall state the party who will conduct the required functional testing. The party responsible for the functional testing shall not be directly involved in the design or construction of the project and shall provide documentation to the *code official* certifying that the installed lighting controls meet the provisions of Section 505.

When *occupant sensors*, time switches, programmable schedule controls, *photosensors or daylighting controls* are installed, at a minimum, the following procedures shall be performed:

1. Confirm that the placement, sensitivity and time-out adjustments for *occupant sensors* yield acceptable performance, i.e. lights turn off only after space is vacated and do not turn on unless space is occupied.
2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.
3. Confirm that photosensor controls reduce electric light based on the amount of usable daylight in the space as specified.

~~505.2.3~~ 505.2.5 Sleeping unit controls. *(No change to current text)*

505.2.4 Exterior lighting controls. *(No change to current text)*

26. Delete and substitute as follows as follows:

~~TABLE 505.5.2~~
~~INTERIOR LIGHTING POWER ALLOWANCES~~

~~**Building Area Typea**~~	~~**(W/ft2)**~~
~~Automotive Facility~~	~~0.9~~
~~Convention Center~~	~~1.2~~
~~Court House~~	~~1.2~~
~~Dining: Bar Lounge/Leisure~~	~~1.3~~
~~Dining: Cafeteria/Fast Food~~	~~1.4~~
~~Dining: Family~~	~~1.6~~
~~Dormitory~~	~~1.0~~
~~Exercise Center~~	~~1.0~~
~~Gymnasium~~	~~1.1~~
~~Healthcare—clinic~~	~~1.0~~
~~Hospital~~	~~1.2~~
~~Hotel~~	~~1.0~~
~~Library~~	~~1.3~~
~~Manufacturing Facility~~	~~1.3~~
~~Motel~~	~~1.0~~
~~Motion Picture Theater~~	~~1.2~~
~~Multifamily~~	~~0.7~~
~~Museum~~	~~1.1~~

~~Building Area Typea~~	~~(W/ft2)~~
~~Office~~	~~1.0~~
~~Parking Garage~~	~~0.3~~
~~Penitentiary~~	~~1.0~~
~~Performing Arts Theater~~	~~1.6~~
~~Police/Fire Station~~	~~1.0~~
~~Post Office~~	~~1.1~~
~~Religious Building~~	~~1.3~~
~~Retailb~~	~~1.5~~
~~School/University~~	~~1.2~~
~~Sports Arena~~	~~1.1~~
~~Town Hall~~	~~1.1~~
~~Transportation~~	~~1.0~~
~~Warehouse~~	~~0.8~~
~~Workshop~~	~~1.4~~

TABLE 505.5.2
LIGHTING POWER DENSITY

Building Area Type[a]	**Whole Building**	**Space by Space**
	(W/ft2)	
Active Storage		0.8
Atrium – First Three Floors		0.6
Atrium – Each Additional Floor		0.2
AUTOMOTIVE FACILITY	0.9	
Classroom/lecture/training		1.3
Conference/Meeting/Multipurpose		1.1
Corridor/Transition		0.5
Electrical/Mechanical		1.1
Food Preparation		1.2
Inactive Storage		0.2
Lobby		1.1
Restroom		0.8
Stairway		0.6
CONVENTION CENTER	1.2	
Exhibit Space		1.3
Audience/Seating Area		0.9
COURTHOUSE	1.2	
Audience/Seating Area		0.9
Courtroom		1.9
Confinement Cells		0.9
Judges Chambers		1.3
Dressing/Locker/Fitting Room		0.6
DINING: BAR LOUNGE/LEISURE	1.3	
Lounge/Leisure Dining		1.4
DINING: CAFETERIA/FAST FOOD	1.4	
DINING: FAMILY	1.6	
Dining		1.4
Kitchen		1.2
DORMITORY	1	
Living Quarters		1.1
Bedroom		0.5
Study Hall		1.4
EXERCISE CENTER	1	

Building Area Type[a]	Whole Building	Space by Space
Dressing/Locker/Fitting Room		0.6
Audience/Seating Area		0.3
Exercise Area		0.9
Exercise Area/Gymnasium		0.9
RETAIL: SUPERMARKET	1.3	
GYMNASIUM	1.1	
Dressing/Locker/Fitting Room		0.6
Audience/Seating Area		0.4
Playing Area		1.4
Exercise Area		0.9
HEALTHCARE CLINIC	1	
Corridors w/patient waiting, exam		1
Exam/Treatment		1.5
Emergency		2.7
Public & Staff Lounge		0.8
Hospital/Medical supplies		1.4
Hospital - Nursery		0.6
Nurse station		1
Physical therapy		0.9
Patient Room		0.7
Pharmacy		1.2
Hospital/Radiology		0.4
Operating Room		2.2
Recovery		0.8
Active storage		0.9
Laundry-Washing		0.6
HOTEL	1	
Dining Area		1.3
Guest quarters		1.1
Reception/Waiting		2.5
Lobby		1.1
LIBRARY	1.3	
Library-Audio Visual		0.7
Stacks		1.7
Card File & Cataloguing		1.1
Reading Area		1.2
MANUFACTURING FACILITY	1.3	
MOTEL	1	
Dining Area		1.2
Guest quarters		1.1
Reception/Waiting		2.1
MOTION PICTURE THEATER	1.2	
Audience/Seating Area		1.2
Lobby		1
MULTI-FAMILY	0.7	
MUSEUM	1.1	
Active Storage		0.8
General exhibition		1
Restoration		1.7
OFFICE	0.9	
Enclosed		1
Open Plan		1
PARKING GARAGE	0.3	
PENITENTIARY	1.0	
PERFORMING ARTS THEATER	1.6	
Audience/Seating Area		2.6
Lobby		3.3

Building Area Type[a]	Whole Building	Space by Space
Dressing/Locker/Fitting Room		1.1
POLICE STATIONS	1	
FIRE STATIONS	0.8	
Fire Station Engine Room		0.8
Sleeping Quarters		0.3
Audience/Seating Area		0.8
Police Station Laboratory		1.4
POST OFFICETS/SF	1.1	
Sorting Area		1.2
Lobby		1
RELIGIOUS BUILDINGS	1.3	
Lobby		0.6
Worship/Pulpit/Choir		2.4
RETAIL	1.3	
Department Store Sales Area		1.3
Specialty Store Sales Area		1.8
Fine Merchandise Sales Area		2.9
Supermarket Sales Area		1.3
Personal Services Sales Area		1.3
Mass Merchandising Sales Area		1.3
Mall Concourse		1.7
SCHOOL/UNIVERSITY	1.2	
Classroom		1.3
Audience		0.7
Dining		1.1
Office		1.1
Corridor		0.5
Storage		0.5
Laboratory		1.1
RETAIL: SPECIALTY b	1.6	
TOWN HALL	1.1	
TRANSPORTATION	1	
Dining Area		2.1
Baggage Area		1
Airport - Concourse		0.6
Terminal - Ticket Counter		1.5
Reception/Waiting		0.5
SPORTS ARENA	1.1	
WAREHOUSE	0.6	
Fine Material		1.4
Medium/Bulky Material		0.6
WORKSHOP	1.4	

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m2~~.~~

~~a. In cases where both a general building area type and a more specific building area type are listed, the more specific building area type shall apply~~.

b. Where lighting equipment is specified to be installed to highlight specific merchandise in addition to lighting equipment specified for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for merchandise, or additional lighting power as determined below shall be added to the interior lighting power determined in accordance with this line item.

Calculate the additional lighting power as follows:

Additional Interior Lighting Power Allowance = ~~1000watts +~~ (Retail Area 1 X 0.~~6~~ 4W/ft2) + (Retail Area 2 X 0.6 W/ft2) + (Retail Area 3 X ~~1.4~~ 0.9 W/ft2) + (Retail Area 4 X ~~2.5~~ 1.5 W/ft2).

where:

Retail Area 1 = The floor area for all products not listed in Retail Area 2, 3 or 4.
Retail Area 2 = The floor area used for the sale of vehicles, sporting goods and small electronics.
Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork.

Retail Area 4 = The floor area used for the sale of jewelry, crystal and china.

Exception: Other merchandise categories are permitted to be included in Retail Areas 2 through 4 above, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the authority having jurisdiction.

27. Add new text as follows:

SECTION 506
ADDITIONAL EFFICIENCY PACKAGE OPTIONS

506.1 Requirements. Buildings shall comply with at least one of the following:

1. 506.2 Efficient HVAC Performance Requirement
2. 506.3 Efficient Lighting System Requirement
3. 506.4 On-Site Supply of Renewable Energy

At the time of plan submittal, the *code official* shall be provided, by the permittee, documentation designating the intent to comply with Section 506.2, 506.3 or 506.4 in their entirety. Individual tenant spaces must comply with either 506.2 or 506.3 in their entirety unless documentation can be provided that demonstrates compliance with Section 506.4 for the entire building.

506.2 Efficient Mechanical Equipment. Equipment shall meet the minimum efficiency requirements of Tables 506.2.(1) through 506.2(7) in addition to the requirements in Section 503. This section shall only be used where an equipment efficiency option is available.

TABLE 506.2(1)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	REQUIRED EFFICIENCYa
Air conditioners, Air cooled	< 65,000 Btu/hd	Split system	For zones 1 to 5: 15.0 SEER, 12.5 EER For zones 6 to 8: 14 SEER, 12 EER
		Single package	For zones 1 to 5: 15.0 SEER, 12.0 EER For zones 6 to 8: 14.0 SEER 11.6 EER
	≥ 65,000 Btuh/h and < 240,000 Btu/h	Split system and single package	For zones 1 to 5: 12.0 EERb, 12.4 IPLVb For zones 6 to 8: 11.5 EERb, 11.9 IPLVb
	≥ 240,000 Btu/h and < 760,000 Btu/h	Split system and single package	For zones 1 to 5: 10.8 EERb, 12.0 IPLVb For zones 6 to 8: 10.5 EERb, 10.9 IPLVb
	≥ 760,000 Btu/h		For zones 1 to 5: 10.2 EERb, 11.0 IPLVb For zones 6 to 8: 9.7 EERb, 11.0 IPLVb
Air conditioners, Water and evaporatively cooled		Split system and single package	14.0 EER

For SI: 1 British thermal unit per hour = 0.2931 W.
a. IPLVs are only applicable to equipment with capacity modulation.
b. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

TABLE 506.2(2)
UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	REQUIRED EFFICIENCYa
Air cooled (Cooling mode)	< 65,000 Btu/hd	Split system	For zones 1 to 5: 15.0 SEER, 12.5 EER For zones 6 to 8: 14.0 SEER, 12.0 EER
		Single package	For zones 1 to 5: 15.0 SEER, 12.0 EER For zones 6 to 8: 14.0 SEER, 11.6 EER
	≥ 65,000 Btu/h and < 240,000 Btu/h	Split system and single package	For zones 1 to 5: 12.0 SEER, 12.4 EER For zones 6 to 8: 11.5 EERb, 11.9 IPLVb
	≥ 240,000 Btu/h	Split system and single package	For zones 1 to 5: 12.0 SEER, 12.4 EER For zones 6 to 8: 10.5 EERb, 10.9 IPLVb
Water SOURCES (Cooling mode)	< 135,000 Btu/h	85°F entering water	14.0 EER
Air cooled (Heating mode)	< 65,000 Btu/hd (Cooling capacity)	Split system	For zones 1 to 5: 9.0 HSPF For zones 6 to 8: 8.5 HSPF
		Single package	For zones 1 to 5: 8.5 HSPF For zones 6 to 8: 8.0 HSPF
	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb outdoor air	3.4 COP
		17°F db/15°F wb outdoor air	2.4 COP
	≥ 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb outdoor air	3.2 COP
		77°F db/15°F wb outdoor air	2.1 COP
Water SOURCES (Heating mode)	< 135,000 Btu/h (Cooling capacity)	70°F entering water	4.6 COP

For SI: °C = [(°F) - 32] / 1.8, 1 British thermal unit per hour = 0.2931 W.
db = dry-bulb temperature, °F; wb = wet-bulb temperature, °F
a. IPLVs and Part load rating conditions are only applicable to equipment with capacity modulation.
b. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

TABLE 506.2(3)
PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINALHEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY	REQUIRED EFFICIENCYb
Air conditioners	< 7,000 Btu / h	11.9 EER
& Heat Pumps (Cooling Mode)	7,000 Btu / h and < 10,000 Btu / h	11.3 EER
	10,000 Btu / h and < 13,000 Btu / h	10.7 EER
	> 13,000 Btu / h	9.5 EER

a. Replacement units must 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) high and less than 42 inches (1067 mm) wide.

TABLE 506.2(4)
WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	REQUIRED EFFICIENCY	TEST PROCEDURE
Warm air furnaces, gas fired	< 225,000 Btu/h	—	For zones 1 & 2, NR. For zones 3 & 4 90 AFUE or 90 Et For zones 4-8 are 92 AFUE or 92 Et	DOE 10 CFR Part 430 or ANSI Z21.47
	≥ 225,000 Btu/h	Maximum capacity	90% Ec note 1	ANSI Z21.47
Warm air furnaces, oil fired	< 225,000 Btu/h	—	For zones 1 & 2, NR. For zones 3 to 8 are 85 AFUE or 85 Et	DOE 10 CFR Part 430 or UL 727
	≥ 225,000 Btu/h	Maximum capacity	85% Et, Note 1	UL 727
Warm air duct furnaces, gas fired	All capacities	Maximum capacity	*90% Ec*	ANSI Z83.8
Warm air unit heaters, gas fired	All capacities	Maximum capacity	*90% Ec*	ANSI Z83.8
Warm air unit heaters, oil fired	All capacities	Maximum capacity	*90% Ec*	UL 731

For SI: 1 British thermal unit per hour = 0.2931 W.
1 Units must also include an IID (intermittent ignition device), 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.
Where there two ratings 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.
Et = Thermal efficiency.
Ec = Combustion efficiency (100% less flue losses).
Efficient furnace fan: All fossil fuel furnaces in zones 3 to 8 shall have a furnace electricity ratio not greater than 2% and shall include a manufacturer's designation of the furnace electricity ratio.

TABLE 506.2(5)
BOILER, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	TEST PROCEEDURE	REQUIRED EFFICIENCY
Gas Hot Water	< 300,000 Btu / h	DOE 10 CFR Part 430	90% Et
	> 300,000 Btu / h and > 2.5 mBtu/h	DOE 10 CFR Part 431	89% Et
Gas Steam	< 300,000 Btu / h	DOE 10 CFR Part 430	89% Et
	> 300,000 Btu / h	DOE 10 CFR Part 431	89% Et
Oil	< 300,000 Btu / h	DOE 10 CFR Part 430	90% Et
	> 300,000 Btu / h	DOE 10 CFR Part 431	89% Et
Et = thermal efficiency			

TABLE 506.2(6)
CHILLERS - EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	REQUIRED EFFICIENCY- CHILLERS		OPTIONAL COMPLIANCE PATH - REQUIRED EFFICIENCY - CHILLERS WITH VSD	
		Full Load (KW /TON)	IPLV (KW /TON)	Full Load (KW /TON)	IPLV (KW /TON)
Air Cooled w/ Condenser	All	1.2	1.0	N/A	N/A
Air Cooled w/o Condenser	All	1.08	1.08	N/A	N/A
Water Cooled, Reciprocating	All	0.840	0.630	N/A	N/A
Water Cooled, Rotary Screw and Scroll	< 90 tons	0.780	0.600	N/A	N/A
	[3]90 tons and < 150 tons	0.730	0.550	N/A	N/A
	[3]150 tons and	0.610	0.510	N/A	N/A

EQUIPMENT TYPE	SIZE CATEGORY	REQUIRED EFFICIENCY- CHILLERS		OPTIONAL COMPLIANCE PATH - REQUIRED EFFICIENCY - CHILLERS WITH VSD	
	< 300 tons				
	> 300 tons	0.600	0.490	N/A	N/A
Water Cooled, Centrifugal	< 150 tons	0.610	0.620	0.630	0.400
	[3] 150 tons and < 300 tons	0.590	0.560	0.600	0.400
	300 tons and < 600 tons	0.570	0.510	0.580	0.400
	> 600 tons	0.550	0.510	0.550	0.400

a. Compliance with full load efficiency numbers and IPLV numbers are both required.
b. Only Chillers with Variable Speed Drives (VSD) may use the optional compliance path-for chiller efficiency.
N/A – No credit can be taken for this option

TABLE 506.2(7)
ABSORPTION CHILLERS - EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	REQUIRED EFFICIENCY FULL LOAD COP (IPLV)
Air Cooled, Single Effect	0.60, allowed only in heat recovery applications
Water Cooled, Single Effect	0.70, allowed only in heat recovery applications
Double Effect - Direct Fired	1.0 (1.05)
Double Effect - Indirect Fired	1.20

506.3 Efficient Lighting System. Whole Building Lighting Power Density (Watts/sf) shall meet the requirements *of Table 506.3. and automatic daylighting control requirements in Section 506.3.2.*

506.3.1 Reduced Lighting Power Density - The total interior lighting power (watts) is the sum of all interior lighting powers for all areas in the building. The interior lighting power is the floor area for the building times the value from Table 506.3.

TABLE 506.3
REDUCED INTERIOR LIGHTING POWER

BUILDING TYPE[a]	REDUCED WHOLE BUILDING (Watts/Ft^2)
AUTOMOTIVE FACILITY	0.79
CONVENTION CENTER	1.16
COURTHOUSE	1.08
DINING: BAR LOUNGE/LEISURE	1.19
DINING: CAFETERIA/FAST FOOD	1.34
DINING:FAMILY	1.50
DORMITORY	0.90
EXERCISE CENTER	0.92
FIRE STATIONS	0.74
GYMNASIUM	1.07
HEALTHCARE CLINIC	0.89
HOTEL	0.90
LIBRARY	1.00
MANUFACTURINBG FACILITY	1.24
MOTEL	0.90
MOTION PICTURE THEATER	1.18
MUSEUM	1.04
OFFICE	0.80
PERFORMING ARTS THEATER	1.46
POLICE STATIONS	0.89
POST OFFICE	0.98

BUILDING TYPE[a]	REDUCED WHOLE BUILDING (Watts/Ft^2)
RELIGIOUS BUILDINGS	1.18
RETAIL	1.30
RETAIL: SPECIALTY	1.40
RETAIL: SUPERMARKET	1.30
SCHOOL/UNIVERSITY	1.01
TOWN HALL	0.94
TRANSPORTATION	0.85
WAREHOUSE[b]	0.60
WORKSHOP	1.20

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m2.

a. In cases where both a general building area type and a more specific building area type are listed, the more specific building area type shall apply.

b. At least one half of the floor area shall be in the daylight zone. Automatic daylighting controls shall be installed in daylit zones and shall meet the requirements of Section 505.2.2.2.3.

506.3.2 Automatic Daylighting Controls. Automatic daylighting controls shall be installed in all daylight zones and shall meet the requirements of Section 505.2.2.2.

506.4 On-site Supply of Renewable Energy The building or surrounding property shall supply 3% or more of the building energy use associated with systems and equipment covered by this code through on-site renewable energy. On-site power generation using nonrenewable sources does not meet this requirement.

The *code official* shall be provided with an energy analysis as described in Section 507 that documents on-site renewable energy production is capable of providing at least 3% of the total estimated annual purchased energy for the building functions regulated by this code, or a calculation demonstrating that on-site renewable energy production has a nominal (maximum) rating of at least 1.75 BTUs or at least 0.50 watts per square foot of conditioned floor area.

28. Add new standards to Chapter 6 as follows:

ASTM

E779-03	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
E1677-95 (2000)	Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls
E2178-03	Standard Test Method for Air Permeance of Building Materials
E2357-05	Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
C1371-04	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
C1549	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
E408-71 (02)	Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
E1918-97	Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-Sloped Surfaces in the Field

Reason: *New Buildings Institute (NBI)-American Institute of Architects (AIA)*

NBI and AIA believe that the 20-30% reductions in commercial and high-rise residential building energy use based on this proposal are practical, feasible, and necessary. This Proposal employs improvements to design practices and use of widely available products to improve energy efficiency. Many of the elements have been previously published in NBI's *Core Performance Guide* and implemented in programs or codes at the local and state levels. Incorporating these enhancements in a national model code will help move building practices and markets more quickly, addressing national concerns for energy and the environment in a pragmatic and cost-effective way.

SUBSTANTIATING MATERIAL

The bibliography of substantiating material, along with the technical information and technical substantiation, can be found at www.newbuildings.org/iecc.htm.

THE PROPOSAL

This proposal substantially revises Chapter 5 of the IECC with a series of measures that are integrated to achieve significant energy savings over current national model code. The proposal builds on and updates from 2009 IECC, plus it introduces some new elements such as commissioning of critical systems and a section on "additional efficiency package options" to offer flexibility in achieving these significant savings. Key elements of the Proposal are:

- **Building Envelope -** Includes continuous air barriers, significant improvements in most glazing, and enhancements to opaque envelope performance.

- **Mechanical Systems –** Improves sections regarding economizers, incorporates more use of demand controlled ventilation, and provides additional calculation procedures for determining loads and equipment sizing.
- **Quality Assurance** – Incorporates requirements for testing and commissioning of mechanical systems and performance testing of daylight-related controls.
- **Lighting -** Reduces energy needed for lighting based on more efficient illuminating equipment and the use of several lighting control strategies.
- **Daylighting –** Includes additional availability of toplight sources when combined with automatic daylight controls, and comprehensive control strategy for all daylit zones.
- **Advanced Efficiency Package Options** - Section 506 contains three approximately energy-equivalent packages to add to the savings in this Proposal: These three options are focused on Efficient HVAC Equipment, Reduced Lighting Power Density plus Automatic Daylight Controls, or Onsite Renewable Energy Generation. These options round out the savings in the Proposal and also offer important flexibility in getting to higher levels of efficiency. As energy codes move to higher efficiency levels with new types of strategies, building flexibility into prescriptive codes will offer additional pathways to support market adoption and compliance.

Cost Impact: None given.

ICCFILENAME: HEWLETT-LOYER-MAJETTE-EC1-202-501.2

Public Hearing Results

Note: The following analysis was not in the Code Change monograph but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf :

Analysis: Review of the proposed new standard indicated that, in the opinion of ICC staff, the standard did comply with ICC standards criteria.

Committee Action: Approved as Submitted

Committee Reason: The proposal is a broad revision to Chapter 5 addressing all systems of a building including the building envelop, HVAC systems and lighting and power systems. The change will provide a significant increase in energy savings estimated to be approaching 30 percent over energy usage resulting in buildings built under the 2009 IECC. Although the committee acknowledged many provisions of the proposal could be improved, it was hoped that those deficiencies will be improved through the public comment process.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Dave Hewitt, representing New Buildings Institute, Jessyca Henderson, representing American Institute of Architects, Ron Majette, representing U.S. Department of Energy request Approval as Modified by this Public Comment.

Modify the proposal as follows:

DYNAMIC GLAZING. Any fenestration product that has the fully reversible ability to change its performance properties, including U-factor, SHGC, or VT.

FENESTRATION PRODUCT, FIELD-FABRICATED is a fenestration product ~~including an exterior glass door~~ whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut, or otherwise formed with the specific intention of being used to fabricate a fenestration product or exterior door. Field fabricated does not include site-built fenestration. ~~with a label certificate or products required to have temporary or permanent labels.~~

502.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table 502.2(1), based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U*-factor is equivalent to the same assembly with the *R*-value specified in Table 502.2(1).
2. Unit skylight curbs included as a component of an NFRC 100 rated assembly shall not be required to be insulated.

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

~~**502.2.1.1 Roof solar reflectance and thermal emittance.** Roofs in climate zones 1 to 3 not over ventilated attics or not over cooled spaces shall have a minimum three-year aged - solar reflective index (SRI) of 64 when determined in accordance with the SRI method in ASTM E1980 using a convection coefficient of (12W/m^2·K) or a minimum three-year aged solar reflectance of 0.55 when tested in accordance with ASTM C1549, ASTM~~

~~E903 or ASTM E1918 and a minimum three-year-aged thermal emittance of at least 0.75 when testing in accordance with ASTM C1371 or ASTM E408.~~

~~**Exceptions:**~~

1. ~~Ballasted roofs with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or 23 lbs/ft2 pavers (117 kg/m2).~~
2. ~~Roofs, where a minimum of 75% of the roof area is shaded during the peak sun angle on June 21st by permanent features of the building and/or is covered by off-set photovoltaic arrays, building-integrated photovoltaic arrays, or solar water collectors.~~
3. ~~Metal building roofs or asphaltic membranes in climate zone 3.~~

502.2.6 Slabs on grade. ~~The~~ Where the slab-on-grade is in contact with the ground, the minimum thermal resistance (*R*-value) of the insulation around the perimeter of unheated or heated slab-on-grade floors shall be as specified in Table 502.2(1). The insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The insulation shall extend downward from the top of the slab for a minimum distance as shown in the table or to the top of the footing, whichever is less, or downward to at least 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 a minimum of 10 inches (254 mm) of soil. ~~Where extending outside of the foundation the insulation shall be covered by pavement or by soil a minimum of 10 inches. Thick. For the purposes of this section a slab on grade floor is a slab floor that is in contact with the ground and that is either above grade or less than or equal to 24 inches below the final elevation of the nearest exterior grade.~~

Exception: Where the slab-on-grade floor is greater than 24 inches below the finished exterior grade, perimeter insulation is not required.

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration (~~30~~ 40% maximum of above-grade wall)								
U-factor								

(Portions of Table not shown, remain unchanged)

502.3.2.2. Dynamic Glazing. For compliance with Section 502.3.2, the SHGC for dynamic glazing shall be determined using the manufacturers lowest rated SHGC, and the VT / SHGC ratio shall be determined using the maximum VT and maximum SHGC. Dynamic glazing shall be considered separately from other fenestration, and area-weighted averaging with other fenestration that is not dynamic glazing shall not be permitted.

502.4.1 Air Barriers. ~~The building envelope shall be designed and with a continuous air barrier that complies with Section 502.4.1.1 and 502.4.1.2 to control air leakage into, or out of, the conditioned space. Construction documents shall identify the air barrier components for each assembly, including detailing joints, interconnections and sealing of penetrations. The opaque building envelope air barrier shall be located on the inside of , outside of, or be integral with the building envelope; or any combination thereof.~~ 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 502.4.1.1 and 502.4.1.2.

Exception: Air barriers are not required in buildings located in climate zones 1, 2 and 3.

502.4.1.1 Air barrier construction. The *continuous air barrier* shall ~~have the following characteristics~~ be constructed to comply with all of the following:

1. ~~It~~ The air barrier shall be continuous for all assemblies which are the thermal envelope of the building and across the joints and assemblies. ~~throughout the envelope (at the lowest *floor*, exterior *walls*, and ceiling or *roof*). Air barrier joints and seams shall be sealed; including sealing transitions in planes and changes in materials. Air barrier penetrations shall be sealed.~~
2. ~~The air~~ Air barrier joints and seams shall be sealed including sealing transitions in places and changes in materials. Air barrier penetrations shall be sealed in accordance with Section 502.4.2. 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. ~~component of each assembly shall be joined and sealed in a flexible manner to the air barrier component of adjacent assemblies. The joints and seals shall allow for the relative movement of the assemblies and materials without damage to the air seal.~~
3. ~~The air barrier shall be installed in accordance with the *manufacturer's* instructions in a manner that achieves the performance requirements.~~
3. ~~Where lighting *fixtures* with ventilation holes or other similar objects are to be installed in such a way as to penetrate the *continuous air barrier*, provisions shall be made to maintain the integrity of the *continuous air barrier*.~~ Recessed lighting fixtures shall comply with Section 504.2.8. Where similar objects are installed which penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

   Exception: Buildings that comply with Section 502.4.1.2.3 below are not required to comply with either Item 1 and ~~or 4~~ 3.

502.4.1.2 Air barrier compliance options. A continuous air barrier for the opaque building envelope shall meet the requirements of ~~at least~~ one of the compliance options in Section 502.4.1.2.1, 502.4.1.2.2, or 502.4.1.2.3.

502.4.1.2.1 Materials. ~~Individual materials shall have an air permeability not to exceed 0.02 L/s·m^2 under a pressure differential of 75 Pa (0.004 cfm/ft^2 under a pressure differential of 0.3 in. water (1.57 lb/ft^2)) when tested in accordance with ASTM E2178. The following materials comply with this requirement when all joints are sealed:~~

Materials with an air permeability no greater than 0.02 L/s·m^2 (0.004 cfm/ft^2) under a pressure differential of 75 Pa (0.3 in. water) when tested in accordance with ASTM E2178 shall comply with this section. Materials in items 1 through 13 shall be deemed to comply with this section provided joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

1. Plywood - minimum 3/8 inch (10 mm) in thickness.
2. Oriented strand board - minimum 3/8 inch (10 mm)
3. Extruded polystyrene insulation board - minimum ~~3/4~~ ½ inch (~~19~~ 12 mm) in thickness.
4. Foil-back ~~urethane~~ polyisocyanurate insulation board - minimum ~~¾~~ ½ inch (~~19~~ 12 mm) in thickness.
5. Closed cell spray foam ~~meeting air permeability requirement~~ a minimum density of 1.5 pcf (2.4 kg/m3) no less than 1 ½ inches (36 mm) in thickness.
6. Open cell spray ~~polyurethane~~ foam ~~meeting air permeability requirement~~ with a density between 0.4 and 1.5 pcf (0.6 and 2.4 kg/m^3) no less than 4.5 inches (140 76mm) in thickness.

~~7. Weather resistant barrier meeting air permeability requirement~~

~~8~~ 7. Exterior or interior gypsum board - minimum 1/2 inch (12 mm) in thickness.

~~9~~ 8.. Cement board - minimum 1/2 inch (12 mm) in thickness.

~~10~~.9. Built up roofing membrane.

~~11~~.10. Modified bituminous roof membrane.

11~~12~~. Fully adhered single-ply roof membrane.

~~13~~.12. A Portland cement/sand parge, or gypsum plaster minimum 5/8 inch (16 mm) in thickness.

~~14~~.13. Cast-in-place and precast concrete.

14. Fully grouted concrete block masonry

~~16~~.15. Sheet steel or aluminum.

502.4.1.2.2 Assemblies. ~~Assemblies of materials and components shall have an average air leakage not to exceed 0.2 L/s·m2 @ 75 Pa (0.04 cfm/ft2 under a pressure differential of 0.3" w.g. (1.57psf)) when tested in accordance with ASTM E2357 or ASTM E1677 ASTM. The following assemblies comply with this requirement when all joints are sealed and every characteristic in Section 502.4.4.1.1 is met:~~

Assemblies of materials and components with an average air leakage not to exceed 0.2 L/s·m^2 (0.04 cfm/ft2) under a pressure differential of 75 Pa (0.3" w.g.) when tested in accordance with ASTM E2357, ASTM E1677 or ASTM E283 shall comply with this section. Assemblies listed in items 1 and 2 shall be deemed to comply provided joints are sealed and requirements of Section 502.4.4.1.1 are met.

1) Concrete masonry walls coated with one application ~~either~~ of block filler and two applications of a paint or sealer coating;
2) A Portland cement/sand parge, stucco or plaster minimum 1/2 inch (12 mm) in thickness.

502.4.1.2.3 Building Test. The completed building shall be tested and the air leakage rate of the *building envelope* shall not exceed 2.0 L/s·m^2 @ 75 Pa (0.40 cfm/ft^2 at a pressure differential of 0.3 inch w.g. (1.57 psf)) in accordance with ASTM E779 or an equivalent method approved by the code official.

502.4.2 Air Barrier Penetrations. ~~All penetrations~~ Penetrations of the air barrier and paths of air ~~infiltration/exfiltration shall be made air tight and~~ leakage shall be ~~sealed with caulking materials or closed with gasketing systems~~ caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seals shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. ~~Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.~~ Sealing materials shall be appropriate to the construction materials being sealed. 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.

502.4.3 Fenestration ~~and doors.~~ The air leakage of fenestration assemblies ~~and doors~~ shall meet the provisions of Table 502.4.3. Testing shall be ~~performed~~ in accordance with the applicable reference test standard in Table 502.4.3 by an accredited ~~, and~~ independent testing laboratory and ~~all fenestration assemblies *listed* and~~ *labeled* by the manufacturer.

Exceptions:

1. ~~Site built~~ Field-fabricated fenestration assemblies that are sealed in accordance with Section 502.4.1
2. Fenestration in buildings that comply with Section 502.4.1.2.3 are not required to meet the air leakage requirements in Table 502.4.3.

Table 502.4.3
Maximum Air Infiltration Rate for Fenestration Assemblies

Fenestration Assembly	Maximum Rate (cfm/ft^2)	Test Procedure
Windows	0.20 [a]	AAMA/WDMA/CSA101/I.S.2/A440 or NFRC 400
Sliding Doors	0.20 [a]	
Swinging Doors	0.20 [a]	
Skylights – with condensation weepage openings	0.30	
Skylights – all other	0.20 [a]	
Curtain Walls	0.06 ~~[b]~~	NFRC 400 or ASTM E283 at 1.57 psf (75 Pa)
Storefront Glazing	0.06 ~~[b]~~	
Commercial Glazed Swinging Entrance Doors	1.00 ~~[c]~~	
Revolving Doors	1.00 ~~[c]~~	
Garage Doors	0.40	ANSI/DASMA 105, NFRC 400, or ASTM E283 at 1.57 psf (75 Pa)
Rolling doors	1.00 ~~[c]~~	

a. ~~cfm per square foot of fenestration or door area when tested in accordance with NFRC 400, or AAMA/WDMA/CSA101/I.S.2/A440 at 1.57 psf (75 Pa). Alternatively t~~The maximum rate for windows, sliding and swinging doors, and skylights is permitted to be 0.3 cfm per square foot of fenestration or door area when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf (300 Pa).

~~b. cfm per square foot of fenestration area when tested in accordance with NFRC 400 or ASTM E283 at 1.57 psf (75 Pa)~~

~~c. cfm per square foot of fenestration or door area when tested in accordance with NFRC 400, AAMA/WDMA/CSA101/I.S.2/A440, or ASTM E283 at 1.57 psf (75 Pa)~~

502.4.4 Doors and Access Openings to Shafts, Chutes, ~~Stairwells~~ Stairways, and Elevator Lobbies. ~~These doors~~ Doors and access openings from conditioned space to shafts, chutes stairways and elevator lobbies shall either meet the requirements of 502.4.3 or shall be equipped with weather seals.

Exception: Weatherseals on elevator lobby doors are not required when a smoke control system is installed.

502.4.5 Outdoor air intakes and exhaust openings. Stairway enclosures and elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope shall be provided with dampers in accordance with Section 502.4.5.1 and 502.4.5.2.

~~Dampers shall be installed with controls so that they are capable of automatically opening upon:~~

~~1. the activation of any fire alarm initiating device of the building's fire alarm system;~~
~~2. the interruption of power to the damper.~~

502.4.5.1 Stairway and shaft vents. Stairway and shaft vents shall be provided with ~~Class IA~~ Class I motorized dampers with a maximum leakage rate of 4~~3~~ cfm per square foot (~~5.1~~ 6.8 L/s · C m2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.

Stairway and shaft vent dampers shall be installed with controls so that they are capable of automatically opening upon:

1. The activation of any fire alarm initiating device of the building's fire alarm system; or
2. The interruption of power to the damper.

502.4.5.2 Outdoor air intakes and exhausts. *Outdoor air* supply and exhaust openings shall be provided with Class IA motorized dampers with a maximum leakage rate of 4~~3~~ cfm per square foot (6.8 ~~5.1~~ L/s · C m2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.

Exceptions:

1. Gravity (nonmotorized) dampers having a maximum leakage rate of 20 cfm per square foot (34 L/s · C m2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D are permitted to be used as follows:

1.1. In buildings for exhaust and relief dampers.
1.2. In buildings less than three stories in height above grade.
1.3. For ventilation air intakes and exhaust and relief dampers in buildings of any height located in climate zones 1, 2, and 3.
1.4 Where the design *outdoor air* intake or exhaust capacity does not exceed 300 cfm.

Gravity (nonmotorized) dampers for ventilation air intakes shall be protected from direct exposure to wind.

2. Dampers smaller than 24 inches (610 mm) in either dimension shall be permitted to have a leakage of 40 cfm/ft2 (68 L/s · C m2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.

(Portions of the proposal not shown remain unchanged.)

Commenter's Reason: Public Comment 1 of 6 on EC 147. EC 147 was developed by a collaborative effort between New Buildings Institute, the American Institute of Architects and the U.S. Department of Energy. The proposal was developed in response to many national goals to increase the energy efficiency of new commercial construction by 30% and is designed to modify the Chapter 5 requirements of the building envelope, mechanical and lighting systems to meet this goal. During the passage of EC 147 at the ICC IECC Code Development Hearings in Baltimore, the proponents pledged to work with all interested and affected parties and solicit their comments and input in order to improve on the code change proposal passed by the IECC Committee. Numerous comments were received from parties representing industry and product groups, enforcement agencies and the building and design industry. The comments helped to provide a consensus agreement on several issues raised during testimony, clarified language, increased readability, and strengthened the proposal. The public comments submitted herein by NBI, AIA and DOE are the result of this process. A series of six public comments have been submitted on EC 147 that each focus the discussion on a particular portion of the original code change proposal. The proponents feel that this is necessary to ensure that the voting members of ICC will have the opportunity to hear testimony on each section before voting on the proposal as a whole. Additional information on EC 147 is available at http://newbuildings.org/iecc.htm.

This Public Comment submitted by NBI/AIA and DOE is in response to issues and concerns from interested and affected parties input and clarification of the requirements that were proposed in EC 147 that focus on the building envelope. Several key changes are addressed in this public comment:

Cool Roof Requirements: The requirement for cool roofs was deleted from EC 147. A separate public comment will be submitted to replace the existing language that has strong input and agreement from interested and affected parties.

Skylight curbs – The text was included to clarify that only skylight curbs that were not part of an NFRC rated skylight assembly were covered by the provision.

Window to Wall Ratio (WWR) – EC 147 proposed to limit the glazing area to 30% WWR. After consultation with daylighting experts and lighting designers the limit was removed from EC 147. Another code change proposal, EC 165, was passed as Submitted in Baltimore that includes a 30% WWR limit. A Public Comment to EC 165 is being proposed that will allow up to 40% WWR if daylighting criteria are met in the building design to offset the increased energy usage due to more glazing.

Continuous Air Barrier – The language was modified to clarify the options for meeting the continuous air barrier requirements. Three options are available to the designer:

Comply using a Material: Either a pre-approved material from the list in 502.4.1.2(1) can be used or the material can be tested and shown to meet the maximum air permeability requirement. The "deemed to comply" list is provided to assist the building department in enforcement of the IECC.

Comply Using an Assembly: Either a pre-approved assembly from the list in 502.4.1.2(2) can be used or the material can be tested and shown to meet the maximum air permeability requirement. The "deemed to comply" list is provided to assist the building department in enforcement of the IECC.

Whole Building Testing: Compliance with the continuous air barrier requirement can be demonstrated by testing the building to show that the building envelope has a maximum air leakage.

Fenestration Leakage Rates: Skylights with condensation weepage openings and garage doors were included in the requirements based on input from industry. In addition Table 502.4.3 was modified to include the test standard applicable for each type of fenestration for determining the maximum leakage rate. The air leakage rate values were reviewed by the ASHRAE Envelope Committee and no changes were recommended. These values reflect many values proposed for ASHRAE 90.1-2010.

Public Comment 2:

Dave Hewitt, representing New Buildings Institute, Jessyca Henderson, representing American Institute of Architects, Ron Majette, U.S. Department of Energy request Approval as Modified this Public Comment.

Modify the proposal as follows:

502.2.1.1 Roof solar reflectance and thermal emittance. ~~Roofs in climate zones 1 to 3 not over ventilated attics or not over cooled spaces shall have a minimum three-year aged - solar reflective index (SRI) of 64 when determined in accordance with the SRI method in ASTM E1980 using a convection coefficient of (12W/m^2·K) or a minimum three-year aged solar reflectance of 0.55 when tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 and a minimum three-year-aged thermal emittance of at least 0.75 when testing in accordance with ASTM C1371 or ASTM E408.~~

~~**Exceptions:**~~

1. ~~Ballasted roofs with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or 23 lbs/ft2 pavers (117 kg/m2).~~
2. ~~Roofs, where a minimum of 75% of the roof area is shaded during the peak sun angle on June 21st by permanent features of the building and/or is covered by off-set photovoltaic arrays, building-integrated photovoltaic arrays, or solar water collectors.~~
3. ~~Metal building roofs or asphaltic membranes in climate zone 3.~~

Low-sloped roofs, with a slope less than 2 units vertical in12 horizontal, directly above cooled *conditioned spaces* in climate zones 1, 2, and 3 shall comply with one or more of the options in Table 502.2.1.1.

Exception: The following roofs and portions of roofs are exempt from the requirements in Table 502.2.1.1:

1. Portions of roofs that include or are covered by:
   - 1.1. Photovoltaic systems or components.
   - 1.2. Solar air or water heating systems or components.
   - 1.3. Roof gardens or landscaped roofs.
   - 1.4. Above-roof decks or walkways.
   - 1.5. Skylights.
   - 1.6. HVAC systems, components, and other opaque objects mounted above the roof.
2. Portions of roofs shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings
3. Portions of the roof that are ballasted with a minimum stone ballast of 17 lbs/ft^2 (74 kg/m^2) or 23 lbs/ft^2 pavers (117 kg/m^2)
4. Roofs where a minimum of 75 percent of the roof area meets a minimum of one of the exceptions above.

Table 502.2.1.1
Minimum Roof Reflectance and Emittance Options[a]

Three-year aged solar reflectance[b] of 0.55 and three-year aged thermal emittance[b] of 0.75
Initial solar reflectance[b] of 0.70 and initial thermal emittance[b] of 0.75
Three-year-aged solar reflectance index[c] of 64
Initial solar reflectance index[c] of 82

a. The use of area-weighted averages to meet these requirements shall be permitted. Materials lacking initial tested values for either *solar reflectance* or *thermal emittance*, shall be assigned both an initial *solar reflectance* of 0.10 and an initial *thermal emittance* of 0.90. Materials lacking three-year aged tested values for either *solar reflectance* or *thermal emittance* shall be assigned both a three-year aged *solar reflectance* of 0.10 and a three-year aged *thermal emittance* of 0.90.

b. Tested solar reflectance and thermal emittance shall be in accordance with CRRC-1 Standard.

c. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft^2-F (12W/m^2.K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance. Calculation of initial SRI shall be based on initial tested values of solar reflectance and thermal emittance.

Cool Roof Rating Council (CRRC)

ANSI/CRRC-1 Standard (2010) Cool Roof Rating Council CRRC-1 Standard

ASTM, International (ASTM)

E1980(2001) Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low Sloped Opaque Surfaces

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: Public Comment 2 of 6 on EC 147. EC 147 was developed by a collaborative effort between New Buildings Institute, the American Institute of Architects and the U.S. Department of Energy. The proposal was developed in response to many national goals of increasing the energy efficiency of new commercial construction by 30% and is designed to modify the Chapter 5 requirements of the building envelope, mechanical and lighting systems to meet this goal. During the passage of EC 147 at the ICC IECC Code Development Hearings in Baltimore, the proponents pledged to work with all interested and affected parties and solicit their comments and input in order to improve on the code change proposal passed by the IECC Committee. Numerous comments were received from parties representing industry and product groups, enforcement agencies and the building and design industry. The comments helped to provide a consensus agreement on several issues raised during testimony, clarified language, increased readability, and strengthened the proposal. The public comments submitted herein by NBI, AIA and DOE are the result of this process. A series of six public comments have been submitted on EC 147 that each focus the discussion on a particular portion of the original code change proposal. The proponents feel that this is necessary to ensure that the voting members of ICC will have the opportunity to hear testimony on each section before voting on the proposal as a whole. Additional information on EC 147 is available at *http://newbuildings.org/iecc.htm*.

The proposed change requires a "cool roof" in southern climates. So what is a Cool Roof?

> *"A cool roof reflects and emits the sun's heat back to the sky instead of transferring it to the building below. "Coolness" is measured by two properties, solar reflectance and thermal emittance. Both properties are measured from 0 to 1 and the higher the value, the "cooler" the roof."*
> *from http://www.coolroofs.org/*

The proponents of EC147 consulted with industry experts, designers and advocates of cool roofs, and determined that the cool roof text in the original EC147 was difficult to understand. After iterations with a number of interested parties, this text was developed to be a clearer statement of both the requirement for the use of cool roofs and a practical set of exceptions to the requirement.

Cool roofs save energy by lowering cooling loads. The energy savings are greatest in areas with the greatest cooling loads; hence the change applies to the southernmost climate zones 1 through 3.

This requirement applies to low sloped roofs which are common in commercial construction. The variety of roof coverings applicable to low slope roofs has been greatly expanded in the last decade. Concurrently, methods for testing and comparing the "coolness" of the roofs have been perfected. It turns out that the eye is not a good judge of what is cool, so a tested value is needed to make this an enforceable code change. This requirement is consistent with work done by the Cool Roof Rating Council and the EPA Energy Star Program to promote cool roofs.

Two versions of this change were submitted. The only difference between the versions is in the use of the CRRC-1 Standard. If the Cool Roof Rating Council standard CRRC-1 Standard has received ANSI approval and meets ICC guidelines as a referenced standard, this is the preferred option. The CRRC-1 Standard best defines the testing process for rating cool roofs and incorporates the lessons learned in over a decade of rating roofs. If not available, an alternative presents rating requirements that incorporate the test standards in CRRC-1 standard.

The terms used in these changes were selected to be consistent with the terms in the I-codes. "*Low sloped roofs"* are already in code (IBC 1504.4, 1504.6, 1504.7, 1507.12.3), as well as the terms "*roof gardens*" and "*landscape roofs"* (IBC 1507.16, 1607.11.2.2, 1607.11.3).

There are a number of exceptions for roofs covered by active photovoltaics (PV), solar thermal water or air heating, gardens, decks, and the elements of HVAC systems. Roofs that are shaded are not required to comply. Ballasted roofs (exception #3) have been shown to be another way to save energy and are an important alternative to parts of the roofing industry.
http://www.spri.org/pdf/Thermal%20Performance%20of%20Ballast%20Study%20Final%20Report%2005%2008%20.pdf

There are three options for demonstrating that a material will produce a cool roof. An for 3-year aged requirements are less stringent, as most cool roofs lose some reflectivity over time. A more stringent requirement is set for the initial reflectivity for new materials. Allow testing for initial characteristics allows new products into the market. An alternative SRI combines both solar reflectance and thermal remittance (re-radiating the heat back into the sky).

The summer solstice is longest day of the year and is June 21^{st} in the northern hemisphere. If the code was applied in the southern hemisphere the summer solstice would be December 21^{st}.

There is an existing body of tested materials, such as that in Cool Roof Rating Council database. Those tests would be valid with either version of the code change.

There are a number of secondary benefits of cools roofs, beyond energy savings. Limiting the heat gain on the roof lowers the temperature extremes that roofing products experience and helps increase roof lifetime. Cool roofs help mitigate the "urban heat island effect" that makes cities warmer. Cool roofs lower peak cooling loads and cooling equipment sizes.

Further information on cool roofs, including energy savings and costs can be found in "*Potential Benefits of Cool Roofs on Commercial Buildings: Conserving Energy, Saving Money, and Reducing Emission of Greenhouse Gases and Air Pollutants"* http://www.springerlink.com/content/9r48k34558240825.

Analysis: The standard CRRC-1 Standard was not reviewed or considered by the Energy Code Development Committee prior to the Baltimore hearings and was not considered by the hearing attendees at the time of the code development hearings. Section 3.6.3.1 of Council Policy # 28, *Code Development,* requires that new standards be introduced in the original code change proposal, therefore, the introduction of a new standard via a public comment is not in accordance with the process required by CP # 28 for adding new standards to the code.

Public Comment 3:

Dave Hewitt, representing New Buildings Institute, Jessyca Henderson, representing American Institute of Architects, Ron Majette, representing U.S. Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**501.2 Application.** The *commercial building* project shall comply with the requirements in Sections 502 (Building envelope requirements), 503 (Building mechanical systems), 504(Service water heating), 505 (Electrical power and lighting systems) in its entirety, and one of the additional options as presented in Section 506.As an alternative the *commercial building* project shall exceed by at least 25% comply with the requirements of ASHRAE/IESNA Standard 90.1, Energy Standard for Buildings Except for Low Rise Residential Buildings, Appendix G in its entirety.~~

~~**Exceptions:**~~

1. ~~Buildings conforming to Section 507, provided Sections 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied. Building energy cost shall be equal to or less than 75% percent of the standard reference design building.~~
2. ~~Additions, alterations and repairs shall comply with the applicable requirements in Sections 502, 503, 504, and 505 only or with ASHRAE/IESNA 90.1.~~

<u>**501.2 Application.** Commercial buildings shall comply with one of the following:</u>

1. <u>The requirements of ASHRAE/IESNA 90.1.</u>
2. <u>The requirements of Sections 502, 503, 504 and 505. In addition, commercial buildings shall comply with either Section 506.2, 506.3 or 506.4.</u>

3. The requirements of Section 507, 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

501.2.1 Application to existing buildings. Additions, alterations and repairs to existing buildings shall comply with one of the following:

1. Sections 502, 503, 504 and 505; or
2. ASHRAE/IESNA 90.1

503.2.4.3.3 Automatic start capabilities. ~~Controls designed to automatically adjust the start time of an HVAC system each day to allow for automatically brining the space to desired occupied temperature levels immediately before scheduled occupancy shall be provided on each system.~~ Automatic start controls shall be provided for each HVAC system. The controls shall be capable of automatically adjusting the daily start time of the HVAC system in order to bring each space to the desired occupied temperature immediately prior to scheduled occupancy.

503.2.5.1 Demand controlled ventilation. Demand control ventilation (DCV) is required for spaces larger than 500 ft^2 (50m^2) and with an average occupant load of 25 people per 1000 ft^2(93 m^2) of floor area (as established in Table 403.3 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; or
3. A design outdoor airflow greater than 3,000 cfm (1400 L/s).

Exception: Demand control ventilation is not required for systems and spaces as follows:

1. Systems with energy recovery complying with Section 503.2.6.
2. Multiple-zone systems without direct digital control of individual zones communicating with a central control panel.
3. System with a design outdoor airflow less than 1,200 cfm (600 L/s).
4. Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1,200 cfm (600 L/s).
5. ~~Building spaces where the primary~~ Ventilation provided ~~needs are~~ for process loads only.

503.2.6 Energy recovery ventilation systems. ~~Each fan system shall have an energy recovery system when the system's supply airflow rate exceeds the value listed in Table 503.2.6 based on the climate zone and percentage of *outdoor air* at design conditions. Required energy recovery systems shall have the capability to provide a change in the enthalpy of the *outdoor air* supply equal to at least 50% of the difference between the *outdoor air* and return air enthalpies at design conditions. Provision shall be made to bypass or control the energy recovery system to permit air economizer operation as required by Section 503.4~~

Where the supply airflow rate of a fan system exceeds the values specified in Table 503.2.6, the system shall include an energy recovery system. The energy recovery system shall have the capability to provide a change in the enthalpy of the outdoor air supply 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 which permit operation of the economizer as required by Section 503.4

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 at least one of the following features:
   - 2.1. Variable-air-volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of design values.
   - 2.2. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (1.1°C) above room setpoint, cooled to no cooler than 3°F (1.7°C) below room setpoint, no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Systems serving spaces that ~~are not cooled and~~ are heated to less than 60°F (15.5°C) and 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 recovery in climate zones 1 and 2.
6. Cooling energy recovery in climate zones 3c, 4c, 5b, 5c, 6b, 7, and 8.
7. Systems requiring dehumidification that employ ~~series-style~~ energy recovery ~~coils wrapped around~~ 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 503.2.6

Table 503.2.6
Energy Recovery Requirement

CLIMATE ZONE	% OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE					
	≥30% and <40%	≥40% and <50%	≥50% and <60%	≥60% and <70%	≥70% and <80%	≥80%
	DESIGN SUPPLY FAN AIRFLOW RATE (cfm)					
3B, 3C, 4B, 4C, 5B	NR	NR	NR	NR	≥5000	≥5000
1B, 2B, 5C	NR	NR	≥26000	≥12000	≥5000	≥4000
6B	≥11000	≥5500	≥4500	≥3500	≥2500	≥1500
1A, 2A, 3A, 4A, 5A, 6A	≥5500	≥4500	≥3500	≥2000	≥1000	>0
7, 8	≥2500	≥1000	>0	>0	>0	>0

NR = not required

503.2.9 Mechanical systems commissioning and completion requirements. Mechanical systems shall be commissioned and completed in accordance with Section 508.2.

503.2.9.1 System commissioning. The construction documents shall require commissioning and completion requirements in accordance with this section. The construction documents shall be permitted to refer to equipment specifications for further requirements. Copies of all documentation shall be given to the owner by the registered design professional. The building official may request commissioning documentation for review purposes. At the time of plan submittal, the code official shall be provided, by the permitee, a letter of intent to commission the building in accordance with this code.

503.2.9.1.1 Commissioning plan. A commissioning plan shall be prepared and shall include as a minimum the following items:

1. A detailed explanation of the building's project requirements for mechanical design,
2. A narrative describing the activities that will be accomplished during each phase of commissioning, including guidance on who accomplishes the activities and how they are completed,
3. Equipment and systems to be tested, including the extent of tests,
4. Functions to be tested (for example calibration, economizer control, etc.),
5. Conditions under which the test shall be performed (for example winter and summer design conditions, full outside air, etc.), and
6. Measurable criteria for acceptable performance.

503.2.9.1.2 Systems adjusting and balancing. All HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within 10% of design rates. Test and balance activities shall include as a minimum the following items:

1. **Air systems balancing**: Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the International Mechanical Code. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, Fan speed shall be adjusted to meet design flow conditions.

   Exception: Fans with fan motors of 1 hp or less.

2. **Hydronic systems balancing:** Individual hydronic heating and cooling coils shall be equipped with means for balancing and pressure test connections. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the ability to measure pressure across the pump, or test ports at each side of each pump.

   Exceptions:

   1. Pumps with pump motors of 5 hp or less.

   2. When throttling results in no greater than 5% of the nameplate horsepower draw above that required if the impeller were trimmed.

503.2.9.1.3 Functional performance testing

503.2.9.1.3.1 Equipment functional performance testing. Equipment functional performance testing shall demonstrate the correct installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications. This demonstration is to prove the operation, function, and maintenance serviceability for each of the commissioned systems. Testing shall include all modes of operation, including:

1. All modes as described in the Sequence of Operation,
2. Redundant or automatic back-up mode,
3. Performance of alarms, and
4. Mode of operation upon a loss of power and restored power.

Exception: Unitary or packaged HVAC equipment listed in Tables 503.2.3 (1) through (3) that do not require supply air economizers.

503.2.9.1.3.2 Controls functional performance testing. HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with approved plans and specifications.

503.2.9.1.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and provided to the building owner . The report shall be identified as "Preliminary Commissioning Report" and shall identify:

1. Itemization of deficiencies found during testing required by this section which have not been corrected at the time of report preparation and the anticipated date of correction.
2. Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.
3. Climatic conditions required for performance of the deferred tests, and the anticipated date of each deferred test.

503.2.9.2 Acceptance. Buildings, or portions thereof, required to comply with this section shall not be issued a final certificate of occupancy until such time that the code official has received a letter of transmittal from the building owner that states they have received the Preliminary Commissioning Report as required by Section 503.2.9.1.4. At the request of the code official, a copy of the Preliminary Commissioning Report shall be made available for review.

503.2.9.3 Completion requirements. The construction documents shall require that within 90 days of system acceptance by the code official, the documents described in Section 503.2.9 .3.1 and 503.2.9.3.2 shall be provided to the building owner or their designated representative by the mechanical contractor.

503.2.9.3.1 Drawings. Construction documents shall include as a minimum the location and performance data on each piece of equipment.

~~**503.2.9.3.2 Manuals.** An operating manual and a maintenance manual shall be in accordance with industry-accepted standards and shall include, at a minimum, the following:~~

1. ~~Capacity (input and output) and required maintenance actions for each piece of equipment.~~
2. ~~Operation and maintenance manuals for each piece of equipment.~~
3. ~~Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.~~
4. ~~Names and addresses of at least one service agency.~~
5. ~~HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.~~
6. ~~A complete narrative of how each system is intended to operate, including suggested recommended setpoints.~~

~~**503.2.9.3.3 System balancing report.** A written report describing the activities and measurements completed in accordance with Section 503.2.9.1.2~~

~~**503.2.9.3.4 Final Commissioning Report.** A complete report of test procedures and results identified as "Final Commissioning Report" shall include:~~

1. ~~Results of all Functional Performance Tests.~~
2. ~~Disposition of all deficiencies found during testing, including details of corrective measures used or proposed.~~
3. ~~All Functional Performance Test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.~~

~~**Exception:** Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.~~

503.2.10.1 Allowable fan floor horsepower. Each HVAC system at fan system design conditions shall not exceed the allowable *fan system motor nameplate hp* (Option 1) or *fan system bhp* (Option 2) as shown in Table 503.2.10.1(1). This includes supply fans, return/relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single zone variable-air-volume systems shall comply with the constant volume fan power limitation.

Exceptions: The following fan systems are exempt from allowable fan floor horsepower requirement.

1. Hospital, vivarium and laboratory systems that utilize flow control devices on exhaust and/or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation.
2. Individual exhaust fans with motor nameplate horsepower of 1 hp or less.
3. ~~Fans exhausting air from fume hoods. (Note: If this exception is taken, no related exhaust side credits shall be taken from Table 6.5.3.1.1B and the Fume Exhaust Exception Deduction must be taken from Table 6.5.3.1.1B).~~

TABLE 503.2.10.1(2)
FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT

Device	Adjustment
Credits	
Fully ducted return and/or exhaust air systems	0.5 in w.c. (2.15 in w.c. for laboratory and vivarium systems)
Return and/or exhaust air flow control devices	0.5 in. w.c.
Exhaust filters, scrubbers, or other exhaust treatment.	The pressure drop of device calculated at fan system design condition
Particulate filtration credit: MERV 9 thru 12	0.5 in. w.c.
Particulate filtration credit: MERV 13 thru 15	0.9 in. w.c.
Particulate filtration credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2x clean filter pressure drop at fan system design condition.
Carbon and other gas-phase air cleaners	Clean filter pressure drop at fan system design condition.
~~Heat Recovery Device,~~ Biosafety cabinet	Pressure drop of device at fan system design condition.
Energy recovery device, other than coil runaround loop	(2.2 x Energy Recovery Effectiveness) – 0.5 in w.c. for each airstream
Coil runaround loop	0.6 in. w.c. for each airstream
Evaporative humidifier/cooler in series with another cooling coil	Pressure drop of device at fan system design conditions
Sound attenuation section	0.15 in. w.c.
Exhaust system serving fume hoods	0.35 in. w.c.
Laboratory and Vivarium Exhaust Systems in High Rise Buildings	0.25 in. w.c./100 ft of vertical duct exceeding 75 ft.
~~Deductions~~	
~~Fume hood exhaust exception (required if section 503.2.10.1, Exception 3, is taken)~~	~~-1.0 in w.c.~~

CFM_D – the design airflow through each applicable device from Table 503.2.10.1(2) in cubic feet per minute.

503.3 Simple HVAC systems and equipment (Prescriptive). This section applies to buildings served by unitary or packaged HVAC equipment listed in Tables 503.2.3(1) through 503.2.3(5), each serving one *zone* and controlled by a single thermostat in the zone served. It also applies to two-pipe heating systems serving one or more zones, where no cooling system is installed.

503.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections 503.3.1.1 through 503.4.1.4.

Exceptions: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table 503.3.1(1).

~~2. Systems that require filtration equipment in order to meet the minimum ventilation requirements of Chapter 4 of the *International Mechanical Code*.~~

~~3.~~ <u>2</u>. 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 dew-point temperature to satisfy process needs.

~~4. Systems that include a condenser heat recovery system required by Section 503.4.6.~~

~~5.~~ <u>3</u>. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table 503.3.1(1).

~~6. Systems that serve spaces whose sensible cooling load at design conditions, excluding transmission and infiltration loads, is less than or equal to transmission and infiltration losses at an outdoor temperature of 60°F.~~

~~7.~~ <u>4</u>. Systems expected to operate less than 20 hours per week.

~~8~~.<u>5</u>. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.

~~9~~.<u>6</u> Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table 503.3.1(2).

TABLE 503.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B, ~~2A, 7, 8~~	No requirement
<u>2A</u>, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, <u>7, 8</u>	Economizers on all cooling systems ≥ 54,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.293 W.

a. The total capacity of all systems without economizers shall not exceed 480,000 Btu/h per building, or 20 percent of its air economizer capacity, whichever is greater.

TABLE 503.3.1(2)
EQUIPMENT EFFICIENCY PERFORMANCE
EXCEPTION FOR ECONOMIZERS

CLIMATE ZONES	COOLING EQUIPMENT PERFORMANCE IMPROVEMENT (EER OR IPLV)
2B	10% Efficiency Improvement
3B	15% Efficiency Improvement
4B	20% Efficiency Improvement

503.3.1.1 Air economizers. <u>Air economizers shall comply with Sections 503.3.1.1.1 through 503.3.1.1.4.</u>

503.3.1.1.1 Design capacity. Air economizer systems shall be capable of modulating *outdoor air* and return air dampers to provide up to 100 percent of the design supply air quantity as *outdoor air* for cooling.

503.3.1.1.2 Control signal. Economizer dampers shall be capable of being sequenced with the mechanical cooling equipment and shall not be controlled by only mixed air temperature.

Exception: The use of mixed air temperature limit control shall be permitted for systems controlled from space temperature (such as single-zone systems).

503.3.1.1.3 High-limit shutoff. All air economizers shall be capable of automatically reducing *outdoor air* intake to the design minimum *outdoor air* quantity when *outdoor air* intake will no longer reduce cooling energy usage. High-limit shutoff control types for specific climates shall be chosen from Table 503.3.1.1.3(1). High-limit shutoff control settings for these control types shall be those listed in Table 503.3.1.1.3(2).

TABLE 503.3.1.1.3(1)
HIGH-LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS

CLIMATE ZONES	ALLOWED CONTROL TYPES	PROHIBITED CONTROL TYPES
1b, 2b, 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, 8	Fixed dry bulb Differential dry bulb Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Fixed enthalpy
1a, 2a, 3a, 4a	Fixed dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Differential dry bulb
All other climates	Fixed dry bulb Differential dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	

[a] Electronic enthalpy controllers are devices that use a combination of humidity and dry-bulb temperature in their switching algorithm.

Table 503.3.1.1.3(2)
HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS

DEVICE TYPE	CLIMATE	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHEN):	
		EQUATION	DESCRIPTION
Fixed dry bulb	1b, 2b, 3b, 3c, 4b, 4c, 5b, 5c, 6b, 7, 8,	T_{OA}>75°F	Outdoor air temperature exceeds 75°F
	5a, 6a, 7a	T_{OA}>70°F	Outdoor air temperature exceeds 70°F
	All other zones	T_{OA}>65°F	Outdoor air temperature exceeds 65°F
Differential dry bulb	1b, 2b, 3b, 3c, 4b, 4c, 5a, 5b, 5c, 6a, 6b, 7, 8	T_{OA}>T_{RA}	Outdoor air temperature exceeds return air temperature
Fixed enthalpy	All	h_{OA}> 28 Btu/lb[a]	Outdoor air enthalpy exceeds 28 Btu/lb of dry air[a]
Electronic Enthalpy	All	(T_{OA} , RH_{OA}) > A	Outdoor air temperature/RH exceeds the "A" setpoint curve[b]
Differential enthalpy	All	h_{OA}> h_{RA}	Outdoor air enthalpy exceeds return air enthalpy
Dew-point and dry bulb temperatures	All	DP_{OA}>55°F or T_{OA}>75°F	Outdoor air dry bulb exceeds 75°F or outside dew point exceeds 55°F (65 gr/lb)

a. At altitudes substantially different than sea level, the Fixed Enthalpy limit shall be set to the enthalpy value at 75°F and 50 percent relative humidity. As an example, at approximately 6000 ft elevation the fixed enthalpy limit is approximately 30.7 Btu/lb.
b. Setpoint "A" corresponds to a curve on the psychometric chart that goes through a point at approximately 75°F and 40 percent relative humidity and is nearly parallel to dry-bulb lines at low humidity levels and nearly parallel to enthalpy lines at high humidity levels.

503.3.1.1.4 Relief of Excess Outdoor Air. Systems shall ~~provide~~ be capable of relieving ~~a means to relieve~~ excess *outdoor air* during air economizer operation to prevent over-pressurizing the building. The relief air outlet shall be located to avoid recirculation into the building.

503.4.1 Economizers. Economizers shall comply with Sections 503.4.1.1 through 503.4.1.4.

503.4.1.1 Design Capacity. Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at *outdoor air* temperatures of 50°F dry bulb/45° wet bulb and below.

Exception: Systems in which a water economizer is used and where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb/ 45°F wet bulb must satisfy 100 percent of the expected system cooling load at 45°F dry bulb/40°F wet bulb.

503.4.1.2 Maximum Pressure Drop. Pre-cooling coils and water-to-water heat exchangers used as part of a water economizer system shall either have a water-side pressure drop of less than 15 feet of water or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling (non-economizer) mode.

503.4.1.3 Integrated Economizer Control. Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

Exceptions:

1. Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25 percent of the total system capacity.
2. Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h and use non-integrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.
3. ~~Systems in climate zones 1A, 1B, 2A, 7, 8.~~

503.4.1.4 Economizer Heating System Impact. HVAC system design and economizer controls shall be such that economizer operation does not increase the building heating energy use during normal operation.

Exception: Economizers on VAV systems that cause zone level heating to increase due to a reduction in supply air temperature.

503.4.2 Variable air volume (VAV) fan control. Individual VAV fans with motors of 7.5 horsepower (5.6 kW) or greater shall be:

1. Driven by a mechanical or electrical variable speed drive;
2. Driven by a vane-axial fan with variable-pitch blades; or
3. The fan shall have controls or devices that will result in fan motor demand of no more than 30 percent of their design wattage at 50 percent of design airflow when static pressure set point equals one-third of the total design static pressure, based on manufacturer's certified fan data.

~~Static pressure sensors used to control VAV fans shall be placed in a position such that the controller setpoint is no greater than one-third the total design fan static pressure, except for systems with direct digital control. If this results in the sensor being located downstream of major duct splits, multiple sensors shall be installed in each major branch to ensure the static pressure can be maintained in each branch.~~

503.4.2.1 Static Pressure Sensor Location. Static pressure sensors used to control VAV fans shall be placed in a position such that the controller setpoint is no greater than one-third the total design fan static pressure, except for systems with zone reset control complying with 503.4.2.2. For sensors installed downstream of major duct splits, at least one sensor shall be located on each major branch to ensure that static pressure can be maintained in each branch.

503.4.2.2 Set points for direct digital control. For systems with direct digital control of individual *zone* boxes reporting to the central control panel, the static pressure set point shall be reset based on the *zone* requiring the most pressure, i.e., the set point is reset lower until one *zone* damper is nearly wide open.

(Portions of the proposal not shown remain unchanged.)

Commenter's Reason: Public Comment 3 of 6 on EC 147 EC 147 was developed by a collaborative effort between New Buildings Institute, the American Institute of Architects and the U.S. Department of Energy. The proposal was developed in response to many national goals to increase the energy efficiency of new commercial construction by 30% and is designed to modify the Chapter 5 requirements of the building envelope, mechanical and lighting systems to meet this goal. During the passage of EC 147 at the ICC IECC Code Development Hearings in Baltimore, the proponents pledged to work with all interested and affected parties and solicit their comments and input in order to improve on the code change proposal passed by the IECC Committee. Numerous comments were received from parties representing industry and product groups, enforcement agencies and the building and design industry. The comments helped to provide a consensus agreement on several issues raised during testimony, clarified language, increased readability, and strengthened the proposal. The public comments submitted herein by NBI, AIA and DOE are the result of this process. A series of six public comments have been submitted on EC 147 that each focus the discussion on a particular portion of the original code change proposal. The proponents feel that this is necessary to ensure that the voting members of ICC will have the opportunity to hear testimony on each section before voting on the proposal as a whole. Additional information on EC 147 is available at http://newbuildings.org/iecc.htm.

This Public Comment submitted by NBI, AIA and DOE is focused on clarifying the language in Section 501 of the IECC and also proposes changes to the mechanical section 503 of the IECC to increase the efficiency of HVAC systems, and to bring the IECC into better alignment with the provisions that will appear in ASHRAE 90.1-2010.

The original language proposed in EC 147 for Section 501 required the user to show that building was required to be 25% more efficient than the base case ASHRAE requirements if ASHRAE 90.1 was selected as a compliance option. The proponents submitted a floor amendment at the Baltimore IECC Hearings to eliminate the requirement for increased efficiency but it was ruled out of order. The proposed language clearly states three options for complying with the commercial provisions of the IECC:

Comply with ASHRAE 90. ASHRAE 90.1-2010 will be submitted to the IECC and will be equivalent in energy savings to Chapter 5.
Comply with Chapter 5 Prescriptive.

Comply with Chapter 5 Performance Approach. This option will require that the code user show that the building is 15% more efficient than the Standard Reference Design building. The increase in efficiency is a result of not proposing changes to Section 506 of the 2009 as part of the EC 147 Code Change Proposal.

The proponents have eliminated some of the existing language in the code to be consistent with the code text in the other International Codes.

The Public Comments in Section 503 are submitted to provide clarification to the language proposed in EC 147. Comments were also submitted based on proposals received from the ASHRAE Mechanical Committee to ensure consistency between the provisions in ASHRAE 90.1-2010 and the IECC. The requirements for energy recovery ventilation and also economizers were changed to increase the clarity of the requirement and to expand the scope of where economizers are required to be installed. In addition, the requirement for commissioning was removed from Section 503 and placed in a new Section 508. Changes to EC 147 commissioning language are presented in a separate Public Comment.

Public Comment 4:

Dave Hewitt, representing New Buildings Institute, Jessyca Henderson, representing American Institute of Architects, Ron Majette, representing U.S. Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**503.2.9.1 System commissioning.** The construction documents shall require commissioning and completion requirements in accordance with this section. The construction documents shall be permitted to refer to equipment specifications for further requirements. Copies of all documentation shall be given to the owner by the registered design professional. The building official may request commissioning documentation for review purposes. At the time of plan submittal, the code official shall be provided, by the permitee, a letter of intent to commission the building in accordance with this code.~~

~~**503.2.9.1.1 Commissioning plan.** A commissioning plan shall be prepared and shall include as a minimum the following items:~~

1. ~~A detailed explanation of the building's project requirements for mechanical design,~~
2. ~~A narrative describing the activities that will be accomplished during each phase of commissioning, including guidance on who accomplishes the activities and how they are completed,~~
3. ~~Equipment and systems to be tested, including the extent of tests,~~
4. ~~Functions to be tested (for example calibration, economizer control, etc.),~~
5. ~~Conditions under which the test shall be performed (for example winter and summer design conditions, full outside air, etc.), and~~
6. ~~Measurable criteria for acceptable performance.~~

~~**503.2.9.1.2 Systems adjusting and balancing.** All HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within 10% of design rates. Test and balance activities shall include as a minimum the following items:~~

1. **Air systems balancing**: Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the International Mechanical Code. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, Fan speed shall be adjusted to meet design flow conditions.

   Exception: Fans with fan motors of 1 hp or less.

   2. Hydronic systems balancing: Individual hydronic heating and cooling coils shall be equipped with means for balancing and pressure test connections. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the ability to measure pressure across the pump, or test ports at each side of each pump.

   Exceptions:

   1. Pumps with pump motors of 5 hp or less.

   2. When throttling results in no greater than 5% of the nameplate horsepower draw above that required if the impeller were trimmed.

503.2.9.1.3 Functional performance testing

503.2.9.1.3.1 Equipment functional performance testing. Equipment functional performance testing shall demonstrate the correct installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications. This demonstration is to prove the operation, function, and maintenance serviceability for each of the commissioned systems. Testing shall include all modes of operation, including:

1. All modes as described in the Sequence of Operation,
2. Redundant or automatic back-up mode,
3. Performance of alarms, and
4. Mode of operation upon a loss of power and restored power.

   Exception: Unitary or packaged HVAC equipment listed in Tables 503.2.3 (1) through (3) that do not require supply air economizers.

503.2.9.1.3.2 Controls functional performance testing. HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with approved plans and specifications.

503.2.9.1.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and provided to the building owner . The report shall be identified as "Preliminary Commissioning Report" and shall identify:

1. Itemization of deficiencies found during testing required by this section which have not been corrected at the time of report preparation and the anticipated date of correction.
2. Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.
3. Climatic conditions required for performance of the deferred tests, and the anticipated date of each deferred test.

503.2.9.2 Acceptance. Buildings, or portions thereof, required to comply with this section shall not be issued a final certificate of occupancy until such time that the code official has received a letter of transmittal from the building owner that states they have received the Preliminary Commissioning Report as required by Section 503.2.9.1.4. At the request of the code official, a copy of the Preliminary Commissioning Report shall be made available for review.

503.2.9.3 Completion requirements. The construction documents shall require that within 90 days of system acceptance by the code official, the documents described in Section 503.2.9 .3.1 and 503.2.9.3.2 shall be provided to the building owner or their designated representative by the mechanical contractor.

503.2.9.3.1 Drawings. Construction documents shall include as a minimum the location and performance data on each piece of equipment.

503.2.9.3.2 Manuals. An operating manual and a maintenance manual shall be in accordance with industry-accepted standards and shall include, at a minimum, the following:

1. Capacity (input and output) and required maintenance actions for each piece of equipment.
2. Operation and maintenance manuals for each piece of equipment.
3. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
4. Names and addresses of at least one service agency.
5. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.
6. A complete narrative of how each system is intended to operate, including suggested recommended setpoints.

503.2.9.3.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section 503.2.9.1.2

503.2.9.3.4 Final Commissioning Report. A complete report of test procedures and results identified as "Final Commissioning Report" shall include:

1. Results of all Functional Performance Tests.
2. Disposition of all deficiencies found during testing, including details of corrective measures used or proposed.

3. All Functional Performance Test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

Section 508
SYSTEM COMMISSIONING

508.1 General. This section covers the commissioning of the building mechanical systems in Section 503 and electrical power and lighting systems in Section 505.

508.2 Mechanical systems commissioning and completion requirements. Prior to passing the final mechanical inspection, the *registered design professional* shall provide evidence of mechanical systems *commissioning* and completion in accordance the provisions of this Section.

Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections 508.2.4 and 508.2.5

Exceptions: The following systems are exempt from the commissioning requirements:

1. Mechanical systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h cooling capacity and 600,000 Btu/h heating capacity.
2. Systems included in Section 503.3 that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units

508.2.1 Commissioning plan. A *commissioning plan* shall be developed by a *registered design professional* or approved *agency* and shall include the following items:

1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
2. A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed.
3 Functions to be tested including, but not limited to calibrations and economizer controls.
4. Conditions under which the test will be performed At a minimum, testing must affirm winter and summer design conditions and full outside air conditions.
5. Measurable criteria for performance.

508.2.2 Systems adjusting and balancing. HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the product specifications. Test and balance activities shall include the following:

508.2.2.1. **Air systems balancing**: Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the International Mechanical Code. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, fan speed shall be adjusted to meet design flow conditions.

Exception: Fans with fan motors of 1 hp or less.

508.2.2.2 Hydronic systems balancing: Individual hydronic heating and cooling coils shall be equipped with means for balancing and measuring flow. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the capability to measure pressure across the pump, or test ports at each side of each pump.

Exceptions:

1. Pumps with pump motors of 5 hp or less.
2. When throttling results in no greater than five percent of the nameplate horsepower draw above that required if the impeller were trimmed.

508.2.3 Functional performance testing. Functional performance testing specified in Sections 508.2.3.1 through 508.2.3.3 shall be conducted.

508.2.3.1 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, and
4. Mode of operation upon a loss of power and restoration of power.

Exception: Unitary or packaged HVAC equipment listed in Tables 503.2.3 (1) through (3) that do not require supply air economizers.

508.2.3.2 Controls. HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. *Sequences of operation* shall be functionally tested to document they operate in accordance with *approved* plans and specifications.

508.2.3.3 Economizers. Air economizers shall undergo a functional test to determine that they operate in accordance with manufacturer's specifications.

508.2.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and certified by the *registered design professional* or *approved agency* and provided to the building owner . The report shall be identified as "Preliminary Commissioning Report" and shall identify:

1 Itemization of deficiencies found during testing required by this section that have not been corrected at the time of report preparation,
2. Deferred tests that cannot be performed at the time of report preparation because of climatic conditions.
3. Climatic conditions required for performance of the deferred tests.

508.2.4.1 Acceptance of Report. *Buildings*, or portions thereof, shall not pass the final mechanical inspection until such time as the *code official* has received a letter of transmittal from the *building* owner acknowledging that the *building* owner has received the Preliminary Commissioning Report.

508.2.4.2 Copy of Report. The *code official* shall be permitted to require that a copy of the Preliminary Commissioning Report be made available for review by the code official

508.2.5 Documentation requirements. The *construction documents* shall specify that the *documents* described in this Section be provided to the *building* owner within 90 days of the date of receipt of the *certificate of occupancy*.

508.2.5.1 Drawings. Construction documents shall include the location and performance data on each piece of equipment.

508.2.5.2 Manuals. An operating and maintenance manual shall be provided and include all of the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Name and address of at least one service agency.
4 HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in system programming instructions.
5. A narrative of how each system is intended to operate, including recommended setpoints.

508.2.5.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section 508.2.2.

508.2.5.4 Final Commissioning Report. A report of test procedures and results identified as "Final Commissioning Report" shall be delivered to the building owner and shall include:

1. Results of Functional Performance Tests.
2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
3. Functional Performance Test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

(Portions of the proposal not shown remain unchanged.)

Commenter's Reason: Public Comment 4 of 6 on EC 147 EC 147 was developed by a collaborative effort between New Buildings Institute, the American Institute of Architects and the U.S. Department of Energy. The proposal was developed in response to many national goals of increasing the energy efficiency of new commercial construction by 30% and is designed to modify the Chapter 5 requirements of the building envelope, mechanical and lighting systems to meet this goal. During the passage of EC 147 at the ICC IECC Code Development Hearings in Baltimore, the proponents pledged to work with all interested and affected parties and solicit their comments and input in order to improve on the code change proposal passed by the IECC Committee. Numerous comments were received from parties representing industry and product groups, enforcement agencies and the building and design industry. The comments helped to provide a consensus agreement on several issues raised during testimony, clarified language, increased readability, and strengthened the proposal. The public comments submitted herein by NBI, AIA and DOE are the result of this process. A series of six public comments have been submitted on EC 147 that each focus the discussion on a particular portion of the original code change proposal. The proponents feel that this is necessary to ensure that the voting members of ICC will have the opportunity to hear testimony on each section before voting on the proposal as a whole. Additional information on EC 147 is available at *http://newbuildings.org/iecc.htm*.

These commissioning public comments are based on recommendations received from industry and from further study by NBI/AIA and DOE into effective commissioning language included in the Washington State Nonresidential Energy Code and in the ICC's IgCC-PV1. These are identical to proposed changes to EC147 that were reviewed by the ASHRAE Standard 90.1 Mechanical Committee in addition to BOMA. Several changes are recommended in this public comment that will result in a clearer understanding of the steps necessary for commissioning HVAC systems, who will oversee the process, the code official's limited responsibilities and when commissioning must occur. The following changes were made to language in EC 147.

Creation of Section 508. A new section in the IECC, Section 508, is proposed that will contain requirements that are more process oriented versus those that apply to specific energy features in the building. Section 508 will also contain functional testing language for lighting controls and will provide a place in the IECC for future process oriented requirements.

Minimum Equipment Size Threshold. Based on the new Washington State Energy Code, a minimum total mechanical equipment capacity threshold was added that will focus the commissioning requirements on larger mechanical systems and on buildings with multiple systems that result in a higher output capacity. This threshold will remove the requirement from smaller commercial buildings e.g. tenant buildouts in strip shopping centers or small medical or dental offices. An exception was also placed in the requirements that will exempt systems installed in hotel/motel and high-rise residential that meet the simple building definition in Section 503.3. This will, for example, exempt packaged terminal heat pump (PTHP) systems commonly used in hotel/motel sleeping rooms that are intermittently occupied and where there may be additional costs of commissioning multiple small systems.

Clarified Process and Reduced the Code Official Involvement in Commissioning Process. The commissioning language was restructured to provide clear direction on what is required, who is responsible and what documentation needs to be provided to the code official. In addition, the code official's identified responsibilities in the commissioning process all occur prior to the issuance of the Certificate of Occupancy (see Section 508.2.5) The code official will receive an acknowledgement of the Preliminary Commissioning Report and can review the Preliminary Report if desired. Before issuance of the Certificate of Occupancy, a code official only needs to verify that the approved plans include a statement that the required construction documents and final commissioning report will be delivered to the builder owner.

Public Comment 5:

Dave Hewitt, representing New Buildings Institute, Jessyca Henderson, representing American Institute of Architects, Ron Majette, representing U.S. Department of Energy request Approval as Modified by this Public Comment.

Modify the proposal as follows:

MULTI-SCENE CONTROL*:* A lighting control device or system that allows for two or more pre-defined lighting settings, in addition to all off, for two or more groups of luminaires to suit multiple activities in the space, and allows the automatic recall of those settings.

505.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications and minimum acceptable lighting equipment for exterior applications.

~~Lighting within dwelling units where 75 percent or more of the permanently installed interior light fixtures are fitted with high-efficacy lamps or a minimum of 75 percent of the permanently installed lighting fixtures shall contain only high efficacy lamps.~~

~~**Exception**: Low-voltage lighting.~~

Exception: Dwelling units within commercial buildings shall not be required to comply with Sections 505.2 through 505.5 provided that not less than 75 percent of the permanently installed light fixtures, other than low-voltage lighting, shall be fitted for, and contain only, high efficacy lamps.

505.2.1 Manual Lighting Controls. All buildings must include manual lighting controls that meet the requirements of 505.2.1.1 and 505.2.1.2

505.2.1.1 Interior lighting controls. Each area enclosed by walls or floor-to-ceiling partitions shall have at least one manual control for the lighting serving that area. The required controls shall be located within the area served by the controls or be a remote switch that identifies the lights served and indicates their status.

Exceptions:
1. Areas designated as security or emergency areas that must be continuously lighted.
2. Lighting in stairways or corridors that are elements of the means of egress.

~~**505.2.2 Additional controls.** Each area that is required to have a manual control shall have additional controls that meet the requirements of Sections 505.2.2.1, and 505.2.2.2.~~

~~**505.2.2.1**~~ **505.2.1.2 Light reduction controls.** Each area that is required to have a manual control shall also allow the occupant to reduce the connected lighting load in a reasonably uniform illumination pattern by at least 50 percent. Lighting reduction shall be achieved by one of the following or other *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; or
4. Switching each luminaire or each lamp.

Exceptions: Light reduction controls need not be provided in the following areas and spaces:

1. Areas that have only one luminaire~~.~~ with rated power less than 100 watts
2. Areas that are controlled by an occupant-sensing device.
3. Corridors, storerooms, restrooms, ~~or~~ public lobbies~~.~~, electrical or mechanical rooms
4. *Sleeping unit* (see Section 505.2.3).
5. Spaces that use less than 0.6 watts per square foot (6.5 W/m2).
6. Daylight zones complying with Section 505.2.2.3.2 Automatic Daylighting Controls

505.2.2 Additional Lighting Controls. Each area that is required to have a manual control shall also have controls that meet the requirements of Sections 505.2.2.1, 505.2.2.2 and 505.2.2.3.

Exceptions: Additional lighting controls need not be provided in the following spaces:

1. *Sleeping units*.
2. Spaces where patient care is directly provided.
3. Spaces where an automatic shutoff would endanger occupant safety or security.

505.2.2.1 Automatic Time Switch Control Devices. Automatic Time Switch controls shall be installed to control lighting in all areas of the building.

Exceptions:

1. Emergency egress lighting does not need to be controlled by automatic time switch
2. Lighting in spaces controlled by occupancy sensors does not need to be controlled by automatic time switch controls

The automatic time switch control device shall include an override switching device that complies with the following:

1. The override switch shall be in a readily accessible location
2. The override switch shall be located where the lights controlled by the switch are visible; or the switch shall provide a mechanism which announces the area controlled by the switch;
3. The override switch shall permit manual operation.
4. The override switch, when initiated, shall permit the controlled lighting to remain on for a maximum of 2 hours; and
5. Any individual override switch shall control the lighting for a maximum area of 5,000 square feet (465 m^2).

Exceptions: Within malls, arcades, auditoriums, single tenant retail spaces, industrial facilities and arenas:

1. The time limit shall be permitted to exceed 2 hours provided the override switch is a captive key device; and
2. The area controlled by the override switch is permitted to exceed 5,000 square feet (465 m^2), but shall not exceed 20,000 square feet (1860 m^2).

505.2.2.2 Daylight Zone Control. Daylight zones shall be provided with individual controls which control the lights independent of general area lighting. Contiguous daylight zones adjacent to vertical fenestration are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e. north, east, south, west). Daylight zones under skylights more than 15 feet from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration.

Exception: Daylight spaces enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.

505.2.2.3 Automatic lighting controls. All commercial buildings shall be equipped with automatic control devices to shut off lighting in compliance with one of the following automatic control technologies:

1. Section 505.2.2.3.1 Occupancy Sensors
2. Section 505.2.2.3.2 Time Clock Controls
3. Section 505.2.2.3.3 Automatic Daylighting

Any Lighting control required in Sections 505.2.2.3.1, 505.2.2.2.3.2 and 505.2.2.3.3 shall either be manual on or shall be controlled to automatically turn the lighting on to not more than 50% power unless otherwise provided in Sections 505.2.2.3.1, 505.2.3.2 or 505.2.2.3.3.

Exception: Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants.

505.2.2.3.1 **505.2.2.2 Occupancy sensors.** Occupancy sensors shall be installed in all classrooms, conference/meeting rooms, employee lunch and break rooms, private offices, restrooms, storage rooms and janitorial closets, and other spaces 300 square feet (28 m^2) or less enclosed by floor- to -ceiling height partitions. These automatic control devices shall be installed to automatically turn off lights within 30 minutes of all occupants leaving the space, except spaces with multi-scene control. and shall either be manual on or shall be controlled to automatically turn the lighting on to not more than 50 percent power .

Exception: Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants.

505.2.2.3.2 Time Clock Controls In areas not controlled by occupancy sensors, automatic time switch control device shall be used. It shall incorporate an override switching device that:

1. Is readily accessible
2. Is located so that a person using the device can see the lights or the area controlled by that switch, or so that the area being lit is annunciated.
3. Is manually operated.
4. Allows the lighting to remain on for no more than 2 hours when an override is initiated.
5. Controls an area not exceeding 5,000 square feet (465 m2).

Exceptions:

1. In malls and arcades, auditoriums, single-tenant retail spaces, industrial facilities and arenas, where captive-key override is utilized, override time may exceed 2 hours.
2. In malls and arcades, auditoriums, single-tenant retail spaces, industrial facilities and arenas, the area controlled may not exceed 20,000 square feet (1860 m2).

505.2.2.3 Daylight Zone Control. Daylight zones shall be designed such that lights in the daylight zone are controlled independently of general area lighting and are controlled in accordance with either Section 505.2.2.3.1 or 505.2.2.3.2. Each daylight control zone shall not exceed 2,500 square feet (232 m^2). Contiguous daylight zones adjacent to vertical fenestration are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e. north, east, south, west). Daylight zones under skylights more than 15 feet (4572 mm) from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration.

Exception: Daylight zones enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting

505.2.2.3.1 Manual Daylighting Controls. Manual controls shall be installed in daylight zones unless automatic controls are installed in accordance with Section 505.2.2.3.2.

~~**505.2.2.3.3**~~ **505.2.2.3.2 Automatic daylighting controls.** ~~Automatic controls installed in daylight zones shall control lights in the daylit areas seperately from the non-daylit areas. Controls for calibration adjustments to the lighting control device shall be readily accessible to authorized personnel. Each daylight control zone shall not exceed 2,500 square feet. Automatic daylighting controls must incorporate either an automatic shut-off ability based on time or occupancy in addition to lighting power reduction controls.~~

Set-point and other controls for calibrating the lighting control device shall be readily accessible.

Daylighting controls device shall be capable of automatically reducing the lighting power in response to available daylight by either one of the following methods:

~~Controls will automatically reduce lighting power in response to available daylight by either one of the following methods:~~

1. **Continuous dimming** using dimming ballasts and daylight-sensing automatic controls that are capable of reducing the power of general lighting in the daylit zone continuously to less than 35~~%~~ percent of rated power at maximum light output.

2. **Stepped dimming** using multi-level switching and daylight-sensing controls that are capable of reducing lighting power automatically. The system ~~should~~ shall provide a minimum of two control channels per zone and be installed in a manner such that at least one control step ~~shall reduce power of general lighting in the daylit zone by 30% to 50%~~ is between 50 percent and 70 percent of design lighting ~~of rated~~ power and another control step is no greater than 35 percent of design power ~~that reduces lighting power by 65% to 100%. Stepped dimming control is not allowed in continuously occupied areas with ceiling heights of 14 feet or lower.~~

   ~~**Exception:** Daylight spaces enclosed by walls or ceiling height partitions and containing 2 or fewer luminaire have a separate switch for general area lighting.~~

505.2.3 Specific Application Controls Specific application controls shall be provided for the following:

~~Display/Accent Lighting—Display or accent lighting shall have a separate control device~~.

1. Display and accent light shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space
2. ~~Case Lighting—~~Lighting in cases used for display case purposes shall ~~have a separate control device~~ be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
3. ~~Hotel and Motel Guest Room Lighting—~~Hotel and motel ~~guest rooms~~ sleeping units and guest suites shall have a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles.
4. ~~Task Lighting—~~Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided the control device is readily accessible ~~and located so that the occupant can see the controlled lighting.~~
5. ~~Non-visual Lighting—~~Lighting for non-visual applications, such as plant growth and food warming, shall ~~have a separate control device~~ be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
6. ~~Demonstration Lighting—~~Lighting equipment that is for sale or for demonstrations in lighting education shall ~~have a separate control device~~ be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.

   ~~**Exceptions:**~~

   ~~1. a., b. and d. Where LED lighting is used no additional control is required.~~

~~Where LED lighting is installed as display case, accent, case or task lighting, a separate control device shall not be required.~~

~~**505.2.4**~~ **508.3 Lighting system functional testing.** Controls for automatic lighting systems shall comply with ~~be tested prior to and as a condition for issuance of an approval under Section 104.8 and in accordance with~~ Section 508.3. ~~Testing shall ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. The construction documents shall state the party who will conduct the required functional testing. The party responsible for the functional testing shall not be directly involved in the design or construction of the project and shall provide documentation to the *code official* certifying that the installed lighting controls meet the provisions of Section 505.~~

~~When *occupant sensors*, time switches, programmable schedule controls, *photosensors or daylighting controls* are installed, at a minimum, the following procedures shall be performed:~~

1. ~~Confirm that the placement, sensitivity and time-out adjustments for *occupant sensors* yield acceptable performance, i.e. lights turn off only after space is vacated and do not turn on unless space is occupied.~~
2. ~~Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.~~
3. ~~Confirm that photosensor controls reduce electric light based on the amount of usable daylight in the space as specified.~~

508.3.1 Functional Testing. ~~Controls for automatic lighting systems shall be tested prior to and as a condition for issuance of an approval under Section 104.8.~~ Testing shall ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. The construction documents shall state the party who will conduct the required functional testing. ~~The party responsible for the functional testing shall not be directly involved in the design or construction of the project.~~ Where required by the *code official*, an approved party independent from the design or construction of the project shall be responsible for the functional testing and shall provide documentation to the *code official* certifying that the installed lighting controls meet the provisions of Section 505.

Where *occupant sensors*, time switches, programmable schedule controls, *photosensors or daylighting controls* are installed, ~~at a minimum,~~ the following procedures shall be performed:

1. Confirm that the placement, sensitivity and time-out adjustments for *occupant sensors* yield acceptable performance, ~~i.e. lights turn off only after space is vacated and do not turn on unless space is occupied.~~
2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.
3. Confirm that the placement and sensitivity adjustments for *photosensor* controls reduce electric light based on the amount of usable daylight in the space as specified.

~~**505.2.5 Sleeping unit controls.** *Sleeping units* in hotels, motels, boarding houses or similar buildings shall have at least one master switch at the main entry door that controls all permanently wired luminaires and switched receptacles, except those in the bathroom(s). Suites shall have a control meeting these requirements at the entry to each room or at the primary entry to the suite.~~

505.5.2 Interior lighting power. The total interior lighting power allowance (watts) ~~is the sum for all interior lighting powers~~ is determined according to Table 505.5.2.1 using the Building Area Method, or Table 505.5.2.1 using the Space-by-Space Method, for all areas of the building covered in this permit. For the Building Area Method, the interior lighting power allowance is the floor area for each building area type listed in Table ~~505.5.2~~ 505.5.2.1 times the value from Table ~~505.5.2~~ 505.5.2.1 for that area. For the purposes of this method, an "area" shall be defined as all contiguous spaces that accommodate or are associated with a single building area type as listed in Table ~~505.5.2~~ 505.5.2.1. When this method is used to calculate the total interior lighting power for an entire building, each building area type shall be treated as a separate area. For the Space-by-Space Method, the interior lighting power allowance is determined by multiplying the floor area of each space times the value for the space type in Table 505.5.2.2 that most closely represents the proposed use of the space, and then summing the lighting power allowances for all spaces. Trade-offs among spaces are permitted.

~~**TABLE 505.5.2**~~
~~**INTERIOR LIGHTING POWER ALLOWANCES**~~

~~LIGHTING POWER DENSITY~~		
	~~Whole Building~~	~~Space by Space~~
~~Building Area Typea~~	~~(W/ft2)~~	
Active Storage		0.8
Atrium – First Three Floors		0.6
Atrium – Each Additional Floor		0.2
AUTOMOTIVE FACILITY	0.9	
Classroom/lecture/training		1.3
Conference/Meeting/Multipurpose		1.1
Corridor/Transition		0.5
Electrical/Mechanical		1.1
Food Preparation		1.2
Inactive Storage		0.2
Lobby		1.1
Restroom		0.8
Stairway		0.6
CONVENTION CENTER	1.2	
Exhibit Space		1.3
Audience/Seating Area		0.9
COURTHOUSE	1.2	
Audience/Seating Area		0.9
Courtroom		1.9
Confinement Cells		0.9
Judges Chambers		1.3
Dressing/Locker/Fitting Room		0.6
DINING: BAR LOUNGE/LEISURE	1.3	
Lounge/Leisure Dining		1.4
DINING: CAFETERIA/FAST FOOD	1.4	
DINING: FAMILY	1.6	
Dining		1.4
Kitchen		1.2
DORMITORY	1	
Living Quarters		1.1
Bedroom		0.5
Study Hall		1.4
EXERCISE CENTER	1	
Dressing/Locker/Fitting Room		0.6
Audience/Seating Area		0.3
Exercise Area		0.9
Exercise Area/Gymnasium		0.9
RETAIL: SUPERMARKET	1.3	
GYMNASIUM	1.1	
Dressing/Locker/Fitting Room		0.6
Audience/Seating Area		0.4
Playing Area		1.4
Exercise Area		0.9
HEALTHCARE CLINIC	1	
Corridors w/patient waiting, exam		1
Exam/Treatment		1.5
Emergency		2.7
Public & Staff Lounge		0.8

LIGHTING POWER DENSITY		
	Whole Building	Space by Space
Building Area Typea	(W/ft2)	
Hospital/Medical supplies		1.4
Hospital - Nursery		0.6
Nurse station		1
Physical therapy		0.9
Patient Room		0.7
Pharmacy		1.2
Hospital/Radiology		0.4
Operating Room		2.2
Recovery		0.8
Active storage		0.9
Laundry-Washing		0.6
HOTEL	1	
Dining Area		1.3
Guest quarters		1.1
Reception/Waiting		2.5
Lobby		1.1
LIBRARY	1.3	
Library-Audio Visual		0.7
Stacks		1.7
Card File & Cataloguing		1.1
Reading Area		1.2
MANUFACTURING FACILITY	1.3	
MOTEL	1	
Dining Area		1.2
Guest quarters		1.1
Reception/Waiting		2.1
MOTION PICTURE THEATER	1.2	
Audience/Seating Area		1.2
Lobby		1
MULTI-FAMILY	0.7	
MUSEUM	1.1	
Active Storage		0.8
General exhibition		1
Restoration		1.7
OFFICE	0.9	
Enclosed		1
Open Plan		1
PARKING GARAGE	0.3	
PENITENTIARY	1.0	
PERFORMING ARTS THEATER	1.6	
Audience/Seating Area		2.6
Lobby		3.3
Dressing/Locker/Fitting Room		1.1
POLICE STATIONS	1	
FIRE STATIONS	0.8	
-Fire Station Engine Room		0.8
Sleeping Quarters		0.3
Audience/Seating Area		0.8
Police Station Laboratory		1.4
POST OFFICETS/SF	1.1	
Sorting Area		1.2
Lobby		1
RELIGIOUS BUILDINGS	1.3	
Lobby		0.6
Worship/Pulpit/Choir		2.4
RETAIL	1.3	
Department Store Sales Area		1.3
Specialty Store Sales Area		1.8
Fine Merchandise Sales Area		2.9
Supermarket Sales Area		1.3
Personal Services Sales Area		1.3
Mass Merchandising Sales Area		1.3
Mall Concourse		1.7
SCHOOL/UNIVERSITY	1.2	
Classroom		1.3
Audience		0.7
Dining		1.1
Office		1.1
Corridor		0.5

LIGHTING POWER DENSITY		
	Whole Building	Space by Space
Building Area Typea	(W/ft2)	
Storage		0.5
Laboratory		1.1
RETAIL: SPECIALTY b	1.6	
TOWN HALL	1.1	
TRANSPORTATION	1	
Dining Area		2.1
Baggage Area		1
Airport - Concourse		0.6
Terminal - Ticket Counter		1.5
Reception/Waiting		0.5
SPORTS ARENA	1.1	
WAREHOUSE	0.6	
Fine Material		1.4
Medium/Bulky Material		0.6
WORKSHOP	1.4	

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m2.

TABLE 505.5.2
INTERIOR LIGHTING POWER ALLOWANCES

BUILDING AREA TYPE	LPD (w/ft^2)
AUTOMOTIVE FACILITY	0.9
CONVENTION CENTER	1.2
COURTHOUSE	1.2
DINING: BAR LOUNGE/LEISURE	1.3
DINING: CAFETERIA/FAST FOOD	1.4
DINING: FAMILY	1.6
DORMITORY	1.0
EXERCISE CENTER	1.0
FIRE STATION	0.8
GYMNASIUM	1.1
HEALTH CARE CLINIC	1.0
HOSPITAL	1.2
HOTEL	1.0
LIBRARY	1.3
MANUFACTURING FACILITY	1.3
MOTEL	1.0
MOTION PICTURE THEATER	1.2
MULTIFAMILY	0.7
MUSEUM	1.1
OFFICE	0.9
PARKING GARAGE	0.3
PENETENTIARY	1.0
PERFORMING ARTS THEATER	1.6
POLICE STATION	1.0
FIRE STATION	0.8
POST OFFICE	1.1
RELIGIOUS BUILDING	1.3
RETAIL	1.4
SCHOOL/ UNIVERSITY	1.2
SPORTS ARENA	1.1
TOWN HALL	1.1
TRANSPORTATION	1.0
WAREHOUSE	0.6
WORKSHOP	1.4

Table 505.5.2.2

COMMON SPACE-BY-SPACE TYPES	LPD (w/ft^2)
ATRIUM – First 40 ft in height	0.03 per ft. ht.
ATRIUM – Above 40 ft in height	0.02 per ft. ht.
Audience/Seating Area - Permanent	
For Auditorium	0.9
For Performing Arts Theater	2.6
For Motion Picture Theater	1.2
Classroom/Lecture/Training	1.30
Conference/Meeting/Multipurpose	1.2
Corridor/Transition	.7
Dining Area	
Bar/ Lounge /Leisure Dining	1.40
Family Dining Area	1.40
Dressing/Fitting Room Performing Arts Theater	1.1
Electrical/Mechanical	1.10
Food Preparation	1.20
Laboratory for classrooms	1.3
Laboratory for medical/industrial/research	1.8
Lobby	1.10
Lobby for Performing Arts Theater	3.3
Lobby for Motion Picture Theater	1.0
Locker Room	0.80
Lounge Recreation	0.8
Office -enclosed	1.1
Office – Open Plan	1.0
Restroom	1.0
Sales Area	1.6 (a)
Stairway	0.70
Storage	0.8
Workshop	1.60

BUILDING SPECIFIC SPACE-BY-SPACE TYPES	
CONVENTION CENTER	
Exhibit Space	1.50
Audience/Seating Area	0.90
COURTHOUSE/POLICE STATION/PENETENTIARY	
Courtroom	1.90
Confinement Cells	1.1
Judge Chambers	1.30
Penitentiary Audience Seating	0.5
Penitentiary Classroom	1.3
Penitentiary Dining	1.1
AUTOMOTIVE – SERVICE/REPAIR	0.70
BANK/OFFICE – banking activity area	1.5
DORMITORY Living Quarters	1.10
GYMNASIUM / FITNESS CENTER	
Fitness area	0.9
Gymnasium Audience/Seating	0.40
Playing Area	1.40
HEALTHCARE CLINIC/HOSPITAL	
Corridors /Transition	1.00
Exam/Treatment	1.70
Emergency	2.70
Public & Staff Lounge	0.80
Medical Supplies	1.40
Nursery	0.9
Nurse Station	1.00
Physical Therapy	0.90
Patient Room	0.70
Pharmacy	1.20
Radiology/Imaging	1.3
Operating Room	2.20
Recovery	1.2
Lounge/Recreation	0.8
Laundry - Washing	0.60
HOTEL	
Dining Area	1.30
Guest Rooms	1.10
Hotel Lobby	2.10

COMMON SPACE-BY-SPACE TYPES	LPD (w/ft^2)
Highway Lodging Dining	1.20
Highway Lodging Guest Rooms	1.10
LIBRARY	
Stacks	1.70
Card File & Cataloguing	1.10
Reading Area	1.20
MANUFACTURING	
Corridors /Transition	0.40
Detailed manufacturing	1.3
Equipment Room	1.
Extra High Bay (> 50 ft Floor-Ceiling height)	1.1
High Bay (25- 50 ft Floor-Ceiling ht)	1.20
Low Bay (<25 ft Floor-Ceiling height)	1.2
MUSEUM	
General Exhibition	1.00
Restoration	1.70
PARKING GARAGE – garage areas	0.2
FIRE STATIONS	
Engine Room	0.80
Sleeping Quarters	0.30
POST OFFICE	
Sorting Area	0.9
RELIGIOUS BUILDING	
Fellowship Hall	0.60
Audience Seating	2.40
Worship Pulpit/Choir	2.40
RETAIL	
Dressing/Fitting Area	0.9
Mall Concourse	1.6
Sales Area	1.6(a)
SPORTS ARENA	
Audience seating	0.4
Court Sports Area – Class 4	.7
Court Sports Area – Class 3	1.2
Court Sports Area – Class 2	1.9
Court Sports Area – Class 1	3.0
Ring Sports Area	2.7
TRANSPORTATION	
Air/Train/Bus Baggage Area	1.00
Airport Concourse	0.60
Terminal – Ticket Counter	1.50
WAREHOUSE	
Fine Material Storage	1.40
Medium/Bulky Material	0.60

a. Where lighting equipment is specified to be installed to highlight specific merchandise in addition to lighting equipment specified for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for merchandise, or additional lighting power as determined below shall be added to the interior lighting power determined in accordance with this line item.

Calculate the additional lighting power as follows:

Additional Interior Lighting Power Allowance = 500 **watts** + (Retail Area 1 X 0.6 ~~0.4~~W/ft2) + (Retail Area 2 X 0.6 W/ft2) + (Retail Area 3 X ~~0.9~~ 1.4 W/ft^2) + (Retail Area 4 X ~~1.5~~ 2.5 W/ft^2).

where:

Retail Area 1 = The floor area for all products not listed in Retail Area 2, 3 or 4.
Retail Area 2 = The floor area used for the sale of vehicles, sporting goods and small electronics.
Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork.
Retail Area 4 = The floor area used for the sale of jewelry, crystal and china

Exception: Other merchandise categories are permitted to be included in Retail Areas 2 through 4 above, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the authority having jurisdiction.

(Portions of the proposal not shown remain unchanged.)

Commenter's Reason: Public Comment 5 of 6 on EC 147 EC 147 was developed by a collaborative effort between New Buildings Institute, the American Institute of Architects and the U.S. Department of Energy. The proposal was developed in response to many national goals of increasing the energy efficiency of new commercial construction by 30% and is designed to modify the Chapter 5 requirements of the building envelope, mechanical and lighting systems to meet this goal. During the passage of EC 147 at the ICC IECC Code Development Hearings in Baltimore, the proponents pledged to work with all interested and affected parties and solicit their comments and input in order to improve on the code change proposal passed by the IECC Committee. Numerous comments were received from parties representing industry and product groups, enforcement agencies and the building and design industry. The comments helped to provide a consensus agreement on several issues raised during testimony, clarified language, increased readability, and strengthened the proposal. The public comments submitted herein by NBI, AIA and DOE are the result of this process. A series of six public comments have been submitted on EC 147 that each focus the discussion on a particular portion of the original code change proposal. The proponents feel that this is necessary to ensure that the voting members of ICC will have the opportunity to hear testimony on each section before voting on the proposal as a whole. Additional information on EC 147 is available at *http://newbuildings.org/iecc.htm*.

The lighting section revisions in this comment were developed through extensive consultation with industry and the 90.1 Lighting Subcommittee, and with significant contributions from the International Association of Lighting Designers. The table structure was redesigned to parallel other LPD tables in common use. Most of the values in the whole building type table were not revised from EC 147, but the retail classification was simplified. Most of the revised values in the space-by-space table are parallel to those found in 90.1 Addenda BY.

The lighting controls portion of the Section was carefully disassembled and reconstructed to be both concise and easily understandable – while maintaining the important requirements in EC 147 for manual and automatic controls. Properly executed lighting control strategies significantly reduce power consumption in response to time-of-day signatures, occupancy status, or daylight availability. The revised language in this comment provides detailed, but flexible, criteria to employ lighting controls as standard practice.

The “additional interior lighting power allowance” for retail space-by-space types is revised by these comments to increase both the base allowance and the variable allowances over the values in EC 147 AS. Based on discussions, the revision to this allowance now includes a 500 w base allowance, plus an increased variable (per square foot) allowance based on merchandise “type”. The reduction from 2009 IECC in the base allowance is based on technology and design improvements since its original formulation, and is partially compensated by increases in the variable allowances.

Public Comment 6:

Dave Hewitt, representing New Buildings Institute, Jessyca Henderson, representing American Institute of Architects, Ron Majette, representing U.S. Department of Energy request Approval as Modified by this Public Comment.

Modify the proposal as follows:

ON-SITE RENEWABLE ENERGY. Energy derived from solar radiation, wind, waves, tides, landfill gas, biomass, or the internal heat of the earth. The energy system providing on-site renewable energy shall be located on ~~or adjacent~~ ~~to~~ the project site.

SECTION 506
ADDITIONAL EFFICIENCY PACKAGE OPTIONS

506.1 Requirements. Buildings shall comply with at least one of the following:

1. ~~506.2~~ Efficient HVAC Performance ~~Requirement~~ in accordance with Section 506.2
2. ~~506.3~~ Efficient Lighting System ~~Requirement~~ in accordance with Section 506.3
3. ~~506.4~~ On-Site Supply of Renewable Energy in accordance with Section 506.4

~~At the time of plan submittal, the code official shall be provided, by the permittee, documentation designating the intent to comply with Section 506.2, 506.3 or 506.4 in their entirety.~~ Individual tenant spaces ~~must~~ shall comply with either 506.2 or 506.3 ~~in their entirety~~ unless documentation can be provided that demonstrates compliance with Section 506.4 for the entire building.

506.2 Efficient ~~Mechanical Equipment~~ HVAC Performance.
Equipment shall meet the minimum efficiency requirements of Tables 506.2.(1) through 506.2(7) in addition to the requirements in Section 503. This section shall only be used ~~where an equipment efficiency option is available~~ when the equipment efficiencies in Tables 506.2(1) through 506.2(7) are greater than the equipment efficiencies listed in Table 503.2.3(1) through 503.2.3(7) for the equipment type.

TABLE 506.2(1)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS,
ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	~~REQUIRED~~ MINIMUM EFFICIENCYa
Air conditioners, Air cooled	< 65,000 Btu/hd	Split system	For zones 1 to 5: 15.0 SEER, 12.5 EER For zones 6 to 8: 14 SEER, 12 EER
		Single package	For zones 1 to 5: 15.0 SEER, 12.0 EER For zones 6 to 8: 14.0 SEER 11.6 EER
	≥ 65,000 Btuh/h and < 240,000 Btu/h	Split system and single package	For zones 1 to 5: 12.0 EER[b], 12.5~~4~~ ~~IPLV~~ IEER[b] For zones 6 to 8: 11.5 EER[b], ~~11.9~~ 12.0 ~~IPLV~~ IEER[b]
	≥ 240,000 Btu/h and < 760,000 Btu/h	Split system and single package	For zones 1 to 5: 10.8 EER[b], ~~12.0~~ 11.3 ~~IPLV~~ IEER[b] For zones 6 to 8: 10.5 EER[b], 11.0 ~~10.9~~ ~~IPLV~~ IEER[b]
	≥ 760,000 Btu/h		For zones 1 to 5: 10.2 EER[b], 10.7 ~~11.0~~ ~~IPLV~~ IEER[b] For zones 6 to 8: 9.7 EER[b], 10.2 ~~11.0~~ ~~IPLV~~ IEER[b]
Air conditioners, Water and evaporatively cooled		Split system and single package	14.0 EER

For SI: 1 British thermal unit per hour = 0.2931 W.
a. ~~IPLVs~~ IEERs are only applicable to equipment with capacity modulation. Zones refer to Climate Zones From Section 303.1
b. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

TABLE 506.2(2)
UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	~~REQUIRED~~ MINIMUM EFFICIENCYa
Air cooled (Cooling mode)	< 65,000 Btu/h~~d~~	Split system	For zones 1 to 5: 15.0 SEER, 12.5 EER For zones 6 to 8: 14.0 SEER, 12.0 EER
		Single package	For zones 1 to 5: 15.0 SEER, 12.0 EER For zones 6 to 8: 14.0 SEER, 11.6 EER
	≥ 65,000 Btu/h and < 240,000 Btu/h	Split system and single package	For zones 1 to 5: 12.0 SEER, 12.4 EER For zones 6 to 8: 11.5 EERb, ~~11.9 IPLVb~~ 12.0 IEER$_b$
	≥ 240,000 Btu/h	Split system and single package	For zones 1 to 5: 12.0 SEER, 12.4 EER For zones 6 to 8: 10.5 EERb, ~~10.9 IPLVb~~ 10.5 IEERb
Water SOURCES (Cooling mode)	< 135,000 Btu/h	85°F entering water	14.0 EER
Air cooled (Heating mode)	< 65,000 Btu/h~~d~~ (Cooling capacity)	Split system	For zones 1 to 5: 9.0 HSPF For zones 6 to 8: 8.5 HSPF
		Single package	For zones 1 to 5: 8.5 HSPF For zones 6 to 8: 8.0 HSPF
	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb outdoor air	3.4 COP
		17°F db/15°F wb outdoor air	2.4 COP
	≥ 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb outdoor air	3.2 COP
		77°F db/15°F wb outdoor air	2.1 COP
Water SOURCES (Heating mode)	< 135,000 Btu/h (Cooling capacity)	70°F entering water	4.6 COP

For SI: °C = [(°F) - 32] / 1.8, 1 British thermal unit per hour = 0.2931 W.
db = dry-bulb temperature, °F; wb = wet-bulb temperature, °F

a. ~~IPLVs~~ IEERs and Part load rating conditions are only applicable to equipment with capacity modulation. Zones refer to Climate Zones From Section 303.1
b. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

TABLE 506.2(3)
PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINALHEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY	~~REQUIRED~~ MINIMUM EFFICIENCYY~~b~~
Air conditioners	< 7,000 Btu / h	11.9 EER
& Heat Pumps (Cooling Mode)	7,000 Btu / h and < 10,000 Btu / h	11.3 EER
	10,000 Btu / h and < 13,000 Btu / h	10.7 EER
	> 13,000 Btu / h	9.5 EER

a. Replacement units must 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) high and less than 42 inches (1067 mm) wide.

TABLE 506.2(4)
WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	~~REQUIRED~~ MINIMUM EFFICIENCY	TEST PROCEDURE
Warm air furnaces, gas fired[a]	< 225,000 Btu/h	—	For zones 1 & 2, NR. For zones 3 & 4 90 AFUE or 90 Et[c] For zones 45 ~~-~~8 are 92 AFUE or 92 Et[c]	DOE 10 CFR Part 430 or ANSI Z21.47
	≥ 225,000 Btu/h	Maximum capacity	90% Ec[b] ~~note 1~~	ANSI Z21.47
Warm air furnaces, oil fired[a]	< 225,000 Btu/h	—	For zones 1 & 2, NR. For zones 3 to 8 are 85 AFUE or 85 Et[c]	DOE 10 CFR Part 430 or UL 727
	≥ 225,000 Btu/h	Maximum capacity	85% Et[b] ~~note 1~~	UL 727

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	~~REQUIRED~~ MINIMUM EFFICIENCY	TEST PROCEDURE
Warm air duct furnaces, gas fired[a]	All capacities	Maximum capacity	*90% Ec*	ANSI Z83.8
Warm air unit heaters, gas fired	All capacities	Maximum capacity	*90% Ec*	ANSI Z83.8
Warm air unit heaters, oil fired	All capacities	Maximum capacity	*90% Ec*	UL 731

~~*TBD - To be decided*~~
For SI: 1 British thermal unit per hour = 0.2931 W.
Et = Thermal efficiency.
Ec = Combustion efficiency (100% less flue losses).

a. Efficient furnace fan: Fossil fuel furnaces in zones 3 to 8 shall have a furnace electricity ratio not greater than 2 percent and shall include a manufacturer's designation of the furnace electricity ratio.
~~1~~ b. Units must also include an IID (intermittent ignition device), 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.
c. Where there are two ratings for 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]) units shall be permitted to comply with either rating.

~~*Et* = Thermal efficiency.~~
~~*Ec* = Combustion efficiency (100% less flue losses).~~
~~Efficient furnace fan: All fossil fuel furnaces in zones 3 to 8 shall have a furnace electricity ratio not greater than 2% and shall include a manufacturer's designation of the furnace electricity ratio.~~

~~**TABLE 506.2(5)**~~
~~**BOILER, EFFICIENCY REQUIREMENTS**~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~TEST PROCEEDURE~~	~~REQUIRED~~ ~~MINIMUM~~ ~~EFFICIENCY~~
~~Gas Hot Water~~	~~< 300,000 Btu / h~~	~~DOE 10 CFR Part 430~~	~~90% Et 85% AFUE~~
	~~> 300,000 Btu / h and > 2.5 mBtu/h~~	~~DOE 10 CFR Part 431~~	~~90 89% Et~~
	~~>2.5 mBtu/h~~	~~DOE 10 CFR Part 431~~	~~85% Ec~~
~~Gas Steam~~	~~< 300,000 Btu / h~~	~~DOE 10 CFR Part 430~~	~~89% Et 82% AFUE~~
	~~> 300,000 Btu / h~~	~~DOE 10 CFR Part 431~~	~~89% Et~~
~~Oil~~	~~< 300,000 Btu / h~~	~~DOE 10 CFR Part 430~~	~~90% Et~~
	~~> 300,000 Btu / h~~	~~DOE 10 CFR Part 431~~	~~89% Et~~
~~**Et = thermal efficiency**~~			

TABLE 506.2(5)
BOILER, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	Fuel	SIZE CATEGORY	TEST PROCEEDURE	MINIMUM EFFICIENCY
Steam	Gas	< 300,000 Btu / h	DOE 10 CFR Part 430	83% AFUE
		> 300,000 Btu / h and > 2.5 mBtu/h	DOE 10 CFR Part 431	81% Et
		>2.5 mBtu/h		82% Ec
	Oil	< 300,000 Btu / h	DOE 10 CFR Part 430	85% AFUE
		> 300,000 Btu / h and > 2.5 mBtu/h	DOE 10 CFR Part 431	83% Et
		>2.5 mBtu/h		84% Ec
Hot Water	Gas	< 300,000 Btu / h	DOE 10 CFR Part 430	97% AFUE
		> 300,000 Btu / h and > 2.5 mBtu/h	DOE 10 CFR Part 431	97% Et
		>2.5 mBtu/h		94% Ec
	Oil	< 300,000 Btu / h	DOE 10 CFR Part 430	90% AFUE
		> 300,000 Btu / h and > 2.5 mBtu/h	DOE 10 CFR Part 431	88% Et
		>2.5 mBtu/h		87% Ec

Et = Thermal efficiency.
Ec = Combustion efficiency (100% less flue losses).

TABLE 506.2(6)
CHILLERS - EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	REQUIRED EFFICIENCY- CHILLERS		OPTIONAL COMPLIANCE PATH - ~~REQUIRED~~ MINIMUM EFFICIENCY - CHILLERS WITH VSD	
		Full Load (KW /TON)	IPLV (KW /TON)	Full Load (KW /TON)	IPLV (KW /TON)
Air Cooled w/ Condenser	All	1.2	1.0	N/A	N/A
Air Cooled w/o Condenser	All	1.08	1.08	N/A	N/A
Water Cooled, Reciprocating	All	0.840	0.630	N/A	N/A
Water Cooled, Rotary Screw and Scroll	< 90 tons	0.780	0.600	N/A	N/A
	^{3}90 tons and < 150 tons	0.730	0.550	N/A	N/A
	^{3}150 tons and < 300 tons	0.610	0.510	N/A	N/A
	> 300 tons	0.600	0.490	N/A	N/A
Water Cooled, Centrifugal	< 150 tons	0.610	0.620	0.630	0.400
	^{3} 150 tons and < 300 tons	0.590	0.560	0.600	0.400
	300 tons and < 600 tons	0.570	0.510	0.580	0.400
	> 600 tons	0.550	0.510	0.550	0.400

a. Compliance with full load efficiency numbers and IPLV numbers are both required.
b. Only Chillers with Variable Speed Drives (VSD) may use the optional compliance path~~-~~for chiller efficiency.
N/A – No credit can be taken for this option

TABLE 506.2(7)
ABSORPTION CHILLERS - EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	~~REQUIRED~~ MINIMUM EFFICIENCY FULL LOAD COP (IPLV)
Air Cooled, Single Effect	0.60, allowed only in heat recovery applications
Water Cooled, Single Effect	0.70, allowed only in heat recovery applications
Double Effect - Direct Fired	1.0 (1.05)
Double Effect - Indirect Fired	1.20

506.3 Efficient Lighting System. Whole Building Lighting Power Density (Watts/sf) shall ~~meet~~ comply with the requirements of ~~Table~~ Section 506.3.1. ~~and automatic daylighting control requirements in Section 506.3.2.~~

506.3.1 Reduced Lighting Power Density - The total interior lighting power (watts) of the building shall be determined by using the Reduced Whole Building interior lighting power in Table 506.3.~~1~~ times ~~is the sum of all interior lighting powers for all areas in the building. The interior lighting power is~~ the floor area for the building types. ~~times the value from Table 506.3.~~

~~**TABLE 506.3**~~
~~**REDUCED INTERIOR LIGHTING POWER**~~

~~**BUILDING TYPE**~~[a]	~~**REDUCED WHOLE BUILDING**~~ (Watts/Ft^2)
~~AUTOMOTIVE FACILITY~~	~~0.79~~
~~CONVENTION CENTER~~	~~1.16~~
~~COURTHOUSE~~	~~1.08~~
~~DINING: BAR LOUNGE/LEISURE~~	~~1.19~~
~~DINING: CAFETERIA/FAST FOOD~~	~~1.34~~
~~DINING:FAMILY~~	~~1.50~~
~~DORMITORY~~	~~0.90~~
~~EXERCISE CENTER~~	~~0.92~~
~~FIRE STATIONS~~	~~0.74~~

BUILDING TYPE[a]	REDUCED WHOLE BUILDING (Watts/Ft^2)
GYMNASIUM	1.07
HEALTHCARE CLINIC	0.89
HOTEL	0.90
LIBRARY	1.00
MANUFACTURINBG FACILITY	1.24
MOTEL	0.90
MOTION PICTURE THEATER	1.18
MUSEUM	1.04
OFFICE	0.80
PERFORMING ARTS THEATER	1.46
POLICE STATIONS	0.89
POST OFFICE	0.98
RELIGIOUS BUILDINGS	1.18
RETAIL	1.30
RETAIL: SPECIALTY	1.40
RETAIL: SUPERMARKET	1.30
SCHOOL/UNIVERSITY	1.01
TOWN HALL	0.94
TRANSPORTATION	0.85
WAREHOUSE[b]	0.60
WORKSHOP	1.20

TABLE 506.3
REDUCED INTERIOR LIGHTING POWER

BUILDING AREA TYPE[a]	LPD (w/ft^2)
AUTOMTIVE FACILITY	0.82
CONVENTION CENTER	1.08
COURTHOUSE	1.05
DINING: BAR LOUNGE/LEISURE	0.99
DINING: CAFETERIA/FAST FOOD	0.90
DINING: FAMILY	0.89
DORMITORY	0.61
EXERCISE CENTER	0.88
FIRE STATION	0.71
GYMNASIUM	1.0
HEALTH CARE CLINIC	0.87
HOSPITAL	1.10
HOTEL	1.0
LIBRARY	1.18
MANUFACTURING FACILITY	1.11
HOTEL/MOTEL	0.88

BUILDING AREA TYPE[a]	LPD (w/ft^2)
MOTION PICTURE THEATER	0.83
MUSEUM	1.06
MULTIFAMILY	0.60
OFFICE[b]	0.90/0.85
PERFORMING ARTS THEATER	1.39
POLICE STATION	0.96
POST OFFICE	0.87
RELIGIOUS BUILDING	1.05
RETAIL[b]	1.4/1.3
SCHOOL/ UNIVERSITY	0.99
SPORTS ARENA	0.78
TOWN HALL	0.92
TRANSPORTATION	0.77
WAREHOUSE[c]	0.6
WORKSHOP	1.2

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m2.

a. In cases where both a general building area type and a more specific building area type are listed, the more specific building area type shall apply.

~~b. At least one half of the floor area shall be in daylight zone. Automatic daylighting controls shall be installed in daylighting zones and shall meet the requirements of Section 505.2.2.3, and building shall comply also with either 505.2.2.3.1 or 505.2.2.3.2. Automatic daylighting controls shall be installed in daylit zones and shall meet the requirements of Section 505.2.2.2.3.~~

b. First LPD value applies if no less than 30 percent of conditioned floor area is in daylight zones. Automatic daylighting controls shall be installed in daylighting zones and shall meet the requirements of Section 505.2.2.3. In all other cases, second LPD value applies.

c. No less than 70 percent of the floor area shall be in the daylighting zone. Automatic daylighting controls shall be installed in daylighting zones and shall meet the requirements of Section 505.2.2.3

~~**506.3.2 Automatic Daylighting Controls**. Automatic daylighting controls shall be installed in all daylight zones and shall meet the requirements of Section 505.2.2.~~

506.4 On-site Renewable energy ~~The building or surrounding property shall supply 3% or more of the building energy use associated with systems and equipment covered by this code through on-site renewable energy. On-site power generation using nonrenewable sources does not meet this requirement.~~

~~The code official shall be provided with an energy analysis as described in Section 507 that documents on-site renewable energy production is capable of providing at least 3% of the total estimated annual purchased energy for the building functions regulated by this code, or a calculation demonstrating that on-site renewable energy production has a nominal (maximum) rating of at least 1.75 BTUs or at least 0.50 watts per square foot of conditioned floor area.~~

Total minimum ratings of on-site renewable energy systems shall comply with one of the following:

1. Provide not less than 1.75 btu's, or not less than 0.50 watts, per square foot of conditioned floor area.

2. Provide 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 5;

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: Public Comment 6 of 6 on EC 147 EC 147 was developed by a collaborative effort between New Buildings Institute, the American Institute of Architects and the U.S. Department of Energy. The proposal was developed in response to many national goals of increasing the energy efficiency of new commercial construction by 30% and is designed to modify the Chapter 5 requirements of the building envelope, mechanical and lighting systems to meet this goal. During the passage of EC 147 at the ICC IECC Code Development Hearings in Baltimore, the proponents pledged to work with all interested and affected parties and solicit their comments and input in order to improve on the code change proposal passed by the IECC Committee. Numerous comments were received from parties representing industry and product groups, enforcement agencies and the building and design industry. The comments helped to provide a consensus agreement on several issues raised during testimony, clarified language, increased readability, and strengthened the proposal. The public comments submitted herein by NBI, AIA and DOE are the result of this process. A series of six public comments have been submitted on EC 147 that each focus the discussion on a particular portion of the original code change proposal. The proponents feel that this is necessary to ensure that the voting members of ICC will have the opportunity to hear testimony on each section before voting on the proposal as a whole. Additional information on EC 147 is available at http://newbuildings.org/iecc.htm.

Section 506 provides three optional compliance paths, in addition to the modeling options available both in Section 507 of the IECC and the Energy Cost Budget method of ASHRAE 90.1. The purpose of this section is to provide flexibility to achieve the approximately final 3% of energy savings in the proposal's larger goal to approach 30% in overall energy savings. The specifications included in the three approximately equal energy paths were based on preliminary modeling done by the New Buildings Institute.

These proposed modifications to Section 506 by the proponents of EC 147 accomplish three objectives: make the section easier to understand and implement, update the section to correspond with industry developments, and increase the flexibility within the lighting power density (LPD) option. In addition, the text has been modified to clearly direct code users to the three distinct package options and to remove redundant provisions.

The efficiency equipment tables in the HVAC performance option have substituted IEER values for IPLV values to reflect a new industry standard of measurement. The IEER values themselves were selected based on review of their application in ASHRAE Standard 189.1, and in consultation with other parties working on applying the IPLV value as a minimum specification, including the Consortium for Energy Efficiency (CEE). A new boiler table has been substituted in, and the stringency of its requirements has been reduced in most cases to reflect a careful review of product availability. Several footnotes and references in the HVAC tables have been clarified or corrected.

The whole building LPD option has been modified in close consultation with the International Association of Lighting Designers. The LPD values in the table largely reflect those in Standard 90.1 Addenda BY, and most of these values will likely be incorporated in 90.1-2010. Additional daylighting options were provided for the Retail and Warehouse building types to accomplish the equal energy goal. The general requirement for Automatic Daylighting Controls has been deleted to make this path readily accessible to all building types.

The renewable option has been simplified to provide three straightforward compliance approaches: electricity generation, thermal collection, and a calculation method for any type or combination of energy production. A path to include purchase of renewable power or credits was carefully considered, but not included based on concerns regarding verification and permanence of the transaction after the certificate of occupancy has been issued.

Public Comment 7:

Alex Boesenberg, representing National Electrical Manufacturers Association (NEMA) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

505.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications and minimum acceptable lighting equipment for exterior applications.

<u>**Exception:**</u> Lighting within dwelling units where ~~75 percent or more of the permanently installed interior light fixtures are fitted with high-efficacy lamps or a minimum of 75 percent of the~~ permanently installed lighting fixtures ~~shall contain only high efficacy lamps~~ <u>comply with Section 404.1</u>

~~**Exception**: Low-voltage lighting.~~

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: To harmonize the revised 505.1 with existing accepted proposals and submitted comments on revised clause 404.1, since in this cycle proposals have been made and accepted which will make section 505 apply to both indoor and outdoor instead of just outdoor as before. This also reduces the possibility of competing/ conflictory clauses which may result from existing accepted proposals being incorporated this cycle.

This comment on proposal encourages good lighting practice that is much more likely to result in occupant acceptance, and therefore will remain unchanged after the inspection. When consumers have no guidance about good lighting practices, and misapply compact fluorescent lamps (note: the only widely available screw-base lamp design which meets the IECC definition of "high-efficacy"), one of two things typically happens: (1) the CFLs are removed by the consumer and incandescent lights are installed; or (2) the CFLs are left on for very long periods of time to avoid having to deal with the long warm-up time during which light output is significantly reduced.

This comment on proposal has the additional advantage that the requirement to use lighting controls to operate all low efficacy (non-high-efficacy) lighting results in higher energy savings, since both dimmers and occupancy sensors save energy compared to operating the lights on a switch.

Public Comment 8:

Ron Burton, representing BOMA International requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

506.1 Requirements. Buildings shall comply with ~~at least~~ one of the following:

1~~. 506.2~~ Efficient HVAC Performance ~~Requirement~~ <u>in accordance with Section 506.2</u>
2. ~~506.3~~ Efficient Lighting System ~~Requirement~~ <u>in accordance with Section 506.3</u>
3. ~~506.4~~ On-Site Supply of Renewable Energy <u>in accordance with Section 506.4</u>

~~At the time of plan submittal, the code official shall be provided, by the permittee, documentation designating the intent to comply with Section 506.2, 506.3 or 506.4 in their entirety. Individual tenant spaces must comply with either 506.2 or 506.3 in their entirety unless documentation can be provided that demonstrates compliance with Section 506.4 for the entire building.~~

<u>**Exception:** Buildings that demonstrate compliance with the following:</u>

1. <u>An annual daily average incident solar radiation available to a flat plate collector oriented due south at an angle from horizontal equal to the latitude of the collector location less than 4.0 kW/M^2 per day, accounting for existing buildings, permanent infrastructure that is not part of the building project, topography, and trees, and</u>

2. Purchase of renewable electricity products complying with national consensus standards of at least 7 kWh/ft^2 (75 kWh/m^2) of conditioned space each year until the cumulative purchase totals 70 kWh/ft^2 (750 kWh/m^2) of conditioned space.

506.4 On-site ~~Supply of~~ Renewable energy. ~~The building or surrounding property shall supply 3% or more of the building energy use associated with systems and equipment covered by this code through on-site renewable energy. On-site power generation using nonrenewable sources does not meet this requirement.~~ Total minimum ratings of on-site renewable energy systems shall comply with one of the following:

1. Provide no less than 1.75 btus, or not less than 0.50 watts, per square foot of conditioned floor area; or
2. Provide 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 5.

~~The code official shall be provided with an energy analysis as described in Section 507 that documents on-site renewable energy production is capable of providing at least 3% of the total estimated annual purchased energy for the building functions regulated by this code, or a calculation demonstrating that on-site renewable energy production has a nominal (maximum) rating of at least 1.75 BTUs or at least 0.50 watts per square foot of conditioned floor area.~~

Exception: Buildings that demonstrate compliance with the following are not required to contain on-site renewable energy systems:

1. An annual daily average incident solar radiation available to a flat plate collector oriented due south at an angle from horizontal equal to the latitude of the collector location less than 4.0 kW/M^2 per day, accounting for existing buildings, permanent infrastructure that is not part of the building project, topography, and trees, and
2. Purchase of renewable electricity products complying with national consensus standards of at least 7 kWh/ft^2 (75 kWh/m^2) of conditioned space each year until the cumulative purchase totals 70 kWh/ft^2 (750 kWh/m^2) of conditioned space.

(Portions of code change not shown remain unchanged.)

Commenter's Reason: The requirement for providing 3% of the building energy use from On-Site Renewable Energy is unworkable in many instances. This is especially true in dense urban environments where the installation of various renewable system options is either totally impractical or where the area available for such systems is totally inadequate. This means that for the bulk of buildings constructed in these environments, this option is not available. That will result in a severe disadvantage for those buildings- including most office and other commercial structures in our most important urban centers.

This issue of how to include options for renewable energy systems has been debated and solutions have been developed in other venues, most notably in the development of ASHRAE/USGBC/IES Standard 189.1 which contains a similar scope to the IECC. While renewable energy is clearly encouraged in Standard 189.1, the practical applications and barriers to implementation were acknowledged and alternative paths were provided to address buildings with small footprints relative to their total square footage, buildings in areas where sunlight, wind and other renewable energy sources are severely limited, and other buildings where installation and use of an on-site renewable system was either not feasible or not desired. Options to trade off requirements for on-site renewable systems as well as the addition of provisions to allow the purchase of renewable source energy for the building on the open market in compliance with national consensus standards such as the Green-e Energy National Standard for Renewable Electricity Products as a viable alternative to on-site systems were also added to Standard 189.1. The proposed modification presented here includes provisions similar to those contained in Standard 189.1. EC147 can and should be revised to include such alternatives.

Public Comment 9

Ron Burton, representing BOMA International requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Delete Section 506 in its entirety.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: Proposed addition of the Additional Efficiency Package Options, Section 506, is totally inappropriate for inclusion in the IECC. This proposed section would mandate "above code" provisions that if enacted by the ICC voting members would negate the concept of "minimum" code requirements that has been the cornerstone of the development of ICC codes and the legacy code documents that preceded them. Instead of proposing a straight-forward set of increases in the requirements for HVAC equipment and lighting efficiencies far exceeding any reasonable cost-effectiveness metric and adding what for many building projects will be a mandatory requirement to install renewable energy systems, the proponents are instead attempting to slip this additional section cleverly titled Additional Efficiency Package Options into the IECC. It's as if these additional requirements were somehow "optional" for the design team and the building owner who must foot the rather large bill that will come due once these provisions are included.

Furthermore, the proponents have made absolutely no attempt to justify these additional requirements using any cost/benefit metric – an exercise it should be noted that they somehow managed to accomplish for the ASHRAE SSPC 90.1 development committee in their recent consideration of new ventilation recovery system equipment requirements. It appears therefore this kind of rudimentary economic analysis is in fact possible, but to date no offer to complete this essential task has been forthcoming from the proponents. BOMA International and other organizations representing materially affected parties have repeatedly asked DOE, NBI and AIA to provide at least some idea of what EC147 will cost to implement and what energy savings might accrue over time so that we and the ICC voting members can make a value judgment about whether this proposal is reasonable and justified. Our entreaties have continually been met either with an open rebuff as if the idea was a swarm of gnats to be swatted away, or by saying in effect that this is required in order to meet the "30% solution" and therefore it is justified on that basis alone. It should be pointed out that the "30% solution" is itself a totally arbitrary concept, having no analytical basis whatsoever. 30% and 50% energy efficiency targets were first suggested as stepping stones on the path to zero net energy buildings by a past President of ASHRAE who had no intention of suggesting these targets be mandated in minimum code documents. Nonetheless, these targets gained traction in the political realm and have since become goals for federal agencies and in congressional legislation – ICC voting members should not let them be used as a blunt instrument to gain approval of proposals that cannot otherwise be justified.

BOMA International respectfully submits that it is absolutely essential that such a far-reaching set of proposed requirements be accompanied by some economic impact analysis, however rudimentary. It is the code development process where these kinds of proposals have traditionally had to bring actual justification to the table for open debate and consideration. If Section 506 is allowed to be included in an approval of EC147 for inclusion in the 2012 IECC without addressing the question of economic justification, we will have abandoned ICC core principles and opened the door to the approval of virtually any future changes in the minimum code requirements based solely on a proponent's vision of what is a "good idea".

Public Comment 10:

Craig Conner, Building Quality, representing himself requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.2.1.1 Roof solar reflectance and thermal emittance. ~~Roofs in climate zones 1 to 3 not over ventilated attics or not over cooled spaces shall have a minimum three-year aged - solar reflective index (SRI) of 64 when determined in accordance with the SRI method in ASTM E1980 using a convection coefficient of (12W/m^2·K) or a minimum three-year-aged solar reflectance of 0.55 when tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 and a minimum three-year-aged thermal emittance of at least 0.75 when testing in accordance with ASTM C1371 or ASTM E408.~~

~~**Exceptions:**~~

1. ~~Ballasted roofs with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or 23 lbs/ft2 pavers (117 kg/m2).~~
2. ~~Roofs, where a minimum of 75% of the roof area is shaded during the peak sun angle on June 21st by permanent features of the building and/or is covered by off-set photovoltaic arrays, building-integrated photovoltaic arrays, or solar water collectors.~~
3. ~~Metal building roofs or asphaltic membranes in climate zone 3.~~

Low-sloped roofs, with a slope less than 2 units vertical in12 horizontal, directly above cooled *conditioned spaces* in climate zones 1, 2, and 3 shall comply with one or more of the options in Table 502.2.1.1.

Exception: The following roofs and portions of roofs are exempt from the requirements in Table 502.2.1.1:

1. Portions of roofs that include or are covered by:
   - 1.1. Photovoltaic systems or components.
   - 1.2. Solar air or water heating systems or components.
   - 1.3 Roof gardens or landscaped roofs.
   - 1.4. Above-roof decks or walkways.
   - 1.5. Skylights.
   - 1.6. HVAC systems, components, and other opaque objects mounted above the roof.
2. Portions of roofs shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings
3. Portions of roofs that are ballasted with a minimum stone ballast of 17 lbs/ft^2 (74 kg/m^2) or 23 lbs/ft^2 pavers (117 kg/m^2)
4. Roofs where a minimum of 75 percent of the roof area meets a minimum of one of the exceptions above.

Table 502.2.1.1 Minimum Roof Reflectance and Emittance Options[a]

Three-year aged solar reflectance[b] of 0.55 and three-year aged thermal emittance[c] of 0.75
Initial solar reflectance[b] of 0.70 and initial thermal emittance[c] of 0.75
Three-year-aged solar reflectance index[d] of 64
Initial solar reflectance index[d] of 82

a. The use of area-weighted averages to meet these requirements shall be permitted. Materials lacking initial tested values for either *solar reflectance* or *thermal emittance*, shall be assigned both an initial *solar reflectance* of 0.10 and an initial *thermal emittance* of 0.90. Materials lacking three-year aged tested values for either *solar reflectance* or *thermal emittance* shall be assigned both a three-year aged *solar reflectance* of 0.10 and a three-year aged *thermal emittance* of 0.90.
b. Solar reflectance tested in accordance with ASTM C1549, ASTM E903, or ASTM E1918.
c. Thermal emittance tested in accordance with ASTM C1371 or ASTM E408.
d. Solar reflectance index (SRI) shall be determined in accordance with ASTM E1980 using a convection coefficient of 2.1 BTU/h-ft^2-F (12W/m^2.K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance. Calculation of initial SRI shall be based on initial tested values of solar reflectance and thermal emittance.

ASTM, International (ASTM)

E1980(2001) Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low Sloped Opaque Surfaces

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: This public comment is a backup to the preferred NBI/AIA/DOE comment. It is identical to the preferred comment except for the table notes "b", "c", and "d"; and lack of reference to the CRRC-1 Standard.
The proposed change requires a "cool roof" in southern climates. So what is a Cool Roof?

> *"A cool roof reflects and emits the sun's heat back to the sky instead of transferring it to the building below. "Coolness" is measured by two properties, solar reflectance and thermal emittance. Both properties are measured from 0 to 1 and the higher the value, the "cooler" the roof."*
> *from http://www.coolroofs.org/*

The proponents of EC147 consulted with industry experts, designers and advocates of cool roofs, and determined that the cool roof text in the original EC147 was difficult to understand. After iterations with a number of interested parties, this text was developed to be a clearer statement of both the requirement for the use of cool roofs and a practical set of exceptions to the requirement.

Cool roofs save energy by lowering cooling loads. The energy savings are greatest in areas with the greatest cooling loads; hence the change applies to the southernmost climate zones 1 through 3.

This requirement applies to low sloped roofs which are common in commercial construction. The variety of roof coverings applicable to low slope roofs has been greatly expanded in the last decade. Concurrently, methods for testing and comparing the "coolness" of the roofs have been perfected. It turns out that the eye is not a good judge of what is cool, so a tested value is needed to make this an enforceable code change. This requirement is consistent with work done by the Cool Roof Rating Council and the EPA Energy Star Program to promote cool roofs.

Two versions of this change were submitted. The only difference between the versions is in the use of the CRRC-1 Standard. If the Cool Roof Rating Council standard CRRC-1 Standard has received ANSI approval and meets ICC guidelines as a referenced standard, this is the preferred option. The CRRC-1 Standard best defines the testing process for rating cool roofs and incorporates the lessons learned in over a decade of rating roofs. If not available, an alternative presents rating requirements that incorporate the test standards in CRRC-1 standard.

The terms used in these changes were selected to be consistent with the terms in the I-codes. "*Low sloped roofs"* are already in code (IBC 1504.4, 1504.6, 1504.7, 1507.12.3), as well as the terms "*roof gardens*" and "*landscape roofs"* (IBC 1507.16, 1607.11.2.2, 1607.11.3).

There are a number of exceptions for roofs covered by active photovoltaics (PV), solar thermal water or air heating, gardens, decks, and the elements of HVAC systems. Roofs that are shaded are not required to comply. Ballasted roofs (exception #3) have been shown to be another way to save energy and are an important alternative to parts of the roofing industry.
http://www.spri.org/pdf/Thermal%20Performance%20of%20Ballast%20Study%20Final%20Report%2005%2008%20.pdf

There are three options for demonstrating that a material will produce a cool roof. An for 3-year aged requirements are less stringent, as most cool roofs lose some reflectivity over time. A more stringent requirement is set for the initial reflectivity for new materials. Allow testing for initial characteristics allows new products into the market. An alternative SRI combines both solar reflectance and thermal remittance (re-radiating the heat back into the sky).

The summer solstice is longest day of the year and is June 21st in the northern hemisphere. If the code was applied in the southern hemisphere the summer solstice would be December 21st.

There is an existing body of tested materials, such as that in Cool Roof Rating Council database. Those tests would be valid with either version of the code change.

There are a number of secondary benefits of cools roofs, beyond energy savings. Limiting the heat gain on the roof lowers the temperature extremes that roofing products experience and helps increase roof lifetime. Cool roofs help mitigate the "urban heat island effect" that makes cities warmer. Cool roofs lower peak cooling loads and cooling equipment sizes.

Further information on cool roofs, including energy savings and costs can be found in "*Potential Benefits of Cool Roofs on Commercial Buildings: Conserving Energy, Saving Money, and Reducing Emission of Greenhouse Gases and Air Pollutants"*
http://www.springerlink.com/content/9r48k34558240825.

Public Comment 11:

Mike Ennis, representing Single Ply Roofing Industry, Inc. (SPRI) Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**502.2.1.1 Roof solar reflectance and thermal emittance.** Roofs in climate zones 1 to 3 not over ventilated attics or not over cooled spaces shall have a minimum three-year aged - solar reflective index (SRI) of 64 when determined in accordance with the SRI method in ASTM E1980 using a convection coefficient of (12W/m2.K) or a minimum threeyear- aged solar reflectance of 0.55 when tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 and a minimum three-year-aged thermal emittance of at least 0.75 when testing in accordance with ASTM C1371 or ASTM E408.~~

~~**Exceptions:**~~

1. ~~Ballasted roofs with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or 23 lbs/ft2 pavers (117 kg/m2).~~
2. ~~Roofs, where a minimum of 75% of the roof area is shaded during the peak sun angle on June 21st by permanent features of the building and/or is covered by off-set photovoltaic arrays, building-integrated photovoltaic arrays, or solar water collectors.~~
3. ~~Metal building roofs or asphaltic membranes in climate zone 3.~~

502.2.1.1 Roof coverings. Buildings located in climate zones 1 through 3 which have roofs with a slope of 2 units vertical in 12 units horizontal or less, and where the roofs are located over conditioned spaces which are cooled, a minimum of 75 percent of the roof surfaces shall be in compliance with Section 502.2.1.2 or 502.2.1.3. Roofs surfaces not in compliance with Sections 502.2.1.2 or 502.2.1.3 shall comply with Section 502.2.1.4.

Exceptions:

1. Ballasted roofs with a minimum stone ballast of 17 lbs/ft^2 (74 kg/m^2) or a minimum paver ballast of 23 lbs/ft^2 (117 kg/m^2).
2. Roofs where a minimum of 75 percent of the roof if shaded by permanent shading devices or features of the building during the peak sun angle on the summer solstice.
3. Roofs where a minimum of 75 percent of the roof is covered by off-set photovoltaic arrays, building integrated photovoltaics, or solar or hot-air or water collectors.
4. Extensive or intensive vegetated roofs where a minimum of 75 percent of the roof is covered by a minimum of 15 lbs/ft^2 of growth media or a minimum 9 lbs/ft^2 tray system.
5. Roofs located over:
   5.1. Ventilated attics
   5.2. Spaces which are not conditioned spaces that are cooled
   5.3. Semi-heated spaces

502.2.1.2 Roof solar reflectance and thermal emittance Roof products shall be tested for a minimum three-year aged solar reflectance of 0.55 and thermal emittance 0.75 in accordance with CRRC-1 Standard. The values for solar reflectance and thermal emittance shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be labeled and certified by the manufacturer demonstrating compliance.

502.2.1.3 Solar reflectance index. Roof products shall be permitted to use a Solar Reflectance Index (SRI) where the calculated value shall not be less than 64 in order to demonstrate compliance. The SRI value shall be determined using ASTM E1980 with a convection coefficient of 2.1 Btu/h-ft^2 (12 W/m^2*k) based on three-year aged roof samples tested in accordance with CRRC-1 Standard. The values for solar reflectance and thermal emittance shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be labeled and certified by the manufacturer demonstrating compliance.

502.2.1.4 Other roof products. Roof products not in compliance with Sections 502.2.1.2 or 502.2.1.3 shall use Equation 5-X to demonstrate compliance.

U_{fcom} = U-factor – 0.010 (**Equation 5-X)**

Where:
U_{fcom} = Maximum assembly U-factor required to demonstrate compliance.
U-factor = Maximum Ceiling U-factor value from Table 502.1.2.

VEGETATIVE ROOF:

Extensive vegetative roof. A low profile roof with a growing medium less than 8 inches in depth, composed of plants that can thrive in a rooftop environment with limited water, shallow roots and sparse nutrients.

Intensive vegetative roof. A high profile roof with a growing medium 8 inches or more in depth that can support a wide range of vegetables, shrubs and small trees.

ASTM

~~C1371-04~~	~~Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers~~
~~C1549~~	~~Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer~~
~~E408-71 (02)~~	~~Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques~~
~~E1918-97~~	~~Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-Sloped Surfaces in the Field~~

Cool Roof Rating Council (CRRC)

ANSI/CRRC-1 Standard (2010) Cool Roof Rating Council CRRC-1 Standard

(Portions of the proposal not shown remain unchanged.)

Commenter's Reason: We propose to further modify code change EC147-09/10 with the above proposal.
The benefits of the proposal are:

- Format that is logical in organization and compatible with ICC codes
- Focus on correct terminology
- Use of the new CRRC-1 Standard
- Expansive text to address vague inferences
- Requires labeling of roof products

Format:
The format of this proposal completely revises the original proposal. The charging statement focuses only on the basic components of the requirements, the exceptions are expressed immediately below the charging section paragraph, and the requirements for the two types of compliance are self contained.

Terminology:
Terminology has been changed to reflect what is currently used in the market and with other standards development organizations. Solar absorptance has been changed to solar reflectance, cooled spaces has been changed for a format consistent with the IECC by referring to "conditioned spaces" which are cooled. Additional terminology is proposed to address the definitions of vegetated roofs. The source for these definitions, and the text discussing vegetated roofs, was the International Green Construction Code – Version 1.0. This additional language is proposed in order to overcome the potential issues that can arise when only generically referencing landscaped or vegetated roofs.

Exceptions:
The exceptions have been both modified and enhanced. Additional text was added to the originally proposed exceptions for clarity. In this case exceptions "a", "b", and "c" contain language which clearly identifies the intent of the exception. Additional exemptions have been included to address roofs that are shaded by solar devices, to recognize vegetated roofs, and to recognize that through a first cost benefit assessment that specific roof products are not cost effective.

CRRC-1 Standard:
The introduction of the CRRC-1 Standard is recommended as the document contains far more information than does the reference to the ASTM standards. It was developed by the Cool Roof Rating Council, a not-for-profit organization. The ASTM standards are a good source, but because the verification of a roofing product requires more than just the test method we are recommending the use of the standard instead.
The Standard

- Contains definitions which focus on roof product testing,
- Identifies what constitutes a testing laboratory,
- Contains available tests methods for roof products that cannot be tested under the ASTM standards due to their configuration or make-up,
- Identifies how samples are to be selected,
- Requires 9 test samples for testing, and allows only the average of those tested samples to be considered for the certified report,
- Identified what constitutes aged testing of samples, and what regions aged testing is to take place, and
- Addresses the minimum content of a roof product report of results.

The document was produced under the ANSI process, and does not include the proprietary requirements that are used by the Cool Roof Rating Council for their roof product program.

Expansive text:
We have expended some text in order to be more complete, and therefore more clear on intent. Much of this work is in the exceptions where solar devices and vegetated roofs are concerned. Further, the provisions for compliance are self contained where they describe the minimum requirements, type of roof testing, the independence of the testing agency, and the requirements for labeling.
Labeling:
The original proposal did not require labeling of products. This proposal recommends language which will overcome this issue by requiring labeling and certification by the manufacturer with use of test results from an independent testing agency.
Additional Insulation:
For those buildings where a roof product is chosen which is not in compliance with an alternative that is being proposed to address energy, additional insulation is required to demonstrate compliance. The values chosen are U-factors as this will allow the designer or homeowner the opportunity to choose from many options. The U-factor decrease was derived from the Oak Ridge National Laboratory Cool Roof Calculator. This calculator is based on data obtained during a three-year study to evaluate the impact of roof membrane reflectivity on energy use. As part of this work a model was developed that determines the amount of additional insulation required for a black membrane roof to provide equivalent energy performance to a highly reflective roof membrane. The value provided represents a single correction factor for Climate Zones 1, 2 and 3. This approach is consistent with ASHRAE standard 90.1 2004 and 2007 editions where a deduction in insulation was employed for reflective roofs.

Analysis: The standard CRRC-1 Standard, was not reviewed or considered by the Energy Code Development Committee prior to the Baltimore hearings and was not considered by the hearing attendees at the time of the code development hearings. Section 3.6.3.1 of Council Policy # 28, *Code Development,* requires that new standards be introduced in the original code change proposal, therefore, the introduction of a new standard via a public comment is not in accordance with the process required by CP # 28 for adding new standards to the code.

Public Comment 12:

Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. These commercial buildings shall meet either requirements of ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*, or the requirements contained in this chapter.

501.2 Application. The *commercial building* project shall comply with the requirements in Sections 502 (Building envelope requirements), 503 (Building mechanical systems), 504 (Service water heating), 505 (Electrical power and lighting systems) in its entirety~~, and one of the additional options as presented in Section 506~~. As an alternative the *commercial building* project shall ~~exceed by at least 25%~~ comply with the requirements of ASHRAE/IESNA Standard 90.1, Energy Standard for Buildings Except for Low Rise Residential Buildings~~, Appendix G~~ in its entirety.

Exception~~s~~:

~~1.~~ Buildings conforming to Section 506 ~~507~~, provided Sections 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied. ~~Building energy cost shall be equal to or less than 75% of the standard reference design building.~~

~~2. Additions, alterations and repairs shall comply with the applicable requirements in Sections 502, 503, 504, and 505 only or with ASHRAE/IESNA 90.1.~~

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: The prescriptive path of ASHRAE/IES 90.1-2010 should be allowed as alternative to the IECC sections 502, 503, 504, and 505, without modification. This language is the same as the language in the IECC 2009.

ASHRAE/IESNA Standard 90.1, and its predecessor Standard 90-75, has been a mainstay of the energy conservation standards and codes for buildings used in the United States for over 30 years. In fact Standard 90-75, promulgated and issued by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) in 1975 was used as the basis for the first edition of the Model Energy Code (MEC) in 1977. The MEC was used for the beginning draft for development of the International Energy Conservation Code (IECC). So, since the first MEC in 1977 to the 2009 IECC the code user has always had some edition of Standard 90.1 influencing design or as a compliance path for commercial buildings. There is no technical reason given in EC147 to justify the removal of Standard 90.1 as one of the compliance options after more than 30 years of influence on energy conservation design of buildings.

Public Comment 13:

Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.4.5 Outdoor air intakes and exhaust openings. Stair and elevator shaft vents and other outdoor air intakes and exhaust openings shall be provided with dampers in accordance with Sections 502.4.5.1 and 502.4.5.2.

~~Dampers shall be installed with controls so that they are capable of automatically opening upon:~~
~~1. The activation of any fire alarm initiating device of the building's fire alarm system;~~
~~2. The interruption of power to the damper.~~

502.4.5.1 Stair and shaft vents. Stair and shaft vents shall be provided with Class I~~A~~ motorized dampers with a maximum leakage rate of ~~3~~ 4 cfm per square foot (~~5.1~~ 6.8 L/s · C m^2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.

Stair and shaft vent dampers shall be installed with controls so that they are capable of automatically opening upon:

1. The activation of any fire alarm initiating device of the building's fire alarm system;
2. The interruption of power to the damper.

502.4.5 Outdoor air intakes and exhausts. O*utdoor air* supply and exhaust openings shall be provided with Class I~~A~~ motorized dampers with maximum leakage rate of ~~3~~ 4 cfm per square foot (~~5.1~~ 6.8 L/s · C m^2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.

> **Exception:** Gravity (nonmotorized) dampers having a maximum leakage rate of 20 cfm per square foot (34 L/s · C m^2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D are permitted to be used in buildings for exhaust and relief dampers in buildings less than three stories in height above grade and for ventilation air intakes and exhaust and relief dampers in buildings of any height located in climate zones 1, 2, and 3 or where the outdoor air intake or exhaust capacity does not exceed 300 cfm. Gravity (nonmotorized) dampers for ventilation air intakes must be protected from direct exposure to wind. Dampers smaller than 24 in. in either dimension shall be permitted to have a leakage of 40 cfm/ft2 (68 L/s · C m^2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.

503.2.4.4 Shutoff damper controls. Both outdoor air supply and exhaust ~~ducts~~ systems shall be equipped with motorized dampers that will automatically shut when the systems or spaces served are not in use.

Exceptions:

1. Gravity dampers shall be permitted for exhaust and relief dampers in buildings less than three stories in height above grade.
2. Gravity dampers shall be permitted for buildings of any height located in Climate Zones 1, 2 and 3.
3. Gravity dampers shall be permitted for outside air intake or exhaust airflows of 300 cfm (0.14 m3/s) or less.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: To better align with 90.1 Addendum CB, the maximum allowable leakage rate should remain at 4, not 3. While working on addendum CB, the 90.1 damper working group considered a potential change from class 1 to class 1A dampers (from 4 to 3 cfm/ft2). Class 1 was left in place for the following reasons:

1. The cfm/ft^2 metric favors rectangular dampers over round dampers, because the area of the rectangular damper is greater than a round damper selected for the same duty. This equivalent duty round damper will actually leak less cfm, but will look worse in the cfm/ft^2 metric. Round dampers naturally feature better actual leak tightness with fewer joints in the air path and this should be intuitively obvious. The difference is more pronounced at the higher pressure classes. Round dampers also can be designed to accommodate accurate flow measurement with relatively simple components, due to more uniform flow distribution. Without accurate outdoor air flow measurement, it is difficult to comply with mechanical ventilation codes without wasting energy. A suitable, tested and reported metric in lieu of cfm/ft2 was not readily available.
2. Several practitioners in the 90.1 mechanical subcommittee raised doubts on the economic justification for the added cost of class IA over class I across the board for 3+ story buildings as proposed in EC147. The damper working group did not find cost justification in going from class 2 (10 cfm/ft^2) down to class I in climate zones 1,2,3 low rise buildings and climate zones 1 and 2 in any height building. Especially in these situations, requiring an additional expense for class IA would be even less cost effective.
3. While there are several dampers available in class 1A, not all applications will have a class 1A option.
4. More savings can be achieved through climate and building height differentiations and requiring motorized over gravity backdraft dampers in more situations.
5. Dampers smaller than 24" in. either direction are not readily available with leakage rates of Class 1A, or even Class 1 and 2. Therefore, we propose an exception for these at class 3 (40 cfm/ft^2).

Furthermore, this doesn't discuss leakage through the components of the mechanical equipment which is under 503, not 502. Any change in 502 envelope should be coordinated with section 503, shutoff dampers. Section 503 shutoff dampers has no complementary changes proposed by EC147. This will cause confusion as to code compliance.

The controls requirements for automatic opening on event of fire or loss of power to the damper should refer only to stair and shaft vents, not outdoor air and exhaust openings. In addition, there are currently no controls proposed for automatically shutting outdoor air and exhaust openings when the spaces are not in use. This requirement would bring 502 into agreement with 503.

A comparison table of 90.1 and ICC current and (EC147 proposed) is provided for your reference.

Maximum Damper Leakage Comparison

(cfm per ft2 at 1.0 in. w.g.)

		Ventilation Air Intake				Exhaust/Relief			
	Climate Zone	non-motorized[1]		motorized		non-motorized[1]		motorized	
		90.1	ICC	90.1	ICC	90.1	ICC	90.1	ICC
1,2	less than 3, <=300 cfm	20	20			20	20		
	any height	20	not allowed	4	4(3)	20	not allowed	4	4(3)
3	less than 3, <=300 cfm	20	20			20	20		
	any height	20	not allowed	10	4(3)	20	not allowed	10	4(3)
4,5b,5c									
	less than 3 stories	not allowed	20 if <=300 cfm	10	4(3)	20	20 if <=300 cfm	10	4(3)
	3 or more stories	not allowed	not allowed	10	4(3)	not allowed	not allowed	10	4(3)
5a,6,7,8									
	less than 3 stories	not allowed	20 if <=300 cfm	4	4(3)	20	20 if <=300 cfm	4	4(3)
	3 or more stories	not allowed	not allowed	4	4(3)	not allowed	not allowed	4	4(3)

1 Dampers smaller than 24 in. in either dimension may have leakage of 40 cfm/ft2.

Public Comment 14:

Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

503.2.6 Energy recovery ventilation systems. Each fan system shall have an energy recovery system when the system's supply airflow rate exceeds the value listed in Table 503.2.6 based on the climate zone and percentage of *outdoor* airflow rate at design conditions. Required energy recovery systems shall have ~~the capability to provide a change in the enthalpy of the *outdoor air* supply equal to~~ at least 50% ~~of the difference between the *outdoor air* and return air enthalpies~~ energy recovery effectiveness. Fifty percent energy recovery effectiveness shall mean a change in the enthalpy of the *outdoor air* supply equal to 50 percent of the difference between the *outdoor air* and return air enthalpies at design conditions. Provision shall be made to bypass or control the energy recovery system to permit air economizer operation as required by Section 503.4

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 at least one of the following features:
   - 2.1. Variable-air-volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of design values.
   - 2.2 Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (1.1°C) above room setpoint, cooled to no cooler than 3°F (1.7°C) below room setpoint, no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Systems serving spaces that are not cooled and are heated to less than 60°F (15.5°C).
4. Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.
5. Heating energy recovery in climate zones 1 and 2.
6. Cooling energy recovery in climate zones 3c, 4c, 5b, 5c, 6b, 7, and 8.
7. Systems requiring dehumidification that employ ~~series-style~~ energy recovery ~~coils wrapped around~~ 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 503.2.6

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: These proposed changes reflect the final version of Addendum E to 90.1. The changes were based on modifications to the cost justification analysis and to resolve public review comments and objections.

Public Comment 15:

Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

503.2.10.1 Allowable fan floor horsepower. Each HVAC system at fan system design conditions shall not exceed the allowable *fan system motor nameplate hp* (Option 1) or *fan system bhp* (Option 2) as shown in Table 503.2.10.1(1). This includes supply fans, return/relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single zone variable-air-volume systems shall comply with the constant volume fan power limitation.

Exceptions:

1. Hospital, vivarium and laboratory systems that utilize flow control devices on exhaust and/or return to maintain space pressure relationships necessary for occupant health and safety or environmental control shall be permitted to use variable volume fan power limitation.
2. Individual exhaust fans with motor nameplate horsepower of 1 hp or less.
3. ~~Fans exhausting air from fume hoods. (Note: If this exception is taken, no related exhaust side credits shall be taken from Table 503.2.10.1(2) and the Fume Exhaust Exception Deduction must be taken from Table 503.2.10.1(2).~~

TABLE 503.2.10.1(1)
FAN POWER LIMITATION
(No change to Table)

where:

CFMS = The maximum design supply airflow rate to conditioned spaces served by the system in cubic feet per minute.
Hp = The maximum combined motor nameplate horsepower.
Bhp = The maximum combined fan brake horsepower.

A = Sum of [*PD* _ CFMD / 4131].

where:

PD = Each applicable pressure drop adjustment from Table 503.2.10.1(2) in. w.c.
CFMD – The design airflow through each applicable device from Table 503.2.10.1(2) in cubic feet per minute.

TABLE 503.2.10.1(2)
FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT

Device	Adjustment
Credits	
Fully ducted return and/or exhaust air systems	0.5 in w.c. (2.15 in w.c. for laboratory and vivarium systems)
Return and/or exhaust air flow control devices	0.5 in. w.c.
Exhaust filters, scrubbers, or other exhaust treatment.	The pressure drop of device calculated at fan system design condition
Particulate filtration credit: MERV 9 thru 12	0.5 in. w.c.
Particulate filtration credit: MERV 13 thru 15	0.9 in. w.c.
Particulate filtration credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2x clean filter pressure drop at fan system design condition.
Carbon and other gas-phase air cleaners	Clean filter pressure drop at fan system design condition.
~~Heat Recovery Device,~~ Biosafety cabinet	Pressure drop of device at fan system design condition.
Energy recovery device, other than coil runaround loop	(2.2 x Energy Recovery Effectiveness) – 0.5 in w.c. for each airstream
Coil runaround loop	0.6 in. w.c. for each airstream
Evaporative humidifier/cooler in series with another cooling coil	Pressure drop of device at fan system design conditions
Sound attenuation section	0.15 in. w.c.
Exhaust system serving fume hoods	0.35 in. w.c.
Laboratory and Vivarium Exhaust Systems in High Rise Buildings	0.25 in. w.c./100 ft of vertical duct exceeding 75 ft.
~~Deductions~~	
~~Fume hood exhaust exception (required if section 503.2.10.1, Exception 3, is taken)~~	~~-1.0 in w.c.~~

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: These modifications will harmonize ICC with ASHRAE/IESNA 90.1 Addenda P, CA and DJ. These changes were made to accommodate building types that were commonly taking exception to vast portions of the 90.1 Standard.

Public Comment 16:

Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

505.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications and minimum acceptable lighting equipment for exterior applications.

Lighting within dwelling units where 75 percent or more of the permanently installed interior light fixtures are fitted with high-efficacy lamps or a minimum of 75 percent of the permanently installed lighting fixtures shall contain only high efficacy lamps.

Exception: Low voltage lighting.

Exception: Dwelling units within commercial buildings shall not be required to comply with Sections 505.2 through 505.5 provided that they comply with Section 404.1

505.2.1 Manual Lighting Controls. All buildings must include manual lighting controls that meet the requirements of 505.2.1.1 and 505.2.1.2

505.2.1 505.2.1.1 Interior lighting controls. Each area enclosed by walls or floor-to-ceiling partitions shall have at least one manual control for the lighting serving that area. The required controls shall be located within the area served by the controls or be a remote switch that identifies the lights served and indicates their status.

Exceptions:

1. Areas designated as security or emergency areas that must be continuously lighted.
2. Lighting in stairways or corridors that are elements of the means of egress.

505.2.2 Additional controls. Each area that is required to have a manual control shall have additional controls that meet the requirements of Sections 505.2.2.1, and 505.2.2.2.

505.2.2.1 505.2.1.2 Light reduction controls. Each area that is required to have a manual control shall also allow the occupant to reduce the connected lighting load in a reasonably uniform illumination pattern by at least 50 percent. Lighting reduction shall be achieved by one of the following or other *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; or
4. Switching each luminaire or each lamp.

Exceptions: The following are exempt from light reduction controls:

1. Areas that have only one luminaire with rated power less than 100W.
2. Areas that are controlled by an occupant-sensing device.
3. Corridors, storerooms, restrooms or public lobbies, electrical/mechanical rooms, and stairway.
4. *Sleeping unit* (see Section 505.2.3).
5. Spaces that are allowed less than 0.6 watts per square foot (6.5 W/m^2).
6. Daylight zones complying with Section 505.2.2.3.2.

505.2.2 Additional Lighting Controls. Each area that is required to have a manual control shall also have controls that meet the requirements of Sections 505.2.2.1, 505.2.2.2 and 505.2.2.3.

505.2.2.1 Automatic Time Switch Control Devices. Automatic Time Switch controls shall be installed to control lighting in all areas of the building.

Exceptions:

1. Emergency egress lighting does not need to be controlled by automatic time switch.
2. Lighting in spaces controlled by occupancy sensors does not need to be controlled by automatic time switch controls

The automatic time switch control device shall include an override switching device that complies with the following:

1. The override switch shall be in a readily accessible location
2. The override switch shall be located where the lights controlled by the switch are visible; or the switch shall provide a mechanism which announces the area controlled by the switch;
3. The override switch shall permit manual operation.
4. The override switch, when initiated, shall permit the controlled lighting to remain on for a maximum of 2 hours; and
5. Any individual override switch shall control the lighting for a maximum area of 5,000 square feet (465 m^2).

Exceptions: Within malls, arcades, auditoriums, single tenant retail spaces, industrial facilities and arenas:

1. The time limit shall be permitted to exceed 2 hours provided the override switch is a captive key device; and
2. The area controlled by the override switch is permitted to exceed 5,000 square feet (465 m^2), but shall not exceed 20,000 square feet (1860 m^2).

505.2.2.2 Daylight Zone Control. Daylight zones shall be provided with individual controls which control the lights independent of general area lighting. Contiguous daylight zones adjacent to vertical fenestration are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e. north, east, south, west). Daylight zones under skylights more than 15 feet from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration.

Exception: Daylight spaces enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.

505.2.2.3 Automatic lighting controls. All commercial buildings shall be equipped with automatic control devices to shut off lighting in compliance with one of the following automatic control technologies:

1. Section 505.2.2.3.1 Occupancy Sensors
2. Section 505.2.2.3.2 Time Clock Controls
3. Section 505.2.2.3.3 Automatic Daylighting

Any Lighting control required in Sections 505.2.2.3.1, 505.2.2.2.3.2 and 505.2.2.3.3 shall either be manual on or shall be controlled to automatically turn the lighting on to not more than 50% power unless otherwise provided in Sections 505.2.2.3.1, 505.2.3.2 or 505.2.2.3.3.

Exception: Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants.

505.2.2.3.1 505.2.2.2 Occupancy sensors. Occupancy sensors shall be installed in all classrooms, conference/meeting rooms, employee lunch and break rooms, private offices, restrooms, storage rooms and janitorial closets, and other spaces 300 sf square feet (28 m^2) or less enclosed by floor- to -ceiling height partitions. except spaces with multi-scene control.

Exception: Spaces with multi-scene lighting control shall not be required to turn lights off after occupants leave the space.

Required occupancy sensors shall either be manual on or shall be controlled to automatically turn the lighting on to not more than 50 percent power, except in the following spaces where full automatic-on is allowed:

1. Public corridors and stairways,
2. Restrooms,
3. Primary building entrance areas and lobbies, and
4. Areas where manual-on operation would endanger the safety or security of the room or building occupants.

505.2.2.3.2 Time Clock Controls In areas not controlled by occupancy sensors, automatic time switch control device shall be used. It shall incorporate an override switching device that:

1. Is readily accessible
2. Is located so that a person using the device can see the lights or the area controlled by that switch, or so that the area being lit is annunciated.
3. Is manually operated.
4. Allows the lighting to remain on for no more than 2 hours when an override is initiated.
5. Controls an area not exceeding 5,000 square feet (465 m2).

Exceptions:

1. In malls and arcades, auditoriums, single-tenant retail spaces, industrial facilities and arenas, where captive-key override is utilized, override time may exceed 2 hours.
2. In malls and arcades, auditoriums, single-tenant retail spaces, industrial facilities and arenas, the area controlled may not exceed 20,000 square feet (1860 m2).

505.2.2.3 Daylight Zone Control. Daylight zones shall be designed such that lights in the daylight zone are controlled independently of general area lighting and are controlled in accordance with either Section 505.2.2.3.1 or 505.2.2.3.2. Contiguous daylight zones adjacent to vertical fenestration are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e. north, east, south, west). Daylight zones under skylights more than 15 feet (4572 mm) from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration.

Exception: Daylight zones enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting

505.2.2.3.1 Manual Daylighting Controls. Manual controls are required to be installed in daylight zones unless automatic controls are installed in accordance with Section 505.2.2.3.2.

505.2.2.3.3 505.2.2.3.2 Automatic daylighting controls. Automatic controls installed in daylight zones shall control lights in the daylit areas seperately from the non-daylit areas. Controls for calibration adjustments to the lighting control device shall be readily accessible to authorized personnel. Each daylight control zone shall not exceed 2,500 square feet. Automatic daylighting controls must incorporate either an automatic shut-off ability based on time or occupancy in addition to lighting power reduction controls.

Each daylight control zone shall not exceed 2,500 square feet. Set-point and other controls for calibrating the lighting control device shall be readily accessible. The daylight control device shall be capable of automatically reducing the lighting power in response to available daylight by either one of the following methods:

Controls will automatically reduce lighting power in response to available daylight by either one of the following methods:

1. **Continuous dimming** using dimming ballasts and daylight-sensing automatic controls that are capable of reducing the power of general lighting in the daylit zone continuously to less than 35 percent of rated power at maximum light output.
2. **Stepped dimming** using multi-level switching and daylight-sensing controls that are capable of reducing lighting power automatically. The system should provide a minimum of two control channels per zone and be installed in a manner such that at least one control step shall reduce power of general lighting in the daylit zone to 50 percent to 70 percent of rated power and another control step that reduces lighting power to no more than 35 percent. Stepped dimming control is not allowed in continuously occupied areas with ceiling heights of 14 feet or lower.

   Exception: Daylight spaces enclosed by walls or ceiling height partitions and containing 2 or fewer luminaire have a separate switch for general area lighting.

505.2.3 Specific Application Controls Specific application controls shall be provided for the following:

Display/Accent Lighting—Display or accent lighting shall have a separate control device.

1. Display and accent light shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space
2. Case Lighting—Lighting in cases used for display case purposes shall have a separate control device be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
3. Hotel and Motel Guest Room Lighting—Hotel and motel guest rooms sleeping units and guest suites shall have a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles.
4. Task Lighting—Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided the control device is readily accessible and located so that the occupant can see the controlled lighting.
5. Non-visual Lighting—Lighting for non-visual applications, such as plant growth and food warming, shall have a separate control device be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.
6. Demonstration Lighting—Lighting equipment that is for sale or for demonstrations in lighting education shall have a separate control device be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.

Exception: Where LED lighting is used no additional control is required for items 1, 2, and 4.

505.2.4 Functional Testing. Controls for automatic lighting systems shall comply with be tested prior to and as a condition for issuance of an approval under Section 104.8 and in accordance with Section 508.3. Testing shall ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. The construction documents shall state the party who will conduct the required functional testing. The party responsible for the functional testing shall not be directly involved in the design or construction of the project and shall provide documentation to the *code official* certifying that the installed lighting controls meet the provisions of Section 505.

When *occupant sensors*, time switches, programmable schedule controls, *photosensors or daylighting controls* are installed, at a minimum, the following procedures shall be performed:

1. Confirm that the placement, sensitivity and time-out adjustments for *occupant sensors* yield acceptable performance, i.e. lights turn off only after space is vacated and do not turn on unless space is occupied.
2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.
3. Confirm that photosensor controls reduce electric light based on the amount of usable daylight in the space as specified.

505.2.5 Sleeping unit controls. *Sleeping unit*s in hotels, motels, boarding houses or similar buildings shall have at least one master switch at the main entry door that controls all permanently wired luminaires and switched receptacles, except those in the bathroom(s). Suites shall have a control meeting these requirements at the entry to each room or at the primary entry to the suite.

505.5.2 Interior lighting power. The total interior lighting power allowance (watts) is the sum for all interior lighting powers is determined according to Table 505.5.2.1 using the Building Area Method, or Table 505.5.2.2 using the Space-by-Space Method, for all areas of the building covered in this permit. For the Building Area Method, the interior lighting power allowance is the floor area for each building area type listed in Table 505.5.2 505.5.2.1 times the value from Table 505.5.2 505.5.2.1 for that area. For the purposes of this method, an "area" shall be defined as all contiguous spaces that accommodate or are associated with a single building area type as listed in Table 505.5.2 505.5.2.1. When this method is used to calculate the total interior lighting power for an entire building, each building area type shall be treated as a separate area. For the Space-by-Space Method, the interior lighting power allowance is determined by multiplying the floor area of each space times the value for the space type in Table 505.5.2.2 that most closely represents the proposed use of the space, and then summing the lighting power allowances for all spaces. Trade-offs among spaces are permitted.

Delete Tables 505.5.1 and 505.5.2 and replace as follows:

Table 505.5.2.1

BUILDING AREA TYPE	LPD (w/ft^2)
AUTOMOTIVE FACILITY	0.9
CONVENTION CENTER	1.2
COURTHOUSE	1.2
DINING: BAR LOUNGE/LEISURE	1.3
DINING: CAFETERIA/FAST FOOD	1.4
DINING: FAMILY	1.6
DORMITORY	1.0
EXERCISE CENTER	1.0
FIRE STATION	0.8
GYMNASIUM	1.1
HEALTH CARE CLINIC	1.0
HOSPITAL	1.2
HOTEL	1.0
LIBRARY	1.3
MANUFACTURING FACILITY	1.3
MOTEL	1.0
MOTION PICTURE THEATER	1.2
MULTIFAMILY	0.7
MUSEUM	1.1
OFFICE	0.9

BUILDING AREA TYPE	LPD (w/ft^2)
PARKING GARAGE	0.3
PENETENTIARY	1.0
PERFORMING ARTS THEATER	1.6
POLICE STATION	1.0
FIRE STATION	0.8
POST OFFICE	1.1
RELIGIOUS BUILDING	1.3
RETAIL	1.4
SCHOOL/ UNIVERSITY	1.2
SPORTS ARENA	1.1
TOWN HALL	1.1
TRANSPORTATION	1.0
WAREHOUSE	0.6
WORKSHOP	1.4

Table 505.5.2.2

COMMON SPACE-BY-SPACE TYPES	LPD (w/ft^2)
ATRIUM – First 40 ft in height	0.03 per ft. ht.
ATRIUM – Above 40 ft in height	0.02 per ft. ht.
Audience/Seating Area - Permanent	
For Auditorium	0.9
For Performing Arts Theater	2.6
For Motion Picture Theater	1.2
Classroom/Lecture/Training	1.30
Conference/Meeting/Multipurpose	1.2
Corridor/Transition	.7
Dining Area	
Bar/ Lounge /Leisure Dining	1.40
Family Dining Area	1.40
Dressing/Fitting Room Performing Arts Theater	1.1
Electrical/Mechanical	1.10
Food Preparation	1.20
Laboratory for classrooms	1.3
Laboratory for medical/industrial/research	1.8
Lobby	1.10
Lobby for Performing Arts Theater	3.3
Lobby for Motion Picture Theater	1.0
Locker Room	0.80
Lounge Recreation	0.8
Office -enclosed	1.1
Office – Open Plan	1.0
Restroom	1.0
Sales Area	1.6 (a)
Stairway	0.70
Storage	0.8
Workshop	1.60
BUILDING SPECIFIC SPACE-BY-SPACE TYPES	
CONVENTION CENTER	
Exhibit Space	1.50
Audience/Seating Area	0.90
COURTHOUSE/POLICE STATION/PENETENTIARY	
Courtroom	1.90
Confinement Cells	1.1
Judge Chambers	1.30
Penitentiary Audience Seating	0.5
Penitentiary Classroom	1.3
Penitentiary Dining	1.1
AUTOMOTIVE – SERVICE/REPAIR	0.70
BANK/OFFICE – banking activity area	1.5
DORMITORY Living Quarters	1.10
GYMNASIUM / FITNESS CENTER	
Fitness area	0.9
Gymnasium Audience/Seating	0.40
Playing Area	1.40
HEALTHCARE CLINIC/HOSPITAL	
Corridors /Transition	1.00
Exam/Treatment	1.70

COMMON SPACE-BY-SPACE TYPES	
	LPD (w/ft^2)
Emergency	2.70
Public & Staff Lounge	0.80
Medical Supplies	1.40
Nursery	0.9
Nurse Station	1.00
Physical Therapy	0.90
Patient Room	0.70
Pharmacy	1.20
Radiology/Imaging	1.3
Operating Room	2.20
Recovery	1.2
Lounge/Recreation	0.8
Laundry - Washing	0.60
HOTEL	
Dining Area	1.30
Guest Rooms	1.10
Hotel Lobby	2.10
Highway Lodging Dining	1.20
Highway Lodging Guest Rooms	1.10
LIBRARY	
Stacks	1.70
Card File & Cataloguing	1.10
Reading Area	1.20
MANUFACTURING	
Corridors /Transition	0.40
Detailed manufacturing	1.3
Equipment Room	1.
Extra High Bay (> 50 ft Floor-Ceiling height)	1.1
High Bay (25- 50 ft Floor-Ceiling ht)	1.20
Low Bay (<25 ft Floor-Ceiling height)	1.2
MUSEUM	
General Exhibition	1.00
Restoration	1.70
PARKING GARAGE – garage areas	0.2
FIRE STATIONS	
Engine Room	0.80
Sleeping Quarters	0.30
POST OFFICE	
Sorting Area	0.9
RELIGIOUS BUILDING	
Fellowship Hall	0.60
Audience Seating	2.40
Worship Pulpit/Choir	2.40
RETAIL	
Dressing/Fitting Area	0.9
Mall Concourse	1.6
Sales Area	1.6(a)
SPORTS ARENA	
Audience seating	0.4
Court Sports Area – Class 4	.7
Court Sports Area – Class 3	1.2
Court Sports Area – Class 2	1.9
Court Sports Area – Class 1	3.0
Ring Sports Area	2.7
TRANSPORTATION	
Air/Train/Bus Baggage Area	1.00
Airport Concourse	0.60
Terminal – Ticket Counter	1.50
WAREHOUSE	
Fine Material Storage	1.40
Medium/Bulky Material	0.60

a. Where lighting equipment is specified to be installed to highlight specific merchandise in addition to lighting equipment specified for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for merchandise, or additional lighting power as determined below shall be added to the interior lighting power determined in accordance with this line item.

Calculate the additional lighting power as follows:

Additional Interior Lighting Power Allowance = **1000 watts** + (Retail Area 1 X 0.6 ~~0.4~~W/ft2) + (Retail Area 2 X 0.6 W/ft2) + (Retail Area 3 X ~~0.9~~ 1.4 W/ft^2) + (Retail Area 4 X ~~1.5~~ 2.5 W/ft^2).

where:

Retail Area 1 = The floor area for all products not listed in Retail Area 2, 3 or 4.
Retail Area 2 = The floor area used for the sale of vehicles, sporting goods and small electronics.
Retail Area 3 = The floor area used for the sale of furniture, clothing, cosmetics and artwork.
Retail Area 4 = The floor area used for the sale of jewelry, crystal and china

Exception: Other merchandise categories are permitted to be included in Retail Areas 2 through 4 above, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is *approved* by the authority having jurisdiction.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: This revised text represents practical lighting requirements that synergize with 90.1 where they cover similar items and provide a reasonable set of energy code requirements that appear in 90.1-2010

Public Comment 17:

Michael D. Fisher, Kellen Company, representing Asphalt Roofing Manufacturers Association requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Delete Section 502.2.1.1 in its entirety.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: EC 147 is a comprehensive proposal that is part of a package of proposals intended to achieve significant increases in building energy efficiency. Item 6 of the 28 parts brings requirements for solar reflectance of roofs into the prescriptive requirements of chapter 5 of the IECC. The reason statement includes the following:

> *"NBI and AIA believe that the 20-30% reductions in commercial and high-rise residential building energy use based on this proposal are practical, feasible, and necessary. This Proposal employs improvements to design practices and use of widely available products to improve energy efficiency. Many of the elements have been previously published in NBI's Core Performance Guide and implemented in programs or codes at the local and state levels. Incorporating these enhancements in a national model code will help move building practices and markets more quickly, addressing national concerns for energy and the environment in a pragmatic and cost-effective way."*

Notwithstanding the above assurances regarding cost effective reductions in building energy use, the proponents have presented no supporting technical substantiation addressing this new provision.

The scope of the original proposal was flawed in that it applied to roofs NOT over cooled spaces. The code development committee approved the entire proposal, notwithstanding numerous "fatal" flaws, and directed stakeholders to work together to resolve the issues. ARMA has worked with the DOE during preparation of public comments. We have continued to ask for the economic justification that demonstrates the validity of bringing cool roofing into the prescriptive requirements; the DOE has not provided any data estimating the proposed energy savings, and the commensurate cost effect, of the proposal.

ARMA supports the overall improvements in energy efficiency in EC147 but does not believe that the cool roof requirements should go forward in this form for the following reasons:

- The proponent has failed to provide any economic justification for cool roof prescriptive requirements. No estimate of the expected cooling energy savings or heating energy increases, and no cost factors have been presented.
- The proposal requires only aged performance values, which will delay the introduction of new products. The reason statement claims that including these enhancements will move building practices more quickly, but eliminating the option of using initial values will stall new product solutions.
- The supporting statement also refers to elements of the proposal having been implemented in state codes. In California, the CEC adopted cool roof provisions in response to serious issues with peak cooling energy demands, but included a roof insulation trade-off calculator that allows designers to select a package of roof covering and insulation based upon project needs and budget concerns. This proposal does not include the simple option of a roof insulation trade-off. The proposal also fails to consider the effect of roof slope on cool roof performance.
- Solar heat gain through roof coverings is unique in that as building height increases, the resulting gain through the roof assembly is spread across the increased building area. As an example, consider two buildings with the same 100' by 100' footprint, but of different heights. Building "A" is a single-story structure while Building "B" has ten stories. Assuming story height of 10', A has 10,000 sf of roof area and 4,000 sf of wall area; B has 10,000 sf of roof area and 40,000 sf of wall area. These ratios are significant in that under the proposal, both roofs are required to have the same reflectance despite the disparate relative heat gain. For this reason, solar reflectance is best addressed in terms of total building energy usage through the performance path. Excerpting a single exterior surface is overly simplistic. In the case of solar heat gain through vertical assemblies, a similar approach might be to include low-solar gain fenestration and permanent shading devices for south-facing walls in southern climate zones.

In summary, while cool roof design has a place in today's energy efficient buildings, it has no place in prescriptive energy code requirements without a complete understanding of the economic impact and energy savings. Moreover, if and when cool roof requirements can be determined to be economically justified, their inclusion in prescriptive requirements must also include the option of simple trade-offs for roof insulation and other building envelope components.

Public Comment 18:

Richard Grace, Fairfax County, VA, representing Virginia Plumbing and Mechanical Inspectors Association (VPMIA), Virginia Building Code Officials Association, ICC Region VII requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**503.2.9 Mechanical systems commissioning and completion requirements.** Mechanical systems commissioning and completion shall be in accordance with the provisions of Sections 503.2.9.1 through 503.2.9.4.~~

503.2.9 Commissioning. Where the option of mechanical systems commissioning is elected to be performed, Appendix A shall be considered an approved method.

Delete Sections 503.2.9.1 through 509.2.9.3.4

APPENDIX A

SECTION A101
GENERAL

A101.1 Mechanical systems commissioning and completion requirements. Mechanical systems commissioning and completion shall be in accordance with the provisions of Section-A101.2 through A101.4.4.

A101.2 System commissioning. Commissioning is a process that verifies and documents that the selected building systems have been designed, installed, and function according to the owner's project requirements and construction documents, and to minimum code requirements. Drawing notes shall require commissioning and completion requirements in accordance with this section. Drawing notes may refer to equipment specifications for further requirements. Copies of all documentation shall be given to the owner. The building official may request commissioning documentation for review purposes. At the time of plan submittal, the building jurisdiction shall be provided, by the submittal authority, a letter of intent to commission the building in accordance with this code.

A101.2.1 Commissioning plan. A commissioning plan shall include as a minimum the following items:

1. A detailed explanation of the building's project requirements for mechanical design,
2. A narrative describing the activities that will be accomplished during each phase of commissioning, including guidance on who accomplishes the activities and how they are completed,
3. Equipment and systems to be tested, including the extent of tests,
4. Functions to be tested (for example calibration, economizer control, etc.),
5. Conditions under which the test shall be performed (for example winter and summer design conditions, full outside air, etc.), and
6. Measurable criteria for acceptable performance.

A101.2.2 Systems adjusting and balancing. All HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within 10 percent of design rates. Test and balance activities shall include as a minimum the following items:

1. **Air systems balancing**: Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the International Mechanical Code. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, Fan speed shall be adjusted to meet design flow conditions.

   Exception: Fan with fan motors of 1 hp or less.

2. **Hydronic systems balancing:** Individual hydronic heating and cooling coils shall be equipped with means for balancing and pressure test connections. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the ability to measure pressure across the pump, or test ports at each side of each pump.

   Exceptions:

   1. Pumps with pump motors of 5 hp or less.
   2. When throttling results in no greater than 5 percent of the nameplate horsepower draw above that required if the impeller were trimmed.

A101.2.3 Functional performance testing. Equipment functional performance testing shall be in accordance with Section A101.2.3.1. Functional testing of HVAC controls shall be in accordance with Section A101.2.3.2.

A101.2.3.1 Equipment functional performance testing. Equipment functional performance testing shall demonstrate the correct installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications. This demonstration is to prove the operation, function, and maintenance serviceability for each of the Commissioned systems. Testing shall include all modes of operation, including:

1. All modes as described in the Sequence of Operation,
2. Redundant or automatic back-up mode,
3. Performance of alarms, and

4. Mode of operation upon a loss of power and restored power.

Exception: Unitary or packaged HVAC equipment listed in the International Energy Conservation Code Tables 503.2.3 (1) through (3) that do not require supply air economizers.

A101.2.3.2 Controls functional performance testing. HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with approved plans and specifications.

A101.2.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and provided to the Owner. The report shall be identified as "Preliminary Commissioning Report" and shall identify:

1. Itemization of deficiencies found during testing required by this section which have not been corrected at the time of report preparation and the anticipated date of correction.
2. Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.
3. Climatic conditions required for performance of the deferred tests, and the anticipated date of each deferred test.

A101.3 Acceptance. Buildings, or portions thereof, required by this code to comply with this section shall not be issued a final certificate of occupancy allowing public or owner occupation until such time that the building official has received a letter of transmittal from the building owner that states they have received the Preliminary Commissioning Report as required by Section A101.2.4. At the request of the code official, a copy of the Preliminary Commissioning Report shall be made available for review.

A101.4 Completion requirements. The construction documents shall require that within 90 days after the date of final certificate of occupancy, the documents described in this section be provided to the building owner.

A101.4.1 Drawings. Construction documents shall include as a minimum the location and performance data on each piece of equipment.

A101.4.2 Manuals. An operating manual and a maintenance manual shall be in accordance with industry-accepted standards and shall include, at a minimum, the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Names and addresses of at least one service agency.
4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.
5. A complete narrative of how each system is intended to operate, including suggested setpoints.

A101.4.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section A101.2.2.

A101.4.4 Final commissioning report. A complete report of test procedures and results identified as "Final Commissioning Report" shall include:

1. Results of all Functional Performance Tests.
2. Disposition of all deficiencies found during testing, including details of corrective measures used or proposed.
3. All Functional Performance Test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: We are not opposed to commissioning, in fact we fully support the concept. What we are opposed to is including language into a code that is not enforceable, inconsistent, or is written in such a way that enforcement will place a burden on building owners when occupancy permits are held up based on incomplete commissioning reports. There are many examples of this contained within this code change.

(1) 503.2.9.1 – "**verifies and documents that the selected building systems have been designed, installed, and function according to the owner's project requirements**". A code official's responsibility is to enforce the minimum requirements of the code. Owner's project requirements may far exceed the code's minimum. It is not within the code officials authority to enforce requirements that far exceed code requirements.

(2) 503.2.9.1 - "**Copies of all documentation shall be given to the owner**." We do not agree with language included in the code that requires a code official to verify contractual issues between an owner and their agents, designers, or contractors.

(3) 503.2.9.1.2 – "**All HVAC systems shall be balanced in accordance with generally accepted engineering standards**." "Shall be" is positive, enforceable language, however "generally accepted" is so open ended that consistency between any two individuals will be virtually impossible.

(4) 503.2.9.2 – "**shall not be issued a final certificate of occupancy**". This section states that a certificate of occupancy shall not be issued without receiving a letter from the owner stating that they have received the Preliminary Commissioning Report. Why should the owner of a building be penalized in such a harsh manner for a procedure that can obviously be conducted after occupancy.

(5) 503.2.9.3 – "**shall require that within 90 days after the date of final certificate of occupancy**". This section requires the code official to go back to the building owner after issuing the certificate of occupancy and verify that the building owner was provided with drawings, manuals, system balancing report, and the final commissioning report. Wow! After the certificate of occupancy is issued, the International Energy Conservation Code is no longer applicable to the building or building owner. I truly do not understand how this is going to work. What gives the code official the authority to verify and comply with this code section? What recourse does a code official have if the documentation is not provided to the building owner? Is

the certificate of occupancy voided and the building occupants forced to vacate? After the certificate of occupancy is issued, the IECC is not longer applicable. The applicable code after the certificate of occupancy is issued is the Property Maintenance Code.

Public Comment 19:

Joseph R. Hetzel, Thomas Associates, Inc, representing Door & Access Systems Manufacturers Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Table 502.4.3
Maximum Air Infiltration Rate for Fenestration Assemblies

Fenestration Assembly	Maximum Rate
Windows	0.20 [a]
Sliding Doors	0.20 [a]
Swinging Doors	0.20 [a]
Skylights	0.20 [a]
Curtain Walls	0.06 [b]
Storefront Glazing	0.06 [b]
Commercial Glazed Swinging Entrance Doors	1.00 [c]
Revolving Doors	1.00 [c]
~~Rolling doors~~	~~1.00 [c]~~

a. cfm per square foot of fenestration or door area when tested in accordance with NFRC 400 or AAMA/WDMA/CSA101/I.S.2/A440 at 1.57 psf (75 Pa). Alternatively the maximum rate is permitted to be 0.3 cfm per square foot of fenestration or door area when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf (300 Pa)
b. cfm per square foot of fenestration area when tested in accordance with NFRC 400 or ASTM E283 at 1.57 psf (75 Pa)
c. cfm per square foot ~~of fenestration or door area when tested in accordance with NFRC 400, AAMA/WDMA/CSA101/I.S.2/A440, or ASTM E283 at 1.57 psf (75 Pa)~~

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: By their very design as vertically acting curtain-type membranes that typically wrap around a barrel above a door opening, rolling doors are not designed to control air infiltration, particularly to meet 1.00 cfm/ft^2. Rolling doors are typically associated with non-conditioned and semi-heated spaces only. The ASHRAE Envelope Subcommittee is addressing rolling doors, in revisions to ASHRAE 90.1-2007. In those revisions, rolling doors in semi-heated spaces are exempted from air infiltration requirements in Climate Zones 1-6.

Public Comment 20:

Amanda Hickman, InterCode Incorporated, representing The Air Movement and Control Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 503.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B, ~~2A, 7, 8~~	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems ≥ ~~54,000~~ 33,000 Btu/h [a]

For SI: 1 British thermal unit per hour = 0.293 W.
a. The total capacity of all systems without economizers shall not exceed ~~480,000~~ 300,000 Btu/h per *building*, or 20 percent of its air economizer capacity, whichever is greater.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: Table 607.6.1(1) states that economizers on all cooling systems greater than or equal to 54,000 Btu, However in ASHRAE 189.1p Table 7.4.3.4 they has a minimum system size for which an economizer is required at > 33,000 Btu. We should reconcile the code and the ASHRAE standard.

Also, in today's market, commercial buildings will control a building with two 33,000 Btu units rather than one 54,000 Btu unit in order to prevent from having to use economizer controls. It would be recommended that all commercial building applications require economizers on cooling systems > 33,000 Btu. Restricting the requirement of economizers on all cooling systems > 33,000 Btu to commercial building applications will prevent this requirement from reaching into the residential occupancy codes.

Footnote a. should also be modified from 480,000 to 300,000 Btu/h per *building* to keep consistency as with the change proposed in the main table, as they are both based on same ratio.

Public Comment 21:

Amanda Hickman, InterCode Incorporated, representing The Air Movement and Control Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

503.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections 503.3.1.1 through 503.4.1.4.

Exceptions: Economizers are not required for the <u>following</u> systems ~~listed below~~.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table 503.3.1(1).
~~2. Systems that require filtration equipment in order to meet the minimum ventilation requirements of Chapter 4 of the *International Mechanical Code*.~~
~~3~~ <u>2</u>. Where more than 25% of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F dew-point temperature to satisfy process needs.
~~4. Systems that include a condenser heat recovery system required by Section 503.4.6.~~
~~5. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table 503.3.1(1).~~
~~6. Systems that serve spaces whose sensible cooling load at design conditions, excluding transmission and infiltration loads, is less than or equal to transmission and infiltration losses at an outdoor temperature of 60°F.~~
~~7~~ <u>3</u>. Systems expected to operate less than 20 hours per week.
~~8~~ <u>4</u>. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
~~9~~ <u>5</u>. Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table 503.3.1(2).

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: Exception 2 should be deleted because filtration and economizers should be used in conjunction with one another to obtain the maximum energy savings. Exception 4 should be deleted because Heat recovery systems and economizers should be used in conjunction to obtain the maximum energy savings. Large residential buildings should not be excluded from using economizers if the window systems are not manually operable, therefore Exception 5 should also be deleted. Exception 6 is too complicated and confusing to enforce and understand and it too should be deleted.

Public Comment 22:

Jonathan Humble, representing American Iron & Steel Institute, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Revise Section 202 as follows:

<u>**VEGETATIVE ROOF:**</u>

<u>**Extensive vegetative roof**. A low profile roof with a growing medium less than 8 inches in depth, composed of plants that can thrive in a rooftop environment with limited water, shallow roots and sparse nutrients.</u>

<u>**Intensive vegetative roof**. A high profile roof with a growing medium 8 inches or more in depth that can support a wide range of vegetables, shrubs and small trees.</u>

Revise Section 502.2 as follows:

~~**502.2.1.1 Roof solar reflectance and thermal emittance.** Roofs in climate zones 1 to 3 not over ventilated attics or not over cooled spaces shall have a minimum three-year aged - solar reflective index (SRI) of 64 when determined in accordance with the SRI method in ASTM E1980 using a convection coefficient of (12W/m^2·K) or a minimum three-year-aged solar reflectance of 0.55 when tested in accordance with ASTM C1549, ASTM E903 or ASTM E1918 and a minimum three-year-aged thermal emittance of at least 0.75 when testing in accordance with ASTM C1371 or ASTM E408.~~

~~**Exceptions:**~~

~~1. Ballasted roofs with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or 23 lbs/ft2 pavers (117 kg/m2).~~
~~2. Roofs, where a minimum of 75% of the roof area is shaded during the peak sun angle on June 21st by permanent features of the building and/or is covered by off-set photovoltaic arrays, building-integrated photovoltaic arrays, or solar water collectors.~~
~~3. Metal building roofs or asphaltic membranes in climate zone 3.~~

<u>**502.2.1.1 Roof coverings**. Buildings located in climate zones 1 through 3 which have roofs with a slope of 2 units vertical in 12 units horizontal or less, and where the roofs are located over conditioned spaces which are cooled, a minimum of 75 percent of the roof surfaces shall be in compliance with Section 502.2.1.2 or 502.2.1.3.</u>

<u>**Exceptions:**</u>

<u>1. Ballasted roofs with a minimum stone ballast of 17 lbs/ft2 (74 kg/m2) or a minimum paver ballast of 23 lbs/ft2 (117 kg/m2).</u>

2. Roofs where a minimum of 75 percent of the roof if shaded by permanent shading devices or features of the building during the peak sun angle on the summer solstice.
3. Roofs where a minimum of 75 percent of the roof is covered by off-set photovoltaic arrays, building integrated photovoltaics, or solar or hot-air or water collectors.
4. Extensive or intensive vegetated roofs. All plantings shall be selected according their hardiness zone classifications and shall be capable of withstanding the climate conditions of the jurisdiction and the micro climate conditions of the building site including, but not limited to, wind, precipitation and temperature. Invasive plant species shall not be planted. Selected plants shall not add to the potential for fire hazard in the event of severe drought. The engineered soil medium shall be designed for the physical conditions and local climate to support the plants and shall consist of non-synthetic materials. The planting design shall provide a wind erosion blanket that protects the engineered soil medium until the plants are established. The engineered soil medium that shall be not less than 3 inches in depth in all areas.
5. Low sloped metal building *roofs* in climate zones 2 and 3.
6. Asphaltic membranes in climate zones 2 and 3.
7. Roofs located over:
   7.1. Ventilated attics
   7.2. Spaces which are not conditioned spaces that are cooled
   7.3. Semi-heated spaces

502.2.1.2 Roof solar reflectance and thermal emittance. Roof products shall be tested for a minimum three-year aged solar reflectance of 0.55 and thermal emittance 0.75 in accordance with CRRC-1 Standard. The values for solar reflectance and thermal emittance shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be labeled and certified by the manufacturer demonstrating compliance.

502.2.1.3 Solar reflectance index. Roof products shall be permitted to use a Solar Reflectance Index (SRI) where the calculated value shall not be less than 64 in order to demonstrate compliance. The SRI value shall be determined using ASTM E1980 with a convection coefficient of 2.1 Btu/h-ft^2 (12 W/m^2*k) based on three-year aged roof samples tested in accordance with CRRC-1 Standard. The values for solar reflectance and thermal emittance shall be determined by an independent laboratory accredited by a nationally recognized accreditation program. Roof products shall be labeled and certified by the manufacturer demonstrating compliance.

Revise Chapter 6 as follows:

ASTM

~~C1371-04~~	~~Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers~~
~~C1549~~	~~Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer~~
~~E408-71 (02)~~	~~Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques~~
~~E1918-97~~	~~Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-Sloped Surfaces in the Field~~

Cool Roof Rating Council (CRRC)

ANSI/CRRC-1 Standard (2010) Cool Roof Rating Council CRRC-1 Standard

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: We propose to further modify code change EC147-09/10 with the above proposal.

The benefits of the proposal are:

- Format that is logical in organization and compatible with ICC codes
- Focus on correct terminology
- Use of the new CRRC-1 Standard
- Expansive text to address vague inferences
- Requires labeling of roof products

Format:
The format of this proposal completely revises the original proposal. The charging statement focuses only on the basic components of the requirements, the exceptions are expressed immediately below the charging section paragraph, and the requirements for the two types of compliance are self contained.
Terminology:
Terminology has been changed to reflect what is currently used in the market and with other standards development organizations. Solar absorptance has been changed to solar reflectance, cooled spaces has been changed for a format consistent with the IECC by referring to "conditioned spaces" which are cooled. Additional terminology is proposed to address the definitions of vegetated roofs. The source for these definitions, and the text discussing vegetated roofs, was the International Green Construction Code – Version 1.0. This additional language is proposed in order to overcome the potential issues that can arise when only generically referencing landscaped or vegetated roofs.
Exceptions:
The exceptions have been both modified and enhanced. Additional text was added to the originally proposed exceptions for clarity. In this case exceptions "a", "b", and "c" contain language which clearly identifies the intent of the exception. Additional exemptions have been included to address roofs that are shaded by solar devices, to recognize vegetated roofs, and to recognize that through a first cost benefit assessment that specific roof products are not cost effective when compared to energy savings of the cool roof.
CRRC-1 Standard:
The introduction of the CRRC-1 Standard is recommended as the document contains far more information than does the reference to the ASTM standards. It was developed by the Cool Roof Rating Council, a not-for-profit organization. The ASTM standards are a good source, but because the verification of a roofing product requires more than just the test method we are recommending the use of the standard instead.

The Standard

- Contains definitions which focus on roof product testing,

- Identifies what constitutes a testing laboratory,
- Contains available tests methods for roof products that cannot be tested under the ASTM standards due to their configuration or make-up,
- Identifies how samples are to be selected,
- Requires 9 test samples for testing, and allows only the average of those tested samples to be considered for the certified report,
- Identified what constitutes aged testing of samples, and what regions aged testing is to take place, and
- Addresses the minimum content of a roof product report of results.

The document was produced under the ANSI process, and does not include the proprietary requirements that are used by the Cool Roof Rating Council for their roof product program.

Expansive text:

We have expended some text in order to be more complete, and therefore more clear on intent. Much of this work is in the exceptions where solar devices and vegetated roofs are concerned. Further, the provisions for compliance are self contained where they describe the minimum requirements, type of roof testing, the independence of the testing agency, and the requirements for labeling.

Labeling:

The original proposal did not require labeling of products. This proposal recommends language which will overcome this issue by requiring labeling and certification by the manufacturer with the use of test results from an independent testing agency.

Analysis: The standard CRRC-1 Standard, was not reviewed or considered by the Energy Code Development Committee prior to the Baltimore hearings and was not considered by the hearing attendees at the time of the code development hearings. Section 3.6.3.1 of Council Policy # 28, *Code Development,* requires that new standards be introduced in the original code change proposal, therefore, the introduction of a new standard via a public comment is not in accordance with the process required by CP # 28 for adding new standards to the code.

Public Comment 23:

Jonathan Humble, representing American Iron & Steel Institute, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**CONTINUOUS AIR BARRIER.** A combination of materials and assemblies that restrict or prevent the passage of air through the building thermal envelope.~~

~~**502.4.1 Air Barriers**. The building envelope shall be designed and constructed with a continuous air barrier that complies with Section 502.4.1.1 and 502.4.1.2 to control air leakage into, or out of, the conditioned space. Construction documents shall identify the air barrier components for each assembly, including detailing joints, interconnections and sealing of penetrations. The opaque building envelope air barrier shall be located on the inside or, outside of, or be integral with the building envelope; or any combination thereof.~~

~~**Exception:** Buildings in climate Zones 1, 2 and 3.~~

502.4.1 Window and door assemblies. The air leakage of window and sliding or swinging door assemblies that are part of the building envelope shall be determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, or NFRC 400 by an accredited, independent laboratory, and *labeled* and certified by the manufacturer and shall not exceed the values in Section 402.4.2.

Exception: Site-constructed windows and doors that are weatherstripped or sealed in accordance with Section 502.4.3.

~~**502.4.1.1** The *continuous air barrier* shall have the following characteristics:~~

1. ~~It shall be continuous throughout the envelope (at the lowest *floor*, exterior *walls*, and ceiling or *roof*). Air barrier joints and seams shall be sealed; including sealing transitions in planes and changes in materials. Air barrier penetrations shall be sealed.~~
2. ~~The air barrier component of each assembly shall be joined and sealed in a flexible manner to the air barrier component of adjacent assemblies. The joints and seals shall allow for the relative movement of the assemblies and materials without damage to the air seal.~~
3. ~~The air barrier shall be installed in accordance with the *manufacturer's* instructions in a manner that achieves the performance requirements.~~
4. ~~Where lighting *fixtures* with ventilation holes or other similar objects are to be installed in such a way as to penetrate the *continuous air barrier*, provisions shall be made to maintain the integrity of the *continuous air barrier*.~~

   ~~**Exception:** Buildings that comply with Section 502.4.1.2(3) below are not required to comply with either 1 or 4.~~

~~**502.4.1.2 Air barrier compliance options.** A continuous air barrier for the opaque building envelope shall meet the requirements of at least one of the compliance options in Section 502.4.1.2.1, 502.4.1.2.2, or 502.4.1.2.3~~

~~**502.4.1.2.1 Materials.** Individual materials shall have an air permeability not to exceed 0.02 L/s·m^2 under a pressure differential of 75 Pa (0.004 cfm/ft^2 under a pressure differential of 0.3 in. water (1.57 lb/ft^2)) when tested in accordance with ASTM E2178. The following materials comply with this requirement when all joints are sealed:~~

1. ~~Plywood - minimum 3/8 in (10 mm)~~
2. ~~Oriented strand board - minimum 3/8 in (10 mm)~~
3. ~~Extruded polystyrene insulation board - minimum 3/4 in (19 mm)~~
4. ~~Foil-back urethane insulation board - minimum 3/4 in (19 mm)~~
5. ~~Closed cell spray foam meeting air permeability requirement~~
6. ~~Open cell spray foam meeting air permeability requirement~~
7. ~~Weather resistant barrier meeting air permeability requirement~~
8. ~~Exterior or interior gypsum board - minimum 1/2 in (12 mm)~~
9. ~~Cement board - minimum 1/2 in (12 mm)~~
10. ~~Built up roofing membrane~~

11. Modified bituminous roof membrane
12. Fully adhered single-ply roof membrane
13. A Portland cement/sand parge, or gypsum plaster minimum 5/8 in (16 mm) thick
14. Cast-in-place and precast concrete.
15. Fully grouted concrete block masonry.
16. Sheet steel or aluminum

502.4.1.2.2 Assemblies. Assemblies of materials and components shall have an average air leakage not to exceed 0.2 L/s·m2 @ 75 Pa (0.04 cfm/ft2 under a pressure differential of 0.3" w.g. (1.57psf)) when tested in accordance with ASTM E2357 or ASTM E1677. The following assemblies comply with this requirement when all joints are sealed and every characteristic in Section 502.4.4.1.1 is met:,

1. Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;
2. A Portland cement/sand parge, stucco or plaster minimum 1/2 in (12 mm) thick.

502.4.1.2.3 Building Test. The completed building shall be tested and the air leakage rate of the *building envelope* shall not exceed 2.0 L/s·m^2 @ 75 Pa (0.40 cfm/ft^2 at a pressure differential of 0.3" w.g. (1.57 psf)) in accordance with ASTM E779 or an equivalent method approved by the code official.

502.4.2 Air Barrier Penetrations. All penetrations of the air barrier and paths of air infiltration / exfiltration shall be made air tight and shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seals shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

502.4.2 Curtain wall, storefront glazing and commercial entrance doors. Curtain wall, *storefront* glazing and commercial- glazed swinging entrance doors and revolving doors shall be tested for air leakage at 1.57 pounds per square foot (psf) (75 Pa) in accordance with ASTM E 283. For curtain walls and *storefront* glazing, the maximum air leakage rate shall be 0.3 cubic foot per minute per square foot (cfm/ft^2) (5.5 m3/h × m^2) of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage rate shall be 1.00 cfm/ft^2 (18.3 m3/h × m^2) of door area when tested in accordance with ASTM E 283.

502.4.3 Fenestration and doors. The air leakage of fenestration assemblies and doors shall meet the provisions of Table 502.4.3. Testing shall be performed in accordance with the applicable reference test standard by an accredited and independent testing laboratory and all fenestration assemblies *listed* and *labeled*.

Exception: Site built fenestration assemblies that are sealed in accordance with Section 502.4.1.

502.4.3 Sealing of the building envelope. Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

Table 502.4.3
Maximum Air Infiltration Rate for Fenestration Assemblies

Fenestration Assembly	Maximum Rate
Windows	0.20 [a]
Sliding Doors	0.20 [a]
Swinging Doors	0.20 [a]
Skylights	0.20 [a]
Curtain Walls	0.06 [b]
Storefront Glazing	0.06 [b]
Commercial Glazed Swinging Entrance Doors	1.00 [c]
Revolving Doors	1.00 [c]
Rolling doors	1.00 [c]

a. cfm per square foot of fenestration or door area when tested in accordance with NFRC 400 or AAMA/WDMA/CSA101/I.S.2/A440 at 1.57 psf (75 Pa). Alternatively the maximum rate is permitted to be 0.3 cfm per square foot of fenestration or door area when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf (300 Pa)
b. cfm per square foot of fenestration area when tested in accordance with NFRC 400 or ASTM E283 at 1.57 psf (75 Pa)
c. cfm per square foot of fenestration or door area when tested in accordance with NFRC 400, AAMA/WDMA/CSA101/I.S.2/A440, or ASTM E283 at 1.57 psf (75 Pa)

Revise Chapter 6 as follows:

ASTM

E779-03	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
E1677-95 (2000)	Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls
E2178-03	Standard Test Method for Air Permeance of Building Materials
E2357-05	Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: We appreciate the work that the proponents did on this subject. Unfortunately, the proposal is lacking in areas which suggest that it is not well thought out or ready adoption. We therefore recommend that the original language of IECC-2009 be reinstated.

EC147 part 9 suffers from subjective language which disadvantages the proposal. We show the following examples in Part 9 of the proposal, which are:

- "flexible manner", flexible when scaled against what?

- “relative movement”, relative to what?
- “without damage”, this is not achievable in the context it is written!
- “in a manner”, whose manner?
- “is met”, this is just poor language!
- “air tight”, based on what scale or test method?

The proposal also suggests that building testing take place in order to demonstrate compliance. Not clear is how this can apply to all buildings, from a small individual office building (e.g. 2,000 sq ft) all the way up to a two-million square foot enclosed mall. ASTM E779 is your basic blower door test. For small buildings this test can be executed with relative ease, unfortunately for large buildings it becomes problematic as a result of the shear volume of the internal area to be tested versus the availability of equipment to accurately perform and measure those tests. It is not common nor necessarily readily available to perform such tests in the US market.

The proposal also ignores other test methods already employed in the market, namely ASTM E283 “Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen”. As a result of this proposal the curtain wall industry will be required to test their product twice to demonstrate compliance. This we believe to be onerous and not justified.

While some would articulate that there will be a greater overall good by passing EC174 as a package as is, we believe that accepting something that is broken is not being responsible. In view of the above we propose that the original language of IECC-2009 be reinstated.

Public Comment 24:

Jeff Inks, representing Window & Door Manufacturers Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table 502.2(1), based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

~~Exception~~ <u>Exceptions</u>:

<u>1.</u> Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U*-factor is equivalent to the same assembly with the *R*-value specified in Table 502.2(1).
<u>2. Unit skylight curbs included as a component of an NFRC 100 rated assembly shall not be required to be insulated.</u>

~~Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.~~

(Portions of code change proposal not shown remain unchanged.)

Commenter’s Reason: This exception is needed to clarify that no additional insulation is required for curbs that are components of unit skylight assemblies that have already been rated with the curb included for compliance with applicable IECC energy performance requirements in accordance with NFRC 100 - *Procedure for Determining Fenestration Product U-Factors.* In addition to no need for additional insulation, requiring the application of it would modify the assembly and compromise not only the NFRC 100 rating, but also other required ratings including *AAMA/WDMA/CSA 101/I.S.2/A440*.

Public Comment 25:

Jeff Inks, representing Window & Door Manufacturers Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.4.3 Fenestration and doors. The air leakage of fenestration assemblies and doors shall meet the provisions of Table 502.4.3. Testing shall be performed in accordance with the applicable reference test standard by an accredited and independent testing laboratory and all fenestration assemblies *listed* and *labeled*.

Exception: ~~Site built~~ <u>Field-fabricated</u> fenestration assemblies that are sealed in accordance with Section 502.4.1.

(Portions of code change proposal not shown remain unchanged.)

Commenter’s Reason: This exception should be applicable only to fenestration assemblies that wholly constructed at the job site even though it still represents a weakness in the IECC.

There is no justification for allowing the exception to be applicable to “site built” fenestration assemblies as defined by the IECC. These assemblies can and must also be required to meet the provisions of 502.4.3. Allowing an exception otherwise will result in a significant compromise in efficiency and works directly counter to achieving the overall objectives of EC147.

Public Comment 26:

Jeff Inks, representing Window & Door Manufacturers Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Table 502.4.3
Maximum Air Infiltration Rate for Fenestration Assemblies

Fenestration Assembly	Maximum Rate
Windows	~~0.20~~ 0.30 [a]
Sliding Doors	~~0.20~~ 0.30 [a]
Swinging Doors	~~0.20~~ 0.30 [a]
Skylights	~~0.20~~ 0.30 [a]
Curtain Walls	0.06 [b]
Storefront Glazing	0.06 [b]
Commercial Glazed Swinging Entrance Doors	1.00 [c]
Revolving Doors	1.00 [c]
Rolling doors	1.00 [c]

a. cfm per square foot of fenestration or door area when tested in accordance with NFRC 400 or AAMA/WDMA/CSA101/I.S.2/A440 at 1.57 psf (75 Pa). Alternatively the maximum rate is permitted to be 0.3 cfm per square foot of fenestration or door area when tested in accordance with AAMA/WDMA/CSA101/I.S.2/A440 at 6.24 psf (300 Pa)
b. cfm per square foot of fenestration area when tested in accordance with NFRC 400 or ASTM E283 at 1.57 psf (75 Pa)
c. cfm per square foot of fenestration or door area when tested in accordance with NFRC 400, AAMA/WDMA/CSA101/I.S.2/A440, or ASTM E283 at 1.57 psf (75 Pa)

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: While meeting the proposed new maximum rate of 0.20 cfm may not be a significant problem for some fenestration products it is for others. Regardless, reducing the maximum infiltration to 0.20 cfm from 0.30 cfm will result in added costs to production, testing, and labeling for all products when such a reduction has not been substantiated as necessary or contributing significantly to additional reductions in overall envelope leakage or significant gains in overall energy efficiency.

There are also other unintended problems the will result by reducing the max rate to 0.20 cfm such as increasing the opening force required for many operational windows types, especially double hung products. Air infiltration and operational force are opposing requirements for operable products. Lower air infiltration rates often can only be achieved with higher operational force. Setting the maximum rate at 0.2 cfm when it has not been justified needlessly impairs operability for all users and can lead to conflicts with ADA/Accessibility requirements as well as HUD requirements for low operational force.

Furthermore, reducing the rate to 0.2 cfm is also problematic because the requirement is in conflict with the values in *AAMA/WDMA/CSA 101/I.S.2/A440*. If such a reduction is merited, it should be addressed in the standard rather than establishing contradictory requirements in the IECC.

Public Comment 27:

Richard Lord, Carrier Corporation, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 503.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B, ~~2A, 7, 8~~	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems ≥ 54,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.293 W.
a. The total capacity of all systems without economizers shall not exceed 480,000 Btu/h per building, or 20 percent of its air economizer capacity, whichever is greater.

503.4.1.3 Integrated Economizer Control. Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

Exceptions:

1. Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25% of the total system capacity.

2. Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h and use non-integrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.
~~3. Systems in climate zones 1A, 1B, 2A, 7, 8.~~

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: ASHRAE 90.1 recently completed a detailed energy and economic analysis of economizers and showed that with current commercial buildings they can easily justify requiring economizers in zones 2A, 3A, 4A, 7, and 8. The also changed the requires to require integrated economizers in all zones where economizers are required because most of the economizer controls systems being used are already integrated economizers.

The IEEC standard had already switch to 54K Btu/hr but had not adopted the above changes. By adopting these changes it would make the economizer zone requirements and the integration requirements in the IECC standard consistent with the requirements in ASHRAE 90.1-2010.

Details on the justification of the change can be found in justification for the ASHRAE addendum CY.

Public Comment 28:

Richard Lord, Carrier Corporation, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**TABLE 506.2(1)**~~
~~**UNITARY AIR CONDITIONERS AND CONDENSING UNITS,**~~
~~**ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS**~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~SUBCATEGORY OR RATING CONDITION~~	~~REQUIRED EFFICIENCYa~~
~~Air conditioners, Air cooled~~	~~< 65,000 Btu/hd~~	~~Split system~~	~~For zones 1 to 5: 15.0 SEER, 12.5 EER~~ ~~For zones 6 to 8: 14 SEER, 12 EER~~
		~~Single package~~	~~For zones 1 to 5: 15.0 SEER, 12.0 EER~~ ~~For zones 6 to 8: 14.0 SEER 11.6 EER~~
	~~≥ 65,000 Btuh/h and < 240,000 Btu/h~~	~~Split system and single package~~	~~For zones 1 to 5: 12.0 EERb, 12.4 IPLVb~~ ~~For zones 6 to 8: 11.5 EERb, 11.9 IPLVb~~
	~~≥ 240,000 Btu/h and < 760,000 Btu/h~~	~~Split system and single package~~	~~For zones 1 to 5: 10.8 EERb, 12.0 IPLVb~~ ~~For zones 6 to 8: 10.5 EERb, 10.9 IPLVb~~
	~~≥ 760,000 Btu/h~~		~~For zones 1 to 5: 10.2 EERb, 11.0 IPLVb~~ ~~For zones 6 to 8: 9.7 EERb, 11.0 IPLVb~~
~~Air conditioners, Water and evaporatively cooled~~		~~Split system and single package~~	~~14.0 EER~~

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~
~~a. IPLVs are only applicable to equipment with capacity modulation.~~
~~b. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.~~

TABLE 506.2(1)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS,
ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Conditions	Minimum Efficiency	Test Procedure[a]
Air conditioners, air-cooled	<65,000 Btu/h	All	Split systems	14.0 SEER 12.0 EER	AHRI 210/240
			Single packaged	14.0 SEER 11.6 EER	
Through-the-wall, air-cooled	<30,000 Btu/h	All	Split systems	12.0 SEER	
			Single packaged	12.0 SEER	
Small-duct high velocity, air-cooled	<65,000 Btu/h	All	Split systems	10 SEER	
Air conditioners, air-cooled	>65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)	Split systems and single package	11.5 EER 12.0 IEER	AHRI 340/360
		All other	Split systems and single package	11.3 EER 11.8 IEER	
	>135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)	Split systems and single package	11.5 EER 12.0 IEER	

Equipment Type	Size Category	Heading Section Type	Sub-Category or Rating Conditions	Minimum Efficiency	Test Procedure[a]
		All other	Split systems and single package	11.3 EER 11.8 IEER	
	>240,000 Btu/h and < 760,000 Btu/h	Electric resistance (or none)	Split systems and single package	10.0 EER 10.5 IEER	
		All other	Split systems and single package	9.8 EER 10.3 IEER	
	>760,000 Btu/h	Electric resistance (or none)	Split systems and single package	9.7 EER 10.2 IEER	
		All other	Split systems and single package	9.5 EER 10.0 IEER	
Air conditioners, water and evaporatively cooled	<65,000 Btu/h	All	Split systems and single package	14.0 EER 14.3 IEER	AHRI 210/240
	>65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)	Split systems and single package	14.0 EER 14.3 IEER	AHRI 340/360
		All other	Split systems and single package	13.8 EER 14.1 IEER	
	>135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)	Split systems and single package	14.0 EER 14.3 IEER	
		All other	Split systems and single package	13.8 EER 14.1 IEER	
	>240,000 Btu/h	Electric resistance (or none)	Split systems and single package	14.0 EER 14.0 IEER	
		All other	Split systems and single package	13.8 EER 13.8 IEER	
Condensing units, air-cooled	>135,000 Btu/h			Not applicable match with indoor coil	AHRI 365
Condensing, water or evaporatively cooled	>135,000 Btu/h			Not applicable match with indoor coil	

a. Chapter 6 contains a complete specification of the referenced test procedures, including year version of the test procedure

TABLE 506.2(2)
UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	REQUIRED EFFICIENCYa
Air cooled (Cooling mode)	< 65,000 Btu/hd	Split system	For zones 1 to 5: 15.0 SEER, 12.5 EER For zones 6 to 8: 14.0 SEER, 12.0 EER
		Single package	For zones 1 to 5: 15.0 SEER, 12.0 EER For zones 6 to 8: 14.0 SEER, 11.6 EER
	≥ 65,000 Btu/h and < 240,000 Btu/h	Split system and single package	For zones 1 to 5: 12.0 SEER, 12.4 EER For zones 6 to 8: 11.5 EERb, 11.9 IPLVb
	≥ 240,000 Btu/h	Split system and single package	For zones 1 to 5: 12.0 SEER, 12.4 EER For zones 6 to 8: 10.5 EERb, 10.9 IPLVb
Water SOURCES (Cooling mode)	< 135,000 Btu/h	85°F entering water	14.0 EER
Air cooled (Heating mode)	< 65,000 Btu/hd (Cooling capacity)	Split system	For zones 1 to 5: 9.0 HSPF For zones 6 to 8: 8.5 HSPF
		Single package	For zones 1 to 5: 8.5 HSPF For zones 6 to 8: 8.0 HSPF
	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb outdoor air	3.4 COP
		17°F db/15°F wb outdoor air	2.4 COP
	≥ 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb outdoor air	3.2 COP
		77°F db/15°F wb outdoor air	2.1 COP
Water SOURCES (Heating mode)	< 135,000 Btu/h (Cooling capacity)	70°F entering water	4.6 COP

For SI: °C = [(°F) - 32] / 1.8, 1 British thermal unit per hour = 0.2931 W.
db = dry-bulb temperature, °F; wb = wet-bulb temperature, °F
a. IPLVs and Part load rating conditions are only applicable to equipment with capacity modulation.
b. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

TABLE 506.2(2)
UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Conditions	Minimum Efficiency	Test Procedure[a]
Air conditioners, air-cooled (cooling mode)	<65,000 Btu/h	All	Split systems	14.0 SEER 12.0 EER	AHRI 210/240
			Single packaged	14.0 SEER 11.6 EER	
Through-the-wall, air-cooled (cooling mode)	<30,000 Btu/h	All	Split systems	12.0 SEER	
			Single packaged	12.0 SEER	
Small-duct high velocity, air-cooled (cooling mode)	<65,000 Btu/h	All	Split systems	10.0 SEER	
Air conditioners, air-cooled (cooling mode)	>65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)	Split systems and single package	11.3 EER 11.8 IEER	AHRI 340/360
		All other	Split systems and single package	11.1EER 11.6 IEER	
	>135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)	Split systems and single package	11.3 EER 11.8 IEER	
		All other	Split systems and single package	11.1EER 11.6 IEER	

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Conditions	Minimum Efficiency	Test Procedure[a]
	>240,000 Btu/h	Electric resistance (or none)	Split systems and single package	9.8 EER 9.8 IEER	
		All other	Split systems and single package	9.6 EER 9.6 IEER	
Water-source (cooling mode)	<17,000 Btu/h	All	86°F entering water	14.0 EER	ISO-13256-1
	>17,000 Btu/h and < 65,000 Btu/h	All	86°F entering water	14.0 EER	
	>65,000 Btu/h and < 135,000 Btu/h	All	86°F entering water	14.0 EER	
Groundwater-source (cooling mode)	< 135,000 Btu/h	All	59°F entering water	16.2 EER	
		All	77°F entering water	13.4 EER	
Air conditioners, air-cooled (heating mode)	<65,000 Btu/h	All	Split systems	8.5 HSPF	AHRI210/240
			Single packaged	8.0 HSPF	
Through-the-wall, air-cooled (heating mode)	<30,000 Btu/h	All	Split systems	7.4 HSPF	
			Single packaged	7.4 HSPF	
Small-duct high velocity, air-cooled (heating mode)	<65,000 Btu/h	All	Split systems	6.8 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*	2.2 COP	
	>135,000 Btu/h (cooling capacity)		47°F DB/43°F WB *Outdoor air*	3.2 COP	
			17°F DB/15°F WB *Outdoor air*	2.0 COP	
Water-source (heating mode)	< 135,000 Btu/h (cooling capacity)		68°F entering water	4.2 COP	ISO-13256-1
Groundwater-source (heating mode)	< 135,000 Btu/h (cooling capacity)		50°F entering water	3.6 COP	
			32°F entering fluid	3.1 COP	

a. Chapter 6 contains a complete specification of the referenced test procedures, including year version of the test procedure.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: There are several issues with the tables 506.2(1) and 506.2(2).

1. They include for some of the products the IPLV part load efficiency requirement. The IPLV is no longer used to rate the part load performance of these products as defined in AHRI 340/360-2007. The IPLV has been replaced by the IEER in the AHRI standard and also in the certification program for the products.
2. The efficiency requirements for the products do not align with many of the industry standard optional higher efficiency requirements which will require the development of custom products to meet the requirements.
3. The tables only address some of the products that are cover by the mandatory tables.

Public Comment 29:

Richard Lord, Carrier Corporation, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 506.2(4)
WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	REQUIRED EFFICIENCY	TEST PROCEDURE
Warm air furnaces, gas fired	< 225,000 Btu/h	—	For zones 1 & 2, NR. For zones 3 & 4 90 AFUE or 90 Et For zones 4-8 are 92 AFUE or 92 Et	DOE 10 CFR Part 430 or ANSI Z21.47
	≥ 225,000 Btu/h	Maximum capacity	90% Ec note 1	ANSI Z21.47
Warm air furnaces, oil fired	< 225,000 Btu/h	—	For zones 1 & 2, NR. For zones 3 to 8 are 85 AFUE or 85 Et	DOE 10 CFR Part 430 or UL 727
	≥ 225,000 Btu/h	Maximum capacity	85% Et, Note 1	UL 727
Warm air duct furnaces, gas fired	All capacities	Maximum capacity	*90% Ec*	ANSI Z83.8
Warm air unit heaters, gas fired	All capacities	Maximum capacity	*90% Ec*	ANSI Z83.8
Warm air unit heaters, oil fired	All capacities	Maximum capacity	*90% Ec*	UL 731

For SI: 1 British thermal unit per hour = 0.2931 W.
1 Units must also include an IID (intermittent ignition device), 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.
Where there two ratings 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.
Et = Thermal efficiency.
Ec = Combustion efficiency (100% less flue losses).
Efficient furnace fan: All fossil fuel furnaces in zones 3 to 8 shall have a furnace electricity ratio not greater than 2% and shall include a manufacturer's designation of the furnace electricity ratio.

TABLE 506.2(4)
WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS, EFFICIENCY REQUIREMENTS

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Test Procedure[b]	Minimum Efficiency[a]
Warm air furnace, gas-fired (weatherized)	<225,000 Btu/h	Maximum capacity[d]	DOE 10 CFR Part 430 or ANSI Z21.47	78% AFUE or 80% E_t[c,e]
	>225,000 Btu/h	Maximum capacity[d]	ANSI Z21.47	80% E_c[c,e]
Warm air furnace, gas-fired (non-weatherized)	<225,000 Btu/h	Maximum capacity[d]	DOE 10 CFR Part 430 or ANSI Z21.47	90% AFUE or 92% E_t[c,e]
	>225,000 Btu/h	Maximum capacity[d]	ANSI Z21.47	92% E_c[c,e]
Warm air furnace, oil-fired (weatherized)	<225,000 Btu/h	Maximum capacity[d]	DOE 10 CFR Part 430 or UL 727	78% AFUE or 80% E_t[c,e]
	>225,000 Btu/h	Maximum capacity[d]	UL 727	81% E_t[e]
Warm air furnace, oil-fired (non-weatherized)	<225,000 Btu/h	Maximum capacity[d]	DOE 10 CFR Part 430 or UL 727	85% AFUE or 87%% E_t[c,e]

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Test Procedure[b]	Minimum Efficiency[a]
	>225,000 Btu/h	Maximum capacity[d]	UL 727	87% E_t[e]
Warm air duct furnaces, gas-fired (weatherized)	All capacities	Maximum capacity[d]	ANSI Z83.9	80% E_c[f]
Warm air duct furnaces, gas-fired (non-weatherized)	All capacities	Maximum capacity[d]	ANSI Z83.9	90% E_c[f]
Warm air unit heaters, gas fired (non-weatherized)	All capacities	Maximum capacity[d]	ANSI Z83.8	90% E_c[f,g]
Warm air unit heaters, oil-fired (non-weatherized)	All capacities	Maximum capacity[d]	UL 731	90% E_c[f,g]

a. E_t = thermal efficiency. See test procedure for detailed discussions
b. Section 11 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
c. Combustion units not covered by NAECA (3-phase power or cooling capacity greater than or equal to 65,000 Btu/h) is allowed to comply with either rating
d. Minimum and maximum ratings as provided for and allowed by the unit's controls
e. Units shall also include an interrupted or intermittent ignition device (IID), have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or flue damper. A vent damper is an acceptable alternative to the flue damper for those furnaces where combustion air is drawn from the *conditioned space*.
f. E_c = combustion efficiency (100 percent less flue losses) See test procedures for detailed discussion
g. As of August 8, 2008, according to the Energy Policy Act of 2005, units shall also include an interrupted or intermittent ignition devices (IID) and have either power venting or automatic flue dampers. A vent damper is an acceptable alternative to a flue damper for those unit heaters where combustion air is drawn from the *conditioned space*.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: In the proposed version of the table it requires 90% and 92% for gas fired furnaces. There are several issues with this requirement for outdoor packaged products that have gas fired heating sections..

1. Currently there are no manufacturers that make products with efficiencies above 81%
2. Above 81% there will be conditions where the flue products condense which will form acids which if drained on the roof will cause damage to the roofs.
3. The condensate that forms will freeze during winter operation
4. Studies done for CEE have shown that in commercial equipment because of the different load profiles than residential there are many more hours of cooling than heat. Also because of continuous fan operation required for ventilation and the increased pressure drop of the added surface area to increase the efficiency the resulting increase fan power more than offsets the savings in energy for the higher efficiency furnaces and cannot be justified. See the attached study done for CEE.

Therefore I recommend the ASHRAE 189.1 table be used which considered the above.

Public Comment 30:

Richard Lord, Carrier Corporation, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~TABLE 506.2(6)~~
~~CHILLERS - EFFICIENCY REQUIREMENTS~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~REQUIRED EFFICIENCY- CHILLERS~~		~~OPTIONAL COMPLIANCE PATH - REQUIRED EFFICIENCY - CHILLERS WITH VSD~~	
		~~Full Load (KW /TON)~~	~~IPLV (KW /TON)~~	~~Full Load (KW /TON)~~	~~IPLV (KW /TON)~~
~~Air Cooled w/ Condenser~~	~~All~~	~~1.2~~	~~1.0~~	~~N/A~~	~~N/A~~
~~Air Cooled w/o Condenser~~	~~All~~	~~1.08~~	~~1.08~~	~~N/A~~	~~N/A~~
~~Water Cooled, Reciprocating~~	~~All~~	~~0.840~~	~~0.630~~	~~N/A~~	~~N/A~~
~~Water Cooled, Rotary Screw and Scroll~~	~~< 90 tons~~	~~0.780~~	~~0.600~~	~~N/A~~	~~N/A~~
	~~³90 tons and < 150 tons~~	~~0.730~~	~~0.550~~	~~N/A~~	~~N/A~~

~~EQUIPMENT TYPE~~	~~SIZE CATEGORY~~	~~REQUIRED EFFICIENCY- CHILLERS~~		~~OPTIONAL COMPLIANCE PATH - REQUIRED EFFICIENCY - CHILLERS WITH VSD~~	
	~~[3]150 tons and < 300 tons~~	~~0.610~~	~~0.510~~	~~N/A~~	~~N/A~~
	~~> 300 tons~~	~~0.600~~	~~0.490~~	~~N/A~~	~~N/A~~
~~Water Cooled, Centrifugal~~	~~< 150 tons~~	~~0.610~~	~~0.620~~	~~0.630~~	~~0.400~~
	~~[3]150 tons and < 300 tons~~	~~0.590~~	~~0.560~~	~~0.600~~	~~0.400~~
	~~300 tons and < 600 tons~~	~~0.570~~	~~0.510~~	~~0.580~~	~~0.400~~
	~~> 600 tons~~	~~0.550~~	~~0.510~~	~~0.550~~	~~0.400~~

~~a. Compliance with full load efficiency numbers and IPLV numbers are both required.~~
~~b. Only Chillers with Variable Speed Drives (VSD) may use the optional compliance path for chiller efficiency.~~
~~N/A – No credit can be taken for this option~~

TABLE 506.2(6)
CHILLERS - EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Units	Minimum Efficiency[c] (I-P)				Test Procedure[b]
			Path A		Path B[d]		
			Full Load	IPLV	Full Load	IPLV	
Air-cooled chillers with condenser, electrically operated	<150 tons	EER	10.000	12.500	NA	NA	AHRI 550/590
	>150 tons	EER	10.000	12.750	NA	NA	
Air-cooled without condenser, electrical operated	All capacities	EER	Condenserless units shall be rated with matched condensers				AHRI 550/590
Water-cooled, electrically operated, positive displacement (reciprocating)	All capacities	kw/ton	Reciprocating units required to comply with water cooled positive displacement requirements				AHRI 550/590
Water-cooled electrically operated, positive displacement	<75 tons	kw/ton	0.780	0.630	0.800	0.600	AHRI 550/590
	>75 tons and <150 tons	kw/ton	0.775	0.615	0.790	0.586	
	>150 tons and <300 tons	kw/ton	0.680	0.580	0.718	0.540	
	>300 tons	kw/ton	0.620	0.540	0.639	0.490	
Water-cooled electrically operated, centrifugal[a]	<150 tons	kw/ton	0.634	0.596	0.639	0.450	AHRI 550/590
	>150 tons and <300 tons	kw/ton	0.634	0.596	0.639	0.450	
	>300 tons and <600 tons	kw/ton	0.576	0.549	0.600	0.400	
	>600 tons	kw/ton	0.570	0.539	0.590	0.400	
Air-cooled absorption single effect[g]	All capacities	COP	0.600	NR[f]	NA[e]	NA[e]	AHRI 560
Water-cooled absorption single effect[g]	All capacities	COP	0.700	NR[f]	NA[e]	NA[e]	
Absorption double effect indirect-fired	All capacities	COP	1.000	1.050	NA[e]	NA[e]	
Absorption double effect direct fired	All capacities	COP	1.000	1.000	NA[e]	NA[e]	

a. The chiller equipment requirements do not apply for chillers used in low-temperature applications where the design leaving fluid temperature is <40°F
b Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure
c. Compliance with this standard can be obtained by meeting the minimum requirements of Path A or Path B. However both the full load and IPLV must be met to fulfill the requirements of Path A and Path B
d. Path B is intended for applications with significant operating time at part load. All Path B machines shall be equipped with demand limiting capable controls
e. NA means that this requirement is not applicable and can not be used for compliance
f. NR means that for this category there are no minimum requirements
g. Only allowed to be used in heat recovery applications

h. Packages that are not designed for operation at ARI Standard 550/590 test conditions (and, thus, cannot be tested to meet the requirements of Table C-3) of 44°F leaving chilled-water temperature and 85°F entering condenser-water temperature with 3 gpm/ton condenser-water flow shall have maximum full-load kW/ton and *NPLV* ratings adjusted using the following equation:

Adjusted maximum full load kW/ton rating = (full load kW/ton from Table C-3) / K_{adj}
Adjusted maximum NPLV rating = (IPLV from Table C-3) / K_{adj}
where
K_{adj} = $6.174722 - 0.303668(X) + 0.00629466(X)^2 - 0.000045780(X)^3$
X = DT_{std} + LIFT (°F)
DT_{std} = (24 + (full load kW/ton from Table C-3) · 6.83) / flow (°F)
Flow = condenser-water flow (gpm) / cooling full load capacity (tons)
LIFT = CEWT – CLWT (°F)
CEWT = full load entering condenser-water temperature (°F)
CLWT = full load leaving chilled-water temperature (°F)

The adjusted full load and *NPLV* values are only applicable over the following full-load design ranges:

- minimum leaving chilled-water temperature: 38°F
- maximum condenser entering water temperature: 102°F
- condenser-water flow: 1 to 6 gpm/ton

$X \geq 39$°F and ≤ 60°F

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: There are several issues with the original proposed table.

1. The air cooled efficiencies are expressed in kw/ton which is not used by the industry. The common metric units is either EER or COP. Kw/ton is typically only used for water cooled chillers.
2. The air cooled chiller efficiencies are less than the ASHRAE 90.1-2010 minimum efficiencies. The proposed table has a full load efficiency of 1.2 kw/ton (10.0 EER) and an IPLV of 1.0 kw/ton (12.0 IPLV). The ASHRAE 90.1-2010 table has a lower full load efficiency of 9.562 but requires a higher efficiency of 12.50 IPLV for <150 tons and 12.75 IPLV for >150 tons. The recommended ASHRAE 189.1 table has a full load of 10.0 EER and 12.5 IPLV for <150 tons and 12.75 IPLV for >150 tons
3. The > 600 ton centrifugal requirements require a .550 efficiency for both path A and path B. This does not make technical sense and does not account for the electrical losses of an inverter. This requirement would actually require larger heat exchangers on the path B and resulting costs and would encourage people to comply with the path A
4. The proposed new table includes the Kadj requirements which are needed for centrifugal chillers that are not designed to run at the standard rating conditions.

Based on the above issues, the ASHRAE 189.1 table would be a better table to use for the option requirements defined in table 506.2(6)

Public Comment 31:

Patrick A. McLaughlin, McLaughin & Associates, representing Air-Conditioning, Heating and Refrigeration Institute requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

506.1 Requirements. Buildings shall comply with at least one of the following:

~~1. 506.2 Efficient HVAC Performance Requirement~~
~~2.~~ 1. 506.3 Efficient Lighting System Requirement
~~3.~~ 2. 506.4 On-Site Supply of Renewable Energy

At the time of plan submittal, the *code official* shall be provided, by the permittee, documentation designating the intent to comply with Section ~~506.2~~, 506.3 or 506.4 in their entirety. Individual tenant spaces must comply with ~~either~~ ~~506.2~~ or 506.3 in its ~~their~~ entirety unless documentation can be provided that demonstrates compliance with Section 506.4 for the entire building.

Delete Section 506.2 in its entirety.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: To bring the proposal in compliance with federal law. This proposal prescribes compliance with the applicable federal minimum efficiency standards for federally covered commercial HVAC/water heating equipment, but would require that the building additionally comply with one of the three following requirements: (1) more stringent HVAC efficiency levels; (2) high efficiency lighting requirements; (3) on-site supply of renewable energy. In other words, the proposal states that compliance with federal standards for HVAC equipment is acceptable only if the building contains certain features, i.e. either high efficiency lighting or an on-site supply of renewable energy. There is no provision in the Energy Policy and Conservation Act (EPAC) that allows a state to set conditions for acceptance of the federal standards which Congress has said are to be "the law of the land." Alternatively, the proposed amendment can be interpreted as saying that the building must contain HVAC equipment at the higher efficiency levels unless the building has high efficiency lighting or an on-site supply of renewable energy. Viewed this way, the proposed amendment, if contained in state law, would be an even more transparent violation of federal preemption.

To date, adoption of the IECC by state and local governments has not raised federal preemption issues because the IECC has incorporated the applicable federal standards for federally covered commercial HVAC/water heating equipment contained in ASHRAE 90.1.

Public Comment 32:

Martha Van Geem, CTLGroup, representing Masonry Alliance for Codes and Standards, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. These commercial buildings shall meet either requirements of ASHRAE/IESNA Standard 90.1,*Energy Standard for Buildings Except for Low-Rise Residential Buildings*, or the requirements contained in this chapter.

501.2 Application. The *commercial building* project shall comply with the requirements in Sections 502 (Building envelope requirements), 503 (Building mechanical systems), 504 (Service water heating), 505 (Electrical power and lighting systems) in its entirety~~, and one of the additional options as presented in Section 506~~. As an alternative the *commercial building* project shall ~~exceed by at least 25%~~ the requirements of ASHRAE/IESNA Standard 90.1, Energy Standard for Buildings Except for Low Rise Residential Buildings, ~~Appendix G~~ in its entirety.

Exceptions:

1. Buildings conforming to Section 507, provided Sections 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied. ~~Building energy cost shall be equal to or less than 75% of the standard reference design building.~~
2. ~~Additions, alterations and repairs shall comply with the applicable requirements in Sections 502, 503, 504, and 505 only or with ASHRAE/IESNA 90.1~~.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: ASHRAE 90.1-2010 should be allowed as alternative to the IECC sections 502, 503, 504, and 505, without modification. This language is the same as the language in the IECC 2009.

Public Comment 33:

Theresa A. Weston, representing DuPont Building Innovations requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.4.1 Air Barriers. ~~The building envelope shall be designed and with a continuous air barrier that complies with Section 502.4.1.1 and 502.4.1.2 to control air leakage into, or out of, the conditioned space. Construction documents shall identify the air barrier components for each assembly, including detailing joints, interconnections and sealing of penetrations. The opaque building envelope air barrier shall be located on the inside of , outside of, or be integral with the building envelope; or any combination thereof.~~ A continuous air barrier shall be provided throughout the building themal 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 502.4.1.1 and 502.4.1.2.

Exception: Air barriers need not be provided in buildings located in climate zones 1, 2 and 3.

Section 502.4.1.1 Air barrier construction. The *continuous air barrier* shall ~~have the following characteristics~~ be constructed to comply with all of the following:

1. ~~It~~ The air barrier shall be continuous for all assemblies which are the thermal envelope of the building and across the joints and assemblies. ~~throughout the envelope (at the lowest *floor*, exterior *walls*, and ceiling or *roof*). Air barrier joints and seams shall be sealed; including sealing transitions in planes and changes in materials. Air barrier penetrations shall be sealed.~~

2. ~~The~~ Air barrier joints and seams shall be sealed including sealing transitions in places and changes in materials. Air barrier penetrations shall be sealed in accordance with Section 502.4.2. 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 accommodate expected building movement. ~~component of each assembly shall be joined and sealed in a flexible manner to the air barrier component of adjacent assemblies. The joints and seals shall allow for the relative movement of the assemblies and materials without damage to the air seal.~~

~~3. The air barrier shall be installed in accordance with the *manufacturer's* instructions in a manner that achieves the performance requirements.~~

3. ~~Where lighting *fixtures* with ventilation holes or other similar objects are to be installed in such a way as to penetrate the *continuous air barrier*, provisions shall be made to maintain the integrity of the *continuous air barrier*.~~ Recessed lighting fixtures shall comply with Section 504.2.8. Where similar objects are installed which penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

Exception: Buildings that comply with Section 502.4.1.2.3 below are not required to comply with either Item 1 or ~~4~~ 3.

502.4.1.2 Air barrier compliance options. A continuous air barrier for the opaque building envelope shall meet the requirements of at least one of the compliance options in Section 502.4.1.2.1, 502.4.1.2.2, or 502.4.1.2.3

502.4.1.2.1 Materials. ~~Individual~~ materials shall have an air permeability ~~not to exceed~~ no greater than 0.02 L/s·m2 under a pressure differential of 75 Pa (0.004 cfm/ft2 under a pressure differential of 0.3 in. water (1.57 lb/ft^2)) when tested in accordance with ASTM E2178. Materials used as a n air barrier shall be installed in accordance with manufacturer's installation instructions for air barriers and all joints shall be sealed in accordance with Section 502.4.2. ~~The following materials comply with this requirement when all joints are sealed:~~

~~1. Plywood - minimum 3/8 in (10 mm)~~
~~2. Oriented strand board - minimum 3/8 in (10 mm)~~
~~3. Extruded polystyrene insulation board - minimum 3/4 in (19 mm)~~
~~4. Foil-back urethane insulation board - minimum 3/4 in (19 mm)~~
~~5. Closed cell spray foam meeting air permeability requirement~~
~~6. Open cell spray foam meeting air permeability requirement~~
~~7. Weather resistant barrier meeting air permeability requirement~~
~~8. Exterior or interior gypsum board - minimum 1/2 in (12 mm)~~
~~9. Cement board - minimum 1/2 in (12 mm)~~
~~10. Built up roofing membrane~~
~~11. Modified bituminous roof membrane~~
~~12. Fully adhered single-ply roof membrane~~
~~13. A Portland cement/sand parge, or gypsum plaster minimum 5/8 in (16 mm) thick~~
~~14. Cast-in-place and precast concrete.~~
~~15. Fully grouted concrete block masonry.~~
~~16. Sheet steel or aluminum~~

502.4.1.2.2 Assemblies. Assemblies of materials and components shall have an average air leakage not to exceed 0.2 L/s·m2 @ 75 Pa (0.04 cfm/ft2 under a pressure differential of 0.3" w.g. (1.57psf)) when tested in accordance with ASTM E2357 or ASTM E1677. ~~The following assemblies comply with this requirement when all joints are sealed and every characteristic in Section 502.4.4.1.1 is met:,~~

~~1) Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;~~
~~2) A Portland cement/sand parge, stucco or plaster minimum 1/2 in (12 mm) thick.~~

502.4.1.2.3 Building Test. The completed building shall be tested and the air leakage rate of the *building envelope* shall not exceed 2.0 L/s·m^2 @ 75 Pa (0.40 cfm/ft^2 at a pressure differential of 0.3" w.g. (1.57 psf)) in accordance with ASTM E779 or an equivalent method approved by the code official.

502.4.2 Air Barrier Penetrations. ~~All~~ Penetrations of the air barrier and paths of air leakage ~~infiltration / exfiltration~~ shall be ~~made air tight and~~ shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seals shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials shall be appropriate to the construction materials being sealed. 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 accommodate expected building movement. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials~~.~~

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: The section of the proposal concerning opaque wall air barriers is modified to improve the enforceability of this section of the code. Specifically the "laundry list" materials and assemblies deemed to comply with the requirements were deleted. As there is a performance criteria and test method specified in the code for air barrier materials this list potentially confuses this requirement because the code may be interpreted to also allow any materials equivalent to those on the list. The list itself contains unspecified materials so that checking compliance would be difficult. Furthermore, the proponents have provided no rationale for selection of the listed materials, nor have they provided any test data showing that they meet the performance criteria for air barrier materials or assemblies.

Public Comment 34:

John Woestman, Kellen Company representing Builders Hardware Manufacturers Association (BHMA) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.4.1.1 The *continuous air barrier* shall have the following characteristics:

1. It shall be continuous throughout the envelope (at the lowest *floor*, exterior *walls*, and ceiling or *roof*). Air barrier joints and seams shall be sealed; including sealing transitions in planes and changes in materials. Air barrier penetrations shall be sealed.
2. The air barrier component of each assembly shall be joined and sealed in a flexible manner to the air barrier component of adjacent assemblies. The joints and seals shall allow for the relative movement of the assemblies and materials without damage to the air seal.
3. The air barrier shall be installed in accordance with the *manufacturer's* instructions in a manner that achieves the performance requirements.
4. Site-built fenestration in the building envelope shall be sealed, gasketed, or weatherstripped.
5. Where lighting *fixtures* with ventilation holes or other similar objects are to be installed in such a way as to penetrate the *continuous air barrier*, provisions shall be made to maintain the integrity of the *continuous air barrier*.

Exception: Buildings that comply with Section 502.4.1.2(3) below are not required to comply with either 1 or 4.

502.4.1.2.2 Assemblies. Assemblies of materials and components shall have an average air leakage not to exceed 0.2 L/s·m2 @ 75 Pa (0.04 cfm/ft2 under a pressure differential of 0.3" w.g. (1.57psf)) when tested in accordance with ASTM E2357 or ASTM E1677. The following assemblies comply with this requirement when all joints are sealed and every characteristic in Section 502.4.4.1.1 is met:

1. Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;
2. A Portland cement/sand parge, stucco or plaster minimum 1/2 in (12 mm) thick.

Exception: Fenestration assemblies shall comply with Section 502.4.3.

502.4.3 Fenestration ~~and doors~~. The air leakage of fenestration assemblies ~~and doors~~ shall meet the provisions of Table 502.4.3. Testing shall be performed in accordance with the applicable reference test standard by an accredited and independent testing laboratory and all fenestration assemblies *listed* and *labeled*.

Exception: Site-built fenestration assemblies ~~that are sealed in accordance~~ shall comply with Section 502.4.1 except Section 502.4.1.2.2.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: In accepting proposed change EC147, the Committee's reason statement acknowledged that there are elements of this proposal that need refinement via public comment. We offer this public comment in that spirit. BHMA submitted several public comments for EC147 to allow each subject to be evaluated individually.

Starting with Section 502.4.3 and working backwards through the proposed revisions of this public comment:

Doors are fenestration per the definition in Chapter 2. Deleting the redundant "doors" should reduce confusion with understanding the code.

The exception in Section 502.4.3 refers to Section 502.4.1 for requirements for site-built fenestration. The requirements of Section 502.4.1.2.2 (a sub-section of 502.4.1) for assemblies could be interpreted as applying to fenestration assemblies while it is clear that fenestration assemblies are dealt with in Section 502.4.3. The proposed revisions in Sections 502.4.3 and 502.4.1.2.2 clarify the language. Additionally, to eliminate a circular code reference, the language "except Section 502.4.1.2.2" is recommended to be added to the exception in 502.4.3.

Section 502.4.1 is relatively vague as to specific requirements for site-built fenestration. The proposed language in 502.4.1.1 specifies sealing, gasketing, or weatherstripping as requirements for site-built fenestration.

Public Comment 35:

John Woestman, Kellen Company representing Builders Hardware Manufacturers Association (BHMA) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.4.3 Fenestration and doors. The air leakage of fenestration assemblies and doors shall meet the provisions of Table 502.4.3. Testing shall be performed in accordance with the applicable reference test standard by an accredited and independent testing laboratory and all fenestration assemblies ~~*listed* and~~ shall be *labeled*.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: In accepting proposed change EC147, the Committee's reason statement acknowledged that there are elements of this proposal that need refinement via public comment. We offer this public comment in that spirit. BHMA submitted several public comments for EC147 to allow each subject to be evaluated individually.

Exterior fenestration is required to be *labeled*, but not *listed*, by other sections of the IECC. Exterior fenestration, for purposes of energy efficiency, is almost never listed (except fire-rated windows and doors which are listed for their fire rating).

Public Comment 36:

John Woestman, Kellen Company representing Builders Hardware Manufacturers Association (BHMA) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Table 502.4.3
Maximum Air Infiltration Rate for Fenestration Assemblies

Fenestration Assembly	Maximum Rate
Windows	0.20 [a]
Sliding Doors	0.20 [a]
Swinging Doors	0.20 [a]
Skylights	0.20 [a]
Curtain Walls	0.06 [b]
Storefront Glazing	0.06 [b]
Commercial ~~Glazed Swinging~~ Entrance Doors	1.00 [c]
Revolving Doors	1.00 [c]
Rolling Doors	1.00 [c]

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: In accepting proposed change EC147, the Committee's reason statement acknowledged that there are elements of this proposal that need refinement via public comment. We offer this public comment in that spirit. BHMA submitted several public comments for EC147 to allow each subject to be evaluated individually.

Commercial entrance doors are an important architectural feature of many commercial buildings and must meet conflicting architectural and performance requirements (i.e. aesthetics, frequent use, security, accessibility, egress, abuse, durability, thermal, and air and water infiltration).

Commercial entrance doors may be constructed primarily of glass, be fully glazed, partially glazed, or opaque. Commercial entrance doors may be hinged or pivoting; powered, power-assist, or manual; or may be power operated sliding doors.

Specifically, commercial entry doors often have primary functions that should be prioritized over the more stringent air infiltration requirements placed on other fenestration products. One primary concern is compliance with the opening force requirements of ICC / ANSI A117 (Chapter 11 of the IBC), as well as operational requirements for doors as components of the means of egress as required by Chapter 10 if the IBC and IFC. It is known that aggressive sealing and gasketing of these doors and their openings can impede their operation and cause non-compliance with these primary and priority functions.

This public comment revises the language to eliminate the limitation in this line item to glazed swinging commercial entrance doors.

Public Comment 37:

John Woestman, Kellen Company representing Builders Hardware Manufacturers Association (BHMA) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.4.4 Doors and Access Openings to Shafts, Chutes, Stairwells, and Elevator Lobbies. These doors and access openings shall either meet the requirements of 502.4.3 or shall be ~~equipped with weather seals~~ <u>gasketed, weatherstripped, or sealed.</u>

> **Exception:** ~~Weatherseals on elevator lobby doors are not required when a smoke control system is installed.~~ <u>Door openings required to comply with Section 715 or Section 715.4 of the International Building Code; or doors and door openings required by the *International Building Code* to comply with UL 1784 shall not be required to comply with Section 502.4.4.</u>

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: In accepting proposed change EC147, the Committee's reason statement acknowledged that there are elements of this proposal that need refinement via public comment. We offer this public comment in that spirit. BHMA submitted several public comments for EC147 to allow each subject to be evaluated individually.

This proposal improves the stated requirements of Section 502.4.4 regarding sealing the opening.

And, the revisions to the exception are intended to mesh with requirements for doors in openings required by the IBC to be fire rated (per IBC Section 715 or Section 715.4) or required by the IBC to comply with UL 1784 testing (i.e. smoke doors). Most fire rated doors and smoke doors require gaskets, seals, or weatherstripping to meet fire or smoke performance requirements.

Public Comment 38:

Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) and Julie Ruth, JRuth, Code Consulting, representing American Architectural Manufacturers Association (AAMA) requests Disapproval.

(Steve Ferguson) EC147, approved as submitted by the IECC committee, eliminates an important option for the design of buildings for energy conservation from the IECC and contains numerous flaws that would place incomplete or incorrect information into the code and therefore should be disapproved. The following summarizes the reasons supporting the action of DISAPPROVAL.

ASHRAE/IESNA Standard 90.1, and its predecessor Standard 90-75, has been a mainstay of the energy conservation standards and codes for buildings used in the United States for over 30 years. In fact Standard 90-75, promulgated and issued by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) in 1975 was used as the basis for the first edition of the Model Energy Code (MEC) in 1977. The MEC was used for the beginning draft for development of the International Energy Conservation Code (IECC). So, since the first MEC in 1977 to the 2009 IECC the code user has always had some edition of Standard 90.1 influencing design or as a compliance path for commercial buildings. There is no technical reason given in EC147 to justify the removal of Standard 90.1 as one of the compliance options after more than 30 years of influence on energy conservation design of buildings.

With regard to flaws in the proposal it appears numerous parts of the IECC proposal were based on energy conservation proposals (i.e. addenda) to ASHRAE/IESNA Standard 90.1 - 2007 that were ongoing within the ASHRAE standards making process of Standard 90.1. Examples include requirements for energy recovery ventilation systems, damper leakage, and fan power limitation. Those addenda were still in development when EC147 was submitted to the IECC and therefore still subject to changes through the ANSI standards consensus process ASHRAE follows. Modifications to portions of the technical requirements were made as a result of public review comments received. Thus EC147 contains the technical flaws because it reflects requirements in the initial addenda drafts without revision. Approval of EC147 as submitted will also cause further divergence between the IECC and 90.1-2010.

Specific examples are as follows:

To better align with 90.1 Addendum CB, the maximum allowable duct leakage rate should remain at 4, not 3. While working on addendum CB, the 90.1 damper working group considered a potential change from class 1 to class 1A dampers (from 4 to 3 cfm/ft^2). Class 1 was left in place for the following reasons:

1. The cfm/ft^2 metric favors rectangular dampers over round dampers, because the area of the rectangular damper is greater than a round damper selected for the same duty. This equivalent duty round damper will actually leak less cfm, but will look worse in the cfm/ft^2 metric. Round dampers naturally feature better actual leak tightness with fewer joints in the air path and this should be intuitively obvious. The difference is more pronounced at the higher pressure classes. Round dampers also can be designed to accommodate accurate flow measurement with relatively simple components, due to more uniform flow distribution. Without accurate outdoor air flow measurement, it is difficult to comply with mechanical ventilation codes without wasting energy. A suitable, tested and reported metric in lieu of cfm/ft^2 was not readily available.
2. Several practitioners in the 90.1 mechanical subcommittee raised doubts on the economic justification for the added cost of class IA over class I across the board for 3+ story buildings as proposed in EC147. The damper working group did not find cost justification in going from class 2 (10 cfm/ft^2) down to class I in climate zones 1,2,3 low rise buildings and climate zones 1 and 2 in any height building. Especially in these situations, requiring an additional expense for class IA would be even less cost effective.
3. While there are several dampers available in class 1A, not all applications will have a class 1A option.

4. More savings can be achieved through climate and building height differentiations and requiring motorized over gravity backdraft dampers in more situations.
5. Dampers smaller than 24" in. either direction are not readily available with leakage rates of Class 1A, or even Class 1 and 2. Therefore, we propose an exception for these at class 3 (40 cfm/ft^2).

Furthermore, this doesn't discuss leakage through the components of the mechanical equipment which is under 503, not 502. Any change in 502 envelope should be coordinated with section 503, shutoff dampers. Section 503 shutoff dampers has no complementary changes proposed by EC147. This will cause confusion as to code compliance.

The controls requirements for automatic opening on event of fire or loss of power to the damper should refer only to stair and shaft vents, not outdoor air and exhaust openings. In addition, there are currently no controls proposed for automatically shutting outdoor air and exhaust openings when the spaces are not in use. EC147 does not allow compliance with 502 and 503 approved as submitted.

ASHRAE recommends that EC147, approved as submitted by the IECC committee, be DISAPPROVED based on these reasons.

(Julie Ruth) AAMA is opposed to the reduction of vertical fenestration area permitted under the prescriptive method from 40% to 30% that is included in EC147. We have a concern first with regards to its potential impact on daylighting of commercial buildings, and secondly with regards to how it might be applied to commercial buildings whose exterior skin is hung from the structural elements of the building like a curtain – i.e. curtainwall. For high rise buildings to occur the exterior skin must be hung from the structural frame of the building in this way. The taller the building, the more impractical it becomes for the exterior wall to be load bearing.

As the maximum permitted U-factor and SHGC of glazed fenestration are pushed lower and lower the amount of natural light – daylighting – that enters the building through a specific size area of glazed fenestration is also inherently lowered. This is not a matter of technology not being advanced enough. It's a matter of physics. The coatings that reduce the heat transmittance through the glass do so by blocking the transfer of energy waves through the glass. Since light is transferred by energy waves, these coatings effect the transfer of light as well as the transfer of heat energy.

The only way to counter this reduction in transferred light, and provide an adequate amount of natural light to the interior space when glass that reduces the amount of light transferred per given area, is to increase the size of the glazed fenestration area. Reducing the percentage of fenestration area permitted would not only prohibit this, it would run counter to the change that is needed to maintain natural, zero net energy lighting in the interior space.

With regards to the use of curtainwall on commercial buildings, students of architecture understand that although the use of load bearing exterior walls for low rise buildings do not usually negatively affect the height, or overall design, of the building, it will start to have an effect once the building design rises above a few stories. Furthermore, use of curtainwall as the exterior skin is essential for the construction of buildings greater than 12 to 15 stories in height.

Although some interpret the IECC as only measuring the visibly glazed areas of curtainwall when determining Window to Wall area, the IECC does not define how it is to be determined. Even if one does interpret "window" in this regard to only apply to vision areas and not the entire curtainwall area, the criteria for the other, "spandrel panel" portions of the curtainwall is not defined. The current definition of fenestration in the IECC – "Skylights, roof windows, vertical windows (fixed or moveable), opaque doors, glazed doors, glazed block and combination opaque/glazed doors" offers little guidance in distinguishing what sections of curtainwall are to be counted as "Window area" and what sections of curtainwall are to be counted as "Wall area" but not "Window area". Clarification is needed.

Although it is true that the current proposal only reduces the percentage of vertical fenestration when prescriptive design is performed, its approval could very well be carried over into performance based design next cycle. Such an extension could make future construction of high rise buildings in the U.S. significantly more difficult.

We also have a concern with the redundancy of the footnotes to Table 502.4.3, and the confusion created by reference to "fenestration and doors" throughout Section 502.4.3. The definition of fenestration contained in the IECC includes doors. So the phrase "fenestration and doors" is redundant and confusing.

Finally, we have a concern with the provision of Section 502.2.1 that requires skylight curbs to be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

Section 2610.2 of the 2009 IBC requires light transmitting plastic skylights to be mounted on a curb at least 4 inches above the plane of low slope roofs (slope < 3:12). If insulation is provided above the roof deck to the height of the curb, this makes a 4 inch projection of the curb above the plane of the roof impossible. If the option of providing R-5 insulation is taken the amount of insulation being provided is significantly reduced for most climate zones. Its not clear from this sentence to what distance from the skylight curb the R-5 insulation is to be installed. Perhaps the intent of the sentence is to require insulation be installed vertically along the height of the curb? The detailing intended here is not clear.

Further, NFRC procedures require the curb to be taken into consideration when the U-factor of skylights is determined. Therefore, the curb is already governed by the U-values of Table 502.3. The sentence proposed for Section 502.2.1 conflicts with these requirements, and is unnecessary.

Therefore we urge the disapproval of EC147.

Final Action: AS AM AMPC____ D

EC148-09/10
501.1, 501.2, 502.1.1

Proposed Change as Submitted

Proponent: Mark Nowak, representing Steel Framing Alliance

Revise as follows:

501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. These commercial buildings shall meet either the requirements of ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*, or the requirements contained in this chapter.

> **Exception:** Wall insulation requirements under ASHRAE/IESNA Standard 90.1 shall not be required to exceed the maximum thicknesses of continuous insulation specifically allowed by the exterior finish manufacturer instructions or other applicable building code requirements.

501.2 Application. The *commercial building* project shall comply with the requirements in Sections 502 (Building envelope requirements), 503 (Building mechanical systems), 504 (Service water heating) and 505 (Electrical power and lighting systems) in its entirety. As an alternative the *commercial building* project shall comply with the requirements of ASHRAE/IESNA 90.1 in its entirety.

> **Exception:** Buildings conforming to Section 506, provided Sections 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied.

> **Exception:** Wall insulation requirements under ASHRAE/IESNA Standard 90.1 shall not be required to exceed the maximum thicknesses of continuous insulation specifically allowed by the exterior finish manufacturer instructions or other applicable building code requirements.

502.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Tables 502.2(1) and 502.3 based on the climate *zone* specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table 502.2(1). Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table 502.2(1). Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table 502.3 shall comply with the building envelope provisions of ASHRAE/IESNA90.1.

> **Exception:** Wall insulation requirements under ASHRAE/IESNA Standard 90.1 shall not be required to exceed the maximum thicknesses of continuous insulation specifically allowed by the exterior finish manufacturer instructions or other applicable building code requirements.

Reason: This exception is intended to limit the applicability of ASHRAE/IESNA Standard 90.1 due to concerns of code conflict and liability issues.

Addendum-bb, voted out for public comment during the January 2009 meeting of ASHRAE SSPC 90.1, contains requirements for opaque wall assemblies (Tables 5.5-1 to 5.5-8) that raise concerns about code conflicts, significant departure from standard industry practice, and liability and warranty issues. Ultimately these issues, if 90.1 continues to be referenced in the IECC, will create conflicts with both the IRC and IBC.

In current versions of both the IECC and ASHRAE 90.1, the insulation requirements for light framed wall assemblies in most climates never reach beyond R13 in the cavity with R 7.5 continuous insulation (R13+R7.5). The proposed values in 90.1 Addendum-bb begin to increase to R13 cavity with R 18.8 continuous insulation (R13+R18.8) starting in climate zone 4.

Assuming ASHRAE Handbook of Fundamentals R-values for different continuous insulation materials, to reach a value of R18.8 continuous insulation, a builder would need to use 3 inches of Polyisocyanurate; over 3 inches of Extruded Polystyrene; and almost 5 inches of Expanded Polystyrene. This represents a dramatic departure from current industry practice and will cause conflicts in warranties and code enforcement as detailed below.

Warranty, liability, and code conflicts exist when using thick levels of continuous insulation due to limitations cited in manufacturer installation instructions for exterior finishes. Research into these installation requirements for exterior finishes (vinyl siding, fiber cement siding, wood siding, stucco, brick and stone veneers) installed over continuous insulation revealed that in many cases, installation instructions limit continuous insulation applications to 0.5 inches to 1.5 inches of thickness.

In situations where exterior finishes limit the amount of continuous insulation that their product can be applied over, requiring continuous insulation thicknesses beyond these limitations becomes a liability and a conflict within code. Virtually all product warranties in the building industry include a clause that voids the warranty if materials are not installed per the manufacturer's installation instructions.

Even when no direct limitation of continuous insulation thickness exists in a manufacturer's installation instructions, there is still often recommended levels of insulation. Research found no examples of recommended thicknesses of insulation above 1.5 inches. A wide variety of exterior finishes from multiple manufacturers would have their warranties voided when installed at many of the thicknesses required in Addendum-bb.

In addition, general practice in building codes is to require installation per the manufacturer's instructions. Therefore, not only would thick levels of insulation void warranties, making builders or building owners liable, it would also violate code in many cases. Specific examples of code requiring exterior finishes to be installed per manufacturer's installation instructions can be found in IBC 2009 (section 1405) and IRC 2009 (section R703). In any case where the continuous insulation has been limited by the installation instructions of the exterior finish manufacturer, installing insulation thicker than allowed would violate code.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: Nowak-EC-1-501.1-501.2-502.1.1

Public Hearing Results

Committee Action: Disapproved

Committee Reason: The proponent's concern with the standard should be resolved through the working with ASHRAE to revise the standard.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Jay H. Crandell, ARES Consulting, representing Foam Sheathing Coalition and Mark Nowak, representing Steel Framing Alliance, requests Approval as Modified by this Public Comment.

Replace the proposal as follows:

502.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Tables 502.2(1) and 502.3 based on the climate *zone* specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table 502.2(1). Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table 502.2(1). Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table 502.3 shall comply with the building envelope provisions of ASHRAE/IESNA 90.1. Cladding installation over foam sheathing as required by Table 502.2(1) or ASHRAE/IESNA 90.1 shall comply with Section 502.1.1.1.

502.1.1.1 Cladding installation over foam sheathing. Cladding shall be specified and installed in accordance with Chapter 14 of the *International Building Code* and the cladding manufacturer's installation instructions. Where used, furring and furring attachments shall be designed to resist design loads in accordance with Chapter 16 of the *International Building Code*. In addition, the cladding or furring attachments over foam sheathing shall meet or exceed the minimum fastening requirements of Sections 502.1.1.1.1 or 502.1.1.1.2 for support of cladding weight.

502.1.1.1.1 Direct cladding attachment. Where installed directly over foam sheathing without the use of furring, cladding minimum fastening requirements to support the cladding weight shall be as specified in Table 502.1.1.1.1. For exterior insulation and finish systems, refer to the *International Building Code*, Section 1408.

TABLE 502.1.1.1.1 CLADDING MINIMUM FASTENING REQUIREMENTS FOR DIRECT ATTACHMENT OVER FOAM SHEATHING TO SUPPORT CLADDING WEIGHT[a]

Cladding Fastener Through Foam Sheathing into:	Cladding Fastener -Type and Minimum Size[b]	Cladding Fastener Vertical Spacing (inches)	Maximum Foam Sheathing Thickness (inches)					
			16" o.c. Fastener Horizontal Spacing			24" o.c. Fastener Horizontal Spacing		
			Maximum Cladding Weight:			Maximum Cladding Weight:		
			3 psf	11 psf	25 psf	3 psf	11 psf	25 psf
Wood Framing (minimum 1-1/4 inch penetration)	0.113" diameter nail	6	4	3	1	4	2	0.75
		8	4	2	0.75	4	1.5	DR
		12	4	1.5	DR	3	0.75	DR
	0.120" diameter nail	6	4	3	1.5	4	2	0.75
		8	4	2	1	4	1.5	0.5
		12	4	1.5	0.5	3	1	DR
	0.131" diameter nail	6	4	4	1.5	4	3	1
		8	4	3	1	4	2	0.75
		12	4	2	0.75	4	1	DR
Steel Framing (minimum penetration of steel thickness + 3 threads)	#8 screw into 33 mil steel or thicker	6	3	3	1.5	3	2	DR
		8	3	2	0.5	3	1.5	DR
		12	3	1.5	DR	3	0.75	DR
	#10 screw into 33 mil steel	6	4	3	2	4	3	0.5
		8	4	3	1	4	2	DR

Cladding Fastener Through Foam Sheathing into:	Cladding Fastener -Type and Minimum Size[b]	Cladding Fastener Vertical Spacing (inches)	Maximum Foam Sheathing Thickness (inches)					
			16" o.c. Fastener Horizontal Spacing			24" o.c. Fastener Horizontal Spacing		
			Maximum Cladding Weight:			Maximum Cladding Weight:		
			3 psf	11 psf	25 psf	3 psf	11 psf	25 psf
		12	4	2	DR	3	1	DR
	#10 screw into 43 mil steel or thicker	6	4	4	3	4	4	2
		8	4	4	2	4	3	1.5
		12	4	3	1.5	4	3	DR

For SI: 1 inch = 25.4 mm; 1 pound per square foot (psf) = 0.0479 kPa
DR = design required
o.c. = on center
a. Wood framing shall be Spruce-Pine-Fir or any wood species with a specific gravity of 0.42 or greater. Steel framing shall be minimum 33 ksi steel for 33 mil and 43 mil steel thickness and 50 ksi steel for 54 mil steel or thicker.
b. Fasteners shall comply with applicable material requirements in the *International Building Code* , except fastener length shall be permitted to exceed standard lengths.

502.1.1.1.2 Furred cladding attachment. Where steel or wood furring is used to attach cladding over foam sheathing, furring minimum fastening requirements to support the cladding weight shall be as specified in Table 502.1.1.1.2. Where placed horizontally, wood furring shall be preservative treated wood in accordance with the *International Building Code*, Section 2303.1.8 or naturally durable wood and fasteners shall be corrosion resistant in accordance with the *International Building Code*, Section 2304.9.5. Steel hat channel furring shall have a minimum G60 galvanized coating.

Exception: Furring shall not be required over foam plastic sheathing located behind anchored stone and masonry veneer installed in accordance with the *International Building Code*, Section 1405.6. Veneer ties shall be installed on the surface of the foam plastic sheathing with fasteners of sufficient length to pass through the thickness of foam plastic sheathing and penetrate framing to provide required pull-out resistance in accordance with the *International Building Code*, Chapter 16.

TABLE 502.1.1.1.2 FURRING MINIMUM FASTENING REQUIREMENTS FOR APPLICATION OVER FOAM SHEATHING TO SUPPORT CLADDING WEIGHT [a,b]

Furring Material	Framing Member	Fastener Type and Minimum Size	Minimum Penetration into Wall Framing (inches)	Fastener Spacing in Furring (inches)	Maximum Thickness of Foam Sheathing (inches)					
					16" o.c. FURRING[d]			24" o.c. FURRING[d]		
					Maximum Cladding Weight:			Maximum Cladding Weight:		
					3 psf	11 psf	25 psf	3 psf	11 psf	25 psf
Wood Furring (not less than 1 inch nominal thickness)[c]	Wood Stud (not less than 2 inch nominal thickness)	0.120" diameter nail	1-1/4	8	4	4	1.5	4	2	1
				12	4	2	1	4	1.5	0.5
				16	4	2	0.5	4	1	DR
		0.131" diameter nail	1-1/4	8	4	4	2	4	3	1
				12	4	3	1	4	2	0.75
				16	4	2	0.75	4	1.5	DR
		#8 wood screw[e]	1	12	4	4	1.5	4	3	1
				16	4	3	1	4	2	0.5
				24	4	2	0.5	4	1	DR
		¼" lag screw[e]	1-1/2	12	4	4	3	4	4	1.5
				16	4	4	2	4	3	1
				24	4	3	1	4	2	0.5
Steel Hat Channel (minimum 33 mil thickness) or Wood Furring (not less than 1 inch nominal thickness)[c]	Steel Stud (33 mil thickness)	#8 screw	Steel thickness + 3 threads	12	3	1.5	DR	3	0.5	DR
				16	3	1	DR	2	DR	DR
				24	2	DR	DR	2	DR	DR
		#10 screw	Steel thickness + 3 threads	12	4	2	DR	4	1	DR
				16	4	1.5	DR	3	DR	DR
				24	3	DR	DR	2	DR	DR
	Steel Stud (43 mil or thicker)	#8 Screw	Steel thickness + 3 threads	12	3	1.5	DR	3	0.5	DR
				16	3	1	DR	2	DR	DR
				24	2	DR	DR	2	DR	DR
		#10 screw	Steel thickness + 3 threads	12	4	3	1.5	4	3	DR
				16	4	3	0.5	4	2	DR
				24	4	2	DR	4	0.5	DR

For SI: 1 inch = 25.4 mm; 1 pound per square foot (psf) = 0.0479 kPa.
DR = design required
o.c. = on center
a. Wood furring and wood studs shall be Spruce-Pine-Fir or any softwood species with a specific gravity of 0.42 or greater.Steel hat channel furring shall be minimum 33 ksi steel. Steel studs shall be minimum 33 ksi steel for 33mil and 43 mil thickness and 50 ksi steel for 54 mil steel or thicker.
b. Fasteners shall comply with applicable material requirements in the *International Building Code* , except fastener length shall be permitted to exceed standard lengths. .

c. Where the required cladding fastener penetration into wood material exceeds ¾ inch (19.1 mm) and is not more than 1-1/2 inches (38.1 mm), a minimum 2 inch (51 mm) nominal thickness wood furring shall be used unless approved deformed shank siding nails or siding screws are used to provide equivalent withdrawal strength allowing connection to minimum 1 inch (25 mm) nominal thickness wood furring.
d. Furring shall be spaced a maximum of 24 inches (610 mm) on center, in a vertical or horizontal orientation. In a vertical orientation, furring shall be located over wall studs and attached with the required fastener spacing. In a horizontal orientation, the indicated 8 inch (203.2 mm) and 12 inch (304.8 mm) fastener spacing in furring shall be achieved by use of two fasteners into studs at 16 inches (406.4 mm) and 24 inches (610 mm) on center, respectively.
e. Lag screws shall be installed with a standard cut washer. Lag screws and wood screws shall be pre-drilled in accordance with AF&PA/NDS. Approved self-drilling screws of equal or greater shear and withdrawal strength shall be permitted without pre-drilling.

Commenter's Reason: The purpose of this public comment is to provide cladding connection solutions in EC148-09/10 that help enable compliance with ASHRAE 90.1 and IECC Chapter 5 continuous insulation requirements rather than using an exception statement that limits or alters application of ASHRAE 90.1 due to concern with a lack of readily available siding attachment information for installation over thick foam sheathing. This approach effectively works with the intent of the ASHRAE 90.1 standard in response to the recommendation provided by the IECC committee regarding EC148-09/10.

These siding connection requirements have already been recommended for adoption in the New York State Energy Code which is based on the 2009 IECC in response to a similar concern. This proposal is essentially the same as that approved by the NY code commission with additional editorial improvements as recommended by ICC staff. We have incorporated this proposal as a part of one of the subsections in Section 502.1 as addressed in the original EC148-09/10 proposal. However, in the NYS case, they placed these proposed requirements a new Section 502.2.8 which we are not opposed to doing if staff feels such action results in a better code format.

The proposed requirements are based on a project sponsored by the New York State Energy Research and Development Agency (NYSERDA) and the Steel Framing Alliance. The project report is available for download at http://data.memberclicks.com/site/sfa/NYSERDA_TASK_3_REPORT%20-%20FINAL_(3-22-10).pdf . The purpose of the project was to develop prescriptive fastening requirements for cladding materials installed over foam sheathing to ensure adequate performance. The project included testing of cladding attachments through various thicknesses of foam sheathing using various fastener types on steel frame wall assemblies. Supplemental testing also was sponsored by the Foam Sheathing Coalition (lab report available at www.foamsheathing.org) to address attachments to wood framing and the resulting data is included in the data set analyzed and presented in the NYSERDA project report. Based on rational analysis verified by the extensive test data to control siding connection movement to no more than 0.015" slip under siding dead load (which resulted in safety factors commonly in the range of 5 to 8 relative to average shear capacity), the siding attachment requirements and foam thickness limitations included in this proposal were developed.

The requirements are also included in the NYSERDA report and in the provisions recommended by the NY code commission to be adopted by the New York State Energy Code. These requirements are in addition to (not a replacement for) minimum fastening requirements for various siding materials referenced in the IBC which provide for requirements to resist wind pressure among other things.

Final Action: AS AM AMPC____ D

EC150-09/10
501.1, 501.2

<u>Proposed Change as Submitted</u>

Proponent: Larry Spielvogel, PE, Consulting Engineer

Revise as follows:

501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. These commercial buildings shall meet ~~either the requirements of ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*, or~~ the requirements contained in this chapter.

501.2 Application. The *commercial building* project shall comply with the requirements in Sections 502 (Building envelope), 503 (Building mechanical systems), 504 (Service water heating) and 505 (Lighting) in its entirety.~~ As an alternative the *commercial building* project shall comply with the requirements of ASHRAE/IESNA 90.1 in its entirety.~~

> **Exception:** Buildings conforming to Section 506, provided Sections 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied.

Reason: The purpose of this code change is to delete the current option that exists to use ASHRAE 90.1 in lieu of all of the requirements in Chapter 5 of the IECC. This code change will make the IECC simpler, less expensive to use, and will prevent people from using ASHRAE 90.1 to get around the provisions of IECC Chapter 5.

1. **<u>Circumvents IECC Requirements.</u>** The current option to use the less stringent ASHRAE 90.1 in lieu of the requirements in IECC Chapter 5 provides the user with multiple ways to circumvent many of the IECC and other I Code requirements. Thus, compliance with ASHRAE 90.1 conserves less energy than with IECC compliance. The lighting provisions in Section 9.6 of ASHRAE 90.1 are less stringent than those in 505.5.2 of IECC. For example, office lighting in IECC Table 505.5.2 is limited to 1.0 watts per square foot, while in Table 9.6.1 of ASHRAE 90.1 the limit is 1.1 watts per square foot-10% higher. ASHRAE 90.1 also allows additional lighting power allowances in Section 9.6.2 that are much higher than those in IECC Table 505.5.2. The IECC should not allow people to circumvent adopted lighting power allowances without justification. Finally, IECC 502.4.5 requires the use of the 2007 AMCA standard 500D for dampers in Chapter 6, while ASHRAE 90.1 requires the use of the 1998 AMCA Standard 500D in Section 12. Thus, the option to use ASHRAE 90.1 circumvents the IECC required use of the current 2007 AMCA damper standard.
2. **<u>ASHRAE 90.1 Unenforceable.</u>** ASHRAE 90.1 is unenforceable because the requirements are so numerous and so complex that most code officials do not have and cannot readily or economically get the extensive training and experience to be able to understand and enforce the ASHRAE 90.1 requirements. There are almost no local training courses or programs on ASHRAE 90.1 for code officials. At best, there may be a dozen or so competent and comprehensive training programs on ASHRAE 90.1 each year in the entire country, mostly in a few major cities, and none of those is specifically for code officials. Learning and understanding ASHRAE 90.1 is also difficult even for most practicing architects, engineers, and contractors, making it difficult for them to comply, thus imposing an even greater burden on code officials to verify compliance. Even the ASHRAE 90.1 committee itself has difficulty writing and understanding the standard, since they issue dozens of addenda, errata, formal interpretations, and informal interpretations every single year in attempts to change or clarify their intent and rectify their own numerous errors. The current erratum for the ASHRAE 90.1 Users Manual is 12 pages long and is the fourth edition in less than a year. Thus, the criteria and requirements in ASHRAE 90.1 change almost weekly. Just the 44 addenda shown in Appendix F of ASHRAE 90.1 represent hundreds of changes from the prior 2004 edition. Nor are the changes from the prior edition marked, as they are in the IECC. Which of these many documents and provisions are to be enforced for any specific permit application on any specific day?
3. **<u>Not Coordinated.</u>** The IECC is coordinated with the other International Codes, and ASHRAE 90.1 is not. This results in conflicts and contradictions. For example, the IECC has at least eight references to and requirements for compliance with the International Mechanical Code, while ASHRAE 90.1 has none. While some of the provisions in IECC are similar to ASHRAE, ASHRAE 90.1 has many more requirements and exceptions that do not exist in the IECC, providing more latitude and less stringency than IECC.
4. **<u>Not Unified.</u>** Providing the option to use ASHRAE 90.1 in lieu of IECC Chapter 5 diverts efforts from pursuing a unified and comprehensive set of International Codes. The option to use ASHRAE 90.1 in lieu of IECC Chapter 5 provides an unsupervised and unmonitored path for special and vested interests to include their provisions in ASHRAE 90.1 that would never be accepted in the IECC. Thus, the “back door” to ASHRAE 90.1 opens wider than that for the IECC, especially since so many of the ASHRAE 90.1 voting members work for or represent special interests, so they can pursue those interests from the inside. For example, a significant percentage of the members of the ASHRAE 90.1 Mechanical Subcommittee are employed by manufacturers of heating, air conditioning, and water heating equipment, or by their trade associations. Most of the other voting members of the ASHRAE 90.1 committee do not know enough to debate and vote intelligently on those issues, which are then adopted and included in the standard. As another example, the majority of the voting members of the ASHRAE 90.1 committee know little or nothing about lighting, so there is a great tendency to “rubber stamp” recommendations that come from the Lighting Subcommittee. Accordingly, many provisions in ASHRAE 90.1 diverge substantially from those in IECC.
5. **<u>Copies unavailable.</u>** ASHRAE does not provide free copies of 90.1 ($119 per copy) to code officials. Very few jurisdictions have budgets to purchase copies for each plan checker and inspector, much less the estimated thousands of dollars per user to purchase the many references needed to determine compliance. Few jurisdictions, and similarly few architectural, engineering, or construction firms have the sophisticated software, training, and experience, much less the time and computers required to run the Section 11 Energy Cost Budget (ECB) Method calculations allowed by ASHRAE 90.1 for further compliance options.
6. **<u>Use of ASHRAE 90.1 Not Precluded.</u>** Most, if not all relevant provisions of ASHRAE 90.1 can still be used at the discretion of the user, so long as they are at least as stringent as Chapter 5 of IECC. People who wish to comply with ASHRAE 90.1 for other reasons, such as, but not limited to LEED® certification can still do so, provided they also meet the requirements of Chapter 5 of IECC.

Cost Impact: There will be a cost savings since code officials and users of the IECC will not have to buy additional standards and references or take the time and pay for additional training. The provisions proposed for deletion are simply optional.

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Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: For consistency with the action taken to disapprove EC 149-09/10.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Larry Spielvogel, Consulting Engineer, representing self requests Approval as Submitted.

Commenter's Reason: EC 150 was disapproved in Baltimore. It came within one vote of being approved. At those hearings, there was no rebuttal to the six published reasons, except that ASHRAE now verbally claims they will provide free copies of the Standard to code officials, if they know to request them. To this day, ASHRAE does not even say so or publicize that fact, so most code officials end up having to buy the Standard. Otherwise, the remaining five reasons in the original code change proposal for approval of this code change are all still valid, with no rebuttal.

However, to properly use the ASHRAE Standard as an option to IECC Chapter 5 still requires the purchase of about 50 more documents and standards that are shown and referenced in Section 12 at a cost of thousands of dollars for each code official who enforces the ASHRAE Standard. There are another 15 documents referenced in Appendix E of the ASHRAE Standard. Training on the ASHRAE Standard is not readily available, and when it is available, it is very expensive.

The only purpose for this code change is to remove the option to use ASHRAE Standard 90.1-2010 in lieu of all of the requirements of Chapter 5. As of this writing, the proposed ASHRAE Standard for 2010 has not yet been approved or published. It will likely contain about 100 addenda to the 2007 edition, with many significant and complex changes. Even more training and retraining will be required and hard to find in most locations around the country.

If before the hearing in Charlotte, copies of the 2010 ASHRAE Standard are available, even skimming through the requirements is enough to show the enormous complexity. If you are not familiar with ASHRAE 90.1, then ask the code official and/or plan reviewer who deals with energy in your jurisdiction to see what they think of ASHRAE 90.1 and the difficulty in enforcing its extremely complicated provisions. If copies are not available, then you should vote EC 150 Approval as Submitted. Until the content of the ASHRAE Standard is carefully reviewed and public comment received, you will not know the pros and cons of what you are approving for the 2012 IECC by continuing the Disapproval of EC 150.

In addition to retaining the option to use the ASHRAE Standard in lieu of all requirements in Chapter 5, ASHRAE and others have put forth code change proposals and public comment that would allow users to further pick and choose between individual requirements in ASHRAE and Chapter 5, thus circumventing both. ASHRAE 90.1 has many more exceptions and options for their requirements than Chapter 5, many of which result in less stringency than IECC. How can it possibly be said that ASHRAE 90.1 and Chapter 5 of the IECC have the same stringency- they are two distinctly different standards with different levels of stringency and should remain separate.

For just one of hundreds of examples, will code officials want to and be able to enforce requirements such as the one in Addendum df to Standard 90.1-2007 for fractional horsepower fans in un-air conditioned elevator cabs that "shall not consume over 0.33 Watts per cfm at maximum speed?" However, the Standard does not cover fans in air-conditioned elevator cabs.

The 2010 ASHRAE Standard has become even more complicated and different from IECC Chapter 5. Indeed, even the majority of the members of the ASHRAE committee voting members who wrote and approved the Standard cannot understand all of the requirements, much less the majority of the code officials in the US who will be required to enforce this option, if this option is elected by an applicant.

ASHRAE Standard 90.1 is notorious for containing errors, inconsistencies, and contradictions. As of this writing, ASHRAE has issued nine separate sets of errata for the 2007 Standard that is referenced in the 2009 IECC. The 2007 Standard was relatively mature. They also issue interpretations. Therefore, if ASHRAE's past experience prevails, users and code officials will have to carefully check for published errata and interpretations for each set of plans submitted. What then does "in its entirety" in 501.2 really mean?

ASHRAE Standard 90.1-2010 which is proposed to be referenced in 501.1 was not reviewed or considered by the IECC Code Development committee and it was not considered by any of the hearing attendees at the time of the code development hearings in Baltimore. It is believed that it will be published very shortly before the Final Action Hearings. Thus, the public will not know when the Standard will even be available so it can be reviewed before the hearings. That is simply not due process. Therefore, it is not known if it will "be completed and readily available prior to Final Action Consideration" as stated in Section 3.6.3.1 of the International Code Council Policy #28, *Code Development*. Therefore, the consideration of a revised standard via a public comment is not in accordance with the process required by CP# 28 for updates of standards in the code, especially when that update contains hundreds of changes and additions.

Continuing to allow users of the IECC to elect the option to use ASHRAE Standard 90.1 results in lesser stringency, more options and exemptions, and less compliance than with Chapter 5 of the IECC. Standard 90.1 has several times as many requirements as the IECC, some of which are less stringent. These numerous additional requirements in Standard 90.1 make determination of compliance much more difficult for the code official.

For example, IECC 503.4.1 covers economizers and has three exceptions, while ASHRAE 6.5.1 has nine exceptions, making ASHRAE less stringent. The space-by-space lighting option and the additional lighting power allowances in 90.1 are less stringent than the building area method in IECC. Section 506 of the IECC requires the use of several *approved* values and criteria, an 8,760-hour per year simulation, and a signed certification, while ASHRAE 90.1 Chapter 11 does not and is thus less stringent.

Anyone can use Standard 90.1 and still comply with IECC without having the option that currently exists in 5.1.1 of the IECC. For those rare cases where Standard 90.1 may be more appropriate, the user can demonstrate the benefits to the code official and use Section 102.1 of the IECC, Alternate Materials. Vote for Approval as Submitted.

Public Comment 2:

Jeff Inks, representing Window & Door Manufacturers Association requests Approval as Submitted.

Commenter's Reason: The committee rejected this proposal stating the reference provides an alternative to compliance with Chapter 5 and the balance of the IECC and that the options for use by designers and code officials should be maintained, implying those alternatives and options are not available otherwise. However, removal of the reference does not hinder any of those actions.

We concur with proponents concern regarding enforceability, 90.1's lack of coordination with other I-codes, the fact the reference forces jurisdictions adopting the IECC to also be capable of applying and enforcing two energy codes, and other concerns with 90.1 such as the manner in which it is developed and maintained and compromises in energy efficiency. We therefore urge approval of this proposal as submitted.

Public Comment 3:

Ron Nickson, representing the National Multi-Family Housing Council; Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc. and AGC Flat Glass North America, Inc.; Henry A. Gorry, representing Guardian Industries, Corp.; and Paul Bush, representing PPG Industries request Approval as Modified by this Public Comment.

Modify the proposal as follows:

501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. These commercial buildings shall meet the requirements contained in this chapter.

501.2 Application. The *commercial building* project shall comply with the requirements in Sections 502 (Building envelope), 503 (Building mechanical systems), 504 (Service water heating) and 505 (Lighting) in its entirety.

> **Exception:** Buildings conforming to Section 506, provided Sections 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied, or, buildings conforming to Section 11 of ASHRAE/IESNA 90.1.

Commenter's Reason: Section 506 is the IECC performance path for commercial buildings. Section 11 of ASHRAE/IESNA 90.1 ("ASHRAE 90.1") is ASHRAE 90.1's performance path for commercial buildings. If adopted, this proposed modification of EC150 would retain ASHRAE 90.1 as an alternative to the performance path of IECC Section 506, but eliminate ASHRAE 90.1 as an alternative to IECC's prescriptive path. Proponents of the modification agree with the Committee that the option to use ASHRAE 90.1 should be retained; however, as a practical matter, most smaller commercial building projects that use the simpler, prescriptive path are built using the IECC, whereas, most large commercial building projects are built using the performance provisions found in Section 11 of ASHRAE 90.1. This proposed modification would recognize this standard practice by retaining the option to use the performance path found in Section 11 of ASHRAE 90.1, while limiting the prescriptive provisions to those found in the IECC.

Moreover, the prescriptive provisions of ASHRAE 90.1's 2010 edition are now very likely to differ significantly from the prescriptive provisions of the IECC. In that regard, on June 26, 2010, at a meeting held in Albuquerque, New Mexico, ASHRAE 90.1's Full Committee voted to adopt prescriptive provisions for its 2010 edition that will, literally, contain more than **350** differences from the prescriptive provisions of Chapter 5 of the IECC as recommended for adoption by the IECC Committee. These actions taken by ASHRAE 90.1's Full Committee were later adopted by ASHRAE's Board of Directors. Since it is very likely that ASHRAE's prescriptive provisions will be significantly different from IECC, continuing to use ASHRAE's prescriptive provisions as an option to IECC compliance will give small commercial building developers the option of selecting from two totally different sets of requirements, namely, those found in ASHRAE 90.1 or those found in the IECC. This will, in turn, add an entirely new, completely different layer of complexity to Chapter 5 of the IECC. That, will, in turn, add a whole new set of unnecessary burdens on building code officials that are obligated to learn and enforce the IECC.

Adopting this proposed modification of EC150 will retain ASHRAE 90.1's performance provisions as an alternative to IECC's performance provisions, but will dramatically simplify the commercial provisions of the IECC by eliminating use of ASHRAE 90.1's prescriptive provisions as an alternative to complying with IECC's prescriptive path.

We urge all Final Action voters to vote against the standing motion to disapprove EC150 in order to permit proponents to move the adoption of EC150 as modified by this Public Comment. We also urge all Final Action voters to vote in favor of the simplifications of the IECC's commercial provisions as proposed in this Public Comment.

PLEASE NOTE that, if the membership approves Public Comment #3 to EC147-09/10, the modifications proposed in this public comment will be easily placed within the revised format of Sections 501.2 and 501.2.1 as follows:

501.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of Sections 502, 503, 504 and 505. In addition, commercial buildings shall comply with either Section 506.2, 506.3 or 506.4.
2. The requirements of section 11 of ASHRAE/IESNA 90.1.
3. The requirements of Section 507, 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7. The building energy cost shall be equal to or less than 75 percent of the standard reference design building.

501.2.1 Application to existing buildings. Additions, alterations and repairs to existing buildings shall comply with one of the following:

1. Sections 502, 503, 504 and 505; or
2. Section 11 of ASHRAE/IESNA 90.1

Final Action: AS AM AMPC____ D

EC157-09/10
Table 502.1.2, Table 502.2(1), Table 502.2(2)

Note: EC157-09/10 as published in the Code Development Hearing Agenda in August of 2009, in advance of the hearings in Baltimore, Maryland was not in correct format. The proposal included many changes in values in the tables. The publication of proposed changes to Table 502.1.2 showed only the new values underlined, but had not shown the values proposed for elimination. In some cells of the table the proponent had intended to cross out one digit in a 4 digit value and add one digit. Because no cross-outs were shown these cells appeared to be changing to a 5 digit value. The Proposed change as submitted to ICC had the proper strike through, but in the publishing process the marks did not carry through. The Proposed Change as Submitted is corrected and shown immediately below under Proposed Change as Submitted. The public comments submitted are based on the code change as it was submitted and approved by the Committee. For your information, Table 502.1.2 as it appeared in the published agenda for the Baltimore hearings is at the end of this document after the various public comments.

Proposed Change as Submitted

Proponent: David C. Hewitt, New Buildings Institute, John Loyer, American Institute of Architects

1. Revise as follows:

SECTION 502
BUILDING ENVELOPE REQUIREMENTS

502.1 General (Prescriptive).

502.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Tables 502.2(1) and 502.3 based on the climate *zone* specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the “Group R” column of Table 502.2(1). Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the “All other” column of Table 502.2(1). Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table 502.3 shall comply with the building envelope provisions of ASHRAE/IESNA-90.1.

TABLE 502.1.2
BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMENT, MAXIMUM U-FACTORS

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 deck	~~U-0.063~~ U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.032	~~U-0.048~~ U-0.032	~~U-0.039~~ U-0.028	~~U-0.039~~ U-0.028	~~U-0.039~~ U-0.028	~~U-0.039~~ U-0.028
Metal buildings	~~U-0.065~~ U-0.044	~~U-0.065~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.049~~ U-0.031	~~U-0.049~~ U-0.031	~~U-0.049~~ U-0.029	~~U-0.049~~ U-0.029	~~U-0.035~~ U-0.029	~~U-0.035~~ U-0.029
Attic and other	~~U-0.034~~ 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-0.027~~ U-0.021	~~U-0.027~~ U-0.021	~~U-0.027~~ U-0.021	~~U-0.027~~ U-0.021	~~U-0.027~~ U-0.021	~~U-0.027~~ U-0.021	~~U-0.027~~ U-0.021
Walls, Above Grade																
Mass	~~U-0.058~~ U-0.142	~~U-0.151~~ U-0.142	~~U-0.151~~ U-0.142	U-0.123	~~U-0.123~~ U-0.110	U-0.104	U-0.104	U-0.090	~~U-0.090~~ U-0.078	~~U-0.080~~ U-0.078	~~U-0.080~~ U-0.078	U-0.071	~~U-0.071~~ U-0.061	~~U-0.071~~ U-0.061	~~U-0.071~~ U-0.061	~~U-0.052~~ U-0.061
Metal building	~~U-0.093~~ U-0.179	~~U-0.093~~ U-0.079	~~U-0.093~~ U-0.079	~~U-0.093~~ U-0.052	~~U-0.084~~ U-0.079	~~U-0.084~~ U-0.052	~~U-0.084~~ U-0.052	~~U-0.084~~ U-0.052	~~U-0.069~~ U-0.052	~~U-0.069~~ U-0.052	~~U-0.069~~ U-0.052	~~U-0.069~~ U-0.052	U-0.057 U-0.052	U-0.057 U-0.039	U-0.057 U-0.052	U-0.057 U-0.031
Metal framed	~~U-0.124~~ U-0.077	~~U-0.124~~ U-0.077	~~U-0.124~~ U-0.077	U-0.064	~~U-0.084~~ U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.057	U-0.064	U-0.052	~~U-0.064~~ U-0.045	U-0.037
Wood framed and other	~~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-0.089~~ U-0.064	~~U-0.089~~ 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
Walls, Below Grade																
Below-grade wall[a]	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	~~C-1.140~~ C-0.119	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-0.119~~ C-0.092	~~C-0.075~~ C-0.092
Floors																
Mass	U-0.322	U-0.322	U-0.107	U-0.087	~~U-0.107~~ U-0.076	~~U-0.087~~ U-0.076	~~U-0.087~~ U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.057	~~U-0.064~~ U-0.055	U-0.051	~~U-0.057~~ U-0.055	U-0.051
Joist/Framing	~~U-0.282~~ U-0.066	~~U-0.282~~ U-0.066	~~U-0.052~~ U-0.033	~~U-0.052~~ 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	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	~~F-0.73~~ F-0.54	F-0.54	~~F-0.73~~ F-0.54	F-0.54	F-0.54	F-0.52	~~F-0.52~~ F-0.40	~~F-0.52~~ F-0.40	~~F-0.52~~ F-0.40	~~F-0.51~~ F-0.40
Heated slabs	~~F-1.02~~ F-0.70	~~F-1.02~~ F-0.70	~~F-1.02~~ F-0.70	~~F-1.02~~ F-0.70	~~F-0.90~~ F-0.70	~~F-0.90~~ F-0.70	F-0.65	~~F-0.86~~ F-0.65	~~F-0.86~~ F-0.58	~~F-0.860~~ F-0.58	~~F-0.860~~ F-0.58	~~F-0.688~~ F-0.58	~~F-0.83~~ F-0.55	~~F-0.688~~ F-0.55	~~F-0.688~~ F-0.55	~~F-0.688~~ F-0.55

Table 502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

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 deck	~~R-15~~ R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	~~R-20~~ R-25ci	~~R-20~~ R-25ci	~~R-20~~ R-25ci	~~R-20~~ R-25ci	~~R-20~~ R-30ci	~~R-20~~ R-30ci	~~R-25~~ R-35ci	~~R-25~~ R-35ci	~~R-25~~ R-35ci	~~R-25~~ R-35ci
Metal buildings (with ~~R-5~~ R-3.5 thermal blocks [a,b])	~~R-19~~ R-19 + R11Ls	~~R-19~~ R-19 + R11Ls	~~R-13 + R-13~~ R-19 + R11Ls	~~R-13 + R-13~~ R-13 + R19	~~R-13 + R-13~~ R-19 + R11Ls	~~R-19~~ R-19 + R11Ls	~~R-13 + R-13~~ R-19 + R11Ls	~~R-19~~ R-19 + R11Ls	~~R-13 + R-13~~ R-19 + R11Ls	~~R-19~~ R-19 + R11Ls	~~R-13 + R-19~~ R-25 + R11Ls	~~R-19~~ R-25 + R11Ls	~~R-13 + R-19~~ R-30 + R11Ls	~~R-19 + R-10xx~~ R-30 + R11Ls	~~R-11xx + R-19~~ R-30 + R11Ls	~~R-19 + R-10xx~~ R-30 + R11Ls
Attic and other	~~R-30~~ R-38	R-38	R-38	R-38	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-38~~ R-49	R-49	R-49
Walls, Above Grade																
Mass	~~NR~~ R-5.7ci	R-5.7ci	R-5.7ci	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[b]	~~R-16~~ R-13 + R-6,5 ci.	~~R-16~~ R-13 + R-6,5 ci.	~~R-16~~ R-13 + R-6,5 ci.	~~R-16~~ R-13 + R-13 ci.	~~R-19~~ R-13 + R-6,5 ci	~~R-16~~ R-13 + R-13 ci	~~R-16~~ R-13 + R-13 ci	~~R-16~~ R-13 + R-13 ci	~~R-13 + R-5.6ci~~ R-13 + R-13 ci	~~R-13 + R-5.6ci~~ R-13 + R-13 ci	~~R-13 + R-5.6ci~~ R-13 + R-13 ci	~~R-13 + R-5.6ci~~ R-13 + R-13 ci	~~R-19 + R-5.6ci~~ R-13 + R-13 ci	~~R-19 + R-5.6ci~~ R-13+ R-19.5 ci	~~R-19 + R-5.6ci~~ R-13+ R-13 ci	~~R-19 + R-5.6ci~~ R-13 + R-26 ci
Metal framed	R-13 + R-5 ci	R-13 + R-5 ci	R-13 + R-5 ci	R-13 + R-7.5ci	R-13 + ~~R-3.8ci~~ R-5 ci	R-13 + R-7.5ci	R-13 + R-7.5	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13 + R-18.8ci
Wood framed and other	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8 ci. or R-20	R-13 + 3.8 ci. or R-20	R-13 + 3.8 ci. or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-~~3.8~~ 7.5 ci.	R-13 + R-7.5 ci.	R-13 + R-7.5 ci.	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-15.6ci
Walls, Below Grade																
Below-grade wall[d]	NR	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-7.5ci~~ R-10ci	R-10ci	~~R-7.5ci~~ R-10ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	~~R-6.3ci~~ R-10ci	~~R-8.3ci~~ R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-14.6ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/Framing	NR	NR	R-19	R-30	R-19	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	~~NR~~ R-10 for 24 in. below	R-10 for ~~12~~ 24 in. below	~~NR~~ R-10 for 24 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 24 in. below
Heated slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for ~~24~~ 36 in. below	R-15 for ~~24~~ 36 in. below	R-15 for ~~24~~ 36 in. below	R-20 for 48 in. below	R-20 for 24 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-20 for 48 in. below
Opaque Doors																
Swinging	~~U-0.70~~ U-0.61	~~U-0.70~~ U-0.61	~~U-0.70~~ U-0.61	~~U-0.70~~ U-0.61	~~U-0.70~~ U-0.61	~~U-0.70~~ U-0.61	~~U-0.70~~ U-0.61	~~U-0.70~~ U-0.61	~~U-0.70~~ U-0.37	~~U-0.70~~ U-0.37	~~U-0.70~~ U-0.37	~~U-0.70~~ U-0.37	~~U-0.50~~ U-0.37	~~U-0.50~~ U-0.37	~~U-0.50~~ U-0.37	~~U-0.50~~ U-0.37
Roll-up or sliding	~~U-1.45~~ R-4.75	~~U-1.45~~ R-4.75	~~U-1.4~~ R-4.75	~~U-1.45~~ R-4.75	~~U-1.45~~ R-4.75	~~U-1.45~~ R-4.75	~~U-0.50~~ R-4.75	~~U-0.50~~ R-4.75	~~U-0.50~~ R-4.75	~~U-0.50~~ R-4.75	~~U-0.50~~ R-4.75	~~U-0.50~~ R-4.75	~~U-0.50~~ R-4.75	~~U-0.50~~ R-4.75	~~U-0.50~~ R-4.75	~~U-0.50~~ R-4.75

For SI: 1 inch = 25.4 mm.

ci = Continuous insulation. NR = No requirement.

a. When using *R*-value compliance method, a thermal spacer block is required, otherwise use the *U*-factor compliance method. [see Tables 502.1.2 and 502.2(2)].

b. Assembly descriptions can be found in Table 502.2(2).

c. R-5.7 ci is allowed to be substituted with concrete block walls complying with ASTM C 90, 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 material having a maximum thermal conductivity of 0.44 Btu-in./h-f2 F.

d. When heated slabs are placed below grade, below-grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.

e. Steel floor joist systems shall to be R-38.

~~**TABLE 502.2(2)**~~
~~**BUILDING ENVELOPE REQUIREMENTS-OPAQUE ASSEMBLIES**~~

~~**ROOFS**~~	~~**DESCRIPTION**~~	~~**REFERENCE**~~
~~R-19~~	~~Standing seam roof with single fiberglass insulation layer. This construction is R-19 faced fiberglass insulation batts draped perpendicular over the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.~~	~~ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"~~
~~R-13 + R-13~~ ~~R-13 + R-19~~	~~Standing seam roof with two fiberglass insulation layers. The first *R*-value is for faced fiberglass insulation batts draped over purlins. The second *R*-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.~~	~~ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"~~
~~R-11 + R-19 FC~~	~~Filled cavity fiberglass insulation.~~ ~~A continuous vapor barrier is installed below the purlins and uninterrupted by framing members. Both layers of uncompressed, unfaced fiberglass insulation rest on top of the vapor barrier and are installed parallel, between the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.~~	~~ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"~~
~~**WALLS**~~		
~~R-16, R-19~~	~~Single fiberglass insulation layer.~~ ~~The construction is faced fiberglass insulation batts installed vertically and compressed between the metal wall panels and the steel framing.~~	~~ASHRAE/IESNA 90.1 Table A3.2 including Addendum "G"~~
~~R-13 + R-5.6 ci~~ ~~R-19 + R-5.6 ci~~	~~The first *R*-value is for faced fiberglass insulation batts installed perpendicular and compressed between the metal wall panels and the steel framing. The second rated *R*-value is for continuous rigid insulation installed between the metal wall panel and steel framing, or on the interior of the steel framing.~~	~~ASHRAE/IESNA 90.1 Table A3.2 including Addendum "G"~~

TABLE 502.2(2)
BUILDING ENVELOPE REQUIREMENTS-OPAQUE ASSEMBLIES

ROOFS	**DESCRIPTION**	**REFERENCE**
R-19+R-11 LS R-25+R-11 LS R-30+R-11 LS	Liner System with thermal spacer block. A continuous membrane is installed below the purlins and uninterrupted by framing members. Uncompressed, un-faced insulation rests on top of the membrane between the purlins.	ASHRAE/IESNA 90.1 A2.3.2.4 and Table A2.3 including proposed 90.1-2007 Addendum "bb"
WALLS	-	-
R-19	Single layer fiberglass insulation. The layer of R-19 fiberglass insulation is installed continuously perpendicular to the girts and is compressed when the metal skin is attached to the girts.	ASHRAE/IESNA 90.1 A2.3.2.4 and Table A2.3 including proposed 90.1-2007 Addendum "bb"
R-13+R-6.5 ci. R-13+ R-13 ci. R-13+ R-19.5 ci R-13+ R-26 ci	Single layer fiberglass insulation with continuous insulation. The first R-value is for faced insulation batts installed perpendicular and compressed between the metal wall panels and the steel framing. The second rated R-value is for continuous rigid insulation installed between the metal panel and steel framing, or on the interior of the steel framing..	ASHRAE/IESNA 90.1 A2.3.2.4 and Table A2.3 including proposed 90.1-2007 Addendum "bb"

Reason: This Building Envelope proposal provides opaque wall tables to complement the comprehensive proposal submitted on behalf of New Buildings Institute, the American Institute of Architects and the U.S. Department of Energy. These tables provide significant reductions in thermal bridging and increases in insulation levels for the model code. The envelope assemblies and u-values include specifications from *Core Performance Guide*, 2009 IECC and proposed ASHRAE 90.1-2010.

Cost Impact: This code change proposal will increase the cost of construction.

ICCFILENAME: Majette-EC-55-T. 502.1.2-

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: The change will significantly improve the energy efficiency of the building envelop requirements for commercial buildings. The standards provided are easy to comply with and can be built. The changes are consistent with ASHRAE standards.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Dave Hewitt, representing New Buildings Institute and Jessyca Henderson, representing American Institute of Architects requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 502.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]
~~BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMENT, MAXIMUM U-FACTORS~~

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 deck	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	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-0.031	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
Walls, Above Grade																
Mass	U-0.142	U-0.142	U-0.142	U-0.123	U-0.110	U-0.104	U-0.104	U-0.090	U-0.078	U-0.078	U-0.078	U-0.071	U-0.061	U-0.061	U-0.061	U-0.061
Metal building	~~U-0.179~~ 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-0.077~~ U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.057	U-0.064	U-0.052	U-0.045	U-0.045
Wood framed and other	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-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.036	U-0.036
Walls, Below Grade																
Below-grade wall[b]	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	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	U-0.322	U-0.322	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-0.057	U-0.055	U-0.051	U-0.055	U-0.051
Joist/Framing	U-0.066	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-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	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	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-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.65	F-0.65	F-0.58	F-0.58	F-0.58	F-0.58	F-0.55	F-0.55	F-0.55	F-0.55

a. Use of opaque assembly U-factors, C-factors, and F-factors from ASHRAE 90.1 Appendix A shall be permitted, provided the construction complies with the applicable construction details from ASHRAE 90.1 Appendix A.

~~a.~~b. When heated slabs are ~~placed~~ below grade, below-grade walls ~~must meet~~ shall comply with the F-factor requirements for ~~perimeter insulation according to the~~ heated slabs. ~~on grade construction.~~

TABLE 502.2~~(1)~~
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]
~~BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES~~

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 Deck	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal Buildings (with R-5 ~~R-3.5~~ thermal blocks [a]	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	~~R-13~~ R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-19 + R11 LS	R-25 + R11 LS	R-25 + R11 LS	R-30 + R11 LS	R-30 + R11 LS	R-30 + R11 LS	R-30 + R11 LS
Attic and Other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-~~38~~ 49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, Above Grade																
Mass	R-5.7ci	R-5.7ci	R-5.7ci	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-6.5ci	R-13 + R-6.5ci	R13 + R6.5ci	R-13 + R13ci	R-13 + R6.5ci	R-13 + R13ci	R-13 + R13ci	R-13 + R13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 +R13ci	R-13+ R19.5ci	R-13 + R13ci	R-13+ R-~~26~~ 19.5ci
Metal Framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + ~~R-5~~ R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13+ R17.5ci
Wood Framed and Other	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 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 R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-15.6ci or R20 + 10ci	R-13 + R-15.6ci or R20 + 10ci
Walls, Below Grade																
Below Grade Wall[b]	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-10ci	R-12.5ci
Floors																
Mass	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
Joist / Framing	NR	NR	~~R-19~~ R-30	R-30	~~R-19~~ R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30 [~~c~~e]	R-30	R-30 [~~c~~e]	R-30 [~~c~~e]	R-30 [~~c~~e]
Slab on Grade Floors																
Unheated Slabs	NR	NR	NR	NR	NR	NR	R-10 for 24 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 24 in. below
Heated Slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 36 in. below	R-15 for 36 in. below	R-15 for 36 in. below	R-20 for 48 in. below	R-20 for 24 in below	R-20 for 48 in below	R-20 for 48 in below	R-20 for 48 in below
Opaque Doors																
Swinging	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
Roll-up or Sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner System- A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, un-faced insulation rests on top of the membrane between the purlins.

~~b.~~ a. Assembly descriptions can be found in ~~Table 502.2(2)~~ ASHRAE 90.1 Appendix A.

~~a.~~ b. Where using *R*-value compliance method, a thermal spacer block is required, otherwise use the *U*-factor compliance method ~~[See~~ in Table 502.1.2 ~~and 502.2(2]~~

c. R-5.7 ci is allowed to be substituted with concrete block walls complying with ASTM C 90, 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.

~~b.~~d. Where heated slabs are ~~placed~~ below grade, below-grade walls ~~must meet~~ shall comply with the exterior insulation requirements for ~~perimeter insulation according to the~~ heated slabs ~~slab-on-grade construction~~.

~~c~~e. Steel floor joist systems shall ~~to~~ be insulated to R-38.

TABLE 502.2(2)
BUILDING ENVELOPE REQUIREMENTS-OPAQUE ASSEMBLIES

ROOFS	DESCRIPTION	REFERENCE
R-19+R-11 LS R-25+R-11 LS R-30+R-11 LS	Liner System with thermal spacer block. A continuous membrane is installed below the purlins and uninterrupted by framing members. Uncompressed, un-faced insulation rests on top of the membrane between the purlins.	ASHRAE/IESNA 90.1 A2.3.2.4 and Table A2.3 including proposed 90.1-2007 Addendum "bb"
WALLS	-	-
R-19	Single layer fiberglass insulation. The layer of R-19 fiberglass insulation is installed continuously perpendicular to the girts and is compressed when the metal skin is attached to the girts.	ASHRAE/IESNA 90.1 A2.3.2.4 and Table A2.3 including proposed 90.1-2007 Addendum "bb"
R-13+R-6.5 ci. R-13+ R-13 ci. R-13+ R-19.5 ci R-13+ R-26 ci	Single layer fiberglass insulation with continuous insulation. The first R-value is for faced insulation batts installed perpendicular and compressed between the metal wall panels and the steel framing. The second rated R-value is for continuous rigid insulation installed between the metal panel and steel framing, or on the interior of the steel framing..	ASHRAE/IESNA 90.1 A2.3.2.4 and Table A2.3 including proposed 90.1-2007 Addendum "bb"

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: This proposal provides opaque envelope tables to complement the comprehensive proposal in EC147 as submitted by the New Buildings Institute (NBI), the American Institute of Architects (AIA) and the U.S. Department of Energy (DOE). These opaque envelope tables provide significant reductions in thermal bridging and increases in insulation levels. These levels represent a reasonable upgrade in energy efficiency to levels that have been demonstrated to be viable. The envelope assemblies and U-factors include specifications that were taken from the 2009 IECC and NBI's *Core Performance Guide*, with some limited values from the proposed ASHRAE 90.1-2010. Both EC147 and the original EC157 were Approved as Submitted.

Though the original EC157 was approved by a solid majority, the IECC committee noted that it was important that discussions with the various stakeholders continue in order to consider additional concerns with the table. The original EC 157 tables were largely based on the more stringent of the 2009 IECC tables and the New Buildings Institute's Core Performance Guide . After additional interactions with industry stakeholders a few new options were added to the R-value table in order to allow for the most common request for a wider variety of construction options, rather than just the specific R-values in Table 502.2. A reference to ASHRAE 90.1 Appendix A was added to allow an extensive set of options based on the construction details and U-factors already in the ASHRAE 90.1 Appendix A.

With the addition of the ASHRAE reference and its construction details, the awkward Table 502.2(2) is deleted. The description of LS (liner system) from Table 502.2(2) was retained as a table note in Table 502.2.

The reference to the ASHRAE 90.1 appendix opens up a range of prescriptive options with associated U-factors and descriptions of construction details. This not only allows a much greater set of options, but also provides the required construction details and resulting U-factors that can be used directly to show compliance with Table 502.1.2. We believe this comment is responsive to most of the stakeholder concerns and an improvement in EC157.

Public Comment 2:

Daniel J Walker, Thomas Associations, Inc. representing the Metal Building Manufacturers Association, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 502.1.2
BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMENT, MAXIMUM U-FACTORS

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 deck	U-0.048	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.039~~ U-0.032	~~U-0.039~~ U-0.032	~~U-0.039~~ U-0.032	~~U-0.039~~ 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-0.041	~~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-0.035	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
Walls, Above Grade																
Mass	U-0.142	U-0.142	U-0.142	U-0.123	U-0.110	U-0.104	U-0.104	U-0.090	U-0.078	U-0.078	U-0.078	U-0.071	U-0.061	U-0.061	U-0.061	U-0.061
Metal building	~~U-0.179~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.052~~ U-0.094	~~U-0.079~~ U-0.072	~~U-0.052~~ U-0.072	~~U-0.052~~ U-0.060	~~U-0.052~~ U-0.060	~~U-0.052~~ U-0.060	~~U-0.052~~ U-0.060	~~U-0.052~~ U-0.060	~~U-0.052~~ U-0.060	~~U-0.052~~ U-0.060	~~U-0.039~~ U-0.050	~~U-0.052~~ U-0.050	~~U-0.031~~ U-0.044
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.057	U-0.064	U-0.052	U-0.045	U-0.037
Wood framed and other	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
Walls, Below Grade																
Below-grade wall[a]	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	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	U-0.322	U-0.322	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-0.057	U-0.055	U-0.051	U-0.055	U-0.051
Joist/Framing	U-0.066	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-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	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	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-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.65	F-0.65	F-0.58	F-0.58	F-0.58	F-0.58	F-0.55	F-0.55	F-0.55	F-0.55

Table 502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

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 deck	R-20ci	~~R-20ci~~ R-25ci	~~R-20ci~~ R-25ci	~~R-20ci~~ R-25ci	~~R-20ci~~ R-25ci	~~R-20ci~~ R-25ci	~~R-25ci~~ R-30ci	~~R-25ci~~ R-30ci	~~R-25ci~~ R-30ci	~~R-25ci~~ R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings[b] ~~(with R-5 R-3.5 thermal blocks [a,b])~~	~~R-19 + R11 Ls~~ R-10 + R-19 FC	~~R-19 + R11 Ls~~ R-10 + R-19 FC	~~R-19 + R11 Ls~~ R-10 + R-19 FC	~~R-13 + R19~~ R-10 + R-19 FC	~~R-19 + R11 Ls~~ R-10 + R-19 FC	~~R-19 + R11 Ls~~ R-10 + R-19 FC	R-19 + R-11 Ls	R-19 + R-11 Ls	R-19 + -11 Ls	R-19 + R-11 Ls	R-25 + R-11 Ls	R-25 + R-11 Ls	R-30 + R-11 Ls	R-30 + R-11 Ls	R-30 + R-11 Ls	R-30 + R-11 Ls
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49
Walls, Above Grade																
Mass	R-5.7ci	R-5.7ci	R-5.7ci	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[b]	~~R-13+ R-6.5ci~~ R-0 + R-9.8ci	~~R-13+ R-6.5ci~~ R-0 + R-9.8ci	~~R-13+ -6.5ci~~ R-0 + R-9.8ci	~~R-13+ R-13 ci.~~ R-0 + R-9.8ci	~~R-13+ R-6.5ci~~ R-0 + R-13.0ci	~~R-13+ R-13ci~~ R-0 + R-13.0ci	~~R-13+ R-13ci~~ R-0 + R-15.8ci	~~R-13+ R-13ci~~ R-0 + R-15.8ci	~~R-13+ R-13ci~~ R-0 + R-15.8ci	~~R-13+ R-13ci~~ R-0 + R-15.8ci	~~R-13+ R-13ci~~ R-0 + R-15.8ci	~~R-13+ R-13ci~~ R-0 + R-15.8ci	~~R-13+ R-13ci~~ R-0 + R-15.8ci	~~R-13+ R-19.5ci~~ R-0 + R-19.0ci	~~R-13+ R-13ci~~ R-0 + R-19.0ci	~~R-13+ R-26ci~~ R-0 + R-22.1ci
Metal framed	R-13 + R-5 ci	R-13 + R-5 ci	R-13 + R-5 ci	R-13 + R-7.5ci	R-13 + R-5 ci	R-13 + R-7.5ci	R-13 + R-7.5	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13 + R-18.8ci
Wood framed and other	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5 ci	R-13 + R-7.5 ci	R-13 + R-7.5 ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-15.6ci
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-10ci	R-12.5ci
Floors																
Mass	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-14.6ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/Framing	NR	NR	R-19	R-30	R-19	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24 in. below	R-10 for 24 in. below	NR R-10 for 24 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 24 in. below
Heated slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 36 in. below	R-15 for 36 in. below	R-15 for 36 in. below	R-20 for 48 in. below	R-20 for 24 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-20 for 48 in. below
Opaque Doors																
Swinging	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
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: This public comment is intended to correct issues with the original proposal, primarily the available prescriptive R-value options for metal building walls. The original proposal was drafted based on the latest information at that time from ASHRAE 90.1, but the work at ASHRAE had not yet been completed with regard to metal building walls. Since the time the original proposal was submitted, ASHRAE changed the available prescriptive wall insulation systems for metal buildings to be consistent with the state-of-the-art. The issue is that combinations of compressed fiber glass insulation and rigid board cannot be installed practically in the manner the original proposal called for.

In addition to the changes to the R-value descriptions, this public comment also addresses the required U-factors for metal building walls, which were not in-line with the other requirements for the construction types in Table 502.1.2. What is shown in this public comment is equitable in terms of the total energy performance of the walls when compared to the other wall types covered in the IECC in the original version of EC157.

The descriptions contained in Table 502.2(2) have also been updated to reflect the completed ASHRAE 90.1-2010 metal building insulation descriptions. The wall insulation systems that were previously shown in this table have been deleted since the requirements we propose for the R-value compliance path are all continuous insulation and therefore need no additional descriptions.

---FOR REFERENCE ONLY---

Note: The following table 502.1.2 is the table from the original proposed code change as it was published in the 2012 Code Change monograph for the Baltimore hearings.

TABLE 502.1.2
BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMENT, MAXIMUM U-FACTORS

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 deck	U-0.063 U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048 U-0.039	U-0.048 U-0.039	U-0.048 U-0.039	U-0.048 U-0.039	U-0.048 U-0.032	U-0.048 U-0.032	U-0.039 U-0.028	U-0.039 U-0.028	U-0.039 U-0.028	U-0.039 U-0.028
Metal buildings	U-0.065 U-0.044	U-0.065 U-0.035	U-0.055 U-0.035	U-0.055 U-0.035	U-0.055 U-0.035	U-0.055 U-0.035	U-0.055 U-0.035	U-0.055 U-0.035	U-0.055 U-0.035	U-0.055 U-0.035	U-0.049 U-0.031	U-0.049 U-0.031	U-0.049 U-0.029	U-0.049 U-0.029	U-0.035 U-0.029	U-0.035 U-0.029
Attic and other	U-0.034 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-0.0271	U-0.0271	U-0.0271	U-0.0271	U-0.0271	U-0.0271	U-0.0271
Walls, Above Grade																
Mass	U-0.58? U-0.142	U-0.151 U-0.142	U-0.151 U-0.142	U-0.123	U-0.123 U-0.110	U-0.104	U-0.104	U-0.090	U-0.090 U-0.078	U-0.080 U-0.078	U-0.080 U-0.078	U-0.071	U-0.071 U-0.061	U-0.071 U-0.061	U-0.071 U-0.061	U-0.052 U-0.061
Metal building	U-0.093 U-0.179	U-0.093 U-0.079	U-0.093 U-0.079	U-0.093 U-0.052	U-0.084 U-0.079	U-0.084 U-0.052	U-0.084 U-0.052	U-0.084 U-0.052	U-0.069 U-0.052	U-0.069 U-0.052	U-0.069 U-0.052	U-0.069 U-0.052	U-0.057 U-0.052	U-0.057 U-0.039	U-0.057 U-0.052	U-0.057 U-0.031
Metal framed	U-0.124 U-0.077	U-0.124 U-0.077	U-0.124 U-0.077	U-0.064	U-0.084 U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.057	U-0.064	U-0.052	U-0.064 U-0.045	U-0.037
Wood framed and other	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-0.089 U-0.064	U-0.089 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
Walls, Below Grade																
Below-grade wall[a]	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140 C-0.119	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-0.119 C-0.092	C-0.075 C-0.092
Floors																
Mass	U-0.322	U-0.322	U-0.107	U-0.087	U-0.107 U-0.076	U-0.087 U-0.076	U-0.087 U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.057	U-0.064 U-0.055	U-0.051	U-0.057 U-0.055	U-0.051
Joist/Framing	U-0.282 U-0.066	U-0.282 U-0.066	U-0.052 U-0.033	U-0.052 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	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73 F-0.54	F-0.54	F-0.73 F-0.54	F-0.54	F-0.54	F-0.52	F-0.52 F-0.40	F-0.52 F-0.40	F-0.52 F-0.40	F-0.51 F-0.40
Heated slabs	F-1.02 F-0.70	F-1.02 F-0.70	F-1.02 F-0.70	F-1.02 F-0.70	F-0.90 F-0.70	F-0.90 F-0.70	F-0.65	F-0.86 F-0.65	F-0.86 F-0.58	F-0.860 F-0.58	F-0.860 F-0.58	F-0.688 F-0.58	F-0.83 F-0.55	F-0.688 F-0.55	F-0.688 F-0.55	F-0.688 F-0.55

Final Action: AS AM AMPC____ D

EC158-09/10

Table 502.1.2, Table 502.2(1), Table 502.2(2)

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

1. Revise as follows:

TABLE 502.1.2
BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMANT, MAXIMUM U-FACTORS

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 deck	~~U-0.063~~ U-0.048	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.032	~~U-0.048~~ U-0.032	~~U-0.048~~ U-0.032	~~U-0.048~~ U-0.032	~~U-0.048~~ U-0.032	~~U-0.048~~ U-0.032	~~U-0.039~~ U-0.028	~~U-0.039~~ U-0.028	~~U-0.039~~ U-0.028	~~U-0.039~~ U-0.028
Metal buildings	~~U-0.065~~ U-0.035	~~U-0.065~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.055~~ U-.035	~~U-0.055~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.055~~ U-0.031	~~U-0.055~~ U-0.031	~~U-0.055~~ U-0.031	~~U-0.049~~ U-0.029	~~U-0.049~~ U-0.029	~~U-0.049~~ U-0.029	~~U-0.049~~ U-0.029	~~U-0.035~~ U-0.026	~~U-0.035~~ U-0.026
Attic and other	~~U-0.034~~ U-0.021	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.021	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.021	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.017	~~U-0.027~~1 U-0.017	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.017
Walls, Above Grade																
Mass	U-0.058	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-0.047	~~U-0.080~~ U-0.047	~~U-0.071~~ U-0.047	~~U-0.071~~ U-0.047	~~U-0.071~~ U-0.047	~~U-0.071~~ U-0.047	~~U-0.052~~ U-0.047
Metal building	~~U-0.093~~ U-0.147	~~U-0.093~~ U-0.049	~~U-0.093~~ U-0.079	~~U-0.093~~ U-0.049	~~U-0.084~~ U-0.072	~~U-0.084~~ U-0.049	~~U-0.084~~ U-0.049	~~U-0.084~~ U-0.049	~~U-0.069~~ U-0.049	~~U-0.069~~ U-0.039	~~U-0.069~~ U-0.049	~~U-0.069~~ U-0.039	~~U-0.057~~ U-0.039	~~U-0.057~~ U-0.039	~~U-0.057~~ U-0.039	~~U-0.057~~ U-0.039
Metal framed	~~U-0.124~~ U-0.064	~~U-0.124~~ U-0.064	~~U-0.124~~ U-0.064	U-0.064	~~U-0.084~~ U-0.064	U-0.064	U-0.064	~~U-0.064~~ U-0.037	~~U-0.064~~ U-0.042	~~U-0.064~~ U-0.037	~~U-0.064~~ U-0.037	~~U-0.057~~ U-0.037	~~U-0.064~~ U-0.037	~~U-0.052~~ U-0.037	~~U-0.064~~ U-0.039	U-0.037
Wood framed and other	U-0.089	~~U-0.089~~ U-0.051	~~U-0.089~~ U-0.064	~~U-0.089~~ U-0.051	~~U-0.089~~ U-0.064	~~U-0.089~~ U-0.051	~~U-0.089~~ U-0.051	~~U-0.064~~ U-0.036	~~U-0.064~~ U-0.051	~~U-0.051~~ U-0.036	~~U-0.051~~ U-0.036	~~U-0.051~~ U-0.032	~~U-0.051~~ U-0.036	~~U-0.051~~ U-0.032	~~U-0.036~~ U-0.037	~~U-0.036~~ U-0.032
Walls, Below Grade																
Below-grade wall[a]	C-1.140	C-1.140	C-1.140	C-1.140	C-0.119	C-0.119	~~C-1.140~~ C-0.119	~~C-0.119~~ C-0.092	C-0.119	~~C-0.119~~ C-0.075	~~C-0.119~~ C-0.075	~~C-0.119~~ C-0.054	~~C-0.119~~ C-0.063	~~C-0.092~~ C-0.048	~~C-0.119~~ C-0.054	~~C-0.075~~ C-0.039
Floors																
Mass	U-0.322	U-0.322	~~U-0.107~~ U-0.074	~~U-0.087~~ U-0.064	~~U-0.107~~ U-0.064	~~U-0.087~~ U-0.064	~~U-0.087~~ U-0.057	~~U-0.074~~ U-0.051	~~U-0.074~~ U-0.051	~~U-0.064~~ U-0.051	~~U-0.064~~ U-0.051	~~U-0.057~~ U-0.038	~~U-0.064~~ U-0.042	~~U-0.051~~ U-0.035	~~U-0.057~~ U-0.038	~~U-0.051~~ U-0.031
Joist/Framing - Metal	~~U-0.282~~ U-0.350	~~U-0.282~~ U-0.350	~~U-0.052~~ U-0.038	~~U-0.052~~ U-0.038	~~---~~ U-0.038	~~U-0.033~~ U-0.032	~~U-0.033~~ U-0.031	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.032	~~U-0.033~~ U-0.024	~~U-0.033~~ U-0.027	~~U-0.033~~ U-0.024	~~U-0.033~~ U-0.024	~~U-0.033~~ U-0.024	~~U-0.033~~ U-0.024	~~U-0.033~~ U-0.024
Joist/Framing - Wood and Other	U-0.282	U-0.282	U-0.033	U-0.033	U-0.033	U-0.033	U-0.027	U-0.022	U-0.022	U-0.018	U-0.022	U-0.018	U-0.018	U-0.018	U-0.018	U-0.018
Slab-on-Grade Floors																
Unheated slabs	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	~~F-0.73~~ F-0.52	F-0.52	~~F-0.73~~ F-0.528	~~F-0.54~~ F-0.510	~~F-0.54~~ F-0.510	~~F-0.52~~ F-0.434	~~F-0.52~~ F-0.510	~~F-0.52~~ F-0.434	~~F-0.52~~ F-0.434	~~F-0.51~~ F-0.424
Heated slabs	F-1.02	F-1.02	~~F-1.02~~ F-0.90	~~F-1.02~~ F-0.86	~~F-0.90~~ F-0.86	~~F-0.90~~ F-0.86	F-0.843	~~F-0.86~~ F-0.688	~~F-0.86~~ F-0.688	~~F-0.860~~ F-0.688	~~F-0.860~~ F-0.688	~~F-0.688~~ F-0.671	~~F-0.83~~ F-0.671	~~F-0.688~~ F-0.671	~~F-0.688~~ F-0.671	~~F-0.688~~ F-0.373

a. When heated slabs are placed below-grade, below grade walls must meet the *F*-factor requirements for perimeter insulation according to the heated slab-on-grade construction.

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS - OPAQUE ASSEMBLIES

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 deck	R-15 20ci	R-20 25ci	R-20 25ci	R-20 25ci	R-20 25ci	R-20 25ci	R-20 30ci	R-20 30ci	R-20 30ci	R-20 30ci	R-20 30ci	R-20 30ci	R-25 35ci	R-25 35ci	R-25 35ci	R-25 35ci
Metal buildings (with R-5 thermal blocks[a,b])	R-19 + R-11	R-19 + R-11	R-13 9+ R-131	R-139 + R-131	R-139+ R-131	R-19 + R-11	R-139 + R-131	R-1925 + R-11	R-1325 + R-131 Ls	R-1925 + R-11	R-1330 + R-1131 Ls	R-1930 + R 11	R-1330 + R-1131 Ls	R-1930 + R-101	R-1125 + R-1911 + R-11	R-19225 + R-101 + R-11
Attic and Other	R-3049	R-3860	R-3849	R-3860	R-3849	R-3860	R-3849	R-3860	R-3860	R-3860	R-3860	R-3860	R-3860	R-3860	R-4960	R-4960
Walls, Above Grade																
Mass	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-13.3 19.5ci	R-13.3 19.5ci	R-15.2 19.5ci	R-15.2 19.5ci	R-15.2 19.5ci	R-25 19.5ci	R-25 19.5ci
Metal building[b]	R-16 19	R-16 0+ R-19.5ci	R-163+ R-6.5ci	R-16 0+ R-19.5ci	R-190+ R-13ci	R-190+ R-19.5ci	R-190+ R-19.5ci	R-190+ R-19.5ci	R-190+ R-19.5ci	R-13+ R-18.85.6ci	R-30+ R-5.619.5ci	R-13+ R-5.619.5ci	R-1913+ R-5.619.5ci	R-1913+ R-5.619.5ci	R-1913+ R-5.619.5ci	R-1913+ R-5.619.5ci
Metal framed	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-3.87.5ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-7.518.8ci	R-13+ R-7.515.6ci	R-13+ R-7.518.8ci	R-13+ R-7.518.8ci	R-13+ R-7.518.8ci	R-13+ R-7.518.8ci	R-13+ R-15.618.8ci	R-13+ R-7.518.8ci	R-13+ R-18.8ci
Wood framed and other	R-13	R-13+ R-7.5ci	R-13+ R-3.8ci	R-13+ R-7.5ci	R-13+ R-3.8ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-3.815.6ci	R-13+ R-3.87.5ci	R-13+ R-3.818.8ci	R-13+ R-7.518.8ci	R-13+ R-7.518.8ci	R-13+ R-7.515.6ci	R-13+ R-7.518.8ci	R-13+ R-15.618.8ci	R-13+ R-15.618.8ci
Wall, Below Grade																
Below grade wall[d]	NR	NR	NR	NR	NR R-13 + R-3.8ci	NR	NR R-7.5ci	R-7.510ci	R-7.5ci	R-7.5 12.5ci	-R7.5 12.5ci	R-7.5 17.5 ci	R-7.5 15ci	R-10 20ci	R-7.5 17.5 ci	R-12.5 25ci
Floors																
Mass	NR	NR	R-6.3 10.4ci	R-8.3 12.5ci	R-6.3 12.5ci	R-8.3 12.5ci	R-10 14.6ci	R-10.4 16.7ci	R-10 16.7ci	R-12.5 16.7ci	R-12.5 16.7ci	R-14.6 23ci	R-15 20.9ci	R-16.7 25.1ci	R-15 23ci	R-16.7 29.3ci
Steel Joist/framing Steel/(wood)	NR	NR	R-19 30	R-30	R-19 30	R-30 38	R-30 38	R-30 49	R-30 38	R-30 60	R-30 49	R-30 60	R-30 60	R-30 60	R-30 60	R-30 60
Wood Framing	NR	NR	R-30	R-30	R-30	R-30	R-38	R-49	R-49	R-60	R-49	R-60	R-60	R-60	R-60	R-60
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	NRR-15 for 24 in. below	R-105 for 24 in. below	NRR-15 for 24 in. below	R-120 for 24 in. below	R-120 for 24 in. below	R-1520 for 2448 in. below	R-1520 for 24 in. below	R-1520 for 2448 in. below	R-1520 for 2448 in. below	R-205 for 2448 in. below
Heated slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.510 for 1224 in. below	R-7.515 for 1224 in. below	R-105 for 24 in. below	R-105 for 24 in. below	R-1520 for 24 in. below	R-1520 for 2448 in. below	R-1520 for 2448 in. below	R-1520 for 2448 in. below	R-1520 for 2448 in. below	R-205 for 48 in. below	R-20 for 2448 in. below	R-205 for 48 in. below	R-205 for 48 in. below	R-20 for 48 in. below full slab
Opaque doors																
Swinging	U-0.70	U-0.70 0.50	U-0.70	U-0.70 0.50	U-0.70	U-0.70 0.50	U-0.70 0.50	U-0.70 0.50	U-0.70 0.50	U-0.70 0.50	U-0.70 0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50
Roll-up or sliding	U-1.45	U-1.450 0.50	U-1.450 0.50	U-1.450 0.50	U-1.450 0.50	U-1.450 0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50

For SI: 1 inch = 25.4 mm.

ci = Continuous insulation. NR = No requirement.

a. Where using *R*-value compliance method, a thermal spacer block is required, otherwise use the *U*-factor compliance method. [see Tables 502.1.2 and 502.2(2)].

b. Assembly descriptions can be found in Table 502.2(2).

c. R-5.7 ci is allowed to be substituted with concrete block walls complying with ASTM C 90, 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 material having a maximum thermal conductivity of 0.44 Btu-in./h-f2 F.

d. Where heated slabs are placed below grade, below-grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.

e. Steel floor joist systems shall to be R-38.

2. Delete and substitute as follows:

~~TABLE 502.2(2)~~
~~BUILDING ENVELOPE REQUIREMENTS–OPAQUE ASSEMBLIES~~

~~ROOFS~~	~~DESCRIPTION~~	~~REFERENCE~~
~~R-19~~	~~Standing seam roof with single fiberglass insulation layer. This construction is R-19 faced fiberglass insulation batts draped perpendicular over the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.~~	~~ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"~~
~~R-13 + R-13 R-13 + R-19~~	~~Standing seam roof with two fiberglass insulation layers.~~ ~~The first R-value is for faced fiberglass insulation batts draped over purlins. The second R-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.~~	~~ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"~~
~~R-11 + R-19 FC~~	~~Filled cavity fiberglass insulation.~~ ~~A continuous vapor barrier is installed below the purlins and uninterrupted by framing members. Both layers of uncompressed, unfaced fiberglass insulation rest on top of the vapor barrier and are installed parallel, between the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.~~	~~ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"~~
~~WALLS~~		
~~R-16, R-19~~	~~Single fiberglass insulation layer. The construction is faced fiberglass insulation batts installed vertically and compressed between the metal wall panels and the steel framing.~~	~~ASHRAE/IESNA 90.1 Table A3.2 including Addendum "G"~~
~~R-13 + R-5.6 ci~~ ~~R-19 + R-5.6 ci~~	~~The first R-value is for faced fiberglass insulation batts installed perpendicular and compressed between the metal wall panels and the steel framing. The second rated R-value is for continuous rigid insulation installed between the metal wall panel and steel framing, or on the interior of the steel framing.~~	~~ASHRAE/IESNA 90.1 Table A3.2 including Addendum "G"~~

TABLE 502.2(2)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE AQSSEMBLIES

ROOFS	**DESCRIPTION**	**REFERENCE**
R-19 + R-11 R-25 + R-11 R-30 + R-11	Standing seam roof with two fiberglass insulation layers. The first *R*-value is for faced fiberglass insulation batts draped over purlins. The second *R*-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-5.0 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.	ASHRAE/IESNA 90.1
R-25 + R-11 + R-11	The first *R*-value is for faced fiberglass insulation batts draped over purlins. The second *R*-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-5.0 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins. The third R-value is for unfaced fiberglass insulation batts installed under the purlins with a continuous vapor barrier liner installed below the purlins and uninterrupted by framing members.	ASHRAE/IESNA 90.1
WALLS		
R-19	Single fiberglass insulation layer. The construction is faced fiberglass insulation batts installed vertically and compressed between the metal wall panels and the steel framing.	ASHRAE/IESNA 90.1
R-0 + R-19 ci R-13 + R-18.8 ci R-13 + R 19.5 ci	The first *R*-value is for faced fiberglass insulation batts installed perpendicular and compressed between the metal wall panels and the steel framing. The second rated *R*-value is for continuous rigid insulation installed between the metal wall panel and steel framing, or on the interior of the steel framing.	ASHRAE/IESNA 90.1

Reason: For consistency with Standard 90.1. This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter

5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. Due to the timing of the code development process and ASHRAE standards processes this proposal was submitted in anticipation that by the final action hearings the work to update the standard would be complete.

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

ICCFILENAME: Majette-EC-55-T. 502.1.2-

Public Hearing Results

Committee Action: Disapproved

Committee Reason: The proposal was disapproved because it was based on a preliminary ASHRAE draft which has already been revised.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, representing US Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 502.1.2
BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMENT, MAXIMUM U-FACTORS

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 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-0.031~~ U-0.035	~~U-0.031~~ U-0.035	~~U-0.031~~ U-0.035	~~U-0.029~~ U-0.031	U-0.029	U-0.029	U-0.029	U-0.026	U-0.026
Attic and other	~~U-0.021~~ U-0.027	~~U-0.021~~ U-0.027	~~U-0.021~~ U-0.027	~~U-0.017~~ U-0.027	~~U-0.021~~ U-0.027	~~U-0.017~~ U-0.027	~~U-0.017~~ U-0.021	~~U-0.017~~ U-0.021	~~U-0.017~~ U-0.021	~~U-0.017~~ U-0.021	~~U-0.017~~ U-0.021	~~U-0.017~~ U-0.021	U-0.017	U-0.017	U-0.017	U-0.017
Walls, Above Grade																
Mass	U-~~0.0580.~~ U-0.580	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-0.047~~ U-0.060	~~U-0.047~~ U-0.060	~~U-0.047~~ U-0.053	~~U-0.047~~ U-0.053	~~U-0.047~~ U-0.048	~~U-0.047~~ U-0.048	~~U-0.047~~ U-0.048
Metal building	~~U-0.147~~ U-0.094	~~U-0.049~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.049~~ U-0.094	U-0.072	~~U-0.049~~ U-0.050	~~U-0.049~~ U-0.060	~~U-0.049~~ U-0.050	~~U-0.049~~ U-0.050	~~U-0.039~~ U-0.050	~~U-0.049~~ U-0.050	~~U-0.039~~ U-0.050	~~U-0.039~~ U-0.044	~~U-0.039~~ U-0.044	U-0.039	U-0.039
Metal framed	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	~~U-0.064~~ U-0.055	~~U-0.037~~ U-0.049	~~U-0.042~~ U-0.049	~~U-0.037~~ U-0.043	~~U-0.037~~ U-0.043	U-0.037	U-0.037	U-0.037	~~U-0.039~~ U-0.037	U-0.037
Wood framed and other	U-0.089	~~U-0.051~~ U-0.089	U-0.064	~~U-0.051~~ U-0.064	U-0.064	U-0.051	U-0.051	~~U-0.036~~ U-0.045	~~U-0.051~~ U-0.045	~~U-0.036~~ U-0.040	~~U-0.036~~ U-0.040	~~U-0.032~~ U-0.037	~~U-0.036~~ U-0.037	U-0.032	~~U-0.037~~ U-0.032	U-0.032
Walls, Below Grade																
Below-grade wall[a]	C-1.140	C-1.140	C-1.140	C-1.140	C-0.119[b]	C-0.119[b]	C-0.119	C-0.092	C-0.119	~~C-0.075~~ C-0.092	~~C-0.075~~ C-0.092	~~C-0.054~~ C-0.063	C-0.063	~~C-0.048~~ C-0.063	~~C-0.054~~ C-0.063	~~C-0.039~~ C-0.063
Floors																
Mass	U-0.322	U-0.322	U-0.074	U-0.064	U-0.064	U-0.064	U-0.057	U-0.051	~~U-0.051~~ U-0.057	U-0.051	U-0.051	~~U-0.038~~ U-0.051	U-0.042	~~U-0.035~~ U-0.042	U-0.038	~~U-0.031~~ U-0.038
Joist/Framing - Metal	U-0.350	U-0.350	U-0.038	U-0.038	U-0.038	U-0.032	~~U-0.031~~ U-0.032	~~U-0.027~~ U-0.032	U-0.032	~~U-0.024~~ U-0.032	~~U-0.027~~ U-0.032	~~U-0.024~~ U-0.032	~~U-0.024~~ U-0.027	~~U-0.024~~ U-0.027	U-0.024	U-0.024
Joist/Framing - Wood and Other	U-0.282	U-0.282	U-0.033	U-0.033	U-0.033	U-0.033	U-0.027	~~U-0.022~~ U-0.027	~~U-0.022~~ U-0.027	~~U-0.018~~ U-0.027	~~U-0.022~~ U-0.027	~~U-0.018~~ U-0.027	~~U-0.018~~ U-0.022	~~U-0.018~~ U-0.022	U-0.018	U-0.018
Slab-on-Grade Floors																
Unheated slabs	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	~~F-0.73~~ F-0.54	F-0.52	F-0.52	F-0.528	F-0.510	F-0.510	F-0.434	F-0.510	F-0.434	F-0.434	F-0.424
Heated slabs	F-1.02	F-1.02	F-0.90	F-0.86	F-0.86	F-0.86	F-0.843	F-0.688	F-0.688	F-0.688	F-0.688	F-0.671	F-0.671	F-0.671	F-0.671	F-0.373

a. Where heated slabs are placed below-grade, below grade walls must meet the F-factor requirements for perimeter insulation according to the heated slab-on-grade construction.
b. Below grade wall insulation is not required in warm-humid locations as provided in Figure 301.1.

Table 502.2(1)
Building Envelope Requirements – Opaque Assemblies

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 deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings[a] ~~(with R-5 thermal blocks[a,b])~~	R- 10 ~~19~~ + R-19~~11~~ FC	R- 10 ~~19~~ + R-19 FC	R- 10 ~~9~~ + R-19 ~~11~~ FC	R- 10 + R-19 FC	R- 10 ~~9~~ + R-19 ~~11~~ FC	R- 10 + R-19 FC	R-19 + R- 11 Ls	R- 19~~25~~+ R-11 Ls	R-19 ~~25~~+ R-11~~13~~ Ls	R-19 ~~25~~+ 11 Ls	R-~~30~~ 25+ R-~~19~~ 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 ~~49~~	R-38 ~~60~~	R-38 ~~49~~	R--38 ~~60~~	R-38 ~~49~~	R-38 ~~60~~	R- 49	R-49~~60~~	R-49 ~~60~~	R-49 ~~60~~	R-~~60~~ 49	R-~~60~~ 49	R-60	R-60	R- 60	R- 60
Walls, Above Grade																
Mass	NR	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-15 ~~19.5~~ci	R-~~19.5ci~~ 15ci	R-~~19.5ci~~ 17ci	R-~~19.5ci~~ 17ci	R-~~19.5ci~~ 19ci	R-~~19.5ci~~ 19ci	R-~~19.5ci~~ 19ci
Metal building[b]	R- 0 ~~19~~ + R-9.8ci	R 0+ R-9.8 ~~19.5~~ci	R-0 ~~13~~ + R-9.8 ~~6.5~~ci	R 0+ R- 9.8 ~~19.5~~ci	R- 0+ R-13ci	R- 0+ R-~~19.5~~ 19ci	R- 0+ R-15.8 ~~19.5~~ci	R- 0+ R-~~19.5~~ 19ci	R- 0+ R-~~19.5~~ 19ci	R 0 + R-19ci	R-~~13~~ 0 +R-~~19.5ci~~ 19ci	R-~~13~~ 0 +R-~~9.5ci~~ 19ci	R-~~13~~ 0 +R-~~9.5ci~~ 22.1ci	R-~~13~~ 0 +R-~~9.5ci~~ 22.1ci	R-~~13~~ 0 +R-~~19.5ci~~ 25ci	R-~~13~~ 0 +R-~~19.5ci~~ 25ci
Metal framed	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-7.5 ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ 10ci	R-13+ R-12.5ci	R-13+ R-12.5ci	R-13+ R-15ci	R-13+ R-~~18.8ci~~ 15ci	R-13+ R-18.8ci	R-13+ R-18.8ci	R-13+ R-18.8ci	R-13+ R-18.8ci	R-13+ R-18.8ci
Wood framed and other	R-13	R-13 ~~+ 7.5 ci~~	R-13+ R-3.8ci	R-13+ R-3.8 ~~7.5~~ci	R-13+ R-3.8ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-10 ~~15.6~~ci	R-13+ R-10 ~~7.5~~ci	R-13+ R-12.5 ~~18.8~~ci	R-13+ R-~~18.8ci~~ 12.5ci	R-13+ R-~~18.8ci~~ 15ci	R-13+ R-~~15.6~~ 15ci	R-13+ R-18.8ci	R-13+ R-18.8ci	R-13+ R-18.8ci
Wall, Below Grade																
Below grade wall	NR	NR	NR	NR	R-7.5 ~~13~~ + ~~3.8~~ci[f]	~~NR~~ R-7.5ci[f]	R-7.5ci	R-10ci	R-7.5ci	R-10 ~~12.5~~ci	R-~~12.5~~ci 10ci	R-~~17.5ci~~ 15ci	R-15ci	R-~~20ci~~ 15ci	R-~~17.5ci~~ 15ci	R-~~25ci~~ 15ci
Floors																
Mass	NR	NR	R-10.4ci	R--12.5ci	R-12.5ci	R-12.5ci	R--14.6ci	R-16.7ci	R-14.6 ~~16.7~~ci	R-16.7ci	R-16.7ci	R-16.7ci ~~23ci~~	R--20.9ci	R-20.9 ~~25.1~~ci	R-23ci	R-~~29.3ci~~ 23ci
Steel Joist	NR	NR	R- 30	R-30	R- 30	R- 38	R- 38	R-38 ~~49~~	R-38	R-38	R-~~49~~ 38	R-~~60~~ 38	R-~~60~~ 49	R-~~60~~ 49	R-60	R-60
Wood Framing and other	NR	NR	R-30	R-30	R-30	R-30	R-38	R-38 ~~49~~	R- 38 ~~49~~	R 38 ~~60~~	R-~~49~~ 38	R-~~60~~ 38	R-~~60~~ 49	R-~~60~~ 49	R-60	R-60
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	~~NR~~ R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 24 in. below	R-20 for 24 in. below	R-20 for 48 in. below	R-20 for 24 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-25 for 48 in. below
Heated slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 24 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-25 for 48 in. below	R-25 ~~20~~ for 48 in. below	R-25 for 48 in. below	R-25 for 48 in. below	R-20 full slab
Opaque doors																
Swinging	U-0.70	U-0.50	U-0.70	U-0.50	U-0.70	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50
Roll-up or sliding	U-1.45	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50

For SI: 1 inch = 25.4 mm
ci = continuous insulation. NR = No requirement. Ls = linear system..

~~a. When using R-value compliance method, a thermal spacer block is required, otherwise use the U-factor compliance method. (see Tables 502.1.2 and 502.2(2).~~
a. See Table 502.2(2) for thermal spacer block requirements unless compliance is shown by the overall assembly U-factor.

b. Assembly descriptions can be found in Table 502.2(2)

c. R-5.7 is allowed to be substituted with concrete block walls complying with ASTM C 90, 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 material having a maximum thermal conductivity of 0.44 Btu-in./h-ft2 F.

d. When heated slabs are placed below grade, below-grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.

~~e. Steel floor joist systems shall be R-38~~

f. <u>Below grade wall insulation is not required in warm-humid locations as provided in Figure 301.1.</u>

TABLE 502.2(2)
BUILDING ENVELOPE REQUIREMENTS–OPAQUE ASSEMBLIES

ROOFS	DESCRIPTION	REFERENCE
R-10 ~~19~~ + R-19~~11~~FC ~~R-25 + R-11~~ ~~R-30 + R-11~~	~~Standing seam roof with two fiberglass insulation layers. The first *R*-value is for faced fiberglass insulation batts draped over purlins. The second *R*-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-5.0 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.~~ The first *rated R-value of insulation* represents faced or unfaced insulation installed between the purlins. The second *rated R-value of insulation* represents unfaced insulation installed above the first layer, perpendicular to the purlins and compressed where the metal roof panels are attached. A supporting structure retains the bottom of the first layer at the prescribed depth required for the full thickness of insulation. A minimum R-5 (R-0.9) thermal spacer block between the purlins and the metal roof panels is required, unless compliance is shown by the overall assembly U-factor.	ASHRAE/IESNA 90.1
~~R-25 + R-11 + R-11~~ R-19+ R-11LS R-30 + R-11 LS R-25 + R-11 + R-11LS	A continuous membrane is installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins. For multilayer installations, the last *rated R-value of insulation* is for unfaced insulation draped over purlins and then compressed where the metal roof panels are attached. A minimum R-3 (R-0.5) thermal spacer block between the purlins and the metal roof panels is required, unless compliance is shown by the overall assembly U-factor.	ASHRAE/IESNA 90.1
~~R-25 + R-11 + R-11~~	~~The first *R*-value is for faced fiberglass insulation batts draped over purlins. The second *R*-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-5.0 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins. The third R-value is for unfaced fiberglass insulation batts installed under the purlins with a continuous vapor barrier liner installed below the purlins and uninterrupted by framing members.~~	ASHRAE/IESNA 90.1
WALLS		
~~R-19~~	~~Single fiberglass insulation layer. The construction is faced fiberglass insulation batts installed vertically and compressed between the metal wall panels and the steel framing.~~	~~ASHRAE/IESNA 90.1~~
~~R-0 + R-19ci~~ ~~R-13 + R-18.8 ci~~	~~The first *R*-value is for faced fiberglass insulation batts installed perpendicular and compressed between the metal wall panels and the steel framing. The second rated *R*-value is for continuous rigid insulation installed between the metal wall panel and steel framing, or on the interior of the steel framing.~~	~~ASHRAE/IESNA 90.1~~

Commenter's Reason: This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010.

This public comment modifies the proposed insulation R-values and U-factors based on Addenda "bb" and will increase the consistency to those values that will be published in ASHRAE Standard 90.1-2010 Changes were proposed to the metal building values to reflect consensus values from ASHRAE. Insulation values for other assemblies have been modified to reflect changes that will also occur in ASHRAE 90.1-2010. The assembly U-factors have also been modified to address the changes in assembly R-values.

It is important to note that the insulation values and methods of construction that appear in Table 502.2(1) are only ***one option*** to meeting the U-factor requirements in Table 502.1.2. Designers have the flexibility to meet the U-factor requirements with a variety on assemblies and insulation installation practices and can use trade-off approaches to demonstrate compliance for the building envelope and not limit themselves to only the options in Table 502.2(1). In fact most energy code compliance documentation submitted in the US for commercial buildings utilizes the US DOE COMcheck software that allows trade-offs with construction assemblies reducing the need to comply with the installation practices presented in Table 502.2(1).

Public Comment 2:

Steve Ferguson, representing The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 502. 1.2
BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMENT, MAXIMUM U-FACTORS

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 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-0.031~~ U-0.035	~~U-0.031~~ U-0.035	~~U-0.031~~ U-0.035	~~U- 0.029~~ U- 0.031	U-0.029	U-0.029	U-0.029	U-0.026	U-0.026
Attic and other	~~U-0.021~~ U-0.027	~~U-0.017~~ U-0.027	~~U-0.021~~ U-0.027	~~U-0.017~~ U-0.027	~~U-0.021~~ U-0.027	~~U-0.017~~ U-0.027	~~U-0.017~~ U-0.021	~~U-0.017~~ U-0.021	~~U-0.017~~ U-0.021	~~U-0.017~~ U-0.021	~~U- 0.017~~ U- 0.021	~~U-0.017~~ U-0.021	U-0.017	U-0.017	U-0.017	U-0.017
Walls, Above Grade																
Mass	U-~~0.0580.~~ U-0.580	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-0.047~~ U-0.060	~~U- 0.047~~ U- 0.060	~~U- 0.047~~ U-0.053	~~U-0.047~~ U-0.053	~~U-0.047~~ U-0.048	~~U-0.047~~ U-0.048	~~U-0.047~~ U-0.048
Metal building	~~U-0.147~~ U-0.094	~~U-0.049~~ U-0.094	~~U-0.079~~ U-0.094	~~U-0.049~~ U-0.094	U-0.072	~~U-0.049~~ U-0.050	~~U-0.049~~ U-0.060	~~U-0.049~~ U-0.050	~~U-0.049~~ U-0.050	~~U-0.039~~ U-0.050	~~U- 0.049~~ U- 0.050	~~U- 0.039~~ U- 0.050	~~U-0.039~~ U-0.044	~~U-0.039~~ U-0.044	U-0.039	U-0.039
Metal framed	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	~~U-0.064~~ U-0.055	~~U-0.037~~ U-0.049	~~U-0.042~~ U-0.049	~~U-0.037~~ U-0.043	~~U- 0.037~~ U- 0.043	U-0.037	U-0.037	U-0.037	~~U-0.039~~ U-0.037	U-0.037
Wood framed and othe	U-0.089	~~U-0.051~~ U-0.089	U-0.064	~~U-0.051~~ U-0.064	U-0.064	U-0.051	U-0.051	~~U-0.036~~ U-0.045	~~U-0.051~~ U-0.045	~~U-0.036~~ U-0.040	~~U- 0.036~~ U- 0.040	~~U-0.032~~ U-0.037	~~U-0.036~~ U-0.037	U-0.032	~~U-0.037~~ U-0.032	U-0.032
Walls, Below Grade																
Below-grade wall[a]	C-1.140	C-1.140	C-1.140	C-1.140	C-0.119[b]	C-0.119[b]	C-0.119	C-0.092	C-0.119	~~C-0.075~~ C-0.092	~~C- 0.075~~ C- 0.092	~~C-0.054~~ C-0.063	C-0.063	~~C-0.048~~ C-0.063	~~C-0.054~~ C-0.063	~~C-0.039~~ C-0.063
Floors																
Mass	U-0.322	U-0.322	U-0.074	U-0.064	U-0.064	U-0.064	U-0.057	U-0.051	~~U-0.051~~ U-0.057	U-0.051	U- 0.051	~~U-0.038~~ U-0.051	U-0.042	~~U-0.035~~ U-0.042	U-0.038	~~U-0.031~~ U-0.038
Joist/Framing - Metal	U-0.350	U-0.350	U-0.038	U-0.038	U-0.038	U-0.032	~~U-0.031~~ U-0.032	~~U-0.027~~ U-0.032	U-0.032	~~U-0.024~~ U-0.032	~~U- 0.027~~ U- 0.032	~~U-0.024~~ U-0.032	~~U-0.024~~ U-0.027	~~U-0.024~~ U-0.027	U-0.024	U-0.024
Joist/Framing - Wood and Other	U-0.282	U-0.282	U-0.033	U-0.033	U-0.033	U-0.033	U-0.027	~~U-0.022~~ U-0.027	~~U-0.022~~ U-0.027	~~U-0.018~~ U-0.027	~~U- 0.022~~ U- 0.027	~~U-0.018~~ U-0.027	~~U-0.018~~ U-0.022	~~U-0.018~~ U-0.022	U-0.018	U-0.018
Slab-on-Grade Floors																
Unheated slabs	F-0.73	F-0.73	F-0.73	F-0.73	F-0.73	~~F-0.73~~ F-0.54	F-0.52	F-0.52	F-0.528	F-0.510	F- 0.510	F-0.434	F-0.510	F-0.434	F-0.434	F-0.424
Heated slabs	F-1.02	F-1.02	F-0.90	F-0.86	F-0.86	F-0.86	F-0.843	F-0.688	F-0.688	F-0.688	F- 0.688	F-0.671	F-0.671	F-0.671	F-0.671	F-0.373

a. Where heated slabs are placed below-grade, below grade walls must meet the F-factor requirements for perimeter insulation according to the heated slab-on-grade construction.
b. Below grade wall insulation is not required in warm-humid locations as provided in Figure 301.1.

Table 502.2(1)
Building Envelope Requirements – Opaque Assemblies

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 deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings[a] ~~(with R-5 3 thermal blocks[a,b])~~	R-10 ~~19~~ + R-19~~11~~ FC	R-10 ~~19~~ + R-19 ~~FC~~	R-10 ~~9~~ + R-19 ~~11~~ FC	R- 10 + R-19 FC	R- 10 ~~9~~ + R-19 ~~11~~ FC	R- 10 + R-19 FC	R-19 + R- 11 Ls	R- 19~~25~~+ R-11 Ls	R-19 ~~25~~+ R-11 Ls	R-19 ~~25~~+ 11 Ls	R-~~30~~ 25+ R-~~19~~ 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 ~~49~~	R-38 ~~60~~	R-38 ~~49~~	R-38 ~~60~~	R-38 ~~49~~	R-38 ~~60~~	R- 49	R-49 ~~R-60~~	R-49 ~~60~~	R-49 ~~60~~	R-~~60~~ 49	R-~~60~~ 49	R-60	R-60	R- 60	R- 60
Walls, Above Grade																
Mass	NR	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-15 ~~19.5~~ci	R-~~19.5ci~~ 15ci	R-~~19.5ci~~ 17ci	R-~~19.5ci~~ 17ci	R-~~19.5ci~~ 19ci	R-~~19.5ci~~ 19ci	R-~~19.5ci~~ 19ci
Metal building[b]	R-0 ~~19~~ + R-9.8ci	R-0+ R-9.8 ~~19.5~~ci	R-0~~13~~ + R-9.8 ~~6.5~~ci	R-0+ R-9.8 ~~19.5~~ci	R-0+ R-13ci	R-0+ R-19~~.5~~ci	R-0+ R-15.8 ~~19.5~~ci	R-0+ R-19~~.5~~ci	R-0+ R-19~~.5~~ci	R-0 + R-~~18.8~~19ci	R-~~13~~0 +R-~~19.5ci~~ 19ci	R-~~13~~0 +R-~~19.5ci~~ 19ci	R-~~13~~0 +R-~~19.5ci~~ 22.1ci	R-~~13~~0 +R-~~19.5ci~~ 22.1ci	R-~~13~~0 +R-~~19.5ci~~ 25ci	R-~~13~~0 +R-~~19.5ci~~ 25ci
Metal framed	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-7.5 ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ 10ci	R-13+ R-12.5ci	R-13+ R-12.5ci	R-13+ R-15ci	R-13+ R-~~18.8ci~~ 15ci	R-13+ R-18.8ci	R-13+ R-18.8ci	R-13+ R-18.8ci	R-13+ R-18.8ci	R-13+ R-18.8ci
Wood framed and other	R-13	R-13 ~~+ 7.5 ci~~	R-13+ R-3.8ci	R-13+ R-3.8 ~~7.5~~ci	R-13+ R-3.8ci	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-~~18.8ci~~ 12.5ci	R-13+ R-~~18.8ci~~ 15ci	R-13+ R-15ci	R-13+ R-~~1.~~8 18.8ci	R-13+ R-18.8ci	R-13+ R-18.8ci
Wall, Below Grade																
Below grade wall	NR	NR	NR	NR	R-7.5 ~~13 + 3.8~~ci[f]	~~NR~~ R-7.5ci[f]	R-7.5ci	R-10ci	R-7.5ci	R-10ci	R-~~12.5~~ci 10ci	R-~~17.5ci~~ 15ci	R-15ci	R-~~20ci~~ 15ci	R-~~17.5ci~~ 15ci	R-~~25ci~~ 15ci
Floors																
Mass	NR	NR	R-10.4ci	R-12.5ci	R-12.5ci	R-12.5ci	R-14.6ci	R-16.7ci	R-14.6ci	R-16.7ci	R-16.7ci	R-16.7ci ~~23ci~~	R-20.9ci	R-20.9ci	R-23ci	R-~~29.3ci~~ 23ci
Steel Joist	NR	NR	R- 30	R-30	R- 30	R- 38	R- 38	R-38 ~~49~~	R-38	R-38	R-~~49~~ 38	R-~~60~~ 38	R-~~60~~ 49	R-~~60~~ 49	R-60	R-60
Wood Framing and other	NR	NR	R-30	R-30	R-30	R-30	R-38	R-38 ~~49~~	R- 38	R 38	R-~~49~~ 38	R-~~60~~ 38	R-~~60~~ 49	R-~~60~~ 49	R-60	R-60
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	~~NR~~ R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 24 in. below	R-20 for 24 in. below	R-20 for 48 in. below	R-20 for 24 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-25 for 48 in. below
Heated slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-105 for 24 in. below	R-15 for 24 in. below	R-20 for 24 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-25 for 48 in. below	R-205 for 48 in. below	R-25 for 48 in. below	R-25 for 48 in. below	R-20 full slab
Opaque doors																
Swinging	U-0.70	U-0.50	U-0.70	U-0.50	U-0.70	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50
Roll-up or sliding	U-1.45	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50	U-0.50

FC = Filled cavity, Ls = Liner system. See Table 502.2(2) for detailed descriptions.

a. See Table 502.2(2) for thermal spacer block requirements unless compliance is shown by the overall assembly U-factor.~~When using R-value compliance method, a thermal spacer block is required, otherwise use the U-factor compliance method. [see Tables 502.1.2 and 502.2(2)].~~

Footnotes b through e are unchanged

f. Below grade wall insulation is not required in warm-humid locations as provided in Figure 301.1.

TABLE 502.2(2)
BUILDING ENVELOPE REQUIREMENTS–OPAQUE ASSEMBLIES

ROOFS	DESCRIPTION	REFERENCE
R-10~~9~~ + R-19~~1~~FC ~~R-25 + R-11~~ ~~R-30 + R-11~~	~~Standing seam roof with two fiberglass insulation layers. The first *R*-value is for faced fiberglass insulation batts draped over purlins. The second *R*-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-5.0 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.~~ The first rated R-value of insulation represents faced or unfaced insulation installed between the purlins. The second rated R-value of insulation represents unfaced insulation installed above the first layer, perpendicular to the purlins and compressed where the metal roof panels are attached. A supporting structure retains the bottom of the first layer at the prescribed depth required for the full thickness of insulation. A minimum R-5 thermal spacer block between the purlins and the metal roof panels is required, unless compliance is shown by the overall assembly U-factor.	ASHRAE/IESNA 90.1
R-~~25~~ 19+ R-11Ls R-30 + R-11 Ls R-25 + R-11 + R-11 Ls	~~The first *R*-value is for faced fiberglass insulation batts draped over purlins. The second *R* value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-5.0 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins. The third R-value is for unfaced fiberglass insulation batts installed under the purlins with a continuous vapor barrier liner installed below the purlins and uninterrupted by framing members.~~ A continuous membrane is installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins. For multilayer installations, the last rated R-value of insulation is for unfaced insulation draped over purlins and then compressed where the metal roof panels are attached. A minimum R-3 thermal spacer block between the purlins and the metal roof panels is required, unless compliance is shown by the overall assembly U-factor.	ASHRAE/IESNA 90.1
~~R-25 + R-11 + R-11~~LS	~~The first *R*-value is for faced fiberglass insulation batts draped over purlins. The second *R* value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-5.0 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins. The third R-value is for unfaced fiberglass insulation batts installed under the purlins with a continuous vapor barrier liner installed below the purlins and uninterrupted by framing members.~~	~~ASHRAE/IESNA 90.1~~
~~**WALLS**~~		
~~R-19~~	~~Single fiberglass insulation layer. The construction is faced fiberglass insulation batts installed vertically and compressed between the metal wall panels and the steel framing.~~	~~ASHRAE/IESNA 90.1~~
~~R-0 + R-19 ci~~ ~~R-13 + R-18.8 ci~~ ~~R-13 + R-19.5 ci~~	~~The first *R*-value is for faced fiberglass insulation batts installed perpendicular and compressed between the metal wall panels and the steel framing. The second rated *R* value is for continuous rigid insulation installed between the metal wall panel and steel framing, or on the interior of the steel framing.~~	~~ASHRAE/IESNA 90.1~~

Commenter's Reason: This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010.

This public comment modifies the proposed insulation R-values and U-factors based on Addenda "bb" and will increase the consistency to those values that will be published in ASHRAE Standard 90.1-2010 Changes were proposed to the metal building values to reflect consensus values from ASHRAE. Insulation values for other assemblies have been modified to reflect changes that will also occur in ASHRAE 90.1-2010. The assembly U-factors have also been modified to address the changes in assembly R-values.

It is important to note that the insulation values and methods of construction that appear in Table 502.2(1) are only ***one option*** to meeting the U-factor requirements in Table 502.1.2. Designers have the flexibility to meet the U-factor requirements with a variety on assemblies and insulation installation practices and can use trade-off approaches to demonstrate compliance for the building envelope and not limit themselves to only the options in Table 502.2(1). In fact most energy code compliance documentation submitted in the US for commercial buildings utilizes the US DOE COMcheck software that allows trade-offs with construction assemblies reducing the need to comply with the installation practices presented in Table 502.2(1).

Final Action: AS AM AMPC____ D

EC159-09/10
502.2

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

Revise as follows:

502.2 Specific insulation requirements (Prescriptive). Opaque assemblies shall comply with Table 502.2(1). Where two or more layers of rigid insulation board are used in a construction assembly, the edge joints between each layer of boards shall be staggered.

Reason: For consistency with Standard 90.1. This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. Due to the timing of the code development process and ASHRAE standards processes this proposal was submitted in anticipation that by the final action hearings the work to update the standard would be complete.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: Majette-EC-2-502.2

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: The change allows for better installation practices for multi-layer insulation.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, representing US Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.2 Specific insulation requirements (Prescriptive). Opaque assemblies shall comply with Table 502.2(1). Where two or more layers of ~~rigid insulation board~~ insulated sheathing are ~~used~~ installed ~~in a construction assembly~~ the ~~edge~~ joints associated with one layer of insulated sheathing shall not overlap with the joints of the next layer of insulated sheathing ~~insulation~~ ~~between each layer of boards shall be staggered~~.

Commenter's Reason: This code change was recommended for approval as submitted (AS) at the first hearing. The language approved at the first public hearing is verbatim from ASHRAE Standard 90.1 Addenda ag and will be included in Standard 90.1-2010. So approval of the code change as submitted will result in consistency with that standard. With that said there are opportunities to further improve the text for use in codes.

The intent of the change is to address the manner in which insulated sheathing, a clarification over the original change using the term rigid insulation board, is applied to the exterior of opaque assemblies. Based on discussion at the first hearings DOE tried to improve the language in the code change proposal while retaining the original intent of the proposal. During the first 6 months of 2010 DOE provided evolving copies of the public comment, solicited input from all interested parties and conducted a public meeting on May 11th to discuss this change in addition to addressing new suggestions submitted in late June.

The above public comment represents what DOE believes is an improved version of what was recommended for approval at the first hearing. This clarifies that where two layers are involved, which may be necessitated due to increases in insulation thickness to improve thermal performance, the issue of overlapping joints must also be addressed. The reason for overlapping those joints is not associated with air infiltration as much as it is with heat transfer through conduction where the material thicknesses are not properly abutted leaving what could be a very deep gap in the insulation and thus allowing a thermal bypass through the assembly to the exterior finish. It is recognized that some manufacturers may have specific directions for applying single or multiple layers of insulation so the provisions in Section 303.2 would apply. In the absence of such instructions this change provides needed guidance to contractors and code officials.

Public Comment 2:

John Woestman, Kellen Company, representing Extruded Polystyrene Foam Association (XPSA), requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.2 Specific insulation requirements (Prescriptive). Opaque assemblies shall comply with Table 502.2(1). Where two or more layers of ~~rigid~~ continuous insulation board are used in a construction assembly, the continuous insulation boards shall be installed in accordance with Section 303.2. If the continuous insulation board manufacturer's installation instructions do not address installation of two or more layers, the edge joints between each layer of continuous insulation boards shall be staggered.

Commenter's Reason: Continuous insulation is required to be installed per the manufacturer's installation instructions, per IECC Section 303.2. In the event the manufacturer of the continuous installation board does not address installation of multiple layers in their installation instructions, then the requirements of this section may apply.

Public Comment 3:

Craig Conner, Building Quality, representing himself and Michael D. Fischer, Kellen Company, representing Foam Sheathing Coalition request Disapproval.

Commenter's Reason: (Craig Conner) EC159 addresses a narrow part of the more general requirements to provide an air barrier and increase insulation effectiveness. The air barrier requirements are handled better as part of a more comprehensive description of the air barrier in EC147 (Section 502.4.1). The increased insulation is better handled in the tables covering insulation in EC157 (Section 502). This change (EC159) is unnecessary and sometimes counter productive.

Additional reasons for disapproving the requirement added by EC159 include:

- When there is more than one layer, how will the enforcement staff see the joints in the covered layer?
- There are other ways of sealing joints besides staggering the edges; for example, using interlocking sheathing, or taping the joints. Any one of these should be acceptable.
- Designing buildings to use whole sheets of standard sizes minimizes cuts and construction waste. Requiring all joints to be staggered ensures that many edges need to be cut in the offset layer(s) for every layer after the first.
- Manufacturer's recommendations for attaching insulated sheathing have more fasteners at the edge than in the center of the sheathing. Staggering means more fasteners as the edges of the different layers will not align with each other.

(Michael D Fischer) The proponent's reason for submitting the proposal was limited to consistency with ASHRAE, and did not include any technical justification, nor did it report on any field problems that indicate such a requirement is necessary. The proposal creates a conflict with other sections of the IECC. In particular, Section 303.2 mandates that materials (including insulation) be installed in accordance with the manufacturers installation instructions.

Requiring that multi-layer applications of rigid insulation board be installed with staggered joints may at times be appropriate or even desirable for some rigid insulation materials, in some portions of the envelope, but this proposal is overly broad in scope. Because the added text is in 502.2, it applies to ALL portions of the thermal envelope: roofs, walls (above *and* below grade), slab, and floor applications. The proposed requirement would also be triggered when rigid insulation is used in insulated siding (such as insulated vinyl siding) installed over a layer of foam sheathing.

The proposal scope also omits semi-rigid materials, such as fiberglass or mineral wool insulation boards. Moreover, the proposal is limited to Chapter 5, which leaves no similar requirement for residential occupancies governed by Chapter 4.

Requiring staggered joints for foam sheathing will increase the cost of installation and will likely increase jobsite waste due to the need to trim boards to achieve the desired installation. The extra fasteners likely resulting from the proposal may increase the risk of air infiltration and water penetration into the wall assembly. The proposal does not add to the overall energy efficiency of the building, but if air infiltration increases it could actually decrease efficiency. Increasing the chance of water penetration into the wall could negatively affect insulation performance. EC 147 will put additional air barrier requirements into place; this proposal could be at odds with the intent of that proposal.

In summary, the proposal is unnecessary, incorrectly scoped, overly broad, and likely to cause unintended (and undesirable) consequences.

Final Action: AS AM AMPC____ D

EC159.doc

EC164-09/10
Table 502.3

Proposed Change as Submitted

Proponent: Jeff Lowinski, representing the Window and Door Manufacturers Association (WDMA)

Revise as follows:

Table 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
***U*-Factor**								
~~**Framing materials other than metal with or without metal reinforcement or cladding**~~								
~~*U*-Factor~~ Fixed and operable windows, non-entrance doors	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
~~**Metal framing with or without thermal break**~~								
Curtain Wall/Storefront ~~*U*-Factor~~	1.0	0.70	0.60	0.50	0.45	0.45	0.45	0.45
Entrance Door ~~*U*-Factor~~	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
~~All Other *U*-Factor[a]~~	~~1.20~~	~~0.75~~	~~0.65~~	~~0.55~~	~~0.55~~	~~0.55~~	~~0.50~~	~~0.50~~
SHGC-All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	NR	NR
SHGC: 0.25 ≤ PF <0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
U-Factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
PF = Projection factor (see Section 502.3.2).
~~a. All others includes operable windows, fixed windows and nonentrance doors.~~

Reason: The current prescriptive requirements in Table 502.3 give preferential treatment to particular types of products by providing different rules depending upon the frame material used. Non-metal frame windows are generally more energy efficient than aluminum and metal windows, yet their use is restricted by the imposition of the prescriptive values that discriminate against wood, vinyl, and composite windows.
This proposal removes that preferential treatment (one that conflicts with the foundational principles of the IECC as reproduced below) and uses the current prescriptive values for non-metal frames as the baseline. The use of less efficient windows should not occur without a consideration of other efficiency measures such as increased insulation. This proposal makes no change in requirements for curtainwall, storefront, entrance doors, or non-metal frames. Buildings constructed with elements such as metal framed windows perform differently, and thus should qualify using the performance path.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: Lowinski-EC-1-T. 502.3

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal would result in the exclusion of too many materials that would be needed in order for the windows to meet structural standards. The proposal needs to be balanced with requirements of other codes for window installation.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jeff Inks, representing Window & Door Manufacturers Association requests Approval as Submitted.

Commenter's Reason: The current prescriptive requirements in Table 502.3 give unjustified preferential treatment to particular types of products that discourages the construction of more energy efficient buildings by allowing less stringent energy performance requirements depending upon the frame material used. Non-metal frame windows are generally more energy efficient than aluminum and metal windows, yet their use is restricted by the imposition of the prescriptive values that discriminate against wood, vinyl, and composite windows. This proposal removes that preferential treatment (one that conflicts with the foundational principles of the IECC) and uses the current prescriptive values for non-metal frames as the baseline. The use of less efficient windows should not occur without a consideration of other efficiency measures such as increased insulation to offset the reduced energy performance.

This proposal makes no change in requirements for curtainwall, storefront, entrance doors, or non-metal frames. Buildings constructed with elements such as metal framed windows perform differently, and thus should qualify using the performance path.

The argument continues to be made that such differences are required because of the added structural strength that can be provided by metal framed vertical fenestration products over that provided by non-metal framed fenestration products. That argument is very misleading, implying that there are no applications where all load requirements applicable to the vertical fenestration can be met regardless of framing type. That of course simply isn't true, especially in "punched opening" applications and low rise commercial and residential construction.

The Committee disapproved the proposal in support of that argument stating it "would result in the exclusion of too many materials that would be needed to meet structural standards," which is a subjective determination that has not been substantiated or quantified and again simply isn't true with respect to this proposal. If all required structural design loads for the vertical fenestration, and the building as whole, can be met using either metal or non-metal vertical fenestration, then the energy performance requirements for them should be the same.

Furthermore, because no credit is given in the IECC for using better performing fenestration products that may be more costly, there is less incentive to use them. Again, not only does that give preferential treatment to particular types or classes of materials, products and methods of construction that are not justified, it discourages the construction of more energy efficient buildings. This shortcoming in the IECC is getting worse not better and needs to be addressed if the IECC is to meet the efficiency improvement objectives that have been set for it.

Public Comment 2:

Garrett Stone, Brickfield Burchette Ritts & Stone, representing Cardinal Glass Industries, requests Approval as Modified by this Public Comment.

Modify this proposal as follows:

Table 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Climate Zone	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical fenestration (~~40%~~30% maximum of above-grade wall)								
***U*-factor**								
Fixed and operable windows, curtain wall/storefront, and non-entrance doors	0.50~~1.20~~	0.50~~0.75~~	0.46~~0.65~~	0.38~~0.40~~	0.38~~0.35~~	0.36~~0.35~~	0.29~~0.35~~	0.29~~0.35~~
~~Curtain wall/storefront~~	~~1.00~~	~~0.70~~	~~0.60~~	~~0.50~~	~~0.45~~	~~0.45~~	~~0.45~~	~~0.45~~
Entrance door	1.10~~1.20~~	0.83~~1.10~~	0.77~~0.90~~	0.77~~0.85~~	0.77~~0.80~~	0.77~~0.80~~	0.77~~0.80~~	0.77~~0.80~~
SHGC – all frame types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	NR	NR
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
PF = Projection factor (see Section 502.3.2).

Commenter's Reason: EC164 should be approved as modified by this public comment.

The weaker U-factor requirement for metal-framed windows established in the IECC in 2006 has created substantial anti-efficiency incentives in commercial construction because designers and architects are held to a far more stringent standard for non-metal windows, even though these windows provide substantial energy savings as compared to metal-framed windows. As a result, designers are encouraged—and are likely—to use far less efficient windows.

We supported EC164 as submitted because it would substantially increase the efficiency of commercial buildings under the IECC, simplify compliance and enforcement, and remove the unnecessary material-specific bias between metal-framed and nonmetal-framed punched opening windows. However, EC164, as modified, will accomplish these same goals (with much greater energy efficiency) as well as satisfy the Committee's expressed concern about metal windows meeting the proposed values:

(1) Table 502.3 as modified will establish a single set of U-factors for all fixed and operable windows, regardless of frame type, including curtainwall and storefront. This simplifying improvement will remove the current incentive to install less efficient windows (which results in less efficient buildings) and will lead to more energy savings in commercial buildings.

(2) The modification uses the same U-factor used in ASHRAE 90.1-2010 Addendum bb approved by the ASHRAE Committee in June 2010 for fixed metal windows. Using the same values that ASHRAE has prescribed for fixed metal windows ensures a substantial increase in efficiency for all fenestration types and a level of consistency with ASHRAE. (For climate zone 1, the ASHRAE value varies depending on design temperature. In order to simplify, we selected the more stringent value, 0.50.) We have also modified the entrance door U-factors consistent with the new values in ASHRAE.

(3) The modification also responds directly to the IECC Committee's reasoning for disapproving the original proposal. The Committee stated that "the proposal would result in the exclusion of too many materials that would be needed in order for the windows to meet structural standards." Although we disagree that EC164 as submitted would exclude an unreasonable amount of framing materials, use of the same fixed metal window values as ASHRAE specifically responds to the perceived problem – after all, these values were crafted at ASHRAE specifically for fixed metal-framed windows. While operable metal windows may have higher U-factors, most windows in commercial buildings are fixed. Where the use of operable metal windows is desired, the user is free to use the performance path for compliance or specify more efficient operable windows.

(4) The single set of values proposed in the modification is far more efficient than the IECC's current values for standard metal windows as well as for curtainwall and storefront windows – these metal windows make up most of the windows currently used in commercial buildings. According to the Ducker Research Company, Inc., Study of the U.S. Market for Windows, Doors and Skylights (AAMA/WDMA 2008), page 69, Ex. D.28, 91% of the window area installed in commercial buildings in 2007 was metal-framed windows. With the new values in the proposed modification, the improved insulating value for metal punched opening windows ranges by climate zone from 29% to 58%. Similarly, the improved insulating value for curtainwall and storefront windows ranges from 16% to 50%. Given the impact of windows on space cooling and heating, the benefits of these improved window standards on total building space conditioning energy use can be expected to be substantial. As for the minority of cases where non-metal windows are used, the values are more efficient there as well in all but two climate zones (where the values are very close but slightly higher) – for non-metal windows savings range from 5% to 58% in the six positive climate zones while heat loss increases in zones 5 and 6 by 9% and 3% respectively.

(5) As modified, this proposal adopts the 30% maximum window area permitted by ASHRAE when using the prescriptive path. This proposal alone will substantially increase energy efficiency for those buildings where more than 30% window area would have been installed. After all, the best windows required by the code, even if this proposal is adopted, will have much higher U-factors than the opaque walls.

While the benefits to much lower fenestration U-factors should be intuitively obvious, we thought it would be helpful to understand the order of magnitude impact of fenestration U-factors on commercial building energy use. As a result, we modeled a medium sized office building (specifically, the commercial reference building developed by US DOE) in Phoenix (CZ2), Baltimore (CZ4) and Minneapolis (CZ6) using the U.S. DOE's building energy performance simulation program (EnergyPlus), holding the SHGC of the windows constant, while comparing the new ASHRAE U-factors for Operable Metal windows in each climate zone with the much lower ASHRAE values for non-metal windows. This analysis showed substantial heating and cooling energy savings in all three cases with lower U-factor fenestration. The higher metal U-factors increased combined heating and cooling source energy use by a huge amount -- 7% in Phoenix, 6% in Baltimore and 8% in Minneapolis. This shows how substantial energy savings will be left on the table if much more efficient values for the predominate type of commercial fenestration are not adopted.

In sum, the proposed modification will result in far more energy efficiency, establish requirements that can be met by metal windows and will require the same substantial level of energy efficiency regardless of the material used for framing. As a result, we offer the proposed modification to EC164 in this public comment to accomplish three very important objectives: (1) substantially increase the efficiency of commercial buildings; (2) eliminate an unnecessary material-specific bias or distinction between metal-framed and nonmetal-framed windows; and (3) establish U-factors found by the ASHRAE process to be achievable and cost-effective for metal windows.

Final Action: AS AM AMPC____ D

EC165-09/10
Table 502.3

Proposed Change as Submitted

Proponent: David C. Hewitt, New Buildings Institute, John Loyer, American Institute of Architects

Revise as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4, except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (~~40~~30% maximum of above-grade wall)								
Framing materials other than metal with or without metal reinforcement or cladding								
U-Factor[a]	1.20/ 0.57	~~0.75~~ 0.57	~~0.65~~ 0.40	~~0.40~~ 0.35	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront *U*-Factor[a]	1.0/ 0.57	~~0.70~~ 0.57	~~0.60~~ 0.50	~~0.50~~ 0.42	~~0.45~~ 0.42	~~0.45~~ 0.42	0.40	0.40
Entrance Door *U*-Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other *U*-Factor[a,b]	1.20/ 0.65	~~0.75~~ 0.65	~~0.65~~ 0.60	~~0.55~~ 0.50	~~0.55~~ 0.50	~~0.55~~ 0.50	0.45	~~0.45~~ 0.40
SHGC- All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF <0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum, 5% maximum with automatic day lighting controls[c])								
U-Factor	0.75	~~0.75~~ 0.65	~~0.65~~ 0.55	~~0.60~~ 0.50	~~0.60~~ 0.50	~~0.60~~ 0.50	~~0.60~~ 0.50	~~0.60~~ 0.50
SHGC[d]	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.
PF = Projection factor (see Section 502.3.2).
a. The first U-factor applies when impact rated glazing is installed.
b. "All others" includes operable windows, fixed windows, and ~~nonentrance~~ doors other than entrance doors.
c. Automatic day lighting controls shall meet the requirements of Section 505.2.2.3.3.
d. The SHGC for Climate Zones 1 – 6 can be increased to SHGC no greater than 0.60 if the Visible Transmittance (VT) is not less than 0.60 and automatic day lighting controls are installed that meet the requirements of Section 505.2.2.3.3.

Reason: This Building Envelope proposal provides the fenestration tables to complement the comprehensive proposal submitted on behalf of New Buildings Institute, the American Institute of Architects and the U.S. Department of Energy. This table provides significant improvements in glazing performance for the model code. The u-values and SHGC values include specifications from *Core Performance Guide*, 2009 IECC and proposed ASHRAE 90.1-2010.

Cost Impact: This code change proposal will increase the cost of construction.

ICCFILENAME: HEWITT-LOYER-EC1-T502.3

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: The change provides a good increase in energy savings from improved fenestration standards. More savings can be easily achieved. The committee felt this change would encourage the use of daylighting controls.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Dave Hewitt, representing New Building Institute and Jessyca Henderson, representing American Institute of Architects requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

VISIBLE TANSMITTANCE (VT): The ratio of visible light entering the space through the fenestration product assembly to the incident visible light. Visible Transmittance (VT) includes the effect of glazing material and frame and is expressed as a number between 0 and 1.

502.3 Fenestration (Prescriptive). Fenestration shall comply with Table 502.3. Automatic daylight controls specified by this section shall comply with Section 505.2.2.3.2.

502.3.1 Maximum area. The vertical fenestration area (not including opaque doors and opaque spandrel panels) shall not exceed ~~the percentage~~ 30 percent of the gross above-grade wall area ~~specified in Table 502.3.~~ The skylight area shall not exceed ~~the percentage~~ 3 percent of the gross roof area ~~specified in Table 502.3~~.

502.3.1.1 Increased vertical fenestration area with daylight controls. In climate zones 1 through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. No less than 50 percent of the conditioned floor area is within a daylight zone;
2. Automatic daylight controls are installed in daylight zones; and
3. Visible transmittance (VT) of vertical fenestration is greater than or equal to 1.1 times solar heat gain coefficient (SHGC). Provision 3 not required for fenestration outside the scope of NFRC 200.

502.3.2.1 Increased skylight area with daylight controls. The skylight area shall be permitted to be a maximum of 5 percent of the roof area provided automatic daylight controls are installed in daylight zones under skylights.

502.3.2 Maximum U-factor and SHGC. (*No change in the text of 502.3.2 is proposed, title shown for context of following changes)*

502.3.2.1 Increased vertical fenestration SHGC. In climate zones 1, 2 and 3, vertical fenestration entirely located not less than 6 feet (1729 mm) above the finished floor shall be permitted a maximum SHGC of 0.40.

502.3.2.2 Increased skylight SHGC. In climate zones 1 through 6 skylights shall be permitted a maximum SHGC of 0.60 where located above daylight zones provided with automated daylight controls.

502.3.2.2 Increased skylight U-factor. Where skylights are installed above daylight zones provided with automatic daylight controls, a maximum U-factor of 0.9 shall be permitted in climate zones 1 through 3; and a maximum U-factor of 0.75 shall be permitted in climate zones 4 through 8.

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4, except Marine	5 and Marine 4	6	7	8
Vertical Fenestration ~~(30% maximum above-grade wall)~~								
Framing materials other than metal[a] ~~with or without metal reinforcement or cladding~~								
U-Factor[b]	~~1.20/~~ ~~0.57~~ 0.50	~~0.57~~ 0.40	~~0.40~~ 0.35	0.35	0.35	~~0.35~~ 0.32	~~0.35~~ 0.32	~~0.35~~ 0.32
Metal framing[bc] ~~with or without thermal break~~								
Curtain Wall/Storefront *U*-Factor[b]	~~1.20/~~ 0.57	0.57	0.50	0.42	0.42	0.42	0.40	0.40
Entrance Door *U*-Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other[d] *U*-Factor[b]	0.65	0.65	0.60	0.50	0.50	0.50	0.45	0.40
SHGC- All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF <0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights ~~(3% maximum, 5% maximum with automatic day lighting controls[b])~~								
U-Factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement. PF = Projection factor (see Section 502.3.2).

a. With or without metal reinforcement or cladding.

~~a. The first U-factor applies when impact rated glazing is installed.~~ b. For impact rated fenestration in *wind-borne debris regions* the maximum U-factor shall be 1.20 in Climate Zone 1, 0.75 in Zone 2, and 0.65 in Zone 3.

c. With or without thermal break.

~~b~~ d. "All others" includes operable windows, fixed windows, and doors other than entrance doors.

~~c. Automatic day lighting controls shall meet the requirements of Section 505.2.2.3.3.~~

~~d. The SHGC for Climate Zones 1 – 6 can be increased to SHGC no greater than 0.60 if the Visible Transmittance (VT) is not less than 0.60 and automatic day lighting controls are installed that meet the requirements of Section 505.2.2.3.3.~~

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: This proposal provides a fenestration table to complement the comprehensive proposal in EC147 as submitted by the New Buildings Institute, the American Institute of Architects and the U.S. Department of Energy. This proposal, combined with the opaque envelope tables provided in EC157, completes the comprehensive revision of the commercial energy code in EC147.

At the first hearing EC165 was approved unanimously by the IECC committee. Committee comments affirmed both the reasonable increases in energy efficiency and the extensive stakeholder discussions that resulted in EC165. Several committee members strongly encouraged the proponents to continue stakeholder discussions to address any additional concerns with the fenestration table. The modifications presented here are a result of those discussions.

The EC165 tables are based on the 2009 IECC tables, the New Buildings Institute's Core Performance Guide, and alignment with other prevailing code changes as discussed below. Overall EC165 provides fenestration efficiency levels that have been demonstrated to be practical, increase energy efficiency, and are acceptable to most industry stakeholders.

The most common stakeholder comments concerned the window area. Originally EC165 proposed a reduction in the allowed window area from 40% to 30% of the wall area, as an energy saving measure. (Larger window areas required the performance method.) Multiple stakeholders requested that the 40% option be restored.

Several comments noted that daylighting can save substantial energy. With daylighting, a larger window/skylight area can actually become an energy saving measure as it reduces the need for electric lighting and reduces cooling loads, more than making up for thermal losses through the increased fenestration areas. Both the New Buildings Institute and the American Institute of Architects agreed daylighting can be a major energy-efficiency asset provided electric lighting is reduced when daylight is available. The daylighting option for the 40% WWR is included as this comment's response to broad stakeholder feedback on both glazing area and daylighting issues.

Most modifications to EC165 define prescriptive daylighting options that can be easily enforced and easily understood by design professionals. These modifications restore options for larger window and skylight areas. Automated daylight controls, already described in EC 147, were required in order to ensure energy savings from reduced electric lighting when daylighting was available. The fenestration requirements for windows and skylights used to provide daylighting were adjusted to allow for higher light transmission. This included an increased SHGC, and a minimum visible transmittance (VT) when ratings are available. Skylight requirements were adjusted based on substantial energy savings available from correctly utilized top lighting.

A few other changes are made to EC165 in this comment. Because the "residential style" commercial windows (non-metal windows) are like the windows used in residential buildings, the non-metal window specifications were aligned with the residential code, as approved in EC13, EC34, and EC39. Provisions for hurricane rated glass in EC165 are revised to be consistent with residential specifications in EC13. A definition of Visible Transmittance identical to the one approved in EC3 was added. Several editorial improvements involved moving titles for table rows and table notes into the body of the code which makes the table read more clearly.

Public Comment 2:

Jonathan McHugh, representing McHugh Energy Consultants, Inc. requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.3 Fenestration (Prescriptive). Fenestration shall comply with Table 502.3. Automatic daylight controls specified by this section shall comply with Section 505.2.2.3.2.

502.3.1 Maximum area. The vertical fenestration area (not including opaque doors and opaque spandrel panels) shall not exceed ~~the percentage~~ 30 percent of the gross above-grade wall area ~~specified in Table 502.3~~. The skylight area shall not exceed ~~the percentage~~ 3 percent of the gross roof area ~~specified in Table 502.3~~.

502.3.1.1 Increased vertical fenestration area with daylight controls. In climate zones 1 through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. A minimum of 50 percent of the conditioned floor area is within a daylight zone;
2. Automatic daylight controls are installed in daylight zones; and
3. Visible transmittance (VT) of vertical fenestration is greater than or equal to 1.1 times solar heat gain coefficient (SHGC).

502.3.2.1 Increased skylight area with daylight controls. -The skylight area shall be permitted to be a maximum of 6 percent of the roof area, provided.

1. Skylights have a glazing material or diffuser with a measured haze value greater than 90 percent when tested according to ASTM D1003;
2. Skylight glazing shall have a minimum solar photometric transmittance of 0.40 when tested according to ASTM E972; and
3. Automatic daylight controls are installed in daylight zones under skylights.

502.3.2 Maximum U-factor and SHGC. (*no change in the text of 502.3.2 is proposed, title shown for context of following changes)*

502.3.2.1 Increased vertical fenestration SHGC. In climate zones 1, 2 and 3, vertical fenestration entirely located not less than 6 feet (1729 mm) above the finished floor shall be permitted a maximum SHGC of 0.40.

502.3.2.2 Increased skylight SHGC. In climate zones 1 through 6 skylights with a maximum SHGC of 0.60 shall be permitted above daylight zones, provided;

1. The skylights provide a minimum solar photometric transmittance of 0.40 when tested in accordance with ASTM E972;
2. The skylights shall have a glazing material or a diffuser with a haze rating greater than 90 percent tested in accordance with ASTM D1003 (notwithstanding its scope); and

3. The daylight zones are provided with automated daylight controls.

502.3.2.3 Increased skylight U-factor. Skylights shall be permitted above daylight zones provided:

1. The skylights provide a minimum solar photometric transmittance of 0.40 when tested in accordance with ASTM E972;
2. The skylights shall have a glazing material or a diffuser with a haze rating greater than 90 percent when tested in accordance with ASTM D1003; (notwithstanding its scope);
3. In climate zones 1 through 3 the skylight U-factor shall not exceed 0.9; and
4. In climate zones 4 through 8, the skylight U-factor shall not exceed 0.75.

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4, except Marine	5 and Marine 4	6	7	8
Vertical Fenestration ~~(30% maximum above-grade wall)~~								
Framing materials other than metal[a] ~~with or without metal reinforcement or cladding~~								
U-Factor[b]	~~1.20/~~ ~~0.57~~ 0.50	~~0.57~~ 0.40	~~0.40~~ 0.35	0.35	0.35	~~0.35~~ 0.32	~~0.35~~ 0.32	~~0.35~~ 0.32
Metal framing[bc] ~~with or without thermal break~~								
Curtain Wall/Storefront *U*-Factor[b]	~~1.20/~~ 0.57	0.57	0.50	0.42	0.42	0.42	0.40	0.40
Entrance Door *U*-Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other[d] *U*-Factor[b]	0.65	0.65	0.60	0.50	0.50	0.50	0.45	0.40
SHGC- All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF <0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights ~~(3% maximum, 5% maximum with automatic day lighting controls[D])~~								
U-Factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement. PF = Projection factor (see Section 502.3.2).
a. With or without metal reinforcement or cladding.
~~a. The first U-factor applies when impact rated glazing is installed.~~ b. For impact rated fenestration in *wind-borne debris regions* the maximum U-factor shall be 1.20 in Climate Zone 1, 0.75 in Zone 2, and 0.65 in Zone 3.
c. With or without thermal break.
~~b~~ d. "All others" includes operable windows, fixed windows, and doors other than entrance doors.
~~c. Automatic day lighting controls shall meet the requirements of Section 505.2.2.3.3.~~
~~d. The SHGC for Climate Zones 1 – 6 can be increased to SHGC no greater than 0.60 if the Visible Transmittance (VT) is not less than 0.60 and automatic day lighting controls are installed that meet the requirements of Section 505.2.2.3.3.~~

ASTM

D1003 07 Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics
E972 - 07 Standard Test Method for Solar Performance Transmittance of Sheet Materials Using Sunlight.

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: The edits to this proposal will increase the allowable skylight area, SHGC and U-factor when daylighting controls are used and the skylights are performance (diffusing and high solar photometric transmittance). This roughly approximates the recent daylighting changes to ASHRAE 90.1. These changes allow a relaxing of the fenestration requirements that are focused on heat loss and gain in return for much larger energy savings associated with admitting daylight and reducing lighting energy consumption in response to daylight. The vast majority of spaces that are using skylighting effectively make use of plastic dome style skylights. These skylights have relatively high U-factors and SHGC as compared to glass skylights. However the cost of these skylights is approximately 1/3 that of glass skylights, and dome shaped skylights have the advantage of intercepting low angle sunlight when it is needed the most – early in the morning and late in the afternoon. Skylights with relatively high visible light transmittance also have fairly high SHGC. If one requires the use of daylighting controls in conjunction with skylights, the traditional expectations of optimal energy performance are reversed. In most situations, the most important feature of the skylight is its visible light transmittance. Depending upon the type of space and the lighting system and climate the optimal energy cost savings frequently occur at skylight areas that are substantially greater than the current 3% skylight to roof area ratio.

It should be noted that the added skylight area, and relaxed SHGC and U-factors are allowed when it is clear that skylights will be used to reduce electric lighting energy. This requires that the skylights are diffusing so they don't cause glare, they have high solar photometric transmittance so they are indeed a daylight aperture and not a dim source of light and lighting controls are indeed saving reducing electric lighting energy consumption. It should be noted that VL is not applied to skylights as VT refers to the visible light transmittance as measured by NFRC 200. Unfortunately NFRC has yet to develop methods for measuring light transmittance through diffusing or curved glazing surfaces. Dome skylights are both and thus have no NFRC VT ratings. Instead we reference another test method that uses an integrating sphere method for measuring transmittance ASTM E972.

It should be noted that the reduced stringency for skylight U-factors represents double glazed dome skylights with thermally broken metal frames in climate zones 1 though 3 and triple glazed skylights with thermally broken metal frames for all other climate zones. .A very detailed simulation study of warehouses, retail spaces and offices with thousands of DOE-2 runs formed the basis of the daylighting measures that the ASHRAE 90.1 committee adopted. This study can be downloaded from: http://www.h-m-g.com/ASHRAE_Daylighting/

Similar requirements apply to vertical fenestration. When daylighting controls are used, additional energy savings result from having larger glazing areas. Similar to skylighting, a higher level of SHGC is warranted if this results in higher visible light transmittance and thus higher amounts of daylight that can be transmitted. With higher daylight transmittance, more electric lighting can be displaced and result in a greater net energy savings.

Analysis: The standards, ASTM D1003 and E972, were not reviewed proposed as part of the original submittal of EC 165. However ASTM D1003 -07e1 was considered under the proposal EC173 and found to be in compliance with CP28. ASTM D972-96 (2002) was considered as part of the proposal EC179 and found to be in compliance with CP28. The standard process for code development (CP#28) requires submittal of the standard proposed early in the process to allow the review of the Code Development Committee to determine the appropriateness of the standard as well as the appropriateness of it being referenced in this part of the code. While the standards were found in compliance with CP28, they have not be evaluated regarding the appropriateness of referencing them in this location under the EC165 proposal.

Public Comment 3:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association (AAMA), requests Approval as Modified by this Public Comment.

Modify the proposal as follows

Table 502.3
Building Envelope Requirements, Fenestration

Climate Zone	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40~~30~~% maximum of above-grade wall)								

c. Automatic lighting controls shall meet the requirements of Section ~~505.2.2.3.3~~ 505.2.2.3.2.
d. The maximum SHGC for Climate Zones 1 through 6 can be increased to ~~SHGC no greater than~~ 0.60 if the Visible Transmittance is not less than
0. 60 and automatic lighting controls are installed that meet the requirements of Section ~~505.2.2.3.3~~. 505.2.2.3.2

(Portions of code change proposal not shown remain unchanged.)

Commenter's Reason: EC165 included a number of energy saving provisions. They consisted of lowering the U-factor for vertical fenestration in a number of different climate zones and product categories, permitting skylights to constitute a greater percentage of the roof when combined with automatic lighting controls, and to have higher SHGC in combination with higher VT, and reduction of the percentage of the exterior wall that is permitted to be vertical fenestration under the prescriptive provisions.

AAMA is in agreement with all of these changes except the reduction of vertical fenestration permitted. As with skylights it is our view that the potential benefit of restricting or reducing heat loss or gain through fenestration must be balanced with the reduction in natural lighting that occurs when fenestration (both in the exterior wall and in the roof) is too harshly restricted.

As the maximum permitted U-factor and SHGC of glazed fenestration are pushed lower and lower the amount of natural light – daylighting – that enters the building through a specific size area of glazed fenestration is also inherently lowered. This is not a matter of technology not being advanced enough. It's a matter of physics. The coatings that reduce the heat transmittance through the glass do so by blocking the transfer of energy waves through the glass. Since light is transferred by energy waves, these coatings affect the transfer of light also.

The only way to counter this reduction in transferred light, and provide an adequate amount of natural light to the interior space, is to increase the size of the glazed fenestration area. Reducing the percentage of fenestration area permitted would not only prohibit this, it would run counter to the change that is needed to maintain natural, zero net energy lighting in the interior space.

This Public Comment also corrects the reference for lighting controls under skylights when the maximum percentage of skylight area in the roof is increased from 3% to 5%. The provisions approved in EC165 refer to Section 505.2.2.3.3, which simply requires separate lighting controls in daylight areas. This Public Comment instead references Section 505.2.2.3.2. A separate Public Comment to EC179 will offer replacement of proposed Section 505.2.5 of that proposal with a new Section 505.2.2.3.2, for the requirements for automatic lighting controls that reduce the lighting level when adequate daylighting is provided.

As noted above, although we disagree with the change to vertical fenestration percentage in EC165 and we are aware that the lighting control requirements for daylight areas under skylights needs to require automatic lighting controls for maximum energy savings, we are in agreement with the other provisions of the proposal. This Public Comment would retain the helpful provisions of EC165, while retaining the current permitted vertical fenestration area of 40% and the new provisions for increased top lighting. We urge the membership to approve EC165 as modified by this Public Comment.

Public Comment 4:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association (AAMA), requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Table 502.3
Building Envelope Requirements, Fenestration

Climate Zone	**1**	**2**	**3**	**4 except Marine**	**5 and Marine 4**	**6**	**7**	**8**
Vertical Fenestration (40~~30~~% maximum of above-grade wall)								

c. Automatic lighting controls shall meet the requirements of Section ~~505.2.2.3.3~~ 505.2.5
d. The maximum SHGC for Climate Zones 1 through 6 can be increased to ~~SHGC no greater than~~ 0.60 if the Visible Transmittance is not less than
0. 60 and automatic lighting controls are installed that meet the requirements of Section ~~505.2.2.3.3.~~ 505.2.5

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: EC165 included a number of energy saving provisions. They consisted of lowering the U-factor for vertical fenestration in a number of different climate zones and product categories, permitting skylights to constitute a greater percentage of the roof when combined with automatic lighting controls, and to have higher SHGC in combination with higher VT, and reduction of the percentage of the exterior wall that is permitted to be vertical fenestration under the prescriptive provisions.

AAMA is in agreement with all of these changes except the reduction of vertical fenestration permitted. As with skylights it is our view that the potential benefit of restricting or reducing heat loss or gain through fenestration must be balanced with the reduction in natural lighting that occurs when fenestration (both in the exterior wall and in the roof) is too harshly restricted.

As the maximum permitted U-factor and SHGC of glazed fenestration are pushed lower and lower the amount of natural light – daylighting – that enters the building through a specific size area of glazed fenestration is also inherently lowered. This is not a matter of technology not being advanced enough. It's a matter of physics. The coatings that reduce the heat transmittance through the glass do so by blocking the transfer of energy waves through the glass. Since light is transferred by energy waves, these coatings Affect the transfer of light also.

The only way to counter this reduction in transferred light, and provide an adequate amount of natural light to the interior space, is to increase the size of the glazed fenestration area. Reducing the percentage of fenestration area permitted would not only prohibit this, it would run counter to the change that is needed to maintain natural, zero net energy lighting in the interior space.

This Public Comment also changes the requirements for lighting controls under skylights when the maximum percentage of skylight area in the roof is increased from 3% to 5%. The provisions approved in EC165 refer to Section 505.2.2.3.3, which simply requires separate lighting controls in daylight areas. This Public Comment instead references Section 505.2.5, which requires multilevel automatic lighting controls that reduce the lighting level when adequate daylighting is provided.

As noted above, although we disagree with the change to vertical fenestration percentage in EC165 and we are aware that the lighting control requirements for daylight areas under skylights needs to require automatic lighting controls for maximum energy savings, we are in agreement with the other provisions of the proposal. This Public Comment would retain the helpful provisions of EC165, while retaining the current permitted vertical fenestration area of 40%. We urge the membership to approve EC165 as modified by this Public Comment.

Public Comment 5:

Garrett Stone, Brickfield Burchette Ritts & Stone, representing Cardinal Glass Industries requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Table 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Climate Zone	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical fenestration (30% maximum of above-grade wall)								
~~**Framing materials other than metal with or without metal reinforcement or cladding**~~								
~~*U*-factor[a]~~	~~1.20/0.57~~	~~0.57~~	~~0.40~~	~~0.35~~	~~0.35~~	~~0.35~~	~~0.35~~	~~0.35~~
~~**Metal framing with or without thermal break**~~								
~~Curtain wall/storefront~~ *U*-factor – Fixed[a]	~~1. 0/0.57~~ 0.50	~~0.57~~0.50	~~0.50~~ 0.46	~~0.42~~ 0.38	~~0.42~~ 0.38	~~0.42~~ 0.36	~~0.40~~ 0.29	~~0.40~~ 0.29
U-factor - Operable	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance door *U*-factor	~~1.20~~ 1.10	~~1.10~~ 0.83	~~0.90~~ 0.77	~~0.85~~ 0.77	~~0.80~~ 0.77	~~0.80~~ 0.77	~~0.80~~ 0.77	~~0.80~~ 0.77
~~All other *U*-factor[a,b]~~	~~1.20/0.65~~	~~0.65~~	~~0.60~~	~~0.50~~	~~0.50~~	~~0.50~~	~~0.45~~	~~0.40~~
SHGC – all frame types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum, 5% maximum with automatic day lighting controls[~~c~~a])								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC[~~d~~b]	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
PF = Projection factor (see Section 502.3.2).
~~a. The first U-factor applies when impact rated glazing is installed.~~
~~b. "All others" includes operable windows, fixed windows, and doors other than entrance doors.~~
a.~~c.~~ Automatic day lighting controls shall meet the requirements of Section 505.2.2.3.3.
b.~~d.~~ The SHGC for Climate Zones 1 through 6 can be increased to SHGC no greater than 0.60 if the Visible Transmittance (VT) is not less than 0.60 and automatic day lighting controls are installed that meet the requirements of Section 505.2.2.3.3.

Commenter's Reason: Cardinal Glass has consistently supported increases in residential and commercial fenestration efficiency in the IECC and at ASHRAE. While it can be argued that EC165, in at least some aspects, would increase efficiency, we think it falls far short of cost-effective and achievable energy savings in this time when we should be aggressively seeking improved savings. ICC should not be content to adopt modest improvements when ASHRAE is on the path to far more substantial improvements in this area. Historically, ASHRAE and the IECC have been reasonably comparable in terms of energy savings, thereby allowing jurisdictions to adopt the IECC for commercial buildings (by Federal law, states are required to have commercial building codes that meet or exceed ASHRAE 90.1).

As a result, we urge the ICC to consider and adopt additional improvements to meet or exceed those already being adopted at ASHRAE. We believe that the ICC can provide leadership by adopting or even improving upon ASHRAE values. Other proposals being considered for which we have submitted public comments with modifications will incorporate or even improve upon ASHRAE in some areas, such as EC164 (U-factor) and EC169 (SHGCs). However, we are also submitting a public comment with modifications for EC165, in the event the ICC elects to use EC165 as the primary vehicle to improve fenestration U-factor in the commercial code.

The proposed modifications in this public comment are intended to accomplish the following objectives:

(1) Combine and simplify all of the window categories into just “Fixed” and “Operable,” similar to ASHRAE 90.1, Addendum bb (as approved by the 90.1 Committee in late June 2010), with the further improvement of eliminating the category of non-metal windows;

(2) Use values consistent with ASHRAE for Fixed and Operable Metal Windows and Entrance Doors, which are much more stringent and energy efficient than those proposed in EC165 as submitted (for climate zone 1, the ASHRAE value varies depending on design temperature; in order to simplify, we selected the more stringent values); and

(3) By eliminating the specific non-metal window category (which currently constitutes less than 10% of commercial window glazing area), the proposal will eliminate the current material-specific bias in and allow more efficient windows to claim the energy savings that they create.

Although Cardinal’s proposed modification to EC164 is preferable because it adopts a single U-factor for both fixed and operable windows for purposes of simplicity and uniformity, the proposed modification to EC165 offers the option of separate U-factors for fixed and operable windows, both of which are the same as those required for metal-framed fenestration U-factors in ASHRAE Addendum bb. As these U-factors were developed specifically for metal-framed windows in the ASHRAE process, there should be no legitimate concern about whether metal-framed windows can meet them.

In addition to substantially improved energy efficiency, simplification, and greater consistency with ASHRAE values, the modification eliminates an unnecessary material-specific distinction between metal-framed and nonmetal-framed windows. The weaker U-factor requirement for metal-framed windows has created anti-efficiency incentives in commercial construction for a number of years because performance values vary based on the type of frame and window. Put another way, until this problem is resolved, the overall energy budget for the building will vary hugely depending on the type of framing material chosen for windows. This will not help the nation meet its energy savings policy objectives.

The extra energy efficiency from the far more stringent proposed values applied to metal windows will dwarf any reduction in energy savings from non-metal windows, which as shown by the AAMA/WDMA market study (Ducker Research Company, Inc., Study of the U.S. Market for Windows, Doors and Skylights (AAMA/WDMA 2008), page 69, Ex. D.28), constituted only 9% of the commercial window glazing area in 2007. Moreover, as a practical matter, in those applications where non-metal windows are used in punched openings, these windows are likely to be designed for residential efficiency requirements, and are likely to have much lower U-factors than would be required under the commercial chapter. It is highly unlikely that this change will have any significant negative effect on energy savings from the use of non-metal windows.

It should also be noted that we do not attempt to address the need to improve SHGCs in this proposed modification, This is because the issue is more specifically addressed in EC169 and our public comment on that proposal.

In sum, this proposed modification will capture an enormous amount of additional energy efficiency over that proposed in EC165 as submitted and simplify the requirements to improve compliance and enforcement, while correcting unacceptable discrimination against non-metal windows.

Public Comment 6:

Jeff Inks, representing Window & Door Manufacturers Association requests Disapproval.

Commenter’s Reason: This proposal further exacerbates a fundamental short coming in the current prescriptive requirements in Table 502.3 that give unjustified preferential treatment to particular types of products that discourages the construction of more energy efficient buildings by allowing less stringent energy performance requirements depending upon the frame material used. Non-metal frame windows are generally more energy efficient than aluminum and metal windows, yet their use is restricted by the imposition of the prescriptive values that discriminate against wood, vinyl, and composite windows.

The argument continues to be made that such differences are required because of the added structural strength that can be provided by metal framed vertical fenestration products over that provided by non-metal framed fenestration products. That argument is very misleading, implying that there are no applications where all load requirements applicable to the vertical fenestration can be met regardless of framing type. That of course simply isn’t true, especially in “punched opening” applications and low rise commercial and residential construction. If all required structural design loads for the vertical fenestration, and the building as whole, can be met using either metal or non-metal vertical fenestration, then the energy performance requirements for them should be the same.

Furthermore, because no credit is given in the IECC for using better performing fenestration products that may be more costly, there is less incentive to use them. Again, not only does that give preferential treatment to particular types or classes of materials, products and methods of construction that are not justified, it discourages the construction of more energy efficient buildings. This shortcoming in the IECC will be made worse and not better by approval of this proposal and we urge that it therefore be disapproved.

Final Action: AS AM AMPC____ D

EC166-09/10

202 (New), Table 502.3, Table 502.3(1) (New), 502.3.2, Table 502.3(2) (New)

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

1. Add new definitions as follows:

OPAQUE PERMANENT PROJECTION. Permanent shading devices attached to the building or consisting of portions of the building such as overhangs or eaves, including open louvers that do not allow the sun to penetrate the louvers during the peak sun angle on June 21 (December 21 southern hemisphere).

VISIBLE TRANSMITTANCE, *VT*: The ratio of visible radiation entering the space through the fenestration product to the incident visible radiation, determined as the spectral transmittance of the total fenestration system, weighted by the photopic response of the eye and integrated into a single dimensionless value.

2. Revise as follows:

502.3.2 Maximum *U*-factor and SHGC. For vertical fenestration and skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) and minimum visible transmittance (VT) shall be as specified in Table 502.3(1) ~~, based on the window projection factor.~~ ~~For skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3.~~ The window projection factor shall be determined in accordance with Equation 5-1.

PF = A/B **(Equation 5-1)**

where:

PF = Projection factor (decimal).
A = Distance measured horizontally from the furthest 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, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

3. Revise and renumber as follows:

TABLE ~~502.3~~ 502.3(1)
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Vertical fenestration (40% maximum of ~~above grade~~ walls associated with the building envelope)								
***U*-factor**								
~~**Framing materials other than metal with or without metal reinforcement or cladding**~~								
Nonmetal framing ~~*U*-factor~~	~~1.20~~ 0.32	~~0.75~~ 0.32	~~0.65~~ 0.28	~~0.40~~ 0.28	~~0.35~~ 0.28	~~0.35~~ 0.28	~~0.35~~ 0.20	~~0.35~~ 0.20
~~**Metal framing with or without thermal break**~~								
~~Curtain Wall/Storefront *U*-factor~~ Metal framing, fixed	~~1.0~~ 0.50	~~0.70~~ 0.50	~~0.60~~ 0.46	~~0.50~~ 0.38	~~0.45~~ 0.38	~~0.45~~ 0.35	~~0.40~~ 0.26	~~0.40~~ 0.26
Metal framing, operable	0.65	0.65	0.60	0.44	0.44	0.42	0.34	0.34
Metal framing, commercial ~~E~~entrance ~~D~~door	~~1.20~~ 0.83	~~1.10~~ 0.83	~~0.90~~ 0.77	~~0.85~~ 0.77	~~0.80~~ 0.77	~~0.80~~ 0.77	~~0.80~~ 0.77	~~0.80~~ 0.77
Metal framing, residential entrance door	0.83	0.77	0.68	0.68	0.68	0.68	0.68	0.68
~~All Other *U*-factora~~	~~1.20~~	~~0.75~~	~~0.65~~	~~0.55~~	~~0.55~~	~~0.55~~	~~0.45~~	~~0.45~~
SHGC- All Frame Types								
Max. SHGC (assembly)~~: PF < 0.25~~	0.25	0.25	0.25	~~0.40~~ 0.26	~~0.40~~ 0.26	~~0.40~~ 0.35	~~0.45~~ 0.40	~~0.45~~ 0.40
~~SHGC: 0.25 ≤ PF <0.5~~	~~0.33~~	~~0.33~~	~~0.33~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~

~~SHGC: PF ≥ 0.5~~	~~0.40~~	~~0.40~~	~~0.40~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~
Min. VT/SHGC (assembly)								
Vertical fenestration <=20% wall area	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Vertical fenestration > 20 to <=40% wall area	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Skylights (3% maximum)								
U-Factor (assembly)	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
Max. SHGC (assembly)	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
PF = Projection factor (see Section 502.3.2)
~~a. All others includes operable windows, fixed windows and nonentrance doors.~~

4. Revise as follows:

502.3.2 Maximum *U*-factor and SHGC. For vertical fenestration, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3, based on the window projection factor. For skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3.

The window projection factor shall be determined in accordance with Equation 5-1.

PF = A/B **(Equation 5-1)**

where:

PF = Projection factor (decimal).

A = Distance measured horizontally from the furthest 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, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

The maximum SHGC for v*ertical fenestration* specified in Table 502.3 and shaded by *opaque permanent projections* shall be permitted to be increased using the multipliers in Table 502.3(2) based on PF as determined in accordance with Equation 5-1 and the orientation of the fenestration.

All *vertical fenestration* within 45 degrees of a south orientation shall be provided with *opaque permanent projections* having a PF of a least 0.5 as determined in accordance with Equation 5-1. All *vertical fenestration* within 45 degrees of an east or west orientation shall be provided with *opaque permanent projections* having a PF of a least 0.5 as determined in accordance with Equation 5-1.

5. Add new table as follows:

TABLE 502.3(2)
VERTICAL FENESTRATION SHGC ADJUSTMENT FACTORS

PF	SHGC Multiplier (over 45 degrees from true north)	SHGC Multiplier (within 45 degrees of true north)
0 – 0.10	1.00	1.00
>0.10 – 0.20	1.10	1.05
>0.10 – 0.20	1.22	1.10
>0.20 – 0.30	1.35	1.15
>0.30 – 0.40	1.49	1.19
>0.40 – 0.50	1.64	1.23
>0.60 – 0.70	1.79	1.28
>0.70 – 0.80	1.96	1.32
>0.80 – 0.90	2.13	1.33
>0.90 – 1.00	2.27	1.37

Reason: For consistency with ASHRAE Standard 90.1-07 addenda "bb and "bm". This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. Due to the timing of the code development process and ASHRAE standards processes this proposal was submitted in anticipation that by the final action hearings the work to update the standard would be complete. The definition of VT is needed as it is relevant in NFRC 200, which is used for fenestration property evaluation.

Cost Impact: The code change proposal will increase the cost of construction to the degree that more efficient products will be required for vertical fenestration.

ICCFILENAME: Majette-EC-52-202-T. 502.3-

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee disapproved the code change because they felt that it put too many restrictions on design flexibility, that the U-values were too onerous; and that the projection requirement particularly difficult to understand and implement.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, representing US Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows

OPAQUE PERMANENT PROJECTION. Permanent shading devices attached to the building or consisting of portions of the building such as overhangs or eaves, including open louvers that do not allow the sun to penetrate the louvers during the peak sun angle on June 21 (December 21 southern hemisphere).

VISIBLE TRANSMITTANCE, *VT*. The ratio of visible radiation entering the space through the fenestration product to the incident visible radiation, determined as the spectral transmittance of the total fenestration system, weighted by the photopic response of the eye and integrated into a single dimensionless value.

LIGHT-TO-SOLAR-GAIN RATIO . The ratio of the center-of-glass visible transmittance to center of-glass solar heat gain coefficient.

SIDELIGHTING EFFECTIVE APERTURE. Relationship of daylight transmitted through vertical fenestration to the primary sidelighted areas. The sidelighting effective aperture is calculated according to the following formula:

Sidelighting effective aperture = (∑ vertical fenestration Area x vertical fenestration VT) / primary sidelighted area where vertical fenestration VT is the visible transmittance of vertical fenestration

PRIMARY SIDELIGHTED AREA. The total primary sidelighted area is the combined primary sidelighted area without double counting overlapping areas. The floor area for each primary sidelighted area is directly adjacent to vertical fenestration below the ceiling with an area equal to the product of the primary sidelighted area width and the primary sidelighted area depth.

The primary sidelighted area width is the width of the vertical fenestration plus, on each side, the smallest of:

1. 2 foot (610 mm), or
2. The distance to any 5-foot (1524 mm) or higher vertical obstruction.

The primary sidelighted area depth is the horizontal distance perpendicular to the vertical fenestration which is the smaller of:

1. One vertical fenestration head height (head height is the distance from the floor to the top of the glazing), or
2. The distance to any 5-foot (1524 mm) or higher vertical obstruction.

502.3.2 Maximum *U*-factor and SHGC. For vertical fenestration and skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) and minimum visible transmittance (VT)/SHGC shall be as specified in Table 502.3(1). The window projection factor shall be determined in accordance with Equation 5-1.

PF = *A/B* **(Equation 5-1)**

Where:

PF = Projection factor (decimal).
A = Distance measured horizontally from the furthest 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, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

The maximum SHGC for v*ertical fenestration* specified in Table 502.3(1) and shaded by *opaque permanent projections* shall be permitted to be increased using the multipliers in Table 502.3(2) based on PF as determined in accordance with Equation 5-1 and the orientation of the fenestration.

502.3.3 Visible transmittance/SHGC ratio. *Fenestration* shall have a ratio of VT divided by SHGC not less than that specified in Table 502.3 for the appropriate *fenestration* area.

Exceptions: The following fenestration shall be exempted from the visible transmittance/SHGC ratio**.**

1. A *light-to-solar-gain ratio* (LSG) of not less than 1.25 is allowed to be used as an alternate to VT/SHGC. When using this option, the center-of-glass visible transmittance and the center-of-glass solar heat gain coefficient shall be determined in accordance with NFRC 300 and NFRC 301.
2. *Fenestration* not covered in the scope of the NFRC 200.
3. Enclosed spaces where the *daylight zone under skylights* is greater than 50 percent of the enclosed space floor area.
4. Enclosed spaces where the vertical fenestration (not including opaque doors) *effective aperture* is greater than or equal to 0.15.

TABLE 502.3(1)
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Vertical fenestration (~~40~~ 30% maximum of walls associated with the building envelope)								
***U*-factor**								
Nonmetal framing	0.51 (0.32)[a]	~~0.32~~ 0.40	~~0.28~~ 0.35	~~0.28~~ 0.32	~~0.28~~ 0.30	~~0.28~~ 0.30	~~0.20~~ 0.26	~~0.20~~ 0.25
Metal framing, fixed	~~0.50~~ 0.73(0.50)[a]	0.50	0.46	0.38	0.38	0.35	~~0.26~~ 0.29	~~0.26~~ 0.29
Metal framing, operable	~~0.65~~ 081 (0.65)[a]	0.65	0.60	~~0.44~~ 0.45	~~0.44~~ 0.45	0.42	~~0.34~~ 0.37	~~0.34~~ 0.37
Metal framing, commercial entrance door	~~0.83~~ 1.10 (0.83)[a]	0.83	0.77	0.77	0.77	0.77	0.77	0.77
Metal framing, residential entrance door	~~0.83~~ 1.10 (0.83)[a]	0.77	0.68	0.68	0.68	0.68	0.68	0.68
SHGC- All Frame Types								
Max. SHGC (assembly)	0.25	0.25	0.25	~~0.26~~ 0.30	~~0.26~~ 0.30	0.35	0.40	0.40
Min. VT/SHGC (assembly)								
Vertical fenestration ~~<=20% wall area~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~
~~Vertical fenestration >20% wall area~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~
Skylights (3% maximum)								
U-Factor (assembly)	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
Max. SHGC (assembly)	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
PF = Projection factor (see Section 502.3.2)
a. Values in ( )'s apply where the cooling design temperature is at least 95 F (35 C)

(Portions of the code change proposal not show remain unchanged)

Commenter's Reason: This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010.
This proposed change will provide consistency between Chapter 5 of the IECC and ASHARE 90.1-10. The proposal introduces the requirement for visable light transmittance (VT) into the code and also requires a ratio of VT/SHGC to ensure that visable light is available even when the SHGC of the fenestration is reduced. A floor modification was submitted to the IECC Code Development Committee at the Code Change Hearings in Baltimore that included the changes in this public comment but was ruled out of order and therefore not heard by the committee. This proposal requires lower U-factor fenestration in colder climates, lower SHGC values in hotter climates to reduce solar gain into the building and also a requirement to ensure that fenestration is installed that allows more visible light into the building if daylighting is proposed. This proposal also reflects the difference that an overhang will have on the North orientation verses those installed on the East, West and South side of the building in shading glazing. Two new standards are proposed for this comment – NFRC 300 and 301.

Public Comment 2:

Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

ENCLOSED SPACE. A volume surrounded by solid surfaces such as walls, floors, roofs, and openable devices such as doors and operable windows.

GENERAL LIGHTING. Lighting that provides a substantially uniform level of illumination throughout an area. General lighting shall not include decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialized application or feature within such area.

LIGHT-TO-SOLAR-GAIN RATIO . The ratio of the center-of-glass visible transmittance to center of-glass solar heat gain coefficient.

SIDELIGHTING EFFECTIVE APERTURE. Relationship of daylight transmitted through vertical fenestration to the primary sidelighted areas. The sidelighting effective aperture is calculated according to the following formula:

S*idelighting effective aperture = (∑ vertical fenestration Area x vertical fenestration VT) / primary sidelighted area*

Where vertical fenestration VT is the visible transmittance of vertical fenestration.

OPAQUE PERMANENT PROJECTION. Permanent shading devices attached to the building or consisting of portions of the building such as overhangs or eaves, including open louvers that do not allow the sun to penetrate the louvers during the peak sun angle on June 21 (December 21 southern hemisphere).

PRIMARY SIDELIGHTED AREA. The total primary sidelighted area is the combined primary sidelighted area without double counting overlapping areas. The floor area for each primary sidelighted area is directly adjacent to vertical fenestration below the ceiling with an area equal to the product of the primary sidelighted area width and the primary sidelighted area depth.

The primary sidelighted area width is the width of the vertical fenestration plus, on each side, the smallest of:
1. 2 foot (610 mm), or
2. the distance to any 5-foot (1524 mm) or higher vertical obstruction.

The Primary sidelighted area depth is the horizontal distance perpendicular to the vertical fenestration which is the smaller of:
1. one vertical fenestration head height (head height is the distance from the floor to the top of the glazing), or
2. the distance to any 5-foot (1524 mm) or higher vertical obstruction.

SIDELIGHTING EFFECTIVE APERTURE. Relationship of daylight transmitted through vertical fenestration to the primary sidelighted areas. The sidelighting effective aperture is calculated according to the following formula:

S*idelighting effective aperture = (∑ vertical fenestration Area x vertical fenestration VT) / primary sidelighted area*

Where vertical fenestration VT is the visible transmittance of vertical fenestration.

VISIBLE TRANSMITTANCE, *VT*. The ratio of visible radiation entering the space through the fenestration product to the incident visible radiation, determined as the spectral transmittance of the total fenestration system, weighted by the photopic response of the eye and integrated into a single dimensionless value.

502.3.1 Maximum area. The vertical *fenestration* area (not including opaque doors) shall not exceed the percentage of the gross *above-grade wall* area specified in Table 502.3. The *skylight* area shall not exceed the percentage of the gross roof area specified in Table 502.3.

Exception: The maximum *skylight* area shall be permitted to be 6 percent of the gross roof area provided:
1. *Skylights have a* glazing material or diffuser with a measured haze value greater than 90 percent when tested in accordance with ASTM D1003.
2. *Skylight* glazing shall have a minimum solar photometric transmittance of 0.40 when tested in accordance with ASTM E972, and
3. All general lighting in the *daylight zone under skylights* controlled by automatic daylighting controls in accordance with Section 505.2.5.
4. The total *daylight zone under skylights* is a minimum of half the *floor area* of the space.

502.3.2 Maximum *U*-factor and SHGC. For vertical fenestration and skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) and minimum visible transmittance (VT)/SHGC shall be as specified in Table 502.3(1). The window projection factor shall be determined in accordance with Equation 5-1.

$PF = A/B$ **(Equation 5-1)**

Where:

PF = Projection factor (decimal).
A = Distance measured horizontally from the furthest 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, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

The maximum SHGC for v*ertical fenestration* specified in Table 502.3(1) and shaded by *opaque permanent projections* shall be permitted to be increased using the multipliers in Table 502.3(2) based on PF as determined in accordance with Equation 5-1 and the orientation of the fenestration

Exception: *Skylights* shall be exempt from SHGC requirements and shall be permitted a maximum *U-factor* of 0.90 Btu/h x ft^2 x ºF in climate zones 1 through 3 and 0.75 Btu/h x ft^2 x ºF in climate zones 4 through 8 provided:

1. S*kylights* have a glazing material or diffuser with a measured haze value greater than 90 percent when tested in accordance with ASTM D1003.
2. *Skylight* glazing shall have a minimum solar photometric transmittance of 0.40 when tested in accordance with ASTM E972, and
3. All general lighting in the *daylight zone under skylights* controlled by automatic daylighting controls in accordance with Section 505.2.5.

502.3.3 Visible transmittance/SHGC ratio. *Fenestration* shall have a ratio of VT divided by SHGC not less than that specified in Table 502.3 for the appropriate *fenestration* area.

Exceptions: The following fenestration shall be exempted from the visible transmittance/SHGC ratio**.**

1. A *light-to-solar-gain ratio* (LSG) of not less than 1.25 is allowed to be used as an alternate to VT/SHGC. When using this option, the center-of-glass visible transmittance and the center-of-glass solar heat gain coefficient shall be determined in accordance with NFRC 300 and NFRC 301.
2. *Fenestration* not covered in the scope of the NFRC 200.
3. Enclosed spaces where the *daylight zone under skylights* is greater than 50 percent of the enclosed space floor area.
4. Enclosed spaces where the vertical fenestration (not including opaque doors) *effective aperture* is greater than or equal to 0.15.

TABLE 502.3(1)
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Vertical fenestration (4~~0~~ 30% maximum of walls associated with the building envelope)								
***U*-factor**								
Nonmetal framing	~~0.32~~ 0.51 (0.32)[a]	~~0.32~~ 0.40	~~0.28~~ 0.35	~~0.28~~ 0.32	~~0.28~~ 0.30	~~0.28~~ 0.30	~~0.20~~ 0.26	~~0.20~~ 0.25
Metal framing, fixed	~~0.50~~ 0.73 (0.50)[a]	~~0.70~~ 0.50	0.46	0.38	0.38	0.35	~~0.26~~ 0.29	~~0.26~~ 0.29
Metal framing, operable	~~0.65~~ 081 (0.65)[a]	0.65	0.60	~~0.44~~ 0.45	~~0.44~~ 0.45	~~0.42~~ 0.43	~~0.34~~ 0.37	~~0.34~~ 0.37
Metal framing, commercial entrance door	~~0.83~~ 1.10 (0.83)[a]	0.83	0.77	0.77	0.77	0.77	0.77	0.77
Metal framing, residential entrance door	~~0.83~~ 1.10 (0.83)[a]	0.77	0.68	0.68	0.68	0.68	0.68	0.68
SHGC- All Frame Types								
Max. SHGC (assembly)	0.25	0.25	0.25	~~0.26~~ 0.30	~~0.35[b]~~ 0.30[b]	0.35~~[b]~~	0.40~~[b]~~	0.40~~[b]~~
Minimum VT/SHGC (assembly)								
Vertical fenestration ~~<=20% wall area~~	~~1.5~~ 1.1	~~1.5~~ 1.1	~~1.5~~ 1.1	~~1.5~~ 1.1	~~1.5~~ 1.1	~~1.5~~ 1.1	~~1.5~~ 1.1	~~1.5~~ 1.1
~~Vertical fenestration > 20 to <=40% wall area~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~
Skylights (3% maximum)								
U-Factor (assembly)	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
Max. SHGC (assembly)	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
PF = Projection factor (see Section 502.3.2)

a. Values in ( )'s apply where the cooling design temperature is at least 95 F (35 C)
b. Vertical *fenestration* facing within 45 degrees of north shall be permitted a maximum SHGC 0.05 higher than that specified in Table 502.3.

Add new standards to Chapter 6 as follows:

National Fenestration Rating Council

300-2004 Standard Test Method for Determining the Solar Optical Properties of Glazing Materials of Glazing Materials and Systems
301-2004 Standard Test Method for Emittance of Specular Surfaces Using Spectrometric Measurements

ASTM

D1003 -07e1 Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics
E972 96(2007) Standard Test Method for Solar Performance Transmittance of Sheet Materials Using Sunlight.

(Portions of the code change proposal not show remain unchanged)

Commenter's Reason: This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010.

This proposed change will provide consistency between Chapter 5 of the IECC and ASHARE 90.1-10. The proposal introduces the requirement for visable light transmittance (VT) into the code and also requires a ratio of VT/SHGC to ensure that visable light is available even when the SHGC of the fenestration is reduced. A floor modification was submitted to the IECC Code Development Committee at the Code Change Hearings in Baltimore that included the changes in this public comment but was ruled out of order and therefore not heard by the committee. This proposal requires lower U-factor fenestration in colder climates, lower SHGC values in hotter climates to reduce solar gain into the building and also a requirement to ensure that fenestration is installed that allows more visible light into the building if daylighting is proposed. This proposal also reflects the difference that an overhang will have on the North orientation verses those installed on the East, West and South side of the building in shading glazing. Two new standards are proposed for this comment – NFRC 300 and 301.

Analysis: The standards NFRC 300 and NFRC 301, were not reviewed or considered by the Energy Code Development Committee prior to the Baltimore hearings and it was not considered by the hearing attendees at the time of the code development hearings. Section 3.6.3.1 of Council Policy # 28, *Code Development,* requires that new standards be introduced in the original code change proposal, therefore, the introduction of a new standard via a public comment is not in accordance with the process required by CP # 28 for adding new standards to the code.

The standards, ASTM D1003 and E972, were not reviewed proposed as part of the original submittal of EC 166. However ASTM D1003 -07e1 was considered under the proposal EC173 and found to be in compliance with CP28. ASTM D972-96 (2002) was considered as part of the proposal EC179 and found to be in compliance with CP28.

Public Comment 3:

Garrett Stone, Brickfield Burchette Ritts & Stone representing Cardinal Glass Industries request Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**OPAQUE PERMANENT PROJECTION.** Permanent shading devices attached to the building or consisting of portions of the building such as overhangs or eaves, including open louvers that do not allow the sun to penetrate the louvers during the peak sun angle on June 21 (December 21 southern hemisphere).~~

~~**VISIBLE TRANSMITTANCE, *VT*:** The ratio of visible radiation entering the space through the fenestration product to the incident visible radiation, determined as the spectral transmittance of the total fenestration system, weighted by the photopic response of the eye and integrated into a single dimensionless value.~~

502.3.2 Maximum *U*-factor and SHGC and Minimum VT/SHGC ratio. For vertical fenestration and skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) ~~and minimum visible transmittance (VT)~~ shall be as specified in Table 502.3~~(1)~~. For vertical fenestration, the maximum VT/SHGC ratio shall be as specified in Table 502.3. ~~The window projection factor shall be determined in accordance with Equation 5-1~~.

Exception:

Where the fenestration projection factor for a specific vertical fenestration product is measured and calculated to be greater than or equal to 0.2, the required SHGC from Table 502.3 shall be adjusted by multiplying the required maximum SHGC by the multiplier specified in Table 502.3.2 corresponding with the orientation of the fenestration product and the projection factor:

Table 502.3.2
PROJECTION FACTOR MULTIPLIERS

Projection Factor	Oriented Within 45 Degrees of True North	All Other Orientation
0.2 ≤ PF < 0.5	1.1	1.2
PF ≥ 0.5	1.2	1.6

The window projection factor shall be determined in accordance with Equation 5-1.

PF = *A/B* **(Equation 5-1)**

Where:

PF = Projection factor (decimal).
A = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or other 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~~, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors~~.

Table 502.3~~(1)~~
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Vertical fenestration (~~40~~30% maximum of walls associated with the building envelope)								
***U*-factor**								
Nonmetal framing	~~0.32~~ 0.51 (0.32)[a]	~~0.32~~ 0.40	~~0.28~~ 0.35	~~0.28~~ 0.32	~~0.28~~ 0.30	~~0.28~~ 0.30	~~0.20~~ 0.26	~~0.20~~ 0.25
Metal framing, fixed	~~0.50~~ 0.73 (0.50)[a]	0.50	0.46	0.38	0.38	0.35	~~0.26~~ 0.29	~~0.26~~ 0.29
Metal framing, operable	~~0.65~~ 0.81 (0.65)[a]	0.65	0.60	~~0.44~~ 0.45	~~0.44~~ 0.45	~~0.42~~ 0.43	~~0.34~~ 0.37	~~0.34~~ 0.37
Metal framing, commercial entrance door	~~0.83~~ 1.10 (0.83)[a]	0.83	0.77	0.77	0.77	0.77	0.77	0.77
Metal framing, residential entrance door	~~0.83~~ 1.10 (0.83)[a]	0.77	0.68	0.68	0.68	0.68	0.68	0.68
SHGC- All Frame Types								
Max. SHGC (assembly)	0.25	0.25	0.25	~~0.26~~ 0.30	~~0.26~~ 0.30	0.35	0.40	0.40
Min. VT/SHGC (assembly)								
Vertical fenestration ~~<=20% wall area~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~	1.1 ~~1.5~~
~~Vertical fenestration > 20 to <=40% wall area~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~	~~1.2~~
Skylights (3% maximum)								
U-Factor (assembly)	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
Max. SHGC (assembly)	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
~~PF = Projection factor (see Section 502.3.2)~~
a. Values in ( )'s apply where the cooling design temperature is at least 95 F (35 C).

502.3.2Maximum*U*-factor and SHGC. For vertical fenestration, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3, based on the window projection factor. For skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3.

The window projection factor shall be determined in accordance with Equation 5-1.

PF = *A/B* **(Equation 5-1)**

where:

PF = Projection factor (decimal).

A = Distance measured horizontally from the furthest 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, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

~~The maximum SHGC for *vertical fenestration* specified in Table 502.3 and shaded by *opaque permanent projections* shall be permitted to be increased using the multipliers in Table 502.3(2) based on PF as determined in accordance with Equation 5-1 and the orientation of the fenestration.~~

~~All *vertical fenestration* within 45 degrees of a south orientation shall be provided with *opaque permanent projections* having a PF of a least 0.5 as determined in accordance with Equation 5-1. All *vertical fenestration* within 45 degrees of an east or west orientation shall be provided with *opaque permanent projections* having a PF of a least 0.5 as determined in accordance with Equation 5-1.~~

~~Table 502.3(2)~~
~~Vertical Fenestration SHGC Adjustment Factors~~

~~PF~~	~~SHGC Multiplier (over 45 degrees from true north)~~	~~SHGC Multiplier (within 45 degrees of true north)~~
~~0 – 0.10~~	~~1.00~~	~~1.00~~
~~>0.10 – 0.20~~	~~1.10~~	~~1.05~~
~~>0.10 – 0.20~~	~~1.22~~	~~1.10~~
~~>0.20 – 0.30~~	~~1.35~~	~~1.15~~
~~>0.30 – 0.40~~	~~1.49~~	~~1.19~~
~~>0.40 – 0.50~~	~~1.64~~	~~1.23~~
~~>0.60 – 0.70~~	~~1.79~~	~~1.28~~
~~>0.70 – 0.80~~	~~1.96~~	~~1.32~~
~~>0.80 – 0.90~~	~~2.13~~	~~1.33~~
~~>0.90 – 1.00~~	~~2.27~~	~~1.37~~

(Portions of the code change proposal not show remain unchanged)

Commenter's Reason: If EC166 is approved, it should be approved as modified by this public comment. We understand that U.S. DOE intends to propose a modification to EC166 to reflect updated ASHRAE 90.1 values to reflect Addendum bb approved by the ASHRAE committee in late June 2010. The above modification is intended to incorporate the same ASHRAE values per the DOE approach, as well as to incorporate the effects of two other code proposals approved by the IECC Committee and make this proposal consistent with those proposals (EC3 and EC174).

Specifically:

EC3 defines VT and incorporates the NFRC rating system for VT into the IECC and establishes default values; this makes the definition proposed in the original EC166 inconsistent and unnecessary.

EC174 refines the approach to projection factor in the IECC for commercial buildings and makes it consistent with ASHRAE 90.1, although more simplified and easier to apply; this makes the attempt to incorporate the ASHRAE methodology in EC166 inconsistent and unnecessary.

See EC3 and EC174 for a more detailed explanation of those proposals.

While Cardinal would prefer that EC166 remove the bias in favor of metal products as proposed in our modifications to EC164 or EC165, we do recognize that if the bias is maintained and either EC164 or EC165 with our modifications is not adopted, then EC166 offers both the greatest improvement in energy efficiency remaining and the opportunity to harmonize with the ASHRAE standard. We also think it is important that if EC166 is adopted, that it properly work with our proposals EC3 and EC174. As a result, we have proposed the modifications included in this public comment as a fallback to our other commercial fenestration public comments.

Final Action: AS AM AMPC____ D

EC168-09/10
Table 502.3

Proposed Change as Submitted

Proponent: Garrett Stone, Brickfield, Burchette, Ritts & Stone, representing Cardinal Glass Industries

Revise as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Climate Zone	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
~~***U*-factor**~~								
~~**Framing materials other than metal with or without metal reinforcement or cladding**~~								
~~*U*-factor~~	~~1.20~~	~~0.75~~	~~0.65~~	~~0.40~~	~~0.35~~	~~0.35~~	~~0.35~~	~~0.35~~
~~**Metal framing with or without thermal break**~~								
Curtain wall/storefront *U*-factor	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	~~0.75~~ 0.65	~~0.65~~ 0.50	~~0.55~~ 0.45	~~0.55~~ 0.45	~~0.55~~ 0.45	0.45	0.45
SHGC – all glazed vertical fenestration ~~frame types~~								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
PF = Projection factor (see Section 502.3.2).
a. All other~~s~~ U-factor includes all other vertical fenestration such as ~~including~~ operable windows, fixed windows and nonentrance doors.

Reason: This proposal eliminates separate categories of window U-factor requirements based on framing materials and combines all windows (other than curtainwall, storefront and entrance doors) under one category with one uniform set of requirements. It is unreasonable and anticompetitive that a building's energy efficiency depends on the material selected for window frames. The proposal removes the incentive to install less-efficient windows and establishes a set of U-factor requirements that, on balance, will increase energy efficiency.

Given complaints at previous code hearings that metal framed products cannot reach the values applicable to non-metal windows, this proposal uses 0.45 as the lowest U-factor for "All other U-factor," which is proposed to include all metal and nonmetal framed fenestration other than curtain wall/storefront and entrance doors. 0.45 is a reasonable U-factor for this category, because fenestration with metal frames are currently required to meet 0.45 in zones 7-8. Extending this 0.45 U-factor to more zones would be a reasonable improvement in the code in this time where energy efficiency improvements are crucial to our nation. Moreover, according to the *2005 ASHRAE Handbook of Fundamentals*, a typical operable low-e with argon, double-pane aluminum thermal break window would have a U-factor of 0.44, while the comparable fixed window would meet a 0.37. (*See* Table 4, at page 31.8.) In fact, this data suggests that an even lower U-factor than 0.45 could be set (perhaps 0.40), but in order to be conservative, this proposal uses 0.45.

Because a uniform U-factor of 0.45 is somewhat weaker than the current requirement for nonmetal framed fenestration in climate zones 4-8, this proposal extends the 0.45 down through zone 4 and then uses the more stringent U-factors from the residential side for zones 1-3 in order to obtain energy savings to offset the theoretical potential for increased energy use in the northern zones (note that in the 2006 IECC the residential values and commercial values for non-metal frames were the same, but in the 2009 IECC the residential values are more stringent in southern climates).

While some might claim this approach weakens the requirements for non-metal-framed windows, as a practical matter this is not the case. For any non-metal framed window to meet the 0.45 U-factor, as a practical matter that window will have a reasonable IG unit with low-e and likely argon. As a result, in almost all cases, it will still have a U-factor equal to or less the current 0.35 requirement. Moreover, since metal-framed windows are predominant in commercial construction, the improved requirements for these windows will save far more energy, offsetting any losses on the non-metal side.

It should be noted that in the current draft proposal under review, ASHRAE 90.1 is proposing 0.26 for metal frames for fixed windows and 0.34 for metal frames in operable windows in the coldest zones (7-8), increasing to 0.36/0.42 for zone 6 and 0.38/0.44 for zones 4-5. *See First Public Review Draft of Proposed Addendum bb to ASHRAE Standard 90.1-2007*, Tables 5.5-1 – 5.5-8. The proposal above takes a more moderate approach, implementing uniformity and more flexibility in these climate zones.

Opponents of a uniform U-factor requirement often claim that metal-framed windows are desirable because of "structural benefits," and that a reduction in energy efficiency is an appropriate trade-off. We believe that a direct trade-off between structural requirements and energy efficiency is a bad precedent for the International Codes, because structural requirements and efficiency requirements should be set at optimum levels, individually. Just as it makes no sense to reduce the structural requirements of a building because it is more energy efficient, it makes no sense to reduce efficiency requirements because of perceived "structural benefits" afforded by different window frame types. However, this proposal accomplishes both objectives by requiring more efficient windows, but still permitting metal-framed windows to participate without resort to the performance path.

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

ICCFILENAME: Stone-EC-1-T. 592.3

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee was unconvinced that the weighted average included in the table would achieve the same level of energy savings across the various materials contained in the table.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jeff Inks, representing Window & Door Manufacturers Association requests Approval as Submitted.

Commenter's Reason: We concur with the proponents reasons and believe this proposal provides an effective alternative for addressing the problem with the current prescriptive requirements in Table 502.3 which give unjustified preferential treatment to particular types of products that discourages the construction of more energy efficient buildings by allowing less stringent energy performance requirements depending upon the frame material used. Non-metal frame windows are generally more energy efficient than aluminum and metal windows, yet their use is restricted by the imposition of the prescriptive values that discriminate against wood, vinyl, and composite windows. This proposal removes that preferential treatment (one that conflicts with the foundational principles of the IECC) and uses the current prescriptive values for non-metal frames as the baseline. The use of less efficient windows should not occur without a consideration of other efficiency measures such as increased insulation to offset the reduced energy performance.

The argument continues to be made that such differences are required because of the added structural strength that can be provided by metal framed vertical fenestration products over that provided by non-metal framed fenestration products. That argument is very misleading, implying that there are no applications where all load requirements applicable to the vertical fenestration can be met regardless of framing type. That of course simply isn't true, especially in "punched opening" applications and low rise commercial and residential construction. If all required structural design loads for the vertical fenestration, and the building as whole, can be met using either metal or non-metal vertical fenestration, then the energy performance requirements for them should be the same.

Furthermore, because no credit is given in the IECC for using better performing fenestration products that may be more costly, there is less incentive to use them. Again, not only does that give preferential treatment to particular types or classes of materials, products and methods of construction that are not justified, it discourages the construction of more energy efficient buildings. This shortcoming in the IECC is getting worse not better and needs to be addressed if the IECC is to meet the efficiency improvement objectives that have been set for it.

Public Comment 2:

Garrett Stone, Brickfield Burchette Ritts & Stone, representing Cardinal Glass Industries, requests Approval as Modified by this Public Comment.

Modify the proposal as follows

Table 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Climate Zone	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
Curtain wall/storefront *U*-factor	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other Operable *U*-factor[a]	0.65~~1.20~~	0.65	0.60~~0.50~~	0.45	0.45	0.43~~0.45~~	0.37~~0.45~~	0.37~~0.45~~
All other Fixed *U*-factor[a]	0.50	0.50	0.46	0.38	0.38	0.35	0.29	0.29
SHGC – all glazed vertical fenestration								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
PF = Projection factor (see Section 502.3.2).
a. All other Operable U-factor includes all other operable vertical fenestration such as operable windows~~, fixed windows~~ and nonentrance doors. All other Fixed U-factor includes all other fixed vertical fenestration such as fixed windows.

Commenter's Reason: The proposed modifications in this public comment use the same values for fixed and operable metal windows as the ASHRAE 90.1-2010 Addendum bb approved by the ASHRAE 90.1 Committee in June 2010. By including both the fixed and operable metal values that were determined by ASHRAE to be achievable and cost-effective for metal windows, there can be no valid claim that metal windows cannot meet these values. The values represent a small increase in stringency for operable metal windows and a substantial increase in stringency for fixed metal windows. By substantially increasing the stringency of these products that make up the vast majority of the fenestration in commercial buildings, this modification addresses the Committee's concern that EC168 as submitted might not achieve the same or greater stringency on a weighted average basis than the original standard, which differentiated between metal and non-metal windows.

The approach embodied in EC168 as submitted and as modified would resolve the current issues of product discrimination among window types currently in the IECC. While Cardinal prefers its approach contained in its public comment modifications to EC164 and/or EC165, which can be expected to yield far more energy savings, we submit that the approach of EC168 would at least create a fair competitive playing field and some additional energy savings.

Final Action: AS AM AMPC____ D

EC169-09/10
Table 502.3

Proposed Change as Submitted

Proponent: Garrett Stone, Brickfield, Burchette, Ritts & Stone, representing Cardinal Glass Industries

Revise as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Climate Zone	**1**	**2**	**3**	**4 Except Marine**	**5 and Marine 4**	**6**	**7**	**8**
Vertical fenestration (40% maximum of above-grade wall)								
***U*-factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain wall/storefront *U*-factor	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
SHGC – all frame types								
SHGC: PF < 0.25	0.25	0.25	0.25	~~0.40~~ 0.25	~~0.40~~ 0.25	~~0.40~~ 0.25	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	~~NR~~ 0.33	~~NR~~ 0.33	~~NR~~ 0.33	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	~~NR~~ 0.40	~~NR~~ 0.40	~~NR~~ 0.40	NR	NR
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
PF = Projection factor (see Section 502.3.2).
a. All others includes operable windows, fixed windows and nonentrance doors.

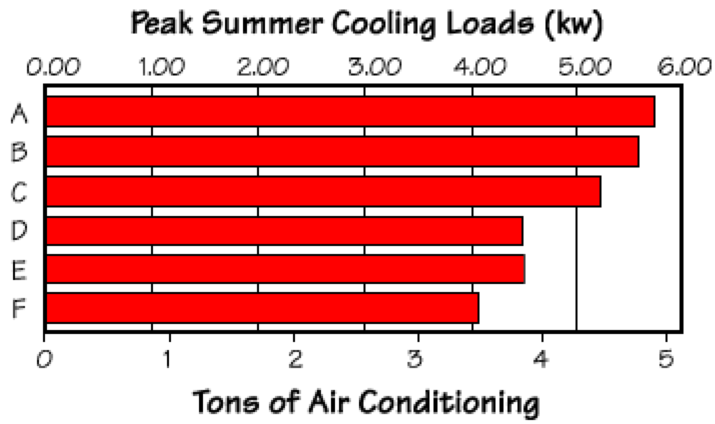
Reason: This proposal will save energy, reduce energy costs and reduce peak electricity demand with virtually no negative construction cost impact by establishing SHGC requirements for climate zones 4-6 consistent with the existing requirements for climate zones 1-3. This proposal will reduce the solar heat gain for buildings permitted in these climate zones by at least 37.5%.

The SHGC requirements for high-rise residential and commercial fenestration in the 2009 IECC and ASHRAE 90.1-2007 already recognize that SHGC should be controlled in all climate zones. (There is a maximum SHGC currently extending through climate zone 8 in both codes.) Likewise, the *Core Performance Guide* published by the New Buildings Institute sets a maximum SHGC for commercial buildings in all climate zones similar to the values proposed above, even when paired with effective shading. *See* Table 2.6.1. The current proposed revisions for ASHRAE 90.1 propose similar improvements, setting the SHGC at 0.26 in zones 4-5 and 0.35 in zone 6. *See First Public Review Draft of Proposed Addendum bb to ASHRAE Standard 90.1-2007*, Tables 5.5-1 – 5.5-8. Now is the time to improve the values in the *IECC*.

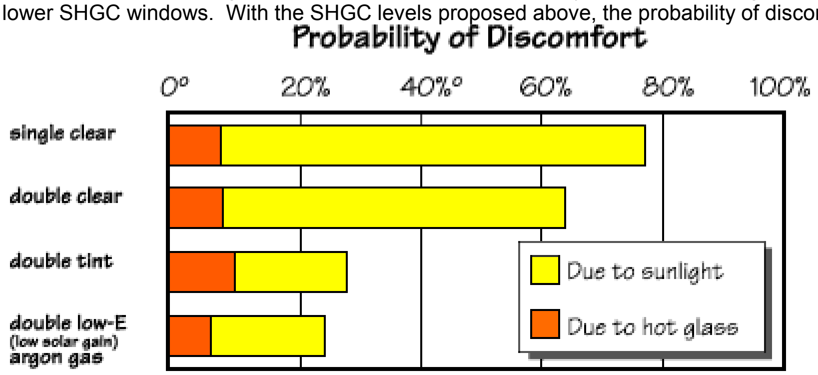
The types of buildings regulated under chapter 5 are typically internal-heat load dominated, and usually reach their maximum energy intensity during summer peak electricity times of the day and year. Despite a more northerly location, the electric utility systems of states throughout these climates zones peak in the summer, just like most of their southern counterparts, primarily due to air conditioning loads for commercial and residential buildings. As a result, demand is the highest at these times, requiring electric utilities to use expensive peaking plants or older, highly inefficient plants, to meet the demand. The result is exponentially higher cost and more pollution. Many states are currently embroiled in debates over how to meet (and pay for) rising electric peak demand and where to site new power plants.

Low SHGC fenestration is the obvious answer to this growing problem. The following chart, developed by the U.S. Department of Energy's Lawrence Berkley National Laboratory (LBNL), which is found on the Efficient Window Collaborative (EWC) website (www.efficientwindows.org), shows the potential for saving peak demand (and tons of HVAC) for different window types. While this is a residential home illustration, the point is equally valid for commercial buildings, which use basically the same glass.

Window E is a higher solar gain low-e double-pane window that meets the current U-factor requirement in climate zone 4. Window F is the low SHGC, low U-factor window that would meet the current U-factor requirement plus the SHGC maximum of this proposal. The reduction in peak cooling load is nearly half of a kW, reducing by almost a half ton the size of the air conditioning unit. As is readily apparent, improved windows will lead to smaller HVAC sizes (with lower costs to the building owner) and lower peak cooling loads (saving the state from building additional peak capacity).



Similarly, the following chart from the same source shows the probability of discomfort during summer from sunlight and hot glass. Again, this is an issue that is even more important for commercial than residential construction, since commercial buildings are more likely to be occupied during the daytime when the potential for discomfort is greatest. The summertime probability of discomfort ranges from over 60% with double pane clear glass to almost 20% with lower SHGC windows. With the SHGC levels proposed above, the probability of discomfort is even lower.



Windows with low SHGC will reduce the volatility of temperatures in the building. This will reduce occupant discomfort and make it less likely that occupants will need to adjust the thermostats down resulting in much greater energy cost.

In sum, lower SHGCs directly result in smaller electric loads, reduced HVAC sizing, greater comfort, less pollution and reduced energy use and cost in commercial buildings. Moreover, construction cost is not an issue since:

(1) the upgrade to lower SHGC comes for little or no cost since low-e fenestration is already specified by both the U-factor and SHGC requirements for these climate zones, making the SHGC merely a function of the particular version of low-e coating chosen; and

(2) far more dollars can be saved in downsizing HVAC systems.

Moreover, this result can be achieved with little impact on visible light transmission. We estimate that a 37.5% reduction in the requirement from 0.40 SHGC to 0.25 SHGC need only cost about 7-10% of the visible light (the center of glass VT of a product that would meet the 0.40 is around 70 – 72%% while there are glazing products that will meet 0.25 with center-of-glass VTs around 65%).

Studies have shown that reasonable improvements in building energy codes are some of the least expensive means of curbing electrical peak demand. The consulting firm McKinsey & Co. found in its recent report, *Reducing U.S. Greenhouse Emissions: How Much at What Cost*?, that improvements to residential and commercial buildings, including the thermal envelope, are among the most cost-effective means of reducing electric demand (and greenhouse gas emissions). *See* Pages 20, 61-62. The report also found that buildings are not currently built to optimum economic and efficiency levels. *See* Page 39.

Since lowering the SHGC to 0.25 from 0.40 (the current requirement for zones 4-6) comes at no cost and yields energy-saving and peak-reducing benefits, there is no reason not to capture the benefits of lower SHGC for these climates.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: Stone-EC-4-T. 502.3

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee felt that the reduction is SGC factors were not acceptable. ASHRAE studies and information do not support the values in the proposal.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Garrett Stone, Brickfield Burchette Ritts & Stone, representing Cardinal Glass Industries requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Table 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Climate Zone	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
***U*-factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain wall/storefront *U*-factor	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
SHGC – all frame types								
SHGC: ~~PF < 0.25~~	0.25	0.25	0.25	0.30~~0.25~~	0.30~~0.25~~	0.35~~0.25~~	0.40~~0.45~~	0.40~~0.45~~
~~SHGC: 0.25 ≤ PF < 0.5~~	~~0.33~~	~~0.33~~	~~0.33~~	~~0.33~~	~~0.33~~	~~0.33~~	~~NR~~	~~NR~~
~~SHGC: PF ≥ 0.5~~	~~0.40~~	~~0.40~~	~~0.40~~	~~0.40~~	~~0.40~~	~~0.40~~	~~NR~~	~~NR~~
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
PF = Projection factor (see Section 502.3.2).
a. All others includes operable windows, fixed windows and nonentrance doors.

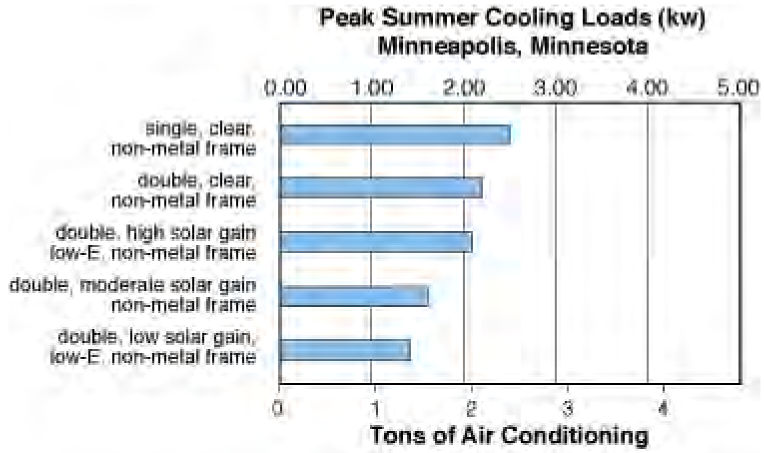
Commenter's Reason: EC169 should be approved as modified by this public comment or as submitted.
Cardinal Glass submits the proposed modifications in this public comment to address the only concern raised by the IECC Code Development Committee regarding this proposal at the October hearings. The Committee did not believe that the ASHRAE studies and information available at the time supported the values in EC169. We disagree and continue to believe that the uniform SHGC standard for commercial fenestration in climate zones 1-6 proposed in the original EC169 is the best course and would save energy, construction costs, and operation costs. However, in response to the Committee's reason, it should be noted that the values in this proposed modification are directly supported by ASHRAE since they are the values required by ASHRAE 90.1-2010 Addendum bb as approved by the ASHRAE 90.1 Committee in late June 2010 and would also bring substantial, energy savings, although less than EC169 as submitted.

The modification in this public comment also proposes to delete the SHGC values for higher projection factors from the table consistent with the approach approved by the IECC Committee in approving EC174.

For many years, the IECC and ASHRAE 90.1 have included limitations on fenestration SHGC for commercial and high-rise residential buildings in all climate zones. The trend in these maximum SHGCs has also been to reduce them (similar to residential windows in the southern zones). These limits in the commercial energy codes already recognize that solar heat gain should be controlled and reduced for most commercial buildings. Commercial buildings in particular, due to occupancy and usage schedules, lighting and typical internal-heat driven energy usage, require as much solar heat control as possible. Utilities across the country, including the northernmost states, are summer-peaking because of the growth of air conditioning loads. Any reduction in peak electricity will not only save building owners and operators money during times when power is most expensive; it will also curb the need for utilities to construct peak generation capacity and will reduce peak energy prices to other consumers.

To confirm that the use of lower SHGCs in more northern climates zones with substantial heating loads produce substantial energy efficiency benefits, we modeled a medium sized office building (specifically, the commercial reference building developed by US DOE) in Baltimore (CZ4) and Minneapolis (CZ6) using the U.S. DOE's building energy performance simulation program (EnergyPlus), holding the U-factor of the windows constant and comparing 0.25 SHGC with 0.40 SHGC. In both climate zones, there were energy and electrical peak load savings from the lower SHGC. In Baltimore, the energy savings were pronounced, almost 5%, although the savings were much smaller in Minneapolis. As for peak demand, Minneapolis saw the largest percentage savings, almost 6% of the peak load and almost 5 kW of peak reduction.

The following chart based on data provided by Lawrence Berkeley National Laboratory (LBNL), which can be found on the Efficient Window Collaborative (EWC) website – http://www.efficientwindows.org/hvac.cfm -- illustrates the peak demand and HVAC sizing benefits from low SHGC windows by showing the potential peak demand impact from different window types in a residential home in a northern climate. As is readily apparent, requiring a lower SHGC would have a positive impact on electrical peak demand and equipment sizing (note that the last window, a low solar gain low-E window, would have an SHGC below 0.25). If low SHGC windows provide this much benefit in a single residential home in climate zone 6, the benefit of lower SHGCs (like a 0.25) for internal-heat-load dominated commercial buildings in zones 4-6 will obviously be a lot greater.



The impact of EC169 as modified on IECC Table 502.3 will be efficiency and peak demand improvement in climate zones 4-8. EC169 as submitted would establish a single, more stringent SHGC requirement for climate zones 1-6, creating efficiencies of scale and allowing window manufacturers to achieve uniform efficiency targets; however, the revised values in this public comment will still provide a substantial amount of savings.

Final Action: AS AM AMPC____ D

EC170-09/10
Table 502.3, 502.3.2

Proposed Change as Submitted

Proponent: Garrett Stone, Brickfield, Burchette, Ritts & Stone, representing Cardinal Glass Industries

Revise as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Climate Zone	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
***U*-factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain wall/storefront *U*-factor	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
SHGC – all frame types								
SHGC~~: PF < 0.25~~	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
~~SHGC: 0.25 ≤ PF < 0.5~~	~~0.33~~	~~0.33~~	~~0.33~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~
~~SHGC: PF ≥ 0.5~~	~~0.40~~	~~0.40~~	~~0.40~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement
~~PF = Projection factor (see Section 502.3.2).~~
a. All others includes operable windows, fixed windows and nonentrance doors.

502.3.2 Maximum *U*-Factor and SHGC. For vertical fenestration and skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3~~, based on the window projection factor~~. ~~For skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3.~~

~~The window projection factor shall be determined in accordance with Equation 5-1.~~

~~PF = A/B~~ ~~**(Equation 5-1)**~~

~~Where:~~

~~PF = Projection factor (decimal).~~
~~A = Distance measured horizontally from the furthest 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 be evaluated separately, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.~~

Reason: This proposal saves energy and simplifies the commercial building prescriptive path by removing inaccurate projection factor trade-offs for SHGC. Users may continue to use projection factors in the more detailed Total Building Performance compliance option in Section 506, where orientation and the specific impact of each overhang are more precisely measured and calculated.

There are more detailed and accurate methods to calculate the benefits of projection factors, such as an alternative proposal submitted in this cycle which applies a simplified version of the calculation used in ASHRAE 90.1-2007. However, by eliminating complicated calculations for overhangs, the proposal above simplifies compliance and enforcement efforts, consistent with the purpose of the simplified prescriptive path in section 502 of the IECC. In addition, the proposal ensures reduced energy cost, energy usage, peak demand, and smaller HVAC sizing.

Simpler Calculations. The current fenestration table in the IECC allows a weaker fenestration SHGC when projection factors are incorporated into the building's design. This extra set of calculations is difficult for code officials and designers alike, because (when it is done correctly) an accurate projection factor must be calculated for each window, and then worked into an area-weighted average. Similarly, the code official must inspect and measure each overhang to determine if the exception is properly applied. The proposed change is easier for a building official to enforce, and it allows more design freedom and greater certainty for the designer because it reduces the number of calculations and gives certain values for window performance. The proposal does not prevent the addition of overhangs, it simply gives no energy efficiency credit for such a design feature in the prescriptive path. This approach recognizes that given the cost differential between the cost of an overhang and improved SHGC, that no designer would add overhangs for cost reasons to meet the code.

More Uniformity. The SHGC projection factor trade-off is irregularly applied in the table, and the values do not conform with accepted methods of calculation. The trade-off ratios change depending on climate zone for no particular reason. For example, it makes no sense in climate zones 4-6 that there is no SHGC requirement once the projection factor reaches 0.25. The effects of projection factor values recorded in Table 502.3 cannot be duplicated using the more accurate method employed in ASHRAE 90.1-2007. The prescriptive path should contain only requirements that can be consistently applied and enforced, and the end result should vary as little as possible from building to building.

More Guaranteed Efficiency. Good solar control in windows can substantially increase comfort for the occupant and reduce electrical peak demands and HVAC sizing. However, solar control can be more or less effective, depending on the orientation of the building, climate zone, reflection, and percentage of the window exposed to the sun. Because these variables are not properly incorporated into the IECC's calculation of projection factor, the projection factor trade-off is highly inaccurate. To make matters worse, the projection factor is traded off against windows with low SHGC (as tested and certified according to objective criteria), which consistently block unwanted heat gain regardless of the building's orientation. The current method for determining projection factor in the IECC is far too inaccurate to trade away the guaranteed efficiency of an SHGC rating. To save energy and remove unnecessary complexity, this trade-off should be removed from the prescriptive path.

Cost Impact: This proposal should not add to the cost of construction.

ICCFILENAME: Stone-EC-6-T. 502.3-502.3.2

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee preferred change approved by the committee in EC174-09/10.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Garrett Stone, Brickfield Burchette Ritts & Stone, representing Cardinal Glass Industries requests Approval as Submitted.

Commenter's Reason: Cardinal Glass submitted two different code proposal options to address the issue of the use of the projection factor in the prescriptive path of the IECC for commercial buildings. These two proposals, EC170 and EC174, were considered by the IECC Committee and the Committee voted in favor of approval of EC174, noting that it preferred the approach of EC174 over EC170.

Although Cardinal Glass agrees with the decision of the IECC Code Development Committee to approve its code proposal EC174, Cardinal also supports EC170 as submitted in case EC174 is not ultimately approved.

Table 502.3 of the 2009 IECC currently assigns three specific SHGC requirements to fenestration based on projection factor, but it does not take orientation into account and uses inaccurate values. EC170 simplifies Table 502.3 by removing projection factor from the prescriptive path and moving all projection factor calculations into the performance path where SHGC and projection factor can be accurately calculated in conjunction with other factors such as orientation and thermal mass that affect the overall efficiency of the building. By contrast, EC174 retains simplified projection factor calculations in the prescriptive chapter, but adds a more precise calculation based on ASHRAE 90.1 that hinges on the appropriate orientation of fenestration, as well as other improvements.

Final Action: AS AM AMPC____ D

EC172-09/10
502.3.1 (New), Chapter 6

Proposed Change as Submitted

Proponent: Julie Ruth, PE, JRuth Code Consulting; Margaret Webb, IGMA; Rand Baldwin, AEC; David Walker, NGA; Donn Harter, AGA; Kim Mann; Bill Koffel, representing American Architectural Manufacturers Association, Insulating Glass Manufacturers Alliance, Aluminum Extruders Council, National Glass Association, Americas Glass Association, Glass Association of North America, Glazing Industry Code Committee

1. Add new text as follows:

502.3.1 Storefront and curtainwall in commercial buildings. U-factors and SHGC for storefront and curtainwall in commercial buildings are permitted to be determined in accordance with AAMA 507. When AAMA 507 is used, the product performance shall be documented by a certificate of compliance, as described in AAMA 507, that is signed and submitted to the code official by a registered design professional. The product line testing and simulation, as described in AAMA 507, shall be conducted in accordance with NFRC 100 and NFRC 200 by an approved, accredited, independent laboratory.

2. Add standards to Chapter 6 as follows:

AAMA

507-07	Standard Practice for Determining the Thermal Performance Characteristics of Fenestration Systems Installed Commercial Buildings

Reason: For the last few cycles AAMA has sought approval of code change proposals that would clarify that use of AAMA 507 meets the requirements of the *International Energy Conservation Code* and therefore may be used to determine U-factor and SHGC for fenestration in commercial buildings. This code change proposal again seeks to place that clarification within the IECC by responding to the three principal concerns raised during the previous cycles in the following manner:

1. Concern that if approved, residential window manufacturers might try to use the new code text to avoid having to label their products in compliance with NFRC 100 or NFRC 200.

This proposal limits the use of AAMA 507 to curtainwall and storefront in commercial buildings in two distinct ways -- with the express language used - and with the placement of the provisions in Chapter 5 of the IECC. Placing the new text in Chapter 5 strengthens the intent of limiting the use of AAMA 507 to commercial buildings.

2. Concern that the results of AAMA 507 may not be consistent with those of NFRC 100 and NFRC 200.

Although there are provisions within AAMA 507 that permit use of other methods for product line testing and simulation when determining fenestration U-factor and SHGC, the proposal specifically limits performing product line testing and simulation: they must be done in accordance with NFRC procedures. This would include the mandatory use of NFRC stipulated sizes.

When this approach is taken, previous analysis has found and verified that the variation between AAMA 507 and NFRC 100 for U-factor and NFRC 200 for SHGC is never greater than 0.06%. A variation that is only 6/100 of 1% is not statistically significant.

3. Concern that relying upon the Certificate of Compliance, provided in accordance with AAMA 507 and this code change proposal, would result in less oversight of the final product than the current requirements of the IECC provide.

The key oversight tool within AAMA 507 is the Certificate of Compliance. It is developed using NFRC procedures, using accredited, independent laboratories and simulators, as required by NFRC. As a result, the values that are listed on the certificate are developed with the same level of oversight as any other values that would come from an NFRC accredited laboratory. Previous editions of AAMA 507 did not mandate the use of the Certificate of Compliance, but AAMA 507 was revised to mandate the use of the Certificate of Compliance, primarily to respond to concerns raised by this issue during earlier code change cycles.

Beyond that, AAMA 507 and this proposal rely upon the contractual relationship existing on all commercial jobs between the registered design professional, the general contractor and the glazing contractor to provide assurance that the actual product installed in the field is the same as that specified in the approved construction documents. This is the same relationship that is relied upon for many other aspects of commercial construction, including the structural framework of the building itself if it is constructed of structural steel.

Furthermore, this combination of the Certificate of Compliance and the contract documents, memorializing the agreement between the contractors and designers, actually provides a stronger level of oversight than what is currently required by the IECC for the determination of U-factor and SHGC. Section 303.1.3 of the 2009 *International Energy Conservation Code* requires *U*-factors of fenestration products (windows, doors and skylights) to be “determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer”. Similarly, the same section requires the SHGC of fenestration products to be “determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer”. Although the use of the word “labeled” in the International Codes often implies a requirement for third party certification, the ICC has issued a Formal Interpretation (ICC Committee Interpretation 18-08) stating that the text (of then Section 102.1.3 of the 2006 IECC - now of Section 303.1.3 of the 2009 IECC) does not require third party labeling of the product. The key here is the phrase “labeled and certified by the manufacturer”. The Formal Interpretation then goes on to say that the process to be used to determine U-factor and SHGC in compliance with the IECC is that manufacturers “have their products rated by an accredited and independent testing laboratory. The manufacturer then labels their products demonstrating their commitment to provide accurate energy and energy-related performance information. The code does not require that the labeling be done by an approved third party agency.”

This code change proposal requires, as Sec. 303.1.3 of IECC 2009 does, that the U-factor and SHGC of the product be determined by accredited and independent laboratories. Beyond the requirements of Section 303.1.3, the proposal requires that the Certificate of Compliance, signed by the registered design professional, and developed in accordance with AAMA 507, be provided to verify the performance of the actual installation. This proposed protocol actually provides a significantly greater level of oversight than what the IECC currently requires.

Therefore, permitting use of AAMA 507 to determine the U-factors and SHGC of curtainwall and storefront does not weaken the IECC. If the glazing contractor decides in favor of using this approach, they are actually engaging in a more stringent program than that currently required by the IECC.

Cost Impact: The code change proposal will not increase the cost of construction.

Analysis: A review of the standard(s) proposed for inclusion in the code, AAMA 507-07, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: Ruth-EC-5-502.3.1-Ch 6

Public Hearing Results

Errata: Add Craig Conner as a co-proponent for EC172. Mr. Conner's reason statement for EC171 applies. See note on EC171.

Note: The following analysis was not in the Code Change monograph but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf :

Analysis: Review of the proposed new standard indicated that, in the opinion of ICC staff, the standard did comply with ICC standards criteria.

Committee Action: **Disapproved**

Committee Reason: The provisions of Section 303.1.3 on the labeling of fenestration products do not allow the procedure included in this proposal. The proposal may be headed in a good direction to increase the number of fenestration rating agencies and this would appear to be setting up an alternative process, however the proposal still needs improvements. Of concern is determining the appropriate person or professional who would be able to sign the proposed certificates.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association and Craig Conner, Building Quality request Approval as Submitted.

Commenter's Reason: (Julie Ruth) This Public Comment seeks approval of EC172, as submitted. EC172 strengthens the requirements of the IECC with regards to the determination of U-factor and SHGC for curtainwall and storefront in commercial buildings.

Although the IECC requires the U-factor and SHGC of fenestration products to be determined in accordance with NFRC procedures, the method by which this information is to be verified and provided to the code official is not clearly defined. Section 303.1.3 requires that "*U*-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer" and that "the solar heat gain coefficient (SHGC) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer." Formal interpretation of Section 303.1.3 issued by the ICC states that third party labeling of the products by NFRC is not required. This has been based upon the stated intent for adding these provisions to the IECC originally. It is further indicated by the use of the phrase "labeled by the manufacturer".

EC172 would add specific requirements for the method to be used to provide the code official with the U-factor and SHGC, through a Certificate of Compliance that has been provided in accordance with AAMA 507, and signed by a registered design professional. Use of the AAMA 507 protocol results in U-factor or SHGC determination within a matter of minutes, rather than the 100 days or more required for NFRC certification of a project. This quick, and yet extremely accurate, turnaround is possible because the framing manufacturer who provides the AAMA 507 Certificate of Compliance form to the designer or glazing contractor has already had the analysis done that is necessary to determine the U-factor or SHGC of a glazed system. AAMA 507, and EC172, requires that analysis to be done using NFRC procedures. The results of the analysis is provided on the manufacturer's Certificate of Compliance form as a table or matrix that indicates the resultant U-factor or SHGC for the system, dependent upon the Center of glass values for the glazing that is to be placed in the frame. The designer or glazing contractor simply determines the center of glass U-value or SHGC for the glazing material proposed for use, which can be obtained from the NFRC Glass Library, locates that value in the matrix on the framing manufacturer's Certificate of Compliance form, and then reads the resultant U-value or SHGC from the matrix.

EC172 also responds to concerns raised with previous proposals to add reference to AAMA 507 to the IECC for the determination of U-factor and SHGC of fenestration in commercial buildings. Specifically, the application of AAMA 507 is limited to curtainwall and storefront in commercial buildings in EC172, AAMA 507 has been revised to require the use of the Certificate of Compliance, and EC172 would require the Certificate of Compliance to be signed by a registered design professional. Previous proposals would have permitted the use of AAMA 507 for windows in commercial buildings, and would have permitted the glazing contractor as well as a registered design professional to sign the Certificate of Compliance.

As adoption and enforcement of energy codes continues to increase, the need for a specific method of providing the needed information on the thermal performance of glazed systems in commercial buildings becomes even more pronounced. We urge the membership to approve EC172 as submitted.

(Craig Conner) AAMA 507 is an alternative window-rating procedure for storefront and curtain wall. This alternative is needed to produce site-built ratings in time to respond to the normal commercial bid process for site-built windows. Having AAMA 507 as an alternative encourages energy-efficient commercial windows and makes compliance with the window-rating requirement more practical.

The American Recovery and Reinvestment Act requires the governors give DOE assurances that units of local government will implement a plan for achieving 90% compliance with the energy codes. The lack of compliance with the required site-built window ratings is often given as an area needing substantial improvement. (In contrast, factory-built windows are routinely rated.) Many jurisdictions do not require ratings for site-built windows. Only a small percentage of window fabricators/manufacturers rate their site-built product. Providing an industry-friendly alternative for rating site-built windows would encourage compliance with the requirement to rate site-built fenestration.
(See: Measuring 90% Compliance-12/1/09. PNNL-18587. http://www.energycodes.gov/news/pdfs/compliance_measurement_topic_brief1.pdf)

Final Action: AS AM AMPC____ D

EC173-09/10
502.3.2 (New), Chapter 6 (New)

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

Add new text as follows:

502.3.2 Minimum *Skylight* Fenestration Area. In *enclosed spaces* greater than 10,000 square feet, (900 m^2), directly under a roof with ceiling heights greater than 15 feet (4.6 m), and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the total *daylight zone under skylights* shall be a minimum of half the floor area and provide a minimum *skylight* area to *daylight zone under skylights* of 3 percent with a skylight VLT of at least 0.40 or provide a minimum skylight effective aperture of at least 1 percent.

Skylights shall have a glazing material or diffuser with a measured haze value greater than 90% when tested according to ASTM D1003. General lighting in the daylight area shall be controlled as described in Section 505.2.2.3.

Exceptions:

1. In climate zones 6 through 8
2. Where the designed *general lighting* power densities less than 0.5 W/ft^2 (5.4 W/m^2)
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
4. Where the daylight area under rooftop monitors is greater than 50% of the enclosed space floor area.

3. Add new standard to Chapter 6 as follows:

ASTM

D 1003-07e1 Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics

Reason: This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. Due to the timing of the code development process and ASHRAE standards processes this proposal was submitted in anticipation that by the final action hearings the work to update the standard would be complete. To promote energy use reduction through daylighting. For background documentation on the analysis used to derive these proposed requirements, go to http://www.h-m-g.com/ASHRAE_Daylighting/

Cost Impact: The code change proposal can increase or decrease the cost of construction depending on the cost of any additional skylights to be installed and the reduced cost in lighting equipment.

Analysis: A review of the standard(s) proposed for inclusion in the code, ASTM D1003-07, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: Majette-EC-3-502.3.2-

Public Hearing Results

Note: The following analysis was not in the Code Change monograph but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf :

Analysis: Review of the proposed new standard indicated that, in the opinion of ICC staff, the standard did comply with ICC standards criteria.

Committee Action: **Approved as Modified**

Modify the proposal as follows:

502.3.2 Minimum *Skylight* Fenestration Area. In *enclosed spaces* greater than 10,000 square feet, (900 m^2), directly under a roof with ceiling heights greater than 15 feet (4.6 m), and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the total *daylight zone under skylights* shall be a minimum of half the floor area and provide a minimum *skylight* area to *daylight zone under skylights* of 3 percent with a skylight VLT of at least 0.40 or provide a minimum skylight effective aperture (net translucent skylight area) of at least 1 percent. Skylights shall have a glazing material or diffuser with a measured haze value greater than 90% when tested according to ASTM D1003. General lighting in the daylight area shall be controlled as described in Section 505.2.2.3.

Exceptions:

1 In climate zones 6 through 8.
2. Where the designed *general lighting* power densities less than 0.5 W/ft2 (5.4 W/m^2)
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
~~4. Where the daylight area under rooftop monitors is greater than 50% of the enclosed space floor area.~~

(Portions of proposal not shown remain unchanged).

Committee Reason: The change coordinates with progress in the ASHRAE standard as contained in Addenda AL. It provides a great opportunity to save energy by using skylights in these types of facilities.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, representing US Department of Energy, and Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

ENCLOSED SPACE. A volume surrounded by solid surfaces such as walls, floors, roofs, and openable devices such as doors and operable windows.

GENERAL LIGHTING. Lighting that provides a substantially uniform level of illumination throughout an area. General lighting shall not include decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialized application or feature within such area.

502.3.2 Minimum Skylight Fenestration Area. In an enclosed ~~spaces~~ space greater than 10,000 square feet, (929 m^2), directly under a roof with ceiling heights greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the total daylight zone under skylights shall be not less than ~~a minimum of~~ half the floor area and shall provide a minimum skylight area to daylight zone under skylights of either:

1. Not less than 3 percent with a skylight ~~VLT~~ VT of at least 0.40, or
2. Provide a minimum skylight effective aperture of at least 1 percent determined in accordance with Equation 5-2.

$$\text{Skylight Effective Aperture} = \frac{0.85 \times \text{Skylight Area} \times \text{Skylight VT} \times \text{WF}}{\text{Daylight zone under skylights}} \qquad \textbf{(Equation 5-2)}$$

Where:

Skylight area = Total fenestration area of skylights.
Skylight VT = Area weighted average visible transmittance of skylights.
WF = Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater.
Light well depth = Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.

Exceptions: Skylights above daylight zones of enclosed spaces are not required in:

1. Buildings in climate zones 6 through 8
2. Spaces where the designed *general lighting* power densities less than 0.5 W/ft^2 (5.4 W/m^2)
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
4. Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.

503.3.2.1 Lighting controls in daylight zones under skylights. All lighting in the daylight zone shall be controlled by multi-level lighting controls that comply with Section 505.2.5.

Exceptions: Skylights above daylight zones of enclosed spaces are not required in:

1. Buildings in climate zones 6 through 8
2. Spaces where the designed *general lighting* power densities less than 0.5 W/ft^2 (5.4 W/m^2)
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
4. Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.

502.3.2.2 Haze factor. Skylights in office, storage, automotive service, manufacturing, non-refrigerated warehouse, retail store, and distribution/sorting area spaces shall have a glazing material or diffuser with a measured haze ~~value~~ factor greater than 90 percent when tested in accordance with ~~according to~~ ASTM D1003. ~~General lighting in the daylight area shall be controlled as described in Section 505.2.2.3.~~

Exception: Skylights designed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles, or the geometry of skylight and light well need not comply with Section 502.3.2.2.

~~**Exceptions:**~~

1. ~~In climate zones 6 through 8~~
2. ~~Where the designed *general lighting* power densities less than 0.5 W/ft2 (5.4 W/m2)~~
3. ~~Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.~~
4. ~~Where the daylight area under rooftop monitors is greater than 50% of the enclosed space floor area.~~

505.2.5 Multi-level lighting controls. Where multi-level lighting controls are required by this code, the general lighting in the daylight zone shall be separately controlled by at least one multi-level lighting control that reduces the lighting power in response to daylight available in the space. Where the daylit illuminance in the space is greater than the rated illuminance of the general lighting of daylight zones, the general lighting shall be automatically controlled so that its power draw is no greater than 35 percent of its rated power. The multi-level lighting control shall be located so that calibration and set point adjustment controls are readily accessible and separate from the light sensor.

(*Portions of the code change not shown remain unchanged.)*

Commenter's Reason: (Ronald Majette) This proposal is based on an earlier analysis by ASHRAE in the creation of ASHRAE 90.1-2010 and is submitted in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010.

EC 173 was passed As Submitted at the code change hearings in Baltimore. The proposed public comments will increase the clarity of the provision and adds a requirement also for automatic controls for luminaries located in the daylit zones. The control requirements were passed in EC 179 and were modified and included in this proposal to be consistent with the control language proposed in EC 147. The public comment also adds the definition of Effective Aperture which is not currently defined in the IECC. In order to not limit the design of the building, the haze factor for skylights has been limited to certain occupancies where more of a diffuse skylight is shown to be more effective and where glare from direct sunlight can be an issue. A skylight shading option is also provided for these spaces.

(Steve Ferguson): This proposal is based on an earlier analysis by ASHRAE in the creation of ASHRAE 90.1-2010 and is submitted in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010.

EC 173 was passed As Submitted at the code change hearings in Baltimore. The proposed public comments will increase the clarity of the provision and adds a requirement also for automatic controls for luminaries located in the daylit zones. The control requirements were passed in EC 179 and were included in this proposal to be consistent with EC 147. The public comment also adds the definition of Effective Aperture which is not currently defined in the IECC.

In order to not limit the design of the building, the haze factor for skylights has been limited to certain occupancies where more of a diffuse skylight is shown to be more effective and where glare from direct sunlight can be an issue. A skylight shading option is also provided for these spaces.

Public Comment 2:

Julie Ruth, JRuth Code Consulting representing American Architectural Manufacturers Association requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

502.3.2 Minimum *Skylight* Fenestration Area. In *enclosed spaces* greater than 10,000 square feet, (929 m^2), directly under a roof with ceiling heights greater than 15 feet (610 mm), and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the total daylight zone under skylights shall be a minimum of half the floor area and provide ~~a minimum *skylight* area to *daylight zone under skylights* of~~ either

1. A minimum skylight area to daylight zone under skylights of 3 percent with a skylight ~~VLT~~ VT of at least 0.40, or
2. ~~provide~~ A minimum skylight effective aperture of ~~at least~~ 1 percent, as determined in accordance with Equation 5-2

$$\text{Skylight Effective Aperture} = \frac{0.85 \text{ X Skylight Glazing Area x Skylight VT X WF}}{\text{Daylight zone under skylights}} \quad \textbf{(Equation 5-2)}$$

Where:

Skylight Glazing area = Total projected area of the glazing exposed to daylight .
Skylight VT = Area weighted average ratio of visible light that is transmitted through the glazing to the light that is incident to the skylight. Default VT for Tubular Daylight Devices (TDDs) = 0.40.

VT for domed skylights shall be based upon measurement of VT of the glazing sheet or sheets prior to forming, as determined by testing in accordance with ASTM D1003.

WF = Area weighted average well factor

Where:

WF = 0.9 if light well depth is less than 2 feet (0.6m), or
WF = 0.7 if light well depth is 2 feet (0.6m) or greater, and
Light well depth = Vertical distance from the underside of the lowest point of the outermost glazing to the ceiling plane under the skylight.
Daylight area under skylights = Area of the daylight zone under skylights, as defined in Section 202.

Exceptions: The following spaces are exempt from Section 502.3.2:

1. In climate zones 6 through 8.
2. Where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2).
3. Where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.

503.3.2.1 Lighting controls in daylight zones under skylights. All lighting in the daylight zone shall be controlled by multi-level lighting controls that comply with Section 505.2.2.3.2.

502.3.2.2 Haze ~~Factor~~. Value Skylights in office, storage, automotive service, manufacturing, non-refrigerated warehouse, retail store, and distribution/sorting area spaces shall have a glazing material or diffuser with a measured haze value greater than 90% when tested according to ASTM D1003. ~~General lighting in the daylight area shall be controlled as described in Section 505.2.2.3.~~

Exception: Skylights designed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles, or by the geometry of the skylight and light well shall be exempt from meeting Section 502.3.2.1.

~~**Exceptions:**~~

1. ~~In climate zones 6 through 8~~
2. ~~Where the designed *general lighting* power densities less than 0.5 W/ft2 (5.4 W/m2)~~
3. ~~Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.~~
4. ~~Where the daylight area under rooftop monitors is greater than 50% of the enclosed space floor area.~~

(*Portions of the code change proposal not shown remain unchanged)*

Commenter's Reason: The intent of EC173 was to recognize the significant energy savings that can be achieved through natural lighting of a space by combining light transmitting fenestration with automatic lighting controls. The benefit of this combination has been demonstrated through modeling studies funded in part by the AAMA Skylight Council and research conducted by other parties, including the U.S. Department of Energy, and verified in actual practice by retailers who use skylights in combination with lighting controls to save money.

EC173, as submitted, would require 50% of the floor area in large, open spaces (greater than 10,000 sq. ft), to be daylit by skylights, with the lighting in the daylit areas to be controlled by automatic lighting controls that will reduce the level of lighting provided, and correspondingly the lighting power draw, in response to the daylight provided to the space through skylights. AAMA supported EC173 as originally submitted, but had concerns that certain phrases used in the proposal might be vague or difficult to interpret or enforce.

One of those phrases occurred in proposed exception 4 to Section 502.3.4. The proposed exception referred to "daylight area under rooftop monitors". It was not clear what a rooftop monitor was, or how this exception was to be interpreted or enforce. This Public Comment deletes that exception.

Another phrase that required further clarification was "skylight effective aperture". Since the use of this phrase is an integral part of providing lighting to the interior area, it is necessary to retain it in the proposal and seek to provide further clarification of how it is to be calculated.

This Public Comment borrows from text that has recently been approved by ASHRAE for the calculation of "skylight effective aperture". It is simpler and more direct than other calculation methods that are being used by other code regulation agencies, while providing a meaningful measure of the amount of available light that is being transmitted to the interior space through the skylight.

Skylight effective aperture is dependent upon the amount of light transmitted through the skylight. The most commonly accepted rating for that is the Visible Transmittance (VT) rating, which can be determined through flat sheet glazing materials in accordance with ASTM D1003. At the present time there is no consensus based, industry recognized method of determining the VT rating of domed skylights or Tubular Daylighting Devices (TDDs). Therefore this Public Comment provides a very conservative default VT rating for TDDs of 0.40, and clarifies that the VT of domed skylights is to be determined based upon the VT rating of the glazing material used to create the dome, when in a flat sheet state.

Public Comment 3:

Julie Ruth, JRuth Code Consulting representing American Architectural Manufacturers Association requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

502.3.2 Minimum *Skylight* Fenestration Area. In *enclosed spaces* greater than 10,000 square feet, (900 m^2), directly under a roof with ceiling heights greater than 15 feet (4.6 m), and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, non-refrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the total *daylight zone under skylights* shall be a minimum of half the floor area and provide a minimum *skylight* area to *daylight zone under skylights* of 3 percent with a skylight VLT of at least 0.40 or provide a minimum skylight effective aperture (net translucent skylight area) of at least 1 percent.

Skylights shall have a glazing material or diffuser with a measured haze value greater than 90% when tested according to ASTM D1003. General lighting in the daylight area shall be controlled as described in Section ~~505.2.2.3~~ <u>505.2.2.3.2</u>.

Exceptions:

1 In climate zones 6 through 8.
2. Where the designed *general lighting* power densities less than 0.5 W/ft2 (5.4 W/m^2)
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.

(*Portions of the code change proposal not shown remain unchanged)*

Commenter's Reason: EC173, as submitted, referred to Section 505.2.2.3 for the control requirements for lighting in the daylit zone created under the skylights. Section 505.2.2.3 requires lighting in this zone to have separate controls from lighting in other areas, but it does not require those controls to automatically reduce the lighting load when daylighting occurs.

This Public Comment revises the section reference to refer to Section 505.2.2.3.2. The proposed requirements for this section are to be included in a Public Comments on EC147 and EC179.

Final Action: AS AM AMPC____ D

EC174-09/10

502.3.2, Table 502.3

Proposed Change as Submitted

Proponent: Garrett Stone, Brickfield, Burchette, Ritts & Stone, representing Cardinal Glass Industries

Revise as follows:

502.3.2 Maximum *U*-Factor and SHGC. For vertical fenestration the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3, based on the window projection factor. For skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3.

> **Exception:** Where the fenestration projection factor for a specific vertical fenestration product is measured and calculated and determined to be greater than or equal to 0.2, the required SHGC from Table 502.3 shall be adjusted by multiplying the required maximum SHGC by the following multipliers corresponding with the orientation of the fenestration product and the projection factor:

Projection Factor	Oriented Within 45 Degrees of True North	All Other Orientation
0.2 ≤ PF < 0.5	1.1	1.2
PF ≥ 0.5	1.2	1.6

The window projection factor shall be determined in accordance with Equation 5-1.

PF = A/B **(Equation 5-1)**

Where:

PF = Projection F~~f~~actor (decimal).

A = Distance measured horizontally from the furthest 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 be evaluated separately~~, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors~~.

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Climate Zone	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
***U*-factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain wall/storefront *U*-factor	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
SHGC – all frame types								
SHGC~~: PF < 0.25~~	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
~~SHGC: 0.25 ≤ PF < 0.5~~	~~0.33~~	~~0.33~~	~~0.33~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~
~~SHGC: PF ≥ 0.5~~	~~0.40~~	~~0.40~~	~~0.40~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~	~~NR~~
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement

~~PF = Projection factor (see Section 502.3.2).~~

a. All others includes operable windows, fixed windows and nonentrance doors.

Reason: This proposal improves the code by:
(1) incorporating the more precise ASHRAE 90.1 projection factor adjustment methodology into the IECC;
(2) recognizing that projection factors vary by orientation;
(3) allowing the projection factor adjustment as an exception where the projection factor of each window has actually been measured; and
(4) eliminating the area-weighted average approach from this exception.

While eliminating the projection factor trade-off would be the best solution, if a projection factor trade-off is to be retained by the IECC for buildings subject to chapter 5 of the IECC, it should be developed so as to accurately establish a trade-off while maintaining reasonable simplicity for ease of application in code compliance and enforcement. This proposal meets these objectives.

Simple, But More Accurate Adjustment Multiplier. ASHRAE 90.1 provides an adjustment multiplier that must be applied individually to each window, based on projection factor and orientation. This is a more precise and accurate approach to calculate projection factor and determine its effects than the prescriptive table in the current IECC, because the current IECC does not take into account the orientation of the windows and it allows a weighted-average approach. However, the ASHRAE method requires a great deal of calculation, because the adjustment must be applied to the SHGC of each individual window to determine compliance. In contrast, the above proposal is written to overcome this hurdle – specifically, the adjustment multiplier is applied as an adjustment to the prescriptive maximum SHGC requirement, thereby eliminating the need to recalculate the value for every window – instead, the multipliers need only be applied once to the prescriptive value for each zone to determine the appropriate requirements.

To further simplify the calculation, the proposal retains only two categories, but modifies the first category from 25%-50% to 20%-50% to better match the categories in ASHRAE, and the multipliers have all been rounded off.

Orientation. For many years, ASHRAE 90.1 has recognized that projection factor is more or less effective depending on the orientation of the window. Ideally, good passive solar design should incorporate precise window orientation and window selection on all sides of the building in order to ensure proper use (and shading) of the sun throughout the year. However, ASHRAE 90.1 has simplified the calculation into two general categories: Fenestration oriented within 45 degrees of true north; and all other orientation. The above proposal has adopted these general categories to maintain consistency with ASHRAE 90.1, and to introduce a simple element of orientation into the projection factor calculation.

Measurement. In the case of projection factor trade-offs, where SHGC values (which are tested and labeled according to objective national standards) are being traded off for building components that are not objectively tested (and are typically determined in the design and permitting phase), the IECC should ensure that projection factor is being properly measured and calculated for each window taking advantage of the projection factor exception.

Area-Weighting. An area-weighted average approach does not make sense for the projection factor calculation because additional shading on some windows does not balance out the lack of shading on others, especially when those windows are oriented differently. For example, 100% shading on a north-facing window, where shading provides little benefit, cannot compensate for a west-facing window with complete sun exposure. However, an area-weighted average approach would simply average the two windows regardless of the actual shading benefits. The above proposal eliminates the area-weighting approach from the projection factor calculation and requires calculation for each window, benefiting designers who are properly orienting and shading all the windows of the home. It should be noted that current SHGC requirements for these buildings do not allow area-weighting of product SHGCs; it is inconsistent with this requirement to allow area-weighting in the case of projection factors.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: Stone-EC-2-502.3.2-T. 502.3

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: The committee approved the change because they felt it was a reasonable approach to incorporating projection factors into the envelop design.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Craig Conner, Building Quality, representing himself, Thomas D. Culp, Birch Point Consulting, representing Glazing Industry Code Committee, Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association (AAMA) and Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc, and AGC Flat Glass North America, Inc, requests Disapproval.

Commenter's Reason: (Craig Conner): EC174 is not well thought out and complicates the code. As revised by EC174 Section 502.3.2 states that the *U*-factor and SHGC shall be "*as specified in Table 502.3, based on the window projection factor"*, however the change removes the *window projection factor* from Table 502.3.

What does "*measured and calculated and determined*" mean? This removes the allowance to evaluate a group of windows based on an average PF and requires each different window PF to be evaluated separately, potentially creating lots of extra work.

(Thomas D. Culp): EC174 has two major faults which warrants disapproval – a technical flaw regarding orientation, and increased complexity for enforcement. The proponent claims increased accuracy regarding orientation. However, the proposal would irrationally require a lower SHGC on the north side than on the west! For example, with a 3 ft overhang above 6 ft tall glazing on a building in Atlanta, this would require a max SHGC of 0.30 on the north where solar loads are minimal, yet would allow 0.40 SHGC on the west where solar impact on energy efficiency is more critical. Furthermore, this would harm the energy savings from daylighting designs on north facades by forcing darker glass to be used. This makes no technical sense.

Second, the proposal will increase complexity for enforcement. Rather than simply looking up the maximum SHGC for a given projection factor on the main prescriptive table, this proposal will force extra unnecessary steps, referring to a separate table and requiring additional calculations. This increases both the workload and potential for error in code compliance checks.

(Julie Ruth): EC174 removes the current provisions for maximum SHGC of fenestration in commercial buildings based on projection factor and replaces them with a multiplier for projection factor that is based upon orientation of the glazing as well as projection factor. A lower multiplier is given for glazing that is orientated towards the north than for glazing oriented in the other three directions.

Although it is true that the benefits of shading northern oriented glass is less than for glass oriented towards the east, west or south, it is also true that concern about solar heat gain through northern orientated glass is not as great, whether the glass is protected by an overhanging projection or not. Therefore, the maximum SHGC for northern oriented glazing should be less stringent than it is for glazing with east, west or south orientations, which means that a higher maximum SHGC should be permitted for northern oriented glazing – not a lower one. This is true whether the glazing is protected from the sun's rays by an overhanging projection, or not.

The provisions provided in EC174 would actually result in lower maximum SHGCs for glazing that is northern oriented than for glazing facing the other three orientations, as shown below:

Current provisions:

Maximum SHGC

Climate Zone	1	2	3	4 except Marine	5 and Marine 4	6	7	8
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR

Net Result of EC174:

Maximum SHGC

Climate Zone	**1**		**2**		**3**		**4**		**5**		**6**		**7**		**8**	
Orientation	**< 45° of True North**	**Other**	**< 45° of True North**	**Other**	**< 45° of True North**	**Other**	**< 45° of True North**	**Other**	**< 45° of True North**	**Other**	**< 45° of True North**	**Other**	**< 45° of True North**	**Other**	**< 45° of True North**	**Other**
PF < 0.2	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**	**0.25**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.40**	**0.45**	**0.45**	**0.45**	**0.45**
0.2 ≤ PF < 0.5	**0.28**	**0.30**	**0.28**	**0.30**	**0.28**	**0.30**	**0.44**	**0.48**	**0.44**	**0.48**	**0.44**	**0.48**	**0.50**	**0.54**	**0.50**	**0.54**
PF ≥ 0.5	**0.30**	**0.40**	**0.30**	**0.40**	**0.30**	**0.40**	**0.48**	**0.64**	**0.48**	**0.64**	**0.48**	**0.64**	**0.54**	**0.72**	**0.54**	**0.72**

As can be seen in the table above, in addition to establishing lower SHGC values for northern oriented glazing, EC174 would also put a maximum SHGC limitation in place for glazing in all orientations, in all climate zones, regardless of whether an overhanging projection is provided or not. Although it is appropriate to limit SHGC in south facing glazing in southern climate zones, in northern climate zones warmth from the sun should be taken advantage of, and the provisions of the IECC should encourage that, not prohibit or restrict it.

It may be appropriate to go back and revisit the current SHGC provisions of Table 502.3 to take into consideration orientation as well as projection factor. If that is done, however, it should start with the base SHGC numbers and permit higher SHGCs for northern oriented glazing, and for glazing in northern climate zones. The one sided approach provided in EC174 is inaccurate and ineffective. We urge its disapproval.

(Thomas S. Zaremba): EC174-09/10 should be disapproved because it makes the affected sections of Chapter 5 that deal with shading credits (or projection factor) **far** more complicated and **far** more difficult for building code officials to apply with no corresponding assurance or verification that any measurable energy will actually be saved.

In the last two development cycles, the Proponent of EC174 has attempted to eliminate the use of projection factors from the code altogether. In each cycle, however, the IECC Committee and the membership at Final Action Hearings have disagreed with the Proponent, voting each time to retain projection factors in the code.

Now, the Proponent wants to entangle the use of projection factors in a myriad of new complexities that will not only make it far more difficult to use projection factors in building designs, it will also impose enormous new burdens on building code officials that are required to learn and verify compliance with these new provisions. While proposing to add enormous complexity to the code, the Proponent fails to provide any assurance or even any estimate as to whether, or, if so, how much, energy savings will actually result from adding these new complexities to the code.

How would EC174 make the code more complicated? First, the proposal eliminates projection factor entirely from Table 502.3. In the 2009 edition of the IECC, the prescriptive SHGC values for windows benefiting from solar control resulting from the use of projection factors are all specified by climate zone within Table 502.3. Currently, Table 502.3 is complete in that it specifies all prescriptive fenestration requirements for commercial buildings. If EC174 is adopted it would remove projection factors and corresponding SHGCs from Table 502.3 and with it the ability of building code officials to simply match projection factors in any given climate zone to the SHGC values that are currently and conveniently set out in that single Table.

Instead, for every projection factor used in a building, EC174 would require the building code official to go through multiple steps to compute new SHGC values. These steps include the necessity to: (1) verify whether the projection factor is greater than or equal to 0.2, (2) if it is, determine and verify the orientation of the building (remember to take your compass to the job site), (3) after determining and verifying building orientation, determine and verify the exact projection factor at issue, (4) then, pick the correct multiplier from the new table set out in EC174 on the basis of whether the projection factor is ≤ 0.2 or < 0.5 or whether it is ≥ 0.5, and, finally, (5) use the correct multiplier to compute new, adjusted SHGC values from those found in Table 502.3 for each affected window.

This proposal eliminates the simplicity of applying projection factors to SHGCs as now found in Table 502.3. It would substitute, instead, new and multiple steps that would all need to be taken and verified every time a projection factor is included in the design of a building. The Proponent would impose these new complexities on building code officials with absolutely no assurance that any energy savings of any magnitude will result, let alone of a magnitude commensurate to the size of the new burdens being imposed.

EC174 will destroy the completeness, the simplicity and the usefulness of Table 502.3 and, at the same time, it will unnecessarily complicate the 2012 edition of the IECC. Final Action voters are strongly urged to vote against the standing motion to approve EC174 as submitted and, instead, to vote in favor of disapproving EC174.

Final Action: AS AM AMPC____ D

EC176-09/10
502.3.3 (New)

Proposed Change as Submitted

Proponent: Thomas D. Culp, Ph.D., Birch Point Consulting LLC, representing Aluminum Extruders Council

Add new text as follows:

502.3.3 Area-weighted U-factor. An area-weighted average shall be permitted to satisfy the *U*-factor requirements for each fenestration product category listed in Table 502.3. Individual fenestration products from different fenestration product categories listed in Table 502.3 shall not be combined in calculating area-weighted average *U*-factor.

Reason: This proposal clarifies that area-weighted averages may be used to comply with the U-factor requirements in Table 502.3, similar to what is allowed in Chapter 4 and in ASHRAE 90.1. Currently, it is ambiguous whether each individual fenestration product must meet the specified requirement, or whether the overall average of all the individual products within that product type may be used.

There is a large diversity of fenestration products in commercial construction, and enforcement issues can arise where there are a small number of minority products which do not meet the prescriptive requirements, yet the overall performance of all fenestration assemblies is well below the requirement. Area-weighted averaging would alleviate this problem. Enforcement by the building official should not be a problem in that Section 103.2 already requires that area-weighted U-factor calculations be provided on construction documents.

This proposal also clarifies that different product categories (skylight, curtainwall, entrance door, etc.) may not be mixed in the area-weighted calculation, because it would then be uncertain which U-factor requirement would be used for code compliance.

A similar proposal was rejected last cycle because it also included area weighted averaging for SHGC. The committee correctly pointed out that it is not appropriate to average SHGC on different sides of the building (e.g. west and north). Therefore, this proposal does not include SHGC, and only addresses U-factor.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: CULP-EC-3-502.3.3.DOC

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee disapproved the change because it move a prescriptive standard over to being predominately a performance standard. A prescriptive standard is important to maintain.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Dave Hewitt, representing New Buildings Institute and Jessyca Henderson, representing American Institute of Architects request Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.3.3 Area-weighted U-factor and SHGC An area-weighted average shall be permitted to satisfy the U-factor and SHGC requirements in each fenestration category listed in Table 502.3. Individual fenestration products from different fenestration categories listed in Table 502.3 shall not be combined in calculating area-weighted average U-factor or SHGC.

(Portions of the proposal not shown remain unchanged)

Commenter's Reason: This comment clarifies that area-weighted averages may be used to comply with the U-factor and SHGC requirements in Table 502.3, similar to what is allowed in Chapter 4 and in ASHRAE 90.1. Currently, it is ambiguous whether each individual fenestration product must meet the specified requirement, or whether the overall average of all the individual products within that product type may be used.

There is a large diversity of fenestration products in commercial construction, and enforcement issues can arise where there are a small number of minority products which do not meet the prescriptive requirements, yet the overall performance of all fenestration assemblies is well below the requirement. This can also occur when special entry or highlight glazing features are included that may be different from the primary glazing strategy. Area-weighted averaging would alleviate this problem. The calculation protocol for area weighting is relatively simple; enforcement by the building official should not be a problem in that Section103.2 already requires that area-weighted U-factor calculations be provided on construction documents.

An allowance for SHGC values to be similarly averaged is proposed because SHGC tends to be closely related to window U-value. If SHGC values are not allowed to fluctuate in a similar manner, the usefulness of the U-value averaging allowance is substantially reduced.

A similar averaging proposal was rejected last cycle because it included area weighted averaging for SHGC. However, the proponents of this language suggest that the extremely rare potential for abuse of the SHGC averaging allowance is outweighed by the need for a workable U-value averaging protocol. Without some flexibility on SHGC, the U-value averaging proposal is seldom workable.

Public Comment 2:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association (AAMA), requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.3.3 Area-weighted U-factor. An area-weighted average shall be permitted to satisfy the *U*-factor requirements ~~for each fenestration product category~~ listed in Table 502.3. Individual fenestration products from different fenestration product categories listed in Table 502.3 shall ~~not~~ be permitted to be combined in calculating area-weighted average *U*-factor if the total accumulative fenestration UA (sum of U-factor times glazed assembly area for each glazed assembly) is less than or equal to the total UA resulting from using the U-factors in Table 502.3 (multiplied by the same assembly area as in the proposed building). The SHGC requirements of Table 502.3 shall be met for each individual glazed assembly area and shall not be evaluated based upon an area-weighted average.

Commenter's Reason: EC176, as submitted and approved during the Code Development hearings in Baltimore, permits the area weighted averaging of U-factor for fenestration within each specific category. This is a good first step towards recognizing that the total heat loss through a building envelope depends upon the average U-factor for the building envelope, the temperature differential on each side of the building envelope, and the total area of the envelope. Heat loss is not affected by how the U-factor is distributed over the building envelope.

Therefore, permitting area weighted averaging of fenestration within product categories is appropriate. This public comment goes one step beyond the original proposal by permitting area weighted averaging across product categories of fenestration. Doing so requires the determination of a target UA value for all of the fenestration areas in the envelope. This Public Comment establishes the target fenestration UA using the same method as that provided in current Section 402.1.4 for the determination of the total building envelope alternative UA for residential construction.

Permitting the use of this method would increase the options available to a building designer or contractor under the prescriptive method of the IECC, before having to go as far as using performance based design. It should be noted that it does so without permitting a tradeoff between fenestration and opaque wall insulation. The averaging is limited to the fenestration only.

Public Comment 3:

Garrett Stone, Brickfield Burchette Ritts & Stone, representing Cardinal Glass Industries requests Disapproval.

Commenter's Reason: EC176 should be disapproved.

EC176 will reduce energy efficiency for commercial and high-rise residential buildings. In the commercial prescriptive path of the 2009 IECC (Table 502.3), the U-factor maximum applies to each window individually. From a practical standpoint, because window U-factors vary from window to window, the fact that each individual unit has to meet prescriptive requirements means that, under the current requirements, the average window U-factor is likely to be somewhat lower than the prescriptive value. This is a conservative approach to energy efficiency that ensures that no window will exceed the U-factor maximum, and will lead to some measure of additional efficiency. EC176 removes that limitation and turns the current maximum U-factor requirement for each product into an area-weighted average calculation. Windows with U-factors above the prescriptive values that would not have qualified under the 2009 IECC will now be allowed if they are offset by windows below the prescriptive U-factor. The average U-factor allowed, as a practical matter, will likely be significantly increased, even though the prescriptive values in the table do not change.

Although the Committee viewed this as correcting an oversight, in reality, past attempts to introduce weighted averaging in this area have been consistently rejected by the ICC. We believe that these past decisions reflected the recognition that such an approach would reduce the stringency and effectiveness of the energy code while adding compliance complexity associated with a weighted average approach.

Cardinal Glass does not oppose weighted averaging of building components within component categories as long as there is a corresponding and sufficient efficiency increase in that component and legitimate reasons to justify weighted averaging. However, EC176 does not propose any strengthening amendments, so the net impact will be a reduction in stringency. Nor does EC176 identify any other compelling justification for this approach. As such, we urge disapproval.

Final Action: AS AM AMPC____ D

EC179-09/10

202 (New), 502.3.3 (New), 505.2.5 (New), Chapter 6

Proposed Change as Submitted

Proponent: Julie Ruth, PE, JRuth Code Consulting, representing American Architectural Manufacturers Association; Tom Culp, Birchpoint Consulting, representing Aluminum Extruders Council

1. Add new definitions as follows:

GENERAL LIGHTING: Lighting that provides a uniform level of illumination throughout an area. General lighting shall not include emergency lighting; decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialized application or feature within such area.

MULTI-LEVEL LIGHTING CONTROLS. Systems that automatically reduce the lighting power draw in a series of at least two levels or by continuous dimming in response to availability of daylight within the interior space (sometimes referred to as "photo control").

HAZE VALUE. The ratio of diffusely transmitted light to total light transmitted.

2. Add new text as follow.

502.3.3 Minimum daylighting: In spaces enclosed by walls or floor-to-ceiling partitions that are greater than 25,000 square feet (2000 m^2) in area and directly under a roof with ceiling heights greater than 15 feet (4.6 m), in single story buildings of Group E, F-1, F-2, M, S-1 or S-2 occupancies, a minimum of 50 percent of the floor area shall be in a daylight zone. The maximum percentage of gross roof assembly area that is permitted to be roof mounted fenestration (including but not limited to skylights, tubular daylighting devices, light-transmitting smoke vents, and roof windows) in these spaces shall be 6 percent. All lighting in this daylight zone shall be controlled by multi-level lighting controls that comply with Section 505.2.5.

Roof mounted fenestration in these spaces shall meet the following criteria:

1. The haze value of the combined glazing materials or diffuser in the assembly shall be identified by a manufacturer's designation that indicates manufacturer, testing laboratory, haze value and test method used. The haze shall be 90 percent or greater when tested according to ASTM D1003.
2. The minimum fenestration VT shall be 0.60 when determined in accordance with ASTM E972 or NFRC 200.
3. The maximum U-factor of the fenestration shall meet the requirements of Table 502.3. The maximum SHGC shall be 0.60.

Exceptions:

1. Spaces in climate zones 6 through 8.
2. Auditoriums, theaters, museums, places of worship, and refrigerated warehouses.
3. Spaces with general lighting power densities less than 0.5 W/ft2 (5.4 W/m2).

505.2.5 Multi-level lighting controls. When multi-level lighting controls are required by this code, the general lighting in the daylight zone shall be separately controlled by at least one multi-level lighting control that reduces the lighting power in response to daylight available in the space. When the daylit illuminance in the space is greater than the rated illuminance of the general lighting of daylight zones, the general lighting shall be automatically controlled so that its power draw is no greater than 35 percent of its rated power. The multi-level lighting control shall be located so that calibration and set point adjustment controls are readily accessible and separate from the light sensor.

3. Add new standards to Chapter 6 as follows:

ASTM

D1003-00	*Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*
E972-96(2002)	*Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight*

Reason: This proposal seeks to take advantage of the tremendous energy savings that can be achieved by incorporating daylighting into building design. A recent study conducted by TIAX LLC for the U.S. Department of Energy found that energy savings of between $0.10 to $0.32/sq foot /year can be achieved by incorporating skylights with lighting controls into the design of commercial buildings.
This proposal would mandate daylighting of those types of spaces for which the report predicted the shortest payback period (4 to 10 years), which are large, open spaces (in the case of this proposal > 25,000 sq. ft) with high ceilings (in the case of this proposal > 15 ft.). Also, the proposal is limited to those occupancies where manual control of daylighting for purposes of the processes that take place within the building are least likely to be needed (educational, mercantile, factory and storage).
Although previous studies have found that significant (>10%) energy savings can be achieved by incorporating skylights with automatic lighting controls with the characteristics defined in this proposal in all climate zones, the greatest savings (20 to 35%) occur in Climate zones 1 to 5. Therefore, this proposal does not require mandatory daylighting in climate zones 6 to 8.
The proposal leaves the exact distribution of skylights to the designer. Requiring the 50% threshold to be met by skylights in no more than 6% of the roof area together with vertical glazing would require the designer to distribute the skylights well over the surface of the roof.
The criteria for the skylights themselves are based either upon the criteria used in the DOE study or current requirements of the IECC. To provide meaningful reduction in lighting load the Visible Transmittance of the skylights must be 0.60 or greater, as was assumed for the study. Visible Transmittance is directly proportional to SHGC, so the lower the SHGC, the lower the VT and the less light transmitted into the interior space. A comparison of VT vs. SHGC of domed skylights listed on the NFRC database on March 30, 2009 yielded the results shown in the graph below.

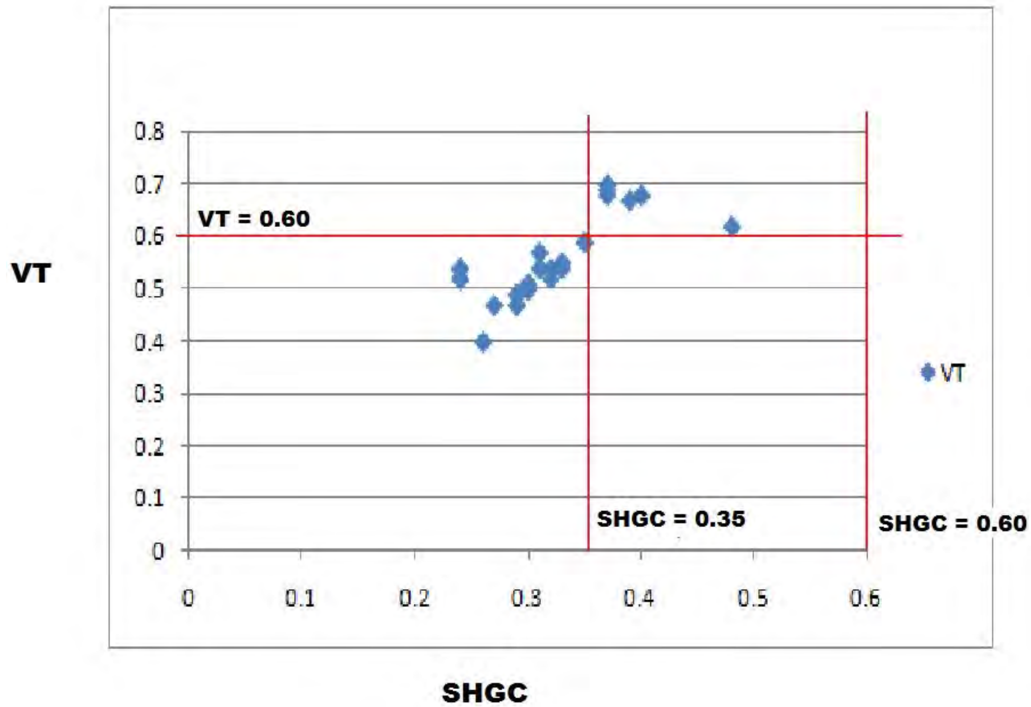


Figure 1 Comparison of VT to SHGC for domed skylights listed in NFRC Database

The TIAX/DOE study found that for skylight to roof area ratios of 6% or less, the energy savings were greater when domed skylights with SHGC of 0.53 were used than when flat skylights with SHGC = 0.35 were used.
As can be seen in the graph above, if a maximum SHGC of 0.35 is required, a domed skylight product with VT > 0.60 is not currently available. The baseline skylight used in the study had an SHGC = 0.53 and VT = 0.65. The study also found energy savings would be achieved for domed skylights with SHGC = 0.59 and VT = 0.62. As can be seen in the graph above, once the SHGC maximum limit of 0.35 is removed, domed skylights with VT > 0.60 are available. Therefore the proposal requires a minimum VT = 0.60 and a maximum SHGC = 0.60.
The proposal relies upon the current requirements of the IECC for maximum U-factor for the skylights used. These are more stringent than the study's baseline skylight U-factor of 0.81. The proposal also adds new criteria for Visible Transmittance and Diffusion of skylights to the IECC, when mandatory daylighting is required. Finally, the proposal relies upon Table 502.3 for vertical glazing, and does not modify any of those requirements for the purposes of providing daylighting to the spaces addressed by this proposal.
Copies of the study quoted "Commercial Building Toplighting: Energy Savings Potential and Potential Paths Forward" NTIS # PB2008-111197 by TIAX LCC, can be obtained from National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161, 703-487-4650. The report has also been posted on the AAMA website, and can be accessed at http://www.aamanet.org/mp/TIAX_DOE-BT_Toplighting_Final_Report.pdf

Cost Impact: There will be some increased cost to construction due to this requirement. It is anticipated, however, that these initial costs will be offset over time by the energy cost savings. As discussed in the TIAX/DOE study, the anticipated payback period is 10 years or less. In some cases (depending upon climate zone, lighting design level, etc) the payback period will be 4 years or less.

Analysis: A review of the standard(s) proposed for inclusion in the code, ASTM D1003-003 and E972-96 (02), for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

Public Hearing Results

Note: The following analysis was not in the Code Change monograph but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf :

Analysis: Review of the proposed new standard indicated that, in the opinion of ICC staff, the standard did comply with ICC standards criteria.

Committee Action: Approved as Modified

Modify the proposal as follows:

1. Add new definitions as follows:

GENERAL LIGHTING: Lighting that provides a uniform level of illumination throughout an area. General lighting shall not include emergency lighting; decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialized application or feature within such area.

MULTI-LEVEL LIGHTING CONTROLS. Systems that automatically reduce the lighting power draw in a series of at least two levels or by continuous dimming in response to availability of daylight within the interior space (sometimes referred to as "photo control").

~~**HAZE VALUE.** The ratio of diffusely transmitted light to total light transmitted.~~

~~**502.3.3 Minimum daylighting.** In spaces enclosed by walls or floor-to-ceiling partitions that are greater than 25,000 square feet (2000 m2) in area and directly under a roof with ceiling heights greater than 15 feet (4.6 m), in single story buildings of Group E, F-1, F-2, M, S-1 or S-2 occupancies, a minimum of 50 percent of the floor area shall be in a daylight zone. The maximum percentage of gross roof assembly area that is permitted to be roof mounted fenestration (including but not limited to skylights, tubular daylighting devices, light-transmitting smoke vents, and roof windows) in these spaces shall be 6 percent. All lighting in this daylight zone shall be controlled by multi-level lighting controls that comply with Section 505.2.5.~~

~~Roof mounted fenestration in these spaces shall meet the following criteria:~~

1. ~~The haze value of the combined glazing materials or diffuser in the assembly shall be identified by a manufacturer's designation that indicates manufacturer, testing laboratory, haze value and testmethod used. The haze shall be 90 percent or greater when tested according to ASTM D1003.~~
2. ~~The minimum fenestration VT shall be 0.60 when determined in accordance with ASTM E972 or NFRC 200.~~
3. ~~The maximum U-factor of the fenestration shall meet the requirements of Table 502.3. The maximum SHGC shall be 0.60.~~

~~**Exceptions:**~~

1. ~~Spaces in climate zones 6 through 8.~~
2. ~~Auditoriums, theaters, museums, places of worship, and refrigerated warehouses.~~
3. ~~Spaces with general lighting power densities less than 0.5 W/ft2 (5.4 W/m^2).~~

505.2.5 Multi-level lighting controls. When multi-level lighting controls are required by this code, the general lighting in the daylight zone shall be separately controlled by at least one multi-level lighting control that reduces the lighting power in response to daylight available in the space. When the daylit illuminance in the space is greater than the rated illuminance of the general lighting of daylight zones, the general lighting shall be automatically controlled so that its power draw is no greater than 35 percent of its rated power. The multi-level lighting control shall be located so that calibration and set point adjustment controls are readily accessible and separate from the light sensor.

~~**3. Add new standards to Chapter 6 as follows:**~~

~~**ASTM**~~
~~D1003-00 *Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*~~
~~E972-96(2002) *Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight*~~

Committee Reason: The modification was to simplify the proposal to just address providing the controls systems; the proposed Section 502.3.3 conflicted with the approved provisions of EC173. The provision of the controls is essential to making the energy savings incorporated in EC173-09/10 achievable. The committee expects this approval to blend with EC 173.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Dave Hewitt, representing New Buildings Institute, Jessyca Henderson, representing American Institute of Architects requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

GENERAL LIGHTING: Lighting that provides a uniform level of illumination throughout an area. General lighting shall not include emergency lighting; decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialized application or feature within such area.

~~**MULTI-LEVEL LIGHTING CONTROLS.** Systems that automatically reduce the lighting power draw in a series of at least two levels or by continuous dimming in response to availability of daylight within the interior space (sometimes referred to as "photo control").~~

~~**HAZE VALUE.** The ratio of diffusely transmitted light to total light transmitted.~~

505.2.2.3.2 Automatic daylighting controls. Set-point and other controls for calibrating the lighting control device shall be readily accessible. Daylighting controls device shall be capable of automatically reducing the lighting power in response to available daylight by either one of the following methods:

1. Continuous dimming using dimming ballasts and daylight-sensing automatic controls that are capable of reducing the power of general lighting in the daylit zone continuously to less than 35 percent of rated power at maximum light output.

2. Stepped dimming using multi-level switching and daylight-sensing controls that are capable of reducing lighting power automatically. The system shall provide a minimum of two control channels per zone and be installed in a manner such that at least one control is between 50 percent and 70 percent of design lighting –power and another control step is no greater than 35 percent of design power

~~**502.3.3 Minimum daylighting:** In spaces enclosed by walls or floor-to-ceiling partitions that are greater than 25,000 square feet (2000 m^2) in area and directly under a roof with ceiling heights greater than 15 feet (4.6 m), in single story buildings of Group E, F-1, F-2, M, S-1 or S-2 occupancies, a minimum of 50 percent of the floor area shall be in a daylight zone. The maximum percentage of gross roof assembly area that is permitted to be roof mounted fenestration (including but not limited to skylights, tubular daylighting devices, light-transmitting smoke vents, and roof windows) in these spaces shall be 6 percent. All lighting in this daylight zone shall be controlled by multi-level lighting controls that comply with Section 505.2.5.~~

~~Roof mounted fenestration in these spaces shall meet the following criteria:~~

1. ~~The haze value of the combined glazing materials or diffuser in the assembly shall be identified by a manufacturer's designation that indicates manufacturer, testing laboratory, haze value and test method used. The haze shall be 90 percent or greater when tested according to ASTM D1003.~~
2. ~~The minimum fenestration VT shall be 0.60 when determined in accordance with ASTM E972 or NFRC 200.~~
3. ~~The maximum U-factor of the fenestration shall meet the requirements of Table 502.3. The maximum SHGC shall be 0.60.~~

~~**Exceptions:**~~

1. ~~Spaces in climate zones 6 through 8.~~
2. ~~Auditoriums, theaters, museums, places of worship, and refrigerated warehouses.~~
3. ~~Spaces with general lighting power densities less than 0.5 W/ft2 (5.4 W/m2).~~

~~**505.2.5 Multi-level lighting controls.** When multi-level lighting controls are required by this code, the general lighting in the daylight zone shall be separately controlled by at least one multi-level lighting control that reduces the lighting power in response to daylight available in the space. When the daylit illuminance in the space is greater than the rated illuminance of the general lighting of daylight zones, the general lighting shall be automatically controlled so that its power draw is no greater than 35 percent of its rated power. The multi-level lighting control shall be located so that calibration and set point adjustment controls are readily accessible and separate from the light sensor.~~

ASTM

~~D1003-00~~ ~~*Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics*~~
~~E972-96(2002)~~ ~~*Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight*~~

Commenter's Reason: This comment modifies the reference on automatic controls for daylight zones to be consistent with specifications in EC 147 as modified by Public Comment and is intended to blend with the specifications in EC 173 as modified by Public Comment..

Final Action: AS AM AMPC____ D

EC180-09/10
502.3.3 (New)

Proposed Change as Submitted

Proponent: Garrett Stone, Brickfield, Burchette, Ritts & Stone, representing Cardinal Glass Industries

Add new text as follows:

502.3.3 Visible Transmittance. For all glazed fenestration products, the area-weighted average ratio of *visible transmittance* / *solar heat gain coefficient* shall be greater than 1.5.

Reason: The effective use of daylighting in commercial construction has long been recognized as bringing energy savings and benefits to a building's occupants. This proposal implements a standard for visible light transmittance (VT) designed to maximize useful daylighting in commercial buildings while maintaining effective control over solar heat gain. While the VT may later be combined with use of automatic lighting controls, this proposal sets a ratio of VT to SHGC acceptable for typical commercial occupancies.

Because commercial buildings are predominantly occupied during daylight hours and internal heat load dominated, building design should maximize both daylighting and appropriate solar control. Historically, designers incorporated tinted glass to control solar heat gain, but the reduced transmission of daylight required more artificial light (requiring additional energy and creating additional internal heat loads). As spectrally selective glazing technologies have been perfected, designers are increasingly using glazing that maximizes the amount of visible light entering buildings, while limiting the solar heat gain. Achieving a high VT/SHGC ratio should not add significant cost to commercial glazing since the technology (low-e coatings) is basically the same for both high and low visible light transmission glass with low SHGCs.

Recognizing the range of VT and SHGC ratings of products currently on the market, this proposal uses the "light-to-solar-gain ratio" method used in the ASHRAE Handbook. *See 2005 ASHRAE Handbook of Fundamentals*, at 31.59. This ratio simply divides the VT (expressed as a number between 0 and 1) by the SHGC (also expressed as a number between 0 and 1). This proposal adopts the VT/SHGC ratio specified in the *Core Performance Guide* (2007) published by the New Buildings Institute, which is >1.5 for all climate zones. which will allow reasonable design flexibility and product selection. *See* Table 2.6.1.

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

ICCFILENAME: Stone-EC-7-502.3.3

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: At the request of the proponent, the committee disapproved this change based on approvals by the committee of related proposals.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Garrett Stone, Brickfield Burchette Ritts & Stone, representing Cardinal Glass Industries, requests Approval as Modified by this Public Comment.

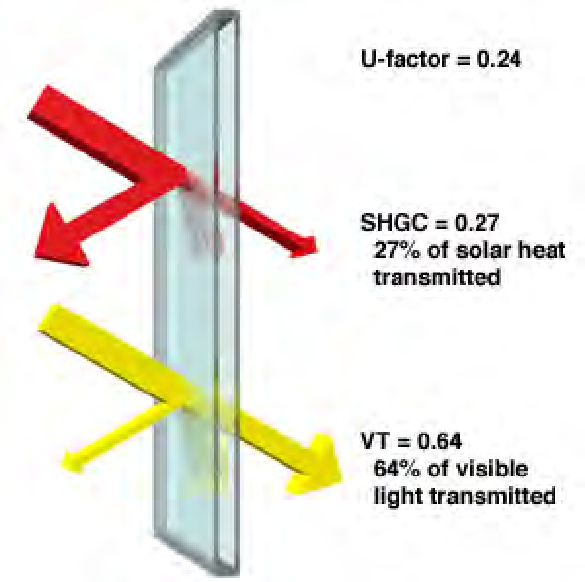
Modify the proposal as follows:

502.3.3 Visible Transmittance. For all glazed fenestration products other than skylights, the area-weighted average ratio of *visible transmittance / solar heat gain coefficient* shall be greater than 1.1~~1.5~~.

Commenter's Reason: EC180 should be approved as modified by this public comment or as submitted.

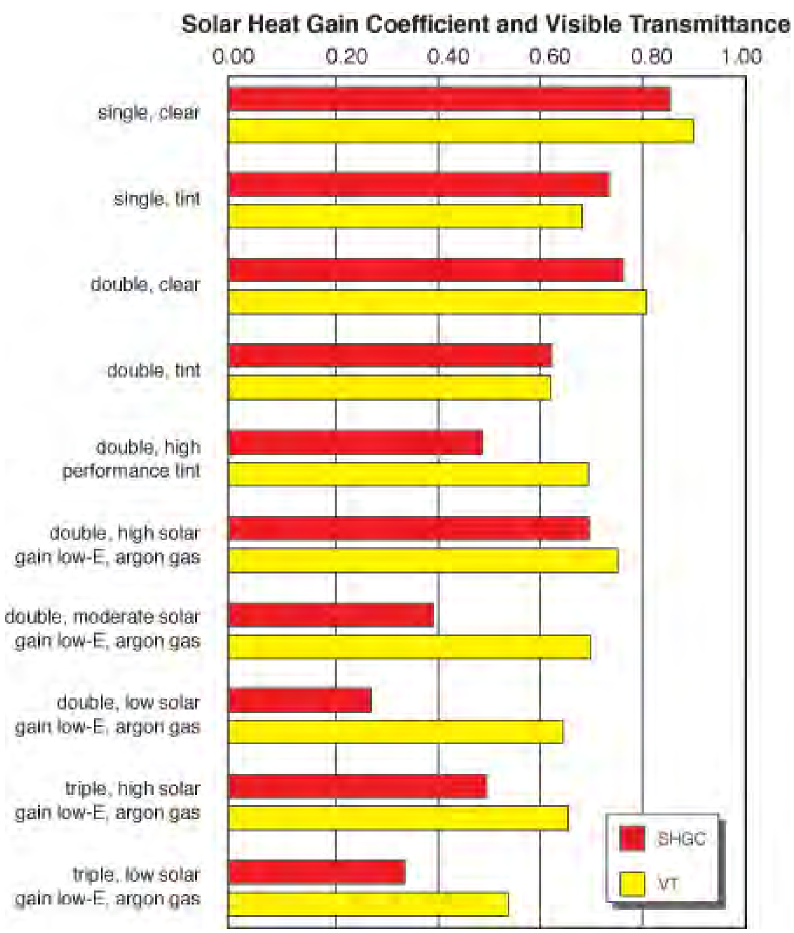
VT is the measure of light transmitted through fenestration. SHGC is the measure of solar heat gain transmitted through fenestration. Reducing SHGC reduces cooling energy use. Increasing VT has the potential to reduce cooling and lighting energy use, but only if lighting use is reduced when daylighting is available. Glass today has the potential to block most of the solar heat gain due to non-visible light, while having only a limited impact on visible light. Although low-SHGC/high-VT glass has been available for some time, this requirement would be the first time the IECC addressed this potential source of energy efficiency. The VT/SHGC ratio requirement would encourage buildings to capitalize on these products.

The following diagram from the website of the Efficient Windows Collaborative shows the effects of a typical low-SHGC/high-VT window that will reduce unwanted solar heat while providing adequate visible light.



Performance of Double-Glazed Low-Solar-Gain Low-E Glass (Spectrally Selective) and Argon Gas Fill

Similarly, the following graph shows a selection of some types of glass and relative VTs and SHGCs and demonstrates that today's windows can achieve extremely low SHGC without sacrificing any significant amount of VT.



Note: All values are for glass only without frame. Source: Residential Windows by Carmody, Selkowitx, Arasteh and Heschong.

EC180 as submitted or as modified has the potential to save energy by maintaining low SHGCs while increasing the amount of daylight let in by the window, potentially offsetting the use of artificial lighting in commercial spaces.

EC180 as submitted proposed a VT/SHGC ratio of 1.5. This means that fenestration on average would have to provide visible light equal to 1½ times the solar heat gain permitted. This was consistent with the First Public Review Draft of ASHRAE 90.1 -2010 Addendum bb, which required this same ratio for glazed fenestration other than skylights in buildings with glazing equal to 20% or less of wall area.

The modification proposed to EC180 in this public comment would reduce the VT/SHGC ratio to 1.1, meaning it would require less visible light as a ratio of SHGC. The 1.1 ratio is currently included in ASHRAE 90.1-2010 Addendum bb (approved by the ASHRAE 90.1 Committee in late June 2010). Adopting this proposal either as modified or as submitted would ensure that the IECC is at least as stringent as ASHRAE 90.1 in this area. While we believe a 1.5 ratio is reasonable, a 1.1 ratio is at least a step in right direction. The modification would also limit this requirement to glazed fenestration other than skylights, consistent with ASHRAE 90.1. It should be noted that ASHRAE adopted some exceptions to the VT/SHGC ratio; however, these exceptions over-complicate this simple concept and are unnecessary in our view. As a result, we have not proposed any exceptions to this requirement.

Final Action: AS AM AMPC____ D

EC182-09/10
202 (New), 502.4, 502.8 (New)

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

1. Add new definition as follows:

SITE. A contiguous area of land that is under the ownership or control of one entity.

2. Add new text as shown:

502.4 Building Integrated Renewable Energy System (Prescriptive). Each building shall be equipped with a renewable energy system, which has the capacity to provide 5 percent of the total energy use of the building on an annual basis. The renewable energy system shall be permitted to be located anywhere on the *building site* and must be capable of being used during daylight hours to provide power for the systems covered in Section 505.7 before being used elsewhere in the building, stored on site and/or transferred back to the grid.

505.7 Hallway and Loading Dock Lighting (Prescriptive). All hallway and loading dock lighting shall be provided with dedicated electrical circuits powered by a renewable energy system.

Exceptions:

1. Loading dock areas for law enforcement, fire, ambulance, and other emergency service vehicles
2. Loading docks and hallways that are not intended for daytime use
3. Where approved by the code official due to building site conditions or lack of building surface areas to support the necessary renewable energy system

3. Revise as follows:

~~**505.7**~~ **505.8 Electrical energy consumption. (Mandatory).** In buildings having individual dwelling units, provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units.

Reason: The availability of renewable energy resources to provide electric power is well known and technology exists today to provide cost effective solutions to replace power generated from non-renewables with power from renewables. This proposal requires such use where the building site or building surfaces will accommodate such installations.

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

ICCFILENAME: Majette-EC-32-502.4-

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee felt the proposal would move the code in a good direction, but there remains too many flaws in the proposal as written. Among the concerns was the difficulty in calculating the 5 % of the energy of the building.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Ronald Majette, representing U.S. Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**SITE.** A contiguous area of land that is under the ownership or control of one entity.~~

~~**502.4**~~ **<u>501.3</u>** ~~**Building Integrated**~~ **Renewable Energy System<u>s</u> (Prescriptive)**. Each building <u>greater than 25,000 square feet (2313 m^2) in floor area</u> shall be equipped with a renewable energy system, which has ~~the~~ <u>a</u> capacity ~~to provide~~ ~~5~~ <u>equal to at least one</u> percent of the total ~~energy use~~ <u>peak connected load</u> of the building ~~on an annual basis~~. ~~The renewable energy system shall be permitted to be located anywhere on the *building site* and must be capable of being used during daylight hours to provide power for the systems covered in Section 505.7 before being used elsewhere in the building, stored on site and/or transferred back to the grid.~~

> <u>**Exception:** Renewable energy systems need not be provided as follows:</u>
> <u>1. Where the building site and the building exterior surfaces do not provide sufficient area on which to locate a renewable energy system having the required capacity.</u>
> <u>2. For Group R-2 occupancy buildings</u>

~~**505.7 Hallway and Loading Dock Lighting (Prescriptive)**. All hallway and loading dock lighting shall be provided with dedicated electrical circuits powered by a renewable energy system.~~

> ~~**Exceptions:**~~
>
> ~~1. Loading dock areas for law enforcement, fire, ambulance, and other emergency service vehicles~~
> ~~2. Loading docks and hallways that are not intended for daytime use~~
> ~~3. Where approved by the code official due to building site conditions or lack of building surface areas to support the necessary renewable energy system~~

Commenter's Reason: Based on the testimony at the first hearing it was apparent that the proposal was too extensive in terms of its covering all commercial buildings and requiring a minimum 5% production of solar energy. In addition it was considered too prescriptive in indicating where the energy so generated should be applied in the building. The committee also indicated, while the proposed code language was in the right direction, it had too many flaws and it would be difficult to calculate the 5% annual energy use and evaluate that for compliance during plan review.

To address those concerns DOE is eliminating the specification of where the energy is to be used and has reduced the minimum production requirement from 5% to 1%. In addition DOE is proposing to tie compliance to the connected load of the building, which is readily available from the energy systems plans and specifications, and has made the provision applicable to fewer commercial buildings based on minimum floor area. In addition exceptions have been added to clarify the lack of solar access and available building area criteria that may not have been easily and uniformly applied as originally worded. An exception has also been added for R-2 buildings as many would be over 25,000 sq. ft. but would also be composed of individual units such as condos that could make it difficult to apply and enforce the provision.

Beyond these improvements to address comments received from the first hearing, DOE also provided an opportunity for all interested parties to review and comment on this public comment during the first 6 months of 2010, held a public meeting to discuss this change on May 11th and received input as late as June 28th. The revisions to the code change are consistent with comments received by DOE. The primary issue though remains the need for the code to require the capture and use of solar energy resources. As covered in the original reason statement and exhibited by increasing pressure on our non-renewable energy resources coupled with policy pressures to improve minimum energy standards we need to look to new opportunities in the codes to secure additional energy efficiency. Within in the context of a prescriptive code, solar is one such opportunity. The above proposal "breaks the ice" in this regard and applies it in all commercial buildings over 25,000 square feet in floor area in a way that is readily reviewed and validated during plan review and inspection. Given our current energy challenges and that only 0.02% of US electricity is produced by PV systems (EIA) serious consideration of this change is warranted.

It should be noted that DOE is not doing this without justification of associated costs. For instance, based on costs of PV systems installed ranging from $5,000 to $6,000 per kW (Advanced Green Technologies) and available solar hours throughout the US and a cost of $0.10 per kWh PV systems are cost effective. Consider the following results: 8 year payback (Chelan County WA); Nellis AFB PV system delivering electricity at $0.022 per kWh (Wikipidia); 112 kW PV system producing 13,300 kWh per month saving $2 million over 30 years (Marin Country Day School CA); 184 kW PV system producing 20,833 kWh per month and saving $37,500 per year (Fairbanks Ridge Family Apartments CA); 7.4 kW PV system producing $1,072 kWh per month and saving $2,000 per year (Build Inc. CA); and at $5,000 per kW, 5 sun hours per day, a 5% discount rate and no incentives a system will pay back in 30 years at $0.10 per kWh (Solarbuzz).

Final Action: AS AM AMPC____ D

EC183-09/10
502.4.1, 502.4.2

Proposed Change as Submitted

Proponent: Thomas D. Culp, Ph.D., Birch Point Consulting LLC, representing Aluminum Extruders Council

Revise as follows:

502.4 Air leakage (Mandatory).

502.4.1 Window and door assemblies. The air leakage of windows, skylights, and ~~sliding or swinging~~ door assemblies that are part of the building envelope shall be determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440, or NFRC 400 by an accredited, independent laboratory, and labeled and certified by the manufacturer. ~~and shall not exceed the values in Section 402.4.2~~ Windows and skylights shall have an air leakage rate of no more than 0.2 cfm per square foot (1.0 L/s/m^2) when tested at a pressure of at least 1.57 pounds per square foot (psf) (75 Pa), or 0.3 cfm per square foot (1.5 L/S/m^2) when tested at a pressure of at least 6.24 pounds per square foot (psf) (300 Pa). Door assemblies shall have an air leakage rate of no more than 0.3 cfm per square foot (1.5 L/s/m^2).

> **Exception:** Site-constructed windows and doors that are weather stripped or sealed in accordance with Section 502.4.3, and commercial entrance doors covered by Section 502.4.2.

502.4.2 Curtain wall, storefront glazing and commercial entrance doors. Curtain wall, storefront glazing and commercial-glazed swinging entrance doors and revolving doors shall be tested for air leakage at a pressure of at least 1.57 pounds per square foot (psf) (75 Pa) in accordance with ASTM E 283. For curtain walls and storefront glazing, the maximum air leakage rate shall be ~~0.3~~ 0.06 cubic foot per minute per square foot (cfm/ft2) (~~5.5~~ 1.1 m3/h × m^2) of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage rate shall be 1.00 cfm/ft^2 (18.3 m3/h × m^2) of door area when tested in accordance with ASTM E 283.

> **Exception:** Site-constructed fenestration and door products that are weatherstripped or sealed in accordance with Section 502.4.3.

Reason: The fenestration air leakage requirements have not been updated for many years, and there is an opportunity to increase stringency of this section. This proposal includes a significant yet realistic improvement in the air leakage for both curtainwall and commercial windows. Air leakage for both residential and commercial fenestration products are currently required to be measured in accordance with ASTM E283 at a test pressure of 1.57 psf. However, in actual practice, architectural specifications often require a higher test pressure of 6.24 psf, where commercial and architectural grade windows commonly achieve 0.3 cfm/ft2 or even 0.1 cfm/ft2 air leakage, and even lower for curtainwall. The air leakage increases with pressure by a factor of L2/L1 = (P2^n)/(P1^n) where n is between 1/2 and 1. Therefore, testing at 6.24 psf is 2-4 times more stringent than the standard testing at 1.57 psf. Put another way, these architectural grade windows would achieve an air leakage rate of between 0.08 – 0.15 cfm/ft2 at the normal test pressure – far below the current requirement.

Therefore, there is a reasonable opportunity for additional energy savings by further strengthening the air leakage requirement. The current language references the residential air leakage requirements in Section 402.4.2. This proposal is intended for commercial products, so rather than referring to the residential chapter, separate and more stringent requirements are explicitly spelled out here in the commercial chapter. We propose to moderately decrease the window and skylight requirement from 0.3 cfm/ft2 to 0.2 cfm/ft2 when being tested at the more standard 1.57 psf, but also leave the 0.3 cfm/ft2 for those products tested at the higher 6.24 psf. This is actually more stringent at the higher test pressure (equivalent to 0.08-0.15 cfm/ft2 at the lower pressure), but we did not feel comfortable lowering the corresponding air leakage at the lower 1.57 psf test pressure to below 0.2 cfm/ft2 to account for lighter products used in light commercial applications. The curtainwall value was reduced to 0.06 cfm/ft2, which our curtainwall manufacturers have confirmed as realistic and appropriate, considering the large fixed glazing area and lower ratio of perimeter frame length to glass area.

For a medium office building (3-story, 56,000 ft2, 40% WWR), the whole building energy savings are estimated to be 1-2% site energy / 0.5-1% source energy for windows, and 2-4.5% site energy / 1-2.5% source energy for curtainwall.

Cost Impact: The code change proposal will not increase the cost of construction, as current products are already achieving these performance levels.

ICCFILENAME: CULP-EC-2-502.4.1-502.4.2.DOC

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee approved EC147-09/10 which addresses the same issues in a different format. The proponent requested disapproval.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Thomas D. Culp , Birch Point Consulting, representing Aluminum Extruders Council, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

FIELD-FABRICATED FENESTRATION. A fenestration product whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut, or otherwise formed with the specific intention of being used to fabricate a fenestration product or exterior door. Field fabricated does not include site-built fenestration designed to be glazed or assembled in the field using specific factory cut or otherwise factory formed framing and glazing units, such as storefront systems, curtain walls, and atrium roof systems.

502.4 Air leakage (Mandatory).

502.4.1 Window and door assemblies. The air leakage of windows, skylights, and door assemblies that are part of the building envelope shall be determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440~~,~~ or NFRC 400 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Air leakage rates shall not exceed the following:

1. Sliding and swinging door assemblies shall have an air leakage rate of no more than 0.3 cfm per square foot (1.5 L/s/m2).
2. Unit skylights with condensation weepage openings shall have an air leakage rate of no more than 0.3 cfm per square foot (1.5 L/s/m2).
3. Windows and all other skylights shall have an air leakage rate of no more than 0.2 cfm per square foot (1.0 L/s/m2) when tested at a pressure of at least 1.57 pounds per square foot (psf) (75 Pa), or 0.3 cfm per square foot (1.5 L/s/m2) when tested at a pressure of at least 6.24 pounds per square foot (psf) (300 Pa). ~~Door assemblies shall have an air leakage rate of no more than 0.3 cfm per square foot (1.5 L/s/m2).~~
4. Garage doors shall have an air leakage rate of no more than 0.4 cfm per square foot (2.0 L/s/m2). Testing for air leakage in accordance with ASTM E 283 at a pressure of at least 1.57 pounds per square foot (psf) (75 Pa) shall also be permitted.

Exceptions: The following installations need not comply with this section:

1. ~~Site-constructed~~ Field-fabricated fenestration ~~windows and doors~~ that is ~~are~~ weatherstripped or sealed in accordance with Section 502.4.3.
2. Commercial entrance doors covered by Section 502.4.2.

502.4.2 Curtain wall, storefront glazing and commercial entrance doors. Curtain wall, storefront glazing and commercial-glazed swinging entrance doors and revolving doors shall be tested for air leakage at a pressure of at least 1.57 pounds per square foot (psf) (75 Pa) in accordance with ASTM E 283. For curtain walls and storefront glazing, the maximum air leakage rate shall be 0.06 cubic foot per minute per square foot (cfm/ft2) (1.1 m3/h × m2) of fenestration area. For commercial glazed swinging entrance doors and revolving doors, the maximum air leakage rate shall be 1.00 cfm/ft2 (18.3 m3/h × m2) of door area when tested in accordance with ASTM E 283.

Exception: ~~Site-constructed~~ Field-fabricated fenestration ~~and door products~~ that is ~~are~~ weatherstripped or sealed in accordance with Section 502.4.3 need not comply with this section.

Commenter's Reason: As the proponent, we asked for disapproval of EC183 at the preliminary hearings because very similar requirements had already been approved as part of EC147 from the New Buildings Institute, American Institute of Architects, and U.S. Department of Energy. Similarly, if EC147 is approved at the final action hearings, we will withdraw this proposal.

However, in the case EC147 is not approved for some other reason, we ask for your support of EC183 either as-submitted or as-modified by this comment. While the original proposal is still a significant improvement over the existing code, the modifications here bring the proposal more in line with the requirements of EC147, and recently approved requirements for ASHRAE 90.1. Additionally, similar requirements already exist in the Massachusetts "stretch" energy code, and have completed public review for the Seattle Energy Code.

This proposal represents a significant increase in energy efficiency, and one easily achieved. While under discussion by ASHRAE 90.1, a review of products from representative manufacturers indicated that over 90% of operable windows already met these criteria, as well as practically 100% of fixed windows. This is true for both residential and commercial windows, and *all* frame types – wood, vinyl, and aluminum.

We ask for you to vote against the initial standing motion for disapproval, followed by a vote to approve of EC183 as modified by this public comment.

Final Action: AS AM AMPC____ D

EC184-09/10
502.4.1 (New), 502.4.3

Proposed Change as Submitted

Proponent: Theresa Weston, PhD., representing DuPont Building Innovations

1. Add new text as follows:

502.4.1 Air Barriers. The building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space. An air barrier system shall also be provided for interior separations between conditioned space and a space designed to maintain temperature levels higher than 50 degrees for heating and less than 85 degrees for cooling or spaces that are designed to operate with humidity levels of less than 20% or more than 60 percent relative humidity.

The air barrier shall have the following characteristics:

1. It shall be continuous, with all joints made airtight per Section 502.4.4
2. Materials used for the air barrier system shall have an air permeability not to exceed 0.004 cfm/ft2 under a pressure differential of 0.3 in. water (1.57psf) (0.02 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2178. Air barrier materials shall be taped or sealed in accordance with the manufacturer's instructions.
3. Air barrier materials shall be maintainable, or, if inaccessible, shall meet the durability requirements for the service life of the envelope assembly.

2. Revise as follows:

~~502.4.3~~ 502.4.4 Sealing of the opaque building envelope. Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials due to thermal and moisture variations and creep. Connections shall be made between:

1. Joints around *fenestration* and *door* frames
2. Junctions between *walls* and foundations, between *walls* at building corners, between *walls* and structural *floors* or *roofs*, and between *walls* and *roof* or *wall* panels
3. Openings at penetrations of utility services through *roofs*, *walls*, and *floors*
4. Site-built *fenestration* and *doors*
5. Building assemblies used as ducts or plenums
6. All other openings in the *building envelope*

Reason: Although the code currently contains requirements parts of the building, the code lacks a comprehensive statement of how air sealing of the whole building is achieved. This proposal introduces a framework to tie together existing language on sealing individual parts of the buildings. This IECC code proposal also includes quantitative, measurable air leakage rates for air barrier materials in order to significantly improve envelope performance and reduce a building's energy consumption.

Building envelope airtightness can have a significant impact on HVAC energy use. Many references exist on the impact of air leakage on HVAC energy use. According to DOE, NRCC, and others, uncontrolled air movement through the building envelope (infiltration and exfiltration) can account for up to 50% of heating and a significant part of cooling loads, representing up to 30% of a building's annual HVAC costs [1, 2, 3, 4, 5, 6, 7].

Air Barriers are well known technologies for achieving airtightness for the opaque building envelope. The air barrier materials must have a very low air leakage rate. The National Building Code of Canada and the Massachusetts Building Code consider 0.004 cfm at 75 Pa (the air permeance of ½" unpainted gypsum board) as the maximum air leakage rate for the air barrier material as part of the opaque envelope. When essentially airtight materials are assembled together by sealing, taping, etc., the assembly will have a higher leakage than the original air barrier material, primarily due to higher leakage at the joints. Likewise, as the assemblies are joined together in a building, that building enclosure will leak more than the individual assemblies, once again primarily due to increased leakage at the joints between assemblies and at unanticipated openings. In order to achieve a reasonable whole building airtightness, the basic materials selected for the air barrier must be resistant to air leakage.

In spite of the common believe that the recent buildings are more airtight, analysis of field data show that whole building leakage rates far exceed the levels generally considered acceptable and the levels that were generally assumed were not being achieved. Clearly, the lack of quantitative air leakage rate standards has allowed very leaky buildings.

An Air Barrier proposal was developed by ASHRAE 90.1, and it is currently out for public review. This proposal requires that materials and assemblies that are acceptable as part of the continuous air barrier for the opaque building envelope shall comply with one of the following requirements (Section 5.4.3.1.3):

a. Materials air permeance not to exceed 0.004 cfm/ft2 under a pressure differential of 0.3" w.g. (1.57psf) (0.02 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2178.

b. Assemblies average air leakage not to exceed 0.04 cfm/ft2 under a pressure differential of 0.3" w.g. (1.57psf) (0.2 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2357 or ASTM E 1677.

References:

About Air Barriers, Air Barrier Association of America, www.airbarrier.org/aboutairbarriers.htm

Air Leakage, University of Waterloo, Building Engineering Group, www.civil.uwaterloo.ca/beg/air_leaks.htm

Air Leakage of Office Buildings, BSRIA, Technical Note 8/95, I. N. Potter, T. J. Jones, and W. B. Booth, www.construction-index.com/docbsriairle.html
Air Sealing, DOE, EERE, Technology Fact Sheet, www.eere.energy.gov/buildings/info/documents/pdfs/26448.pdf
Air Tightness Testing, A Guide for Clients and Contractors, BSRIA, Technical Note 19/2001, Nigel Potter
Energy Impacts of Air Leakage in U.S. Office Buildings, D. A. VanBronkhorst; A. K. Persily; S. J. Emmerich, http://fire.nist.gov/bfrlpubs/build95/PDF/b95024.pdf
Understanding and Controlling Air Flow in Buildings Enclosures, John Straube, www.civil.uwaterloo.ca/beg/Downloads/8thBSTC%20Air%20Flow%20Control.pdf

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: Weston-EC-3-502.4.1

Public Hearing Results

Committee Action: Disapproved

Committee Reason: The content of this proposal were not consistent with EC147-09/10. Proponent anticipates resolving the differences by a public comment.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Theresa A. Weston, representing DuPont Building Innovations requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

502.4.1 Air Barriers. ~~The building envelope shall be designed and constructed with a continuous air barrier to control air leakage into, or out of the conditioned space. An air barrier system shall also be provided for interior separations between conditioned space and a space designed to maintain temperature levels higher than 50 degrees for heating and less than 85 degrees for cooling or spaces that are designed to operate with humidity levels of less than 20% or more than 60 percent relative humidity.~~ A continuous air barrier shall be provided throughout the building themal 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 ~~have the following characteristics~~:comply with the following:

1. ~~It~~ The barrier shall be continuous,
2. ~~with~~ All joints shall be made airtight ~~per~~ in accordance with Section 502.4.4,
3. Materials used for the air barrier system shall have an air permeability ~~not to exceed~~ no greater than 0.004 cfm/ft2 under a pressure differential of 0.3 in. water (1.57psf) (0.02 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2178; and
4. ~~Air barrier materials shall be taped or sealed in accordance with the manufacturer's instructions. Complying materials shall be installed as air barriers in accordance with manufacturer's installation instructions~~ Materials used as an air barrier shall be installed in accordance with manufacturer's installation instructions for air barriers.
~~3. Air barrier materials shall be maintainable, or, if inaccessible, shall meet the durability requirements for the service life of the envelope assembly.~~

502.4.4 Sealing of the opaque building envelope. Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials due to thermal and moisture variations. ~~and creep. Connections shall be made between:~~

~~1. Joints around *fenestration* and *door* frames~~
~~2. Junctions between *walls* and foundations, between *walls* at building corners, between *walls* and structural *floors* or *roofs*, and between *walls* and *roof* or *wall* panels~~

3. ~~Openings at penetrations of utility services through *roofs*, *walls*, and *floors*~~
4. ~~Site-built *fenestration* and *doors*~~
5. ~~Building assemblies used as ducts or plenums~~
6. ~~All other openings in the *building envelope*~~

Commenter's Reason: As the proponent of this proposal we requested disapproval at the technical hearings, so that there would be a chance to revise the proposal to improve the clarity and enforceability of the proposed language. The modification clarifies the original proposal language and intent to improve the quantification and therefore the enforceability of the code's air sealing requirements. Air barriers are important to both the energy efficiency and durability of wall structures. Although the code currently contains requirements parts of the building, the code lacks a comprehensive statement of how air sealing of the whole building is achieved. This IECC code proposal includes quantitative, measurable air leakage rates for air barrier materials in order to significantly improve enforceability of the code requirements and, therefore, envelope performance and energy efficiency. Building envelope airtightness can have a significant impact on HVAC energy use. Many references exist on the impact of air leakage on HVAC energy use. According to DOE, NRCC, and others, uncontrolled air movement through the building envelope (infiltration and exfiltration) can account for up to 50% of heating and a significant part of cooling loads, representing up to 30% of a building's annual HVAC costs [1, 2, 3, 4, 5, 6,7].

Air Barriers are well known technologies for achieving airtightness for the opaque building envelope. The air barrier materials must have a very low air leakage rate. The National Building Code of Canada and the Massachusetts Building Code consider 0.004 cfm at 75 Pa (the air permeance of ½" unpainted gypsum board) as the maximum air leakage rate for the air barrier material as part of the opaque envelope. When essentially airtight materials are assembled together by sealing, taping, etc., the assembly will have a higher leakage than the original air barrier material, primarily due to higher leakage at the joints. Likewise, as the assemblies are joined together in a building, that building enclosure will leak more than the individual assemblies, once again primarily due to increased leakage at the joints between assemblies and at unanticipated openings. In order to achieve a reasonable whole building airtightness, the basic materials selected for the air barrier must be resistant to air leakage. In spite of the common believe that the recent buildings are more airtight, analysis of field data show that whole building leakage rates far exceed the levels generally considered acceptable and the levels that were generally assumed were not being achieved. Clearly, the lack of quantitative air leakage rate standards has allowed very leaky buildings.

References:

About Air Barriers, Air Barrier Association of America, www.airbarrier.org/aboutairbarriers.htm
Air Leakage, University of Waterloo, Building Engineering Group, www.civil.uwaterloo.ca/beg/air_leaks.htm
Air Leakage of Office Buildings, BSRIA, Technical Note 8/95, I. N. Potter, T. J. Jones, and W. B. Booth, www.constructionindex.com/docbsriairle.html
Air Sealing, DOE, EERE, Technology Fact Sheet, www.eere.energy.gov/buildings/info/documents/pdfs/26448.pdf
Air Tightness Testing, A Guide for Clients and Contractors, BSRIA, Technical Note 19/2001, Nigel Potter
Energy Impacts of Air Leakage in U.S. Office Buildings, D. A. VanBronkhorst; A. K. Persily; S. J. Emmerich, http://fire.nist.gov/bfrlpubs/build95/PDF/b95024.pdf
Understanding and Controlling Air Flow in Buildings Enclosures, John Straube, www.civil.uwaterloo.ca/beg/Downloads/8thBSTC%20Air%20Flow%20Control.pdf

Final Action: AS AM AMPC____ D

EC188-09/10
503

<u>Proposed Change as Submitted</u>

Proponent: David Cohan, representing Northwest Energy Efficiency Alliance

Revise as follows:

SECTION 503
BUILDING MECHANICAL SYSTEMS

503.2.1 Calculation of heating and cooling loads. Design loads shall be determined in accordance with the procedures described in the ASHRAE/ACCA Standard 183. <u>The design loads shall account for the building envelope, lighting, ventilation and occupancy loads based on the project design.</u> Heating and cooling loads shall be adjusted to account for load reductions that are achieved when energy recovery systems are utilized in the HVAC system in accordance with the ASHRAE *HVAC Systems and Equipment Handbook*. Alternatively, design loads shall be determined by an *approved* equivalent computation procedure, using the design parameters specified in Chapter 3.

503.2.5.1 Demand controlled ventilation. Demand control ventilation (DCV) is required for spaces larger than 500 ft^2 (50m^2) and with an average occupant load of 40 <u>25</u> people per 1000 ft^2(93 m^2) of floor area (as established in Table 403.3 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; or
3. A design outdoor airflow greater than 3,000 cfm (1400 L/s).

Exceptions:

1. Systems with energy recovery complying with Section 503.2.6.
2. Multiple-zone systems without direct digital control of individual zones communicating with a central control panel.
3. System with a design outdoor airflow less than 1,200 cfm (600 L/s).
4. Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1,200 cfm (600 L/s).
5. <u>Building spaces where the primary ventilation needs are for process loads.</u>

~~**503.2.9 HVAC system completion.** Prior to the issuance of a certificate of occupancy, the design professional shall provide evidence of system completion in accordance with Sections 503.2.9.1 through 503.2.9.3.~~

~~**503.2.9.1 Air system balancing.** Each supply air outlet and *zone* terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International Mechanical Code*. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 horsepower (hp) (7.4 kW) and larger.~~

~~**503.2.9.2 Hydronic system balancing.** Individual hydronic heating and cooling coils shall be equipped with means for balancing and pressure test connections.~~

~~**503.2.9.3 Manuals.** The construction documents shall require that an operating and maintenance manual be provided to the building owner by the mechanical contractor.~~

~~The manual shall include, at least, the following:~~

1. ~~Equipment capacity (input and output) and required maintenance actions.~~
2. ~~Equipment operation and maintenance manuals.~~
3. ~~HVAC system control maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings, at control devices or, for digital control systems, in programming comments.~~
4. ~~A complete written narrative of how each system is intended to operate.~~

503.2.9 Mechanical systems commissioning and completion requirements. Mechanical systems commissioning and completion shall be in accordance with the provisions of Section 503.2.9.1 through 503.2.9.3.4.

503.2.9.1 System commissioning. Commissioning is a process that verifies and documents that the selected building systems have been designed, installed, and function according to the owner's project requirements and construction documents, and to minimum code requirements. Drawing notes shall require commissioning and completion requirements in accordance with this section. Drawing notes may refer to equipment specifications for further requirements. Copies of all documentation shall be given to the owner. The building official may request commissioning documentation for review purposes. At the time of plan submittal, the building jurisdiction shall be provided, by the submittal authority, a letter of intent to commission the building in accordance with this code.

503.2.9.1.1 Commissioning plan. A commissioning plan shall include as a minimum the following items:

1. A detailed explanation of the building's project requirements for mechanical design,
2. A narrative describing the activities that will be accomplished during each phase of commissioning, including guidance on who accomplishes the activities and how they are completed,
3. Equipment and systems to be tested, including the extent of tests,
4. Functions to be tested (for example calibration, economizer control, etc.),
5. Conditions under which the test shall be performed (for example winter and summer design conditions, full outside air, etc.), and
6. Measurable criteria for acceptable performance.

503.2.9.1.2 Systems adjusting and balancing. All HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within 10% of design rates. Test and balance activities shall include as a minimum the following items:

1. **Air systems balancing**: Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the International Mechanical Code. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, Fan speed shall be adjusted to meet design flow conditions.

   Exception: Fan with fan motors of 1 hp or less.

2. **Hydronic systems balancing:** Individual hydronic heating and cooling coils shall be equipped with means for balancing and pressure test connections. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the ability to measure pressure across the pump, or test ports at each side of each pump.

   Exceptions:

   1. Pumps with pump motors of 5 hp or less.
   2. When throttling results in no greater than 5% of the nameplate horsepower draw above that required if the impeller were trimmed.

503.2.9.1.3 Functional performance testing. Equipment functional performance testing shall be in accordance with Section 503.2.9.1.3.1. Functional testing of HVAC controls shall be in accordance with Section 503.2.9.1.3.2.

503.2.9.1.3.1 Equipment functional performance testing. Equipment functional performance testing shall demonstrate the correct installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications. This demonstration is to prove the operation, function, and maintenance serviceability for each of the Commissioned systems. Testing shall include all modes of operation, including:

1. All modes as described in the Sequence of Operation,
2. Redundant or automatic back-up mode,
3. Performance of alarms, and
4. Mode of operation upon a loss of power and restored power.

Exception: Unitary or packaged HVAC equipment listed in Tables 503.2.3 (1) through (3) that do not require supply air economizers.

503.2.9.1.3.2 Controls functional performance testing. HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with approved plans and specifications.

503.2.9.1.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and provided to the Owner. The report shall be identified as "Preliminary Commissioning Report" and shall identify:

1. Itemization of deficiencies found during testing required by this section which have not been corrected at the time of report preparation and the anticipated date of correction.
2. Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.
3. Climatic conditions required for performance of the deferred tests, and the anticipated date of each deferred test.

503.2.9.2 Acceptance. Buildings, or portions thereof, required by this code to comply with this section shall not be issued a final certificate of occupancy allowing public or owner occupation until such time that the building official has received a letter of transmittal from the building owner that states they have received the Preliminary Commissioning Report as required by Section 503.2.9.1.4. At the request of the code official, a copy of the Preliminary Commissioning Report shall be made available for review.

503.2.9.3 Completion requirements. The construction documents shall require that within 90 days after the date of final certificate of occupancy, the documents described in this section be provided to the building owner.

503.2.9.3.1 Drawings. Construction documents shall include as a minimum the location and performance data on each piece of equipment.

503.2.9.3.2 Manuals. An operating manual and a maintenance manual shall be in accordance with industry-accepted standards and shall include, at a minimum, the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Names and addresses of at least one service agency.
4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.
5. A complete narrative of how each system is intended to operate, including suggested setpoints.

503.2.9.3.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section 503.2.9.1.2

503.2.9.3.4 Final commissioning report. A complete report of test procedures and results identified as "Final Commissioning Report" shall include:

1. Results of all Functional Performance Tests.
2. Disposition of all deficiencies found during testing, including details of corrective measures used or proposed.
3. All Functional Performance Test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

   Exception: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

Reason: This proposal takes a large step toward ensuring that the energy savings potential inherent in the IECC is actually achieved in buildings. Commissioning is a systematic process of verification and documentation that ensures that the selected building systems have been designed, installed and function properly, efficiently, and can be maintained in accordance with the contract documents in order to satisfy the building owner's design intent and operational requirements. Almost 20 years of well-documented experience show that, in the absence of commissioning, building systems commonly do not operate as designed or intended. This results in poor energy performance and uncomfortable occupants.

In 2004, Lawrence Berkeley National Laboratory published a study entitled “THE COST-EFFECTIVENESS OF COMMERCIAL-BUILDINGS COMMISSIONING, A Meta-Analysis of Energy and Non-Energy Impacts in Existing Buildings and New Construction in the United States” which analyzed results from 224 buildings across 21 states, representing 30.4 million square feet of commissioned floor area (73 percent in existing buildings and 27 percent in new construction). These projects collectively represent $17 million ($2003) of commissioning investment. The new-construction cohort represents $1.5 billion of total construction costs.

For existing buildings, they found median commissioning costs of $0.27/ft2, whole-building energy savings of 15 percent, and payback times of 0.7 years. For new construction, median commissioning costs were $1.00/ft2 (0.6 percent of total construction costs), yielding a median payback time of 4.8 years (excluding quantified non-energy impacts). These results are conservative insofar as the scope of commissioning rarely spans all fuels and building systems in which savings may be found, not all recommendations are implemented, and significant first-cost and ongoing non-energy benefits are rarely quantified.

The study notes that, “Some view commissioning as a luxury and ‘added’ cost, yet it is only a barometer of the cost of errors promulgated by other parties involved in the design, construction, or operation of buildings. Commissioning agents are just the ‘messengers’; they are only revealing and identifying the means to address pre-existing problems”. The study concludes that “commissioning is one of the most cost-effective means of improving energy efficiency in commercial buildings.”

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

ICCFILENAME: COHAN-EC-2-503.DOC

Public Hearing Results

Committee Action: Approved as Submitted

Committee Reason: The proposal is consistent with the approved EC147-09/10. It provides similar improvements in energy savings. If EC147 proved to be fatally flawed and were disapproved at final action hearings, this change will serve the goal of significant energy savings for the 2012 IECC.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Shahriar Amiri, Arlington County and Richard Grace, Fairfax Virginia, Virginia Plumbing and Mechanical Inspectors Association (VPMIA), Virginia Building Code Officials Association (VBCOA), ICC Region VII, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

503.2.9 Commissioning. Where the option of mechanical systems commissioning is elected to be performed, Appendix A shall be considered an approved method.

APPENDIX A

SECTION A101
GENERAL

~~**503.2.9**~~ **A101.1 Mechanical systems commissioning and completion requirements.** Mechanical systems commissioning and completion shall be in accordance with the provisions of Section ~~503.2.9.1~~ A101.2 through ~~503.2.9.3.4~~ A101.4.4.

~~**503.2.9.1**~~ **A101.2 System commissioning.** Commissioning is a process that verifies and documents that the selected building systems have been designed, installed, and function according to the owner’s project requirements and construction documents, and to minimum code requirements. Drawing notes shall require commissioning and completion requirements in accordance with this section. Drawing notes may refer to equipment specifications for further requirements. Copies of all documentation shall be given to the owner. The building official may request commissioning documentation for review purposes. At the time of plan submittal, the building jurisdiction shall be provided, by the submittal authority, a letter of intent to commission the building in accordance with this code.

~~**503.2.9.1.1**~~ **A101.2.1 Commissioning plan.** A commissioning plan shall include as a minimum the following items:

1. A detailed explanation of the building’s project requirements for mechanical design,
2. A narrative describing the activities that will be accomplished during each phase of commissioning, including guidance on who accomplishes the activities and how they are completed,
3. Equipment and systems to be tested, including the extent of tests,
4. Functions to be tested (for example calibration, economizer control, etc.),
5. Conditions under which the test shall be performed (for example winter and summer design conditions, full outside air, etc.), and
6. Measurable criteria for acceptable performance.

~~503.2.9.1.2~~ A101.2.2 Systems adjusting and balancing. All HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within 10 percent of design rates. Test and balance activities shall include as a minimum the following items:

1. **Air systems balancing**: Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the International Mechanical Code. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, Fan speed shall be adjusted to meet design flow conditions.

   Exception: Fan with fan motors of 1 hp or less.

2. **Hydronic systems balancing:** Individual hydronic heating and cooling coils shall be equipped with means for balancing and pressure test connections. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the ability to measure pressure across the pump, or test ports at each side of each pump.

   Exceptions:

   1. Pumps with pump motors of 5 hp or less.
   2. When throttling results in no greater than 5 percent of the nameplate horsepower draw above that required if the impeller were trimmed.

~~503.2.9.1.3~~ A101.2.3 Functional performance testing. Equipment functional performance testing shall be in accordance with Section ~~503.2.9.1.3.1~~ A101.2.3.1. Functional testing of HVAC controls shall be in accordance with Section ~~503.2.9.1.3.2~~ A101.2.3.2.

~~503.2.9.1.3.1~~ A101.2.3.1 Equipment functional performance testing. Equipment functional performance testing shall demonstrate the correct installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications. This demonstration is to prove the operation, function, and maintenance serviceability for each of the Commissioned systems. Testing shall include all modes of operation, including:

1. All modes as described in the Sequence of Operation,
2. Redundant or automatic back-up mode,
3. Performance of alarms, and
4. Mode of operation upon a loss of power and restored power.

   Exception: Unitary or packaged HVAC equipment listed in the International Energy Conservation Code Tables 503.2.3 (1) through (3) that do not require supply air economizers.

~~503.2.9.1.3.2~~ A101.2.3.2 Controls functional performance testing. HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with approved plans and specifications.

~~503.2.9.1.4~~ A101.2.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and provided to the Owner. The report shall be identified as "Preliminary Commissioning Report" and shall identify:

1. Itemization of deficiencies found during testing required by this section which have not been corrected at the time of report preparation and the anticipated date of correction.
2. Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.
3. Climatic conditions required for performance of the deferred tests, and the anticipated date of each deferred test.

~~503.2.9.2~~ A101.3 Acceptance. Buildings, or portions thereof, required by this code to comply with this section shall not be issued a final certificate of occupancy allowing public or owner occupation until such time that the building official has received a letter of transmittal from the building owner that states they have received the Preliminary Commissioning Report as required by Section ~~503.2.9.1.4~~ A101.2.4. At the request of the code official, a copy of the Preliminary Commissioning Report shall be made available for review.

~~503.2.9.3~~ A101.4 Completion requirements. The construction documents shall require that within 90 days after the date of final certificate of occupancy, the documents described in this section be provided to the building owner.

~~503.2.9.3.1~~ A101.4.1 Drawings. Construction documents shall include as a minimum the location and performance data on each piece of equipment.

~~503.2.9.3.2~~ A101.4.2 Manuals. An operating manual and a maintenance manual shall be in accordance with industry-accepted standards and shall include, at a minimum, the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Names and addresses of at least one service agency.
4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.
5. A complete narrative of how each system is intended to operate, including suggested setpoints.

~~503.2.9.3.3~~ A101.4.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section ~~503.2.9.1.2~~ A101.2.2.

~~503.2.9.3.4~~ A101.4.4 **Final commissioning report.** A complete report of test procedures and results identified as "Final Commissioning Report" shall include:

1. Results of all Functional Performance Tests.
2. Disposition of all deficiencies found during testing, including details of corrective measures used or proposed.
3. All Functional Performance Test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

   Exception: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: (Shahriar Amiri) The proposal approved by the committee takes a huge step towards making sure that the mechanical system performs as designed for its intended purpose. However, the proposed language has serious enforcement flaws. It contains many permissive languages, it has requirements that go well beyond what is required by code and puts a huge responsibility on the local building official in making sure that the project specifications that are beyond the minimum code requirements are met. This is legally impossible to do. We are recommending to place the entire Section in an appendix in an effort to correct it in the next code cycle and to bring it back to the body of the code.

(Richard Grace) We are not opposed to commissioning, in fact we fully support the concept. What we are opposed to is including language into a code that is not enforceable, inconsistent, or is written in such a way that enforcement will place a burden on building owners when occupancy permits are held up based on incomplete commissioning reports. There are many examples of this contained within this code change.

(1) 503.2.9.1 – "**verifies and documents that the selected building systems have been designed, installed, and function according to the owner's project requirements**". A code official's responsibility is to enforce the minimum requirements of the code. Owner's project requirements may far exceed the code's minimum. It is not within the code officials authority to enforce requirements that far exceed code requirements.
(2) 503.2.9.1 - "**Copies of all documentation shall be given to the owner**." We do not agree with language included in the code that requires a code official to verify contractual issues between an owner and their agents, designers, or contractors.
(3) 503.2.9.1.2 – "**All HVAC systems shall be balanced in accordance with generally accepted engineering standards**." "Shall be" is positive, enforceable language, however "generally accepted" is so open ended that consistency between any two individuals will be virtually impossible.
(4) 503.2.9.2 – "**shall not be issued a final certificate of occupancy**". This section states that a certificate of occupancy shall not be issued without receiving a letter from the owner stating that they have received the Preliminary Commissioning Report. Why should the owner of a building be penalized in such a harsh manner for a procedure that can obviously be conducted after occupancy.
(5) 503.2.9.3 – "**shall require that within 90 days after the date of final certificate of occupancy**". This section requires the code official to go back to the building owner after issuing the certificate of occupancy and verify that the building owner was provided with drawings, manuals, system balancing report, and the final commissioning report. Wow! After the certificate of occupancy is issued, the International Energy Conservation Code is no longer applicable to the building or building owner. I truly do not understand how this is going to work. What gives the code official the authority to verify and comply with this code section? What recourse does a code official have if the documentation is not provided to the building owner? Is the certificate of occupancy voided and the building occupants forced to vacate? After the certificate of occupancy is issued, the IECC is not longer applicable. The applicable code after the certificate of occupancy is issued is the Property Maintenance Code.

Public Comment 2:

Dave Hewitt, New Buildings Institute requests Approval as Modified by this Public Comment.

Replace the proposal as follows:

SECTION 508
SYSTEM COMMISSIONING

508.1 General. This section covers the commissioning of the building mechanical systems in Section 503 and electrical power and lighting systems in Section 505.

508.2 Mechanical systems commissioning and completion requirements.

Prior to passing the final mechanical inspection, the registered design professional shall provide evidence of mechanical systems commissioning and completion in accordance the provisions of this Section.

Construction document notes shall clearly indicate provisions for commissioning and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the code official upon request in accordance with Sections 508.2.4 and 508.2.5

Exceptions: The following systems are exempt from the commissioning requirements:

1. Mechanical systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h cooling capacity and 600,000 Btu/h heating capacity.
2. Systems included in Section 503.3 that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units

508.2.1 Commissioning plan. A commissioning plan shall be developed by a registered design professional or approved agency and shall include the following items:

1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
2. A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed.
3. Functions to be tested including, but not limited to calibrations and economizer controls.
4. Conditions under which the test will be performed . Testing must affirm winter and summer design conditions and full outside air conditions.

5. Measurable criteria for performance.

508.2.2 Systems adjusting and balancing. HVAC systems shall be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within the tolerances provided in the product specifications. Test and balance activities shall include the following:

508.2.2.1. **Air systems balancing**: Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International Mechanical Code*. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 10 hp (18.6 kW) and larger. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, fan speed shall be adjusted to meet design flow conditions.

Exception: Fans with fan motors of 1 hp or less.

508.2.2.2 Hydronic systems balancing: Individual hydronic heating and cooling coils shall be equipped with means for balancing and measuring flow. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the capability to measure pressure across the pump, or test ports at each side of each pump.

Exceptions:

1. Pumps with pump motors of 5 hp or less.
2. When throttling results in no greater than five percent of the nameplate horsepower draw above that required if the impeller were trimmed.

508.2.3 Functional performance testing. Functional performance testing specified in Sections 508.2.3.1 through 508.2.3.3 shall be conducted.

508.2.3.1 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, and
4. Mode of operation upon a loss of power and restoration of power.

Exception: Unitary or packaged HVAC equipment listed in Tables 503.2.3 (1) through (3) that do not require supply air economizers.

508.2.3.2 Controls. HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with approved plans and specifications.

508.2.3.3 Economizers. Air economizers shall undergo a functional test to determine that they operate in accordance with manufacturer's specifications.

508.2.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and certified by the registered design professional or approved agency and provided to the building owner . The report shall be identified as "Preliminary Commissioning Report" and shall identify:

1. Itemization of deficiencies found during testing required by this section that have not been corrected at the time of report preparation
2. Deferred tests that cannot be performed at the time of report preparation because of climatic conditions.
3. Climatic conditions required for performance of the deferred tests.

508.2.4.1 Acceptance of Report. Buildings, or portions thereof, shall not pass the final mechanical inspection until such time as the code official has received a letter of transmittal from the building owner acknowledging that the building owner has received the Preliminary Commissioning Report.

508.2.4.2 Copy of Report. The code official shall be permitted to require that a copy of the Preliminary Commissioning Report be made available for review to the code official.

508.2.5 Documentation requirements. The construction documents shall specify that the documents described in this Section be provided to the building owner within 90 days of the date of receipt of the certificate of occupancy.

508.2.5.1Drawings. Construction documents shall include the location and performance data on each piece of equipment.

508.2.5.2 Manuals. An operating and maintenance manual shall be provided and include all of the following:

1 Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Manufacturer's operation manuals and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Name and address of at least one service agency.
4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in system programming instructions.
5. A narrative of how each system is intended to operate, including recommended setpoints.

508.2.5.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section 508.2.2.

508.2.5.4 Final Commissioning Report. A report of test procedures and results identified as "Final Commissioning Report" shall be delivered to the building owner and shall include:

1. Results of Functional Performance Tests.
2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
3. Functional Performance Test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

Portions of the proposal not shown remain unchanged.

Commenter's Reason: This Public Comment contains language identical to that in a public comment submitted to EC 147 as Public comment 4.

Public Comment 3:

Shahriar Amiri, Arlington County requests Disapproval.

Commenter's Reason: The proposal approved by the committee takes a huge step towards making sure that the mechanical system performs as designed for its intended purpose. However, the proposed language has serious enforcement flaws. It contains many permissive languages, it has requirements that go well beyond what is required by code and puts a huge responsibility on the local building official in making sure that the project specifications that are beyond the minimum code requirements are met. This is legally impossible to do.

Final Action: AS AM AMPC____ D

EC191-09/10

503.2.3, Table 503.2.3(8) (New), Table 503.2.3(9) (New), Chapter 6

Proposed Change as Submitted

Proponent: Steve Ferguson, representing The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

1. Revise as follows:

503.2.3 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables 503.2.3(1), 503.2.3(2), 503.2.3(3), 503.2.3(4), 503.2.3(5), 503.2.3(6) ~~and~~ 503.2.3(7), and 503.2.3(8) when tested and rated in accordance with the applicable test procedure. Requirements for plate type liquid to liquid heat exchangers can be found in Table 503.2.3(9). The efficiency shall be verified through certification under an *approved* certification program or, if no certification program exists, 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.

Exception: Water-cooled centrifugal water-chilling packages listed in Table 503.2.3(7) not designed for operation at ARHI Standard 550/590 test conditions of 44°F (7°C) leaving chilled water temperature and 85°F (29°C) entering condenser water temperature with 3 gpm/ton (0.054 I/s.kW) condenser water flow shall have maximum full load and NPLV ratings adjusted using the following equations:

Adjusted maximum full load kW/ton rating = [full load kW/ton from Table 503.2.3(7)]/K_{adj}

Adjusted maximum NPLV rating = [IPLV from Table 503.2.3(7)]/K_{adj}

where:

$K_{adj} = 6.174722 - 0.303668(X) + 0.00629466(X)^2 - 0.000045780(X)^3$
$X = DT_{std} + LIFT$
DT_{std} = {24+[full load kW/ton from Table 503.2.3(7)] × 6.83}/Flow
Flow = Condenser water flow (GPM)/Cooling Full Load Capacity (tons)
LIFT = CEWT – CLWT (°F)
CEWT = Full Load Condenser Entering Water Temperature (°F)
CLWT = Full Load Leaving Chilled Water Temperature (°F)

The adjusted full load and NPLV values are only applicable over the following full-load design ranges:
Minimum Leaving Chilled Water Temperature: 38°F (3.3°C)
Maximum Condenser Entering Water Temperature: 102°F (38.9°C)
Condensing Water Flow: 1 to 6 gpm/ton 0.018 to 0.1076 1/s ◦ kW) and X ≥ 39 and ≤ 60

Chillers designed to operate outside of these ranges or applications utilizing fluids or solutions with secondary coolants (e.g., glycol solutions or brines) with a freeze point of 27°F (-2.8°C) or lower for freeze protection are not covered by this code.

2. Add new table as follows:

TABLE 503.2.3(8)
HEAT REJECTION EQUIPMENT, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type [d]	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Condition	Performance Required[a,b,c]	Test Procedure[e d]
Propeller or Axial Fan Open Circuit Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F Entering wb	≥38.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal Fan Open Circuit Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F Entering wb	≥20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Propeller or Axial Fan Closed Circuit Cooling Towers	All	102°F Entering Water 90°F Leaving Water 75°F Entering wb	≥14.0 gpm/hp	CTI ATC-105S and CTI STD-201
Centrifugal Closed Circuit Cooling Towers	All	102°F Entering Water 90°F Leaving Water 75°F Entering wb	≥ 7.0 gpm/hp	CTI ATC-105S and CTI STD-201
Air-Cooled Condensers	All	125°F Condensing Temperature R-22 Test Fluid 190°F Entering Gas Temperature 15°F Subcooling 95°F Entering db	≥176,000 Btu/h·hp	ARI 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. 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 listed in Table 6.8.1G divided by the fan nameplate rated motor power.
b. 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 listed in Table 6.8.1G divided by the sum of the fan nameplate rated motor power and the spray pump nameplate rated motor power.
c. 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.
d. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
e. 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.

TABLE 503.2.3(9)
HEAT TRANSFER EQUIPMENT

Equipment Type	Subcategory	Minimum Efficiency*	Test Procedure[†]
Liquid to Liquid Heat Exchangers	Plate Type	NR	ARI 400

NR = No Requirement
[†] Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

3. Add new standards as follows:

CTI Cooling Technology Institute,
2611 FM 1960 West, Suite A-101
Houston, TX 77068-3730;
P.O. Box 73383
Houston, TX 77273-3383

CTI ATC-105 (00) Acceptance Test Code for Water Cooling Towers
CTI STD-201 (04) Standard for Certification of Water Cooling Tower Thermal Performance

AHRI

ARI 400-2001 Liquid to Liquid Heat Exchangers with Addendum 2

Reason: Adding these tables into the IECC will set minimum efficiencies for open and closed circuit cooling towers along with air cooled condensers. These tables also require the use of independently certified open circuit cooling towers, closed circuit cooling towers, and plate type liquid to liquid heat exchangers.

This proposal will make the IECC consistent with requirements published in addenda "a", "L", and "ad" to ASHRAE Standard 90.1 –2007.

Cost Impact: None. Most manufacturers already meet these requirements due to similar requirements in ASHRAE SSPC 90.1. Updating the IECC will further reinforce the use of these requirements.

Analysis: A review of the standard(s) proposed for inclusion in the code, ARI 400-01, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: Ferguson-EC-5-503.2.3-T. 503.2.3(8)-Ch 6

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The standards referenced by the change do not comply with ICC policy regarding such references.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment:

Steve Ferguson, representing The American Society of Heating, Refrigerating and Air-Conditioning Engineers, Paul Lindahl, SPX Cooling Technologies and Jess Seawell, Composite Cooling Solutions, representing the Cooling Technology Institute, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 503.2.3(8)
HEAT REJECTION EQUIPMENT, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type[~~d~~e]	Total System Heat Relection Capcity at Rated Conditions	Subcategory or Rating Condition	Performance Required [a,b,c]	Test Procedure [d,f]
Propeller or Axial Fan Open Circuit Cooling Towers	All	95 °F Entering Water 85 °F Leaving Water 75 °F Entering wb	≥38.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal Fan Open Circuit Cooling Towers	All	95 °F Entering Water 85 °F Leaving Water 75 °F Entering wb	≥20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Propeller or Axial Fan Closed Circuit Cooling Towers	All	95 °F Entering Water 85 °F Leaving Water 75 °F Entering wb	≥14.0 gpm/hp	CTI ATC-105S and CTI STD-201
Centrifugal closed Circuit Cooling Towers	All	102 °F Entering Water 90 °F Leaving Water 75 °F Entering wb	≥7.0 gpm/hp	CTI ATC-105S and CTI STD-201
Air-Cooled Condensers	All	125 °F Condensing Temperature R-22 Test Fluid 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. 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 listed in Table ~~6.8.1G~~ 503.2.3(8) divided by the fan nameplate rated motor power.

b. 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 listed in Table ~~6.8.1G~~ 503.2.3(8) divided by the sum of the fan nameplate rated motor power and the spray pump nameplate rated motor power.
c. 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.
d. ~~Section 12~~ Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
e. 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.
f. If 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, if 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.

TABLE 503.2.3(9)
HEAT TRANSFER EQUIPMENT

Equipment Type	Subcategory	Minimum Efficiency*	Test Procedure[a]
Liquid to Liquid Heat Exchangers	Plate Type	NR	~~ARI~~ AHRI 400

NR = No Requirement

a. ~~Section 12~~ Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

Cooling Technology Institute (CTI)

STD-201~~(04)~~ (09) Standard for Certification of Water Cooling Tower Thermal Performance

Air Conditioning, Heating, and Refrigeration Institute (AHRI)

460-2005 Performance Rating of Remote Mechanical Draft Air-Cooled Refrigerant Condensers

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: (Steve Ferguson) For consistency with ASHRAE Standard 90.1. Inclusion of these requirements in the IECC will allow the Authorities Having Jurisdiction (AHJ) to enforce energy efficiency requirements for cooling towers and air cooled condensers.

Note that EC191 (ASHRAE) and EC194 (DOE) are very similar and as such, the cooling tower requirements have been made consistent between the proposals. The proposals have been brought up to the latest Standard 90.1 edition. Several minor revisions to the changes have also been made from the original proposals in response to IECC Committee comments during the Baltimore hearing, including referencing IECC Chapter 6 and the proper IECC table number in the footnotes, along with revising the CTI and AHRI Standards listed to the correct standards and revision year. This update now effectively matches Standard 90.1.

The latest edition of STD-201 (09) along with a file describing the CTI Certification Program is included with this submission for ICC review.. ASHRAE Staff has reviewed CTI standard development procedures and while it does not currently list it in the preface, the standards are developed using a consensus-based process.

(Paul Lindahl and Jess Seawell) For consistency with ASHRAE Standard 90.1. Inclusion of these requirements in the IECC will allow the Authorities Having Jurisdiction (AHJ) to enforce energy efficiency requirements for cooling towers and air cooled condensers.

Note that EC191 (ASHRAE) and EC194 (DOE) are very similar and as such, the cooling tower requirements have been made consistent between the proposals. The proposals have been brought up to the latest Standard 90.1 edition. Several minor revisions to the changes have also been made from the original proposals in response to IECC Committee comments during the Baltimore hearing, including referencing IECC Chapter 6 and the proper IECC table number in the footnotes, along with revising the CTI and AHRI Standards listed to the correct standards and revision year. This update now effectively matches Standard 90.1.

CTI Standards are consensus-based and widely recognized and respected in the industry. Please see below for clarification. Additionally, as a result of the original ICC rejection, the CTI intends to add a statement regarding the consensus-based process to the preface of STD 201 as well as ATC-105 and ATC-105S. Once this update has been made, anticipated at the upcoming CTI Annual Meeting in July 2010, the updated copies will be provided to the ICC for their review.

Discussion of CTI Standards:

The Cooling Technology Institute (CTI) is an industry association that represents the interests of all parties connected with the exchange of heat using the atmosphere as a heat sink, including owners (end users), operators, component and service providers, equipment manufacturers, and general interest members. The Cooling Technology Institute (CTI) has a publicly reviewed, consensus based standards development process that has been designed to comply with ANSI requirements. The CTI has open meetings and voting participation on the committees is open to non-members as well, as long as balance requirements are met per ANSI. Note that the CTI certification process was modeled on the AHRI procedures for operation of certification programs.

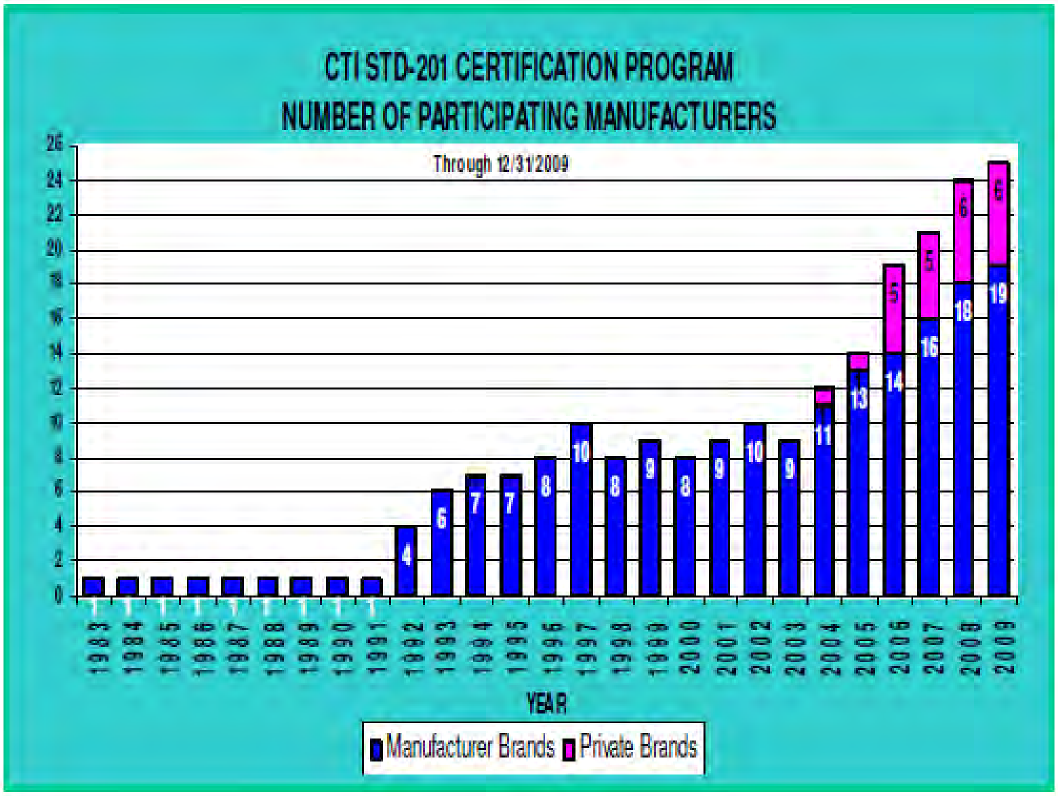
The CTI licenses multiple test agencies for field testing for all cooling towers according to ATC-105 under a balanced committee-supervised program, accessible to any qualified organization to apply. This ensures that agencies participating in the program are qualified in terms of both personnel and equipment and that they are conducting themselves in an independent third party manner. The certification program according to STD-201 applies to the standardized product lines most relevant to HVAC and light industrial applications. The STD-201 governed certification program operates similarly to AHRI in licensing a single independent testing organization to conduct the specific testing required for certification.

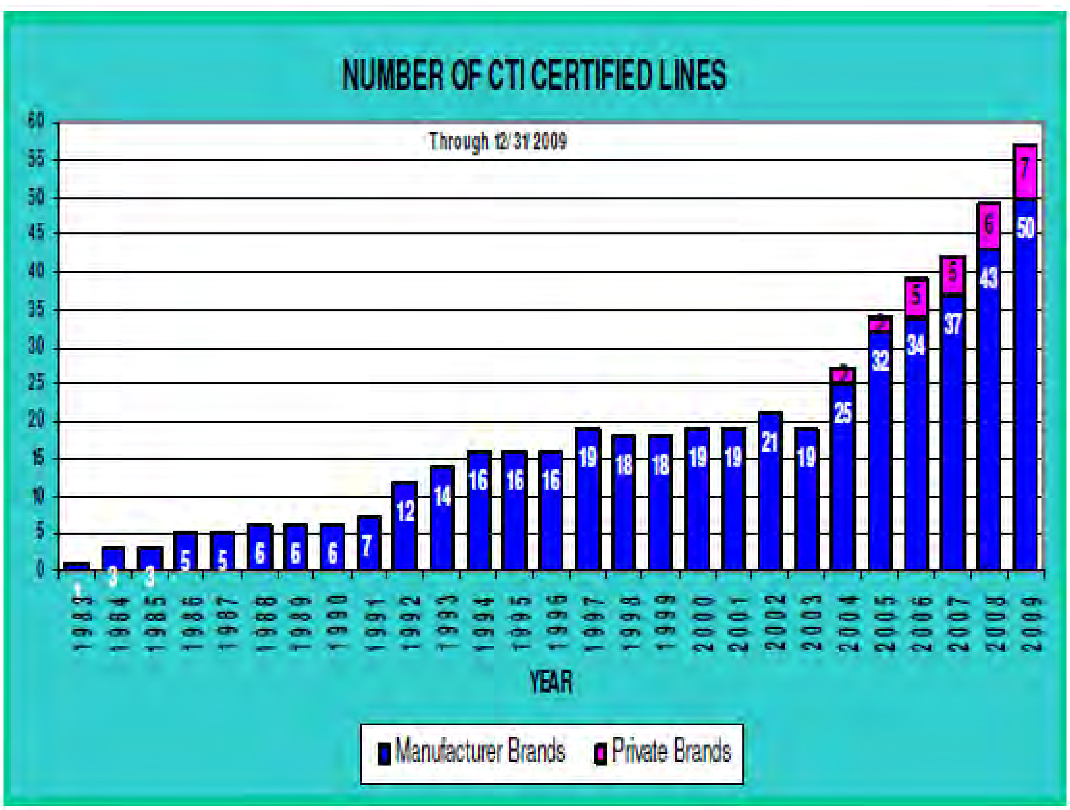
Rejection of the consensus-based CTI Standards and certification program would also suggest the need for rejection of many AHRI Standards, such as AHRI 550/590 for chillers, along with their certification programs.

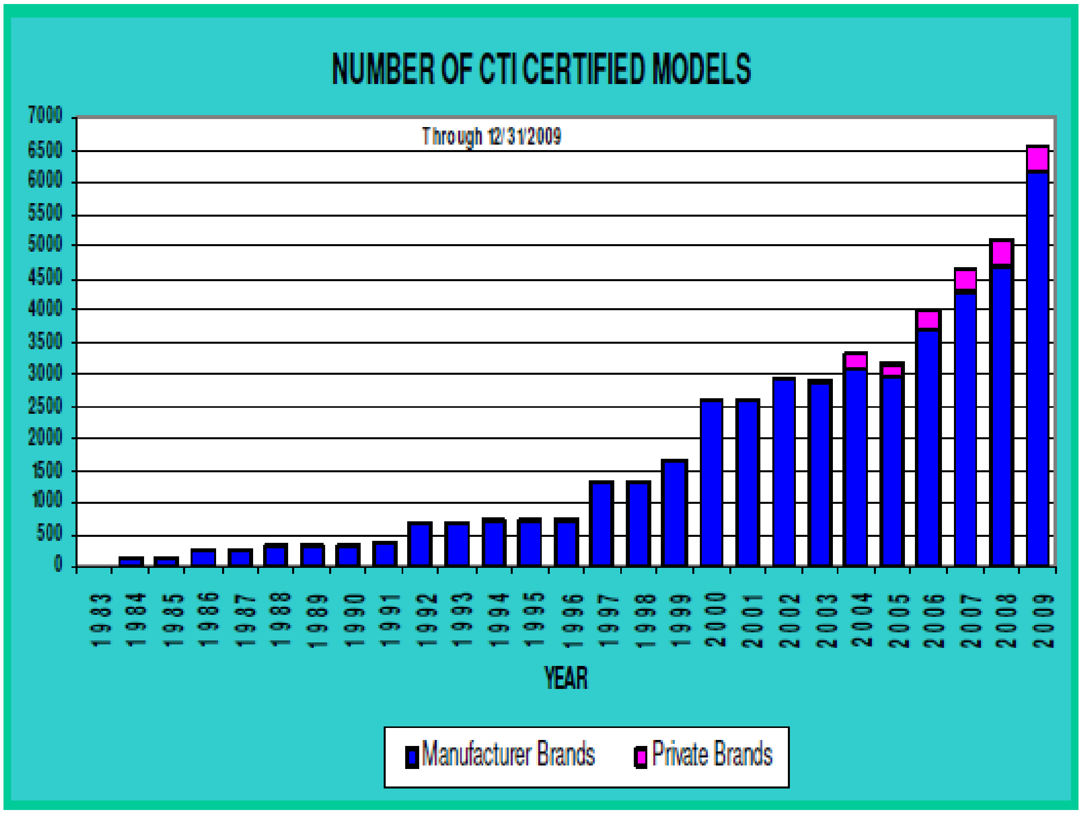
Inclusion of certification requirements in Standard 90.1 has resulted in a significant increase in the number of manufacturers that offer certified cooling tower product lines as well as a corresponding increase in both the number of certified product lines and individual tower models. Certified product lines include a wide variety of designs, encompassing axial fan, centrifugal fan, induced draft, forced draft, counterflow, crossflow, open circuit, and closed circuit cooling towers.

This positive effect is illustrated in the charts below. Inclusion of these requirements in the IECC will help to continue this positive momentum towards a level playing field with products meeting represented performance and increasing energy efficiency. This will be accomplished by providing the Authorities Having Jurisdiction (AHJ) requirements that can be enforced for the energy efficiency requirements for cooling towers as well as air cooled condensers and liquid to liquid heat exchangers.

The latest edition of STD-201 (09) along with a file describing the CTI Certification Program is included with this submission for ICC review.







Analysis: The CTI standard STD 201 was available and reviewed by the Energy Code Development Committee as part of the Baltimore hearings. It should be noted that the 2004 edition was reviewed. As part of the public comment, it is proposed to change the edition to the 2009 edition. The AHRI 460 standard (mislabeled ARI 460) was included in the proposed Table 503.2.4(8) as part of the original code change submittal, but the standard was not called out in part 3 of the proposal where new proposed standards should have been listed. Because it wasn't included in the listing, staff did not request that it be made available to the Committee before the hearings. Therefore the committee did not review this standard. Section 3.6.3.1 of Council Policy # 28, *Code Development,* requires that new standards be introduced in the original code change proposal, and be available for review. .

Final Action: AS AM AMPC____ D

EC192-09/10

503.2.3, 503.2.3.1 (New), 503.2.3.2 (New), Table 503.2(7)

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

1. Revise as follows:

503.2.3 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables 503.2.3(1), 503.2.3(2), 503.2.3(3), 503.2.3(4), 503.2.3(5), 503.2.3(6) and 503.2.3(7) when tested and rated in accordance with the applicable test procedure. The efficiency shall be verified through certification under an *approved* certification program or, if no certification program exists, 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.

503.2.3.1 ~~**Exception:**~~ **Water-cooled centrifugal chilling packages.**~~Water-cooled centrifugal water-chilling packages~~ Equipment ~~listed in Table 503.2.3(7)~~ not designed for operation at ARHI Standard 550/590 test conditions of 44°F (7°C) leaving chilled water temperature and 85°F (29°C) entering condenser water temperature with 3 gpm/ton (0.054 I/s.kW) condenser water flow, and as such whose testing results cannot be readily evaluated against the requirements in Table 503.2.3(7), shall have maximum full load and ~~N~~IPLV ratings in Table 503.2.3(7) adjusted using the following equations and the actual equipment ratings evaluated against the adjusted IPLV:

Adjusted maximum full load kW/ton rating = [full load kW/ton from Table 503.2.3(7)]/*K*adj

Adjusted maximum NPLV rating = [IPLV from Table 503.2.3(7)]/*K*adj

where:

Kadj = $6.174722 - 0.303668(X) + 0.00629466(X)^2 - 0.000045780(X)^3$
X = DTstd + LIFT
$DTstd$ = {24+[full load kW/ton from Table 503.2.3(7)] × 6.83}/Flow
Flow = Condenser ~~water~~ fluid flow (GPM)/Cooling
Full Load Capacity (tons)
LIFT = CEWT – CLWT (_F)
CEWT = Full Load Condenser Entering ~~Water~~ Fluid Temperature (°F)
CLWT = Full Load Leaving Chilled ~~Water~~ Fluid Temperature (°F)

The adjusted full load and NPLV rating values are only applicable to centrifugal chillers meeting all of ~~over~~ the following full-load design ranges:

Minimum Leaving Chilled ~~Water~~ Fluid Temperature: 38°F (3.3°C)

Maximum Condenser Entering ~~Water~~ Fluid Temperature: 102°F (38.9°C)

Condensing ~~Water~~ Fluid Flow: 1 to 6 gpm/ton (0.018 to 0.1076 1/s · kW) and X >= 39 and <= 60

Centrifugal ~~C~~chillers designed to operate outside of these ranges ~~or applications utilizing fluids or solutions with secondary coolants (e.g., glycol solutions or brines) with a freeze point of 27°F (-2.8°C) or lower for freeze protection~~ are not covered by this code.

2. Add new text as follows:

503.2.3.2 Positive displacement (air- and water-cooled) chilling packages. Equipment with a leaving fluid temperature higher than 32°F (0°C), shall meet the requirements of Table 503.2.3(7) when tested or certified with water at standard rating conditions, per the referenced test procedure.

3. Revise table footnote as follows:

TABLE 503.2.3(7)
WATER CHILLING PACKAGES, EFFICIENCY REQUIREMENTS[a]
(No change to table content)

For SI: 1 ton = 907 kg, 1 British thermal unit per hour = 0.2931 W.

a. The centrifugal chiller equipment requirements, after adjustment in accordance with Section 503.2.3.1 or 503.2.3.2, do not apply ~~for~~ to chillers used in low-temperature applications where the design leaving fluid temperature is < ~~40~~ 38ºF. The requirements do not apply to positive displacement chillers with leaving fluid temperatures <= 32 ºF. ~~The requirements do not apply to absorption chillers with design leaving fluid temperatures < 40ºF.~~

b. through e. (No change)

Reason: This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. Due to the timing of the code development process and ASHRAE standards processes this proposal was submitted in anticipation that by the final action hearings the work to update the standard would be complete.

It was not the intent of Standard 90.1 upon which Chapter 5 is based to exempt all chillers with secondary coolants (glycol or brine) for freeze protection from coverage by Table 503.2.3(7) with adjustments per what was the exception and is now a new Section 503.2.3.1. This proposed change corrects the intent of the 90.1 and removes ambiguity. It brings more chillers under the scope of the IECC and therefore will save energy to the degree that some equipment is currently not regulated.

For example, positive-displacement (both air- and water-cooled) chillers with glycol added for freeze protection when the unit is off or for winter operation, would likely have used a secondary coolant with a freeze point below 27°F [-.8°C]. If the positive-displacement chiller were being designed to create a cooling temperature above 32°F [0°C], there is no reason it shouldn't be expected to comply with the proposed code language at the rating conditions and fluid listed in the referenced test procedure. Below 32°F [0°C], machine changes might hinder its ability to meet the requirements.

In addition, centrifugal chillers are outside the scope of Standard 90.1 when the design leaving fluid temperature is below 38°F [3.3°C], and the intent was that they would comply with water as the tested fluid at covered temperature and flow combinations. ARI Standard 550/590 does not allow for testing with secondary coolants, and it is impractical to require it in manufacturer's test facilities used for certification and performance tests.

This proposal changes footnote a to Table 503.2.3(7) in recognition of lower practical scope limits for positive displacement (both air- and water-cooled) and corrects for the lower limit introduced in Addendum M to Standard 90.1-07 for centrifugal chillers.

Cost Impact: The code change proposal will increase the cost of construction only to the degree that equipment that was not previously regulated will now have to satisfy minimum efficiency requirements.

ICCFILENAME: Majette-EC-20-503.2.3

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: The proposal is another step in increasing the efficiency standards of the IECC. The changes reflected in this item are consistent with other codes and standards.

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, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

503.2.3 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables 503.2.3(1), 503.2.3(2), 503.2.3(3), 503.2.3(4), 503.2.3(5), 503.2.3(6) and 503.2.3(7) when tested and rated in accordance with the applicable test procedure. The efficiency shall be verified through certification under an approved certification program or, if no certification program exists, 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.

503.2.3.1: Water-cooled centrifugal chilling packages. ~~Water-cooled centrifugal water-chilling packages Equipment listed in Table 503.2.3(7) not designed for operation at ARHI Standard 550/590 test conditions of 44°F (7°C) leaving chilled water temperature and 85°F (29°C) entering condenser water temperature with 3 gpm/ton (0.054 l/s.kW) condenser water flow, and as such whose testing results cannot be readily evaluated~~

~~against the requirements in Table 503.2.3(7), shall have maximum full load and NIPLV ratings in Table 503.2.3(7) adjusted using the following equations and the actual equipment ratings evaluated against the adjusted IPLV:~~

~~Adjusted maximum full load kW/ton rating = [full load kW/ton from Table 503.2.3(7)]/Kadj~~

~~Adjusted maximum NPLV rating = [IPLV from Table 503.2.3(7)]/Kadj~~

~~where:~~

~~Kadj = 6.174722 - 0.303668(X) + 0.00629466(X)2 - 0.000045780(X)3~~
~~X = DTstd + LIFT~~
~~DTstd = {24+[full load kW/ton from Table 503.2.3(7)] × 6.83}/Flow~~
~~Flow = Condenser water fluid flow (GPM)/Cooling~~
~~Full Load Capacity (tons)~~
~~LIFT = CEWT – CLWT (_F)~~
~~CEWT = Full Load Condenser Entering Water Fluid Temperature (°F)~~
~~CLWT = Full Load Leaving Chilled Water Fluid Temperature (°F)~~

~~The adjusted full load and NPLV rating values are only applicable to centrifugal chillers meeting all of over the following full-load design ranges:~~

~~Minimum Leaving Chilled Water Fluid Temperature: 38°F (3.3°C)~~
~~Maximum Condenser Entering Water Fluid Temperature: 102°F (38.9°C)~~
~~Condensing Water Fluid Flow: 1 to 6 gpm/ton (0.018 to 0.1076 1/s . kW) and X >= 39 and <= 60~~
~~Centrifugal Cchillers designed to operate outside of these ranges or applications utilizing fluids or solutions with secondary coolants (e.g., glycol solutions or brines) with a freeze point of 27°F (-2.8°C) or lower for freeze protection are not covered by this code.~~

Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44°F(7°C) leaving chilled-water temperature and 85°F (29°C) entering condenser water temperature with 3 gpm/ton (0.054 I/s.kW) condenser water flow shall have maximum full-load kW/ton and *NPLV* ratings adjusted using Equations 5-x and 5-y.

Adjusted minimum full-load COP rating = (full-load COP from Table 6.8.1C) × Kadj (**Equation 5-x)**

Adjusted minimum NPLV rating = (IPLV from Table 6.8.1C) × Kadj **(Equation 5-y)**

Where:

Kadj = A * B
A = 0.0000015318 x $(LIFT)^4$ – 0.000202076 x $(LIFT)^3$ + 0.0101800 x $(LIFT)^2$ - 0.264958 x LIFT + 3.930196
B = 0.0027 x LvgEvap (Deg C) + 0.982
LIFT = LvgCond – LvgEvap
LvgCond = Full-load condenser leaving water temperature (°C)
LvgEvap = Full-load leaving evaporator temperature (°C)

SI units shall be used in the Kadj equation.

The adjusted full-load and *NPLV* values shall only be applicable for centrifugal chillers meeting all of the following full-load design ranges:

1. The leaving evaporator fluid temperature is not less than 36°F (2.2°C)
2. The leaving condenser fluid temperature is not greater than 115°F (46.1°C)
3. LIFT is not less than 20°F (11.1 °C) and not greater than 80°F (44.4°C)

Exception: Centrifugal chillers designed to operate outside of these ranges need not comply with this code.

503.2.3.2 Positive displacement (air- and water-cooled) chilling packages. Equipment with a leaving fluid temperature higher than 32°F (0°C), shall meet the requirements of Table 503.2.3(7) when tested or certified with water at standard rating conditions, per the referenced test procedure.

TABLE 503.2.3(7)
WATER CHILLING PACKAGES, EFFICIENCY REQUIREMENTS[a]

(Portions of table not shown remain unchanged)

For SI: 1 ton = 907 kg, 1 British thermal unit per hour = 0.2931 W.
a. The centrifugal chiller equipment requirements, after adjustment in accordance with Section 503.2.3.1 or 503.2.3.2, do not apply for to chillers used in low-temperature applications where the design leaving fluid temperature is less than ~~38ºF~~ 36°F.-The requirements do not apply to positive displacement chillers with leaving fluid temperatures are less than or equal to 32 ºF. The requirements do not apply to absorption chillers with design leaving fluid temperatures are less than 40ºF.
b. through e. (No change)

Commenter's Reason: The proposed changes in this comment coordinate IECC with Addenda BL and BT to 90.1, and will bring more centrifugal chillers into the scope of the IECC.

Final Action: AS AM AMPC____ D

EC193-09/10

Tables 503.2.3(1) and 503.2.3(2) (New)

Proposed Change as Submitted

Proponent: Steve Ferguson, representing The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

Delete Tables 503.2.3(1)-(2) and substitute as follows:

TABLE 503.2.3(1)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Air Conditioners, Air Cooled	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.4 IEER	ARI 340/360
		All other	Split System and Single Package	11.2 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.2 IEER	
		All other	Split System and Single Package	11.0 IEER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.1 IEER	
		All other	Split System and Single Package	9.9 IEER	
	≥760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.8 IEER	
		All other	Split System and Single Package	9.6 IEER	
Air Conditioners, Water and Evaporatively Cooled	< 65,000 Btu/h	All	Split System and Single Package	12.3 IEER	ARI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.7 IEER	ARI 340/360
		All other	Split System and Single Package	11.5 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.2 IEER	
		All other	Split System and Single Package	11.0 IEER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.1 IEER	
		All other	Split System and Single Package	10.9 IEER	

TABLE 503.2.3(2)
UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Air Cooled (Cooling Mode)	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.2 IEER	ARI 340/360
		All other	Split System and Single Package	11.0 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.7 IEER	
		All other	Split System and Single Package	10.5 IEER	

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.6 IEER	
		All other	Split System and Single Package	9.4 IEER	
Air Cooled (Heating Mode)	≥65,000 Btu/h and <135,000 Btu/h (Cooling Capacity)	–	47ºF db/43ºF wb Outdoor Air	3.3 COP	ARI 340/360
			17ºF db/15ºF wb Outdoor Air	2.25 COP	
	≥135,000 Btu/h (Cooling Capacity)	–	47ºF db/43ºF wb Outdoor Air	3.2 COP	
			17ºF db/15ºF wb Outdoor Air	2.05 COP	

Reason: This proposal updates Tables 503.2.3 (1) & (2) and makes them consistent with Tables 6.8.1 A & B published in the supplement to ASHRAE 90.1-2007. The new tables update the COP at 17°F efficiency levels for commercial heat pumps and introduce a new part load energy efficiency descriptor for all commercial unitary products above 65,000 Btu/h of cooling capacity. The new descriptor, called Integrated Energy Efficiency Ratio or IEER is proposed as a replacement to IPLV. The proposed IEER is a significant improvement over IPLV as it allows for uniform rating of all products including single and multi stage units. It is based on a weighted average of performance at 100%, 75%, 50% and 25% of capacity. The new part load metric is expected to more accurately rate the part load performance of commercial unitary equipment.

The new proposed IEER and COP at 17°F were derived based on the expected performance of commercial unitary products meeting the new full load EER and COP at 47°F requirements that will take effect on January 1, 2010. In addition, IEER values are now proposed for product classes with cooling capacities between 65,000 and 240,000 Btu/h, which previously had no IPLV minimums. This proposal will save energy and make the IECC consistent with the supplement to ASHRAE 90.1-2007.

Cost Impact: There are incremental cost increases based on the higher efficiency requirements. These increased efficiency requirements have been approved by ASHRAE and have been published in the supplement to ASHRAE 90.1-2007.

ICCFILENAME: Ferguson-EC-2-T. 503.2.3(1)-(2)

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal deletes equipment types that should remain included in the IECC requirements.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Replace the proposal as follows:

Table 503.2.3(1)
Electrically Operated Unitary Air Conditioners and Condensing Units – Minimum Efficiency Requirements

Equipment Type	Size Category	Heating Section Type	Sub-Category 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	13.0 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	10.0 SEER	

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency	Test Procedure[a]
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 11.4 IEER	AHRI 340/360
		All other	Split System and Single Package	11.0 EER 11.2 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER 11.2 IEER	
		All other	Split System and Single Package	10.8 EER 11.0 IEER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.0 EER 10.1 IEER	
		All other	Split System and Single Package	9.8 EER 9.9 IEER	
	≥760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.7 EER 9.8 IEER	
		All other	Split System and Single Package	9.5 EER 9.6 IEER	
Air Conditioners, water Cooled	< 65,000 Btu/h	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	11.5 EER (before 6/1/2011 12.1 EER (as of 6/1/2011) 11.7 IEER (before 6/1/2011) 12.3 IEER (as of 6/1/2011)	AHRI 340/360
		All other	Split System and Single Package	11.3 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011) 11.5 IEER (before 6/1/2011) 12.1 IEER (as of 6/1/2011)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 12.5 EER (as of 6/1/2011) 11.2 IEER (before 6/1/2011) 12.7 IEER (as of 6/1/2011)	
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 12.3 EER (as of 6/1/2011 11.0 IEER (before 6/1/2011) 12.5 IEER (as of 6/1/2011)	
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 12.4 EER (as of 6/1/2011) 11.1 EER (before 6/1/2011) 12.6 EER (as of 6/1/2011)	
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 12.2 EER (as of 6/1/2011) 10.9 EER (before 6/1/2011) 12.4 EER (as of 6/1/2011)	
	≥760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 12.0 EER (as of 6/1/2011) 11.1 EER (before 6/1/2011) 12.4 EER (as of 6/1/2011)	
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 12.0 EER (as of 6/1/2011 10.9 EER (before 6/1/2011) 12.2 EER (as of 6/1/2011)	
Air Conditioners, evaporatively cooled	< 65,000 Btu/h	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	11.5 EER (before 6/1/2011) 12.1 EER (as of 6/1/2011) 11.7 IEER (before 6/1/2011) 12.3 IEER (as of 6/1/2011)	AHRI 340/360
		All other	Split System and Single Package	11.3 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011) 11.5 IEER (before 6/1/2011) 12.1 IEER (as of 6/1/2011)	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 12.0 EER (as of 6/1/2011) 11.2 IEER (before 6/1/2011) 12.2 IEER (as of 6/1/2011)	
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 11.8 EER (as of 6/1/2011) 11.0 IEER (before 6/1/2011) 12.0 IEER (as of 6/1/2011)	

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency	Test Procedure[a]
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011) 11.1 EER (before 6/1/2011) 12.1 EER (as of 6/1/2011)	
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 12.2 EER (as of 6/1/2011) 10.9 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011)	
	≥760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER (before 6/1/2011) 11.7 EER (as of 6/1/2011) 11.1 EER (before 6/1/2011) 11.9 EER (as of 6/1/2011)	
		All other	Split System and Single Package	10.8 EER (before 6/1/2011) 11.5 EER (as of 6/1/2011) 10.9 EER (before 6/1/2011) 11.7 EER (as of 6/1/2011)	
Condensing units air cooled	≥135,000Btu/h			10.1 EER (before 6/1/2011) 10.5 EER (as of 6/1/2011) 11.4 IEER (before 6/1/2011) 14.0 IEER (as of 6/1/2011)	AHRI 365
Condensing units water cooled	≥135,000Btu/h			13.1 EER (before 6/1/2011) 13.5 EER (as of 6/1/2011 13.6 IEER (before 6/1/2011) 14.0 IEER (as of 6/1/2011)	
Condensing units evaporatively cooled	≥135,000Btu/h			13.1 EER (before 6/1/2011) 13.5 EER (as of 6/1/2011) 13.6 IEER (before 6/1/2011) 14.0 IEER (as of 6/1/2011)	

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/hr are regulated by NAECA, SEER values are those set by NAECA.

TABLE 503.2.3(2)
Electrically Operated Unitary and Applied Heat Pumps—Minimum Efficiency Requirements

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency	Test Procedure[a]
Air cooled (cooling mode)	<65,000 Btu/h[b]	All	Split System	13.0 SEER	AHRI 210/240
			Single Packaged	13.0 SEER	
Through-the-wall, air cooled	≤30,000 Btu/h[b]	All	Split System	13.0 SEER	
			Single Packaged	13.0 SEER	
Single-duct high-velocity air cooled	<65,000 Btu/h[b]	All	Split System	10.0 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 11.2 IEER	AHRI 340/360
		All other	Split System and Single Package	10.8 EER 11.0 IEER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.6 EER 10.7 IEER	
		All other	Split System and Single Package	10.4 EER 10.5 IEER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.5 EER 9.6 IEER	
		All other	Split System and Single Package	9.3 EER 9.4 IEER	
Water source (cooling mode)	<17,000 Btu/h	All	86 F entering water	11.2 EER	ISO 13256-1
	≥17,000 Btu/h and <65,000 Btu/h	All	86 F entering water	12.0 EER	
	≥65,000 Btu/h and <135,000 Btu/h	All	86 F entering water	12.0 EER	

Equipment Type	Size Category	Heating Section Type	Sub-Category or Rating Condition	Minimum Efficiency	Test Procedure[a]
Ground water source (cooling mode)	<135,000 Btu/h	All	59 F entering water	16.2 EER	
		All	77 F entering water	13.4 EER	
Water-source water to water (cooling mode)	<135,000 Btu/h	All	86 F entering water	10.6 EER	ISO 13256-2
			59 F entering water	16.3 EER	
Ground water source Brine to water (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	7.7 HSPF	AHRI 210/240
		–	Single Package	7.7 HSPF	
Through-the-wall, (air cooled, heating mode)	≤30,000 Btu/h[b] (cooling capacity)	–	Split System	7.4 HSPF	
		–	Single Package	7.4 HSPF	
Small-Duct high velocity (air cooled, heating mode)	<65,000 Btu/h[b]	–	Split System	6.8 HSPF	
Air Cooled (Heating Mode)	≥65,000 Btu/h and <135,000 Btu/h (Cooling Capacity)	–	47ºF db/43ºF wb Outdoor Air	3.3 COP	AHRI 340/360
			17ºF db/15ºF wb Outdoor Air	2.25 COP	
	≥135,000 Btu/h (Cooling Capacity)	–	47ºF db/43ºF wb Outdoor Air	3.2 COP	
			17ºF db/15ºF wb Outdoor Air	2.05 COP	
Water source (heating mode)	<135,000 Btu/h (cooling capacity)	–	68 F entering water	4.2 COP	ISO 13256-1
Ground water source (heating mode)	<135,000 Btu/h (cooling capacity)	–	50 F entering water	3.6 COP	
Ground source (heating mode)	<135,000 Btu/h (cooling capacity)	–	32 F entering fluid	3.1 COP	
Water-source water to water (heating mode)	<135,000 Btu/h (cooling capacity)	–	68 F entering water	3.7 COP	ISO 13256-2
		–	50 F entering water	3.1 COP	
Ground source brine to water (heating mode)	<135,000 Btu/h (cooling capacity)	–	32 F entering fluid	2.5 COP	

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/hr are regulated by NAECA, SEER values are those set by NAECA.

Add new standards to Chapter 6 as follows:

International Organization for Standardization (ISO)

13256-2 (1998) Water-Source Heat Pumps—Testing and Rating for Performance-Part 2: Water-to-Water and Brine-to-Water Heat Pumps

Commenter's Reason: The modified Tables 503.2.3(1) and 503.2.3(2) as submitted as part of the original EC193 proposal were incomplete and did not include all the changes that have been adopted by ASHRAE 90.1 per addenda S, CO, and BG to the ASHRAE 90.1-2007 Standard.

Therefore delete the originally submitted modified Tables 503.2.3(1) and table 503.2.3(2) and replace with the following tables.

This change proposal will harmonize with 90.1 and federal requirements covered by NAECA and EPACT. The proposal adds new water to water heat pump products and corrects requirements for products that were not included in the original EC193 proposal

Analysis: The standard, ISO 13256-2, was proposed as part of EC 195. It was reviewed by the Energy Code Development Committee at the Baltimore hearings. EC195 is an alternative proposal also amending Table 503.2.3(2).

Public Comment 2:

Steve Ferguson, The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Table 503.2.3(3)
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 – Minimum Efficiency Requirements

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	12.5 – (0.213 x Cap/1000)[c] EER (before 10/08/2012) 13.8 – (0.300 x Cap/1000)[c] EER (as of 10/08/2012)	AHRI 310/380
PTAC (cooling mode) replacements[b]	All Capacities	95 F db outdoor air	10.9 – (0.213 x Cap/1000)[c] EER	
PTHP (cooling mode) New Construction	All Capacities	95 F db outdoor air	12.3 – (0.213 x Cap/1000)[c] EER (before 10/08/2012) 14.0 – (0.300 x Cap/1000)[c] EER (as of 10/08/2012)	
PTHP (cooling mode) replacements[b]	All Capacities	95 F db outdoor air	10.8 – (0.213 x Cap/1000)[c] EER	
PTHP (heating mode) new construction	All Capacities		3.2 – (0.026 x Cap/1000)[c] COP (before 10/08/2012) 3.2 – (0.026 x Cap/1000)[c] COP (as of 10/08/2012)	
PTHP (heating mode) replacements[b]	All Capacities		2.9 – (0.026 x Cap/1000)[c] 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	
	≥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 slides	<6,000 Btu/h	--	9.7 SEER	ANSI/AHAM RAC-1
	≥6,000 Btu/h and <8,000 Btu/h	--	9.7 EER	
	≥8,000 Btu/h and <14,000 Btu/h	--	9.8 EER	
	≥14,000 Btu/h and <20,000 Btu/h		9.7 SEER	
	≥20,000 Btu/h		8.5 EER	
Room air conditioners, with louvered slides	<8,000 Btu/h		9.0 EER	
	≥8,000 Btu/h and <20,000 Btu/h		8.5 EER	
	≥20,000 Btu/h		8.5 EER	
Room air-conditioner heat pumps with louvered sides	<20,000 Btu/h		9.0 EER	
	≥20,000 Btu/h		8.5 EER	
Room air-conditioner heat pumps without louvered sides	<14,000 Btu/h		8.5 EER	
	≥14,000 Btu/h		8.0 EER	
Room air conditioner casement only	All capacities		8.7 EER	

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency	Test procedure[a]
Room air conditioner casement-slider	All capacities		9.5 EER	

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.
c. Caps means the rated cooling capacity of the project in Btu/h. If the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculations

Air Conditioning, Heating, and Refrigeration Institute (AHRI)

390 -1 (2003) Performance Rating of Single Packaged Terminal Air-Conditioners and Heat Pumps

ANSI/AHAM

RAC 1 (R2008) Room Air Conditioners

Commenter's Reason: ASHRAE 90.1 has added additional products to table 6.8.1D to cover SPVAC products as well as updating the efficiency requirements for PTAC units per the federal ruling. This should have been included with the original EC193 proposal. The intent of this proposal is to correct this oversight and the Table 503.2.3(3) should be deleted and replaced with the following table to be consistent with the ASHRAE 90.1-2010 standard.

This corrects the omission not including the SPVAC products as covered by the ASHRAE 90.1-2004 addendum B and the update to the PTAC efficiencies as amended by the ASHRAE 90.1-2007 Addendum BW.

Analysis: The standards, AHRI 390 and ANSI/AHAM – RAC-1 were not reviewed or considered by the Energy Code Development Committee prior to the Baltimore hearings and they were not considered by the hearing attendees at the time of the code development hearings. Section 3.6.3.1 of Council Policy # 28, *Code Development,* requires that new standards be introduced in the original code change proposal, therefore, the introduction of a new standards via a public comment is not in accordance with the process required by CP # 28 for adding new standards to the code.

Final Action: AS AM AMPC____ D

EC194-09/10
Table 503.2.3(2), Chapter 6

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

1. Delete Table 503.2.3(2) and substitute as follows:

TABLE 503.2.3(2)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS,
ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Total System Heat Rejection Capacity At Rated Conditions	Subcategory or Rating Condition	Performance Required [a, b]	Test Procedure [c]
Propeller or axial fan cooling towers	All	95 °F entering water 85 °F leaving water 75 °F wb outdoor air	≥38.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal fan cooling towers	All	95 °F entering water 85 °F leaving water 75 °F wb outdoor air	≥20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Air-cooled condensers	All	125 °F condensing temperature R22 test fluid 190 °F entering gas temperature 15 °F subcooling 95 °F entering db	≥176,000 Btu/h x hp	AHI 460

a. For purposes of this table, cooling tower performance is defined as the maximum flow rating of the tower divided by the fan nameplate rated motor power.
b. 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.
c. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

2. Add new standard to Chapter 6 as follows:

CTI Cooling Tower Institute
2611 FM 1960 West
Suite A-101
Houston, TX 77068

CTI ARC-105(00) Acceptance Test Code for Water Cooling Towers
CTI STD-201(04) Standard for Certification of Water Cooling Tower Thermal Performance

Reason: For consistency with ASHRAE Standard 90.1.

Cost Impact: The code change proposal could increase the cost of construction to the degree that units of this nature previously having unregulated minimum efficiency will now have to satisfy these minimum requirements.

Analysis: A review of the standard(s) proposed for inclusion in the code, CTI ARC-105-00 and CTI STD-201-04, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: Majette-EC-28-T. 503.2.3(2)

Public Hearing Results

Note: The following analysis was not in the Code Change monograph but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf :

Analysis: Review of the proposed new standard indicated that, in the opinion of ICC staff, the standard did not comply with ICC standards criteria, Sections 3.6.2.1 and 3.6.2.11.

Committee Action: **Disapproved**

Committee Reason: The standards referenced in the proposal do not meet ICC policy for referenced documents. The action taken was consistent with the disapproval of EC191-09/10 and was requested by the proponent.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Ronald Majette, U.S. Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

503.2.3 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables 503.2.3(1), 503.2.3(2), 503.2.3(3), 503.2.3(4), 503.2.3(5), 503.2.3(6) ~~and~~ 503.2.3(7), and 503.2.3(8) when tested and rated in accordance with the applicable test procedure. The efficiency shall be verified through certification under an *approved* certification program or, if no certification program exists, 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.

(Portions of code change proposal not shown remain unchanged)

TABLE 503.2.3(8)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS,
ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Total System Heat Rejection Capacity At Rated Conditions	Subcategory or Rating Condition	Performance Required [a, b]	Test Procedure [c]
Propeller or axial fan cooling towers	All	95 °F entering water 85 °F leaving water 75 °F wb outdoor air	>38.2 gpm/hp	CTI ATC-105
Centrifugal fan cooling towers	All	95 °F entering water 85 °F leaving water 75 °F wb outdoor air	>20.0 gpm/hp	CTI ATC-105
Air-cooled condensers	All	125 °F condensing temperature R22 test fluid 190 °F entering gas temperature 15 °F subcooling 95 °F entering db	>176,000 Btu/h x hp	AHRI 460

a. For purposes of this table, cooling tower performance is defined as the maximum flow rating of the tower divided by the fan nameplate rated motor power.
b. 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.
c. In applying CTI ATC 105 Sections 2.2, 2.3.1, 2.3.2, 2.3.2.1, 2.3.2.2, 2.3.3 through 2.3.7, 2.4 through 2.6, 3.1 through 3.7, 4.1, 4.5, 4.6 and Sections 5 through 9 shall be used to determine the performance of the cooling tower.

Add new standard to Chapter 6 as follows:

Cooling Technology Institute (CTI)

CTI ARC-105(00) Acceptance Test Code for Water Cooling Towers

Commenter's Reason: There are currently no provisions in the IECC that regulate the minimum efficiency of the covered equipment. This public comment is to clarify the application of the appropriate sections of the referenced test procedure CTI 105, thereby indicating how to conduct the necessary test to determine performance without inadvertently violating ICC policy addressing the reference to specific accreditation, testing or certification agencies in the code. This proposal will also bring consistency with ASHRAE Standard 90.1, which is adopted by reference in the IECC.

Public Comment 2:

Paul Lindahl, SPX Cooling Technologies and Jess Seawell, Composite Cooling Solutions, representing the Cooling Technology Institute, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 503.2.3(8)
HEAT REJECTION EQUIPMENT, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type[d]	Total System Heat Rejection Capacity at Rated Conditions	Subcategory or Rating Condition	Performance Required[a,b,c,e]	Test Procedure[d,e,f-e]
Propeller or axial fan open circuit cooling towers	All	95°F entering water 85°F leaving water 75°F wb outdoor air	≥38.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal fan open circuit cooling towers	All	95°F entering water 85°F leaving water 75°F wb outdoor air	≥20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Propeller or axial fan closed circuit cooling towers	All	102°F entering water 90°F leaving water 75°F wb outdoor air	≥38.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal fan closed circuit cooling towers	All	102°F entering water 90°F leaving water 75°F wb outdoor air	≥20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Air-cooled condensers	All	125°F condensing temperature R-22 test fluid 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. 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 listed in Table 503.2.3(8) divided by the fan nameplate rated motor power.
b. 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 listed in Table 503.2.3(8) divided by the sum of the fan nameplate rated motor power and the spray pump nameplate rated motor power.
c. 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.
d. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
e. 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.
f. If 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, if 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.

Add new standards in Chapter 6 as follows:

Cooling Technology Institute (**CTI)**

CTI ATC-105 (00) Acceptance Test Code for Water Cooling Towers
CTI STD-201 (09) Standard for Certification of Water Cooling Tower Thermal Performance

Air Conditioning, Heating, and Refrigeration Institute (AHRI)

AHRI 460-2005 Remote Mechanical Draft Air Cooled Refrigerant Condensers

Commenter's Reason: For consistency with ASHRAE Standard 90.1. Inclusion of these requirements in the IECC will allow the Authorities Having Jurisdiction (AHJ) to enforce energy efficiency requirements for cooling towers and air cooled condensers.

Note that EC191 (ASHRAE) and EC194 (DOE) are very similar and as such, the cooling tower requirements have been made consistent between the proposals. The proposals have been brought up to the latest Standard 90.1 edition. Several minor revisions to the changes have also been made from the original proposals in response to IECC Committee comments during the Baltimore hearing, including referencing IECC Chapter 6 and the proper IECC table number in the footnotes, along with revising the CTI and AHRI Standards listed to the correct standards and revision year. This update now effectively matches Standard 90.1.

CTI Standards are consensus-based and widely recognized and respected in the industry. Please see below for clarification. Additionally, as a result of the original ICC rejection, the CTI intends to add a statement regarding the consensus-based process to the preface of STD 201 as well as ATC-105 and ATC-105S. Once this update has been made, anticipated at the upcoming CTI Meeting in July 2010, the updated copies will be provided to the ICC for their review.

Discussion of CTI Standards:
The Cooling Technology Institute (CTI) is an industry association that represents the interests of all parties connected with the exchange of heat using the atmosphere as a heat sink, including owners (end users), operators, component and service providers, equipment manufacturers, and general interest members. The Cooling Technology Institute (CTI) has a publicly reviewed, consensus based standards development process that has been designed to comply with ANSI requirements. The CTI has open meetings and voting participation on the committees is open to non-members as well, as long as balance requirements are met per ANSI. Note that the CTI certification process was modeled on the AHRI procedures for operation of certification programs.

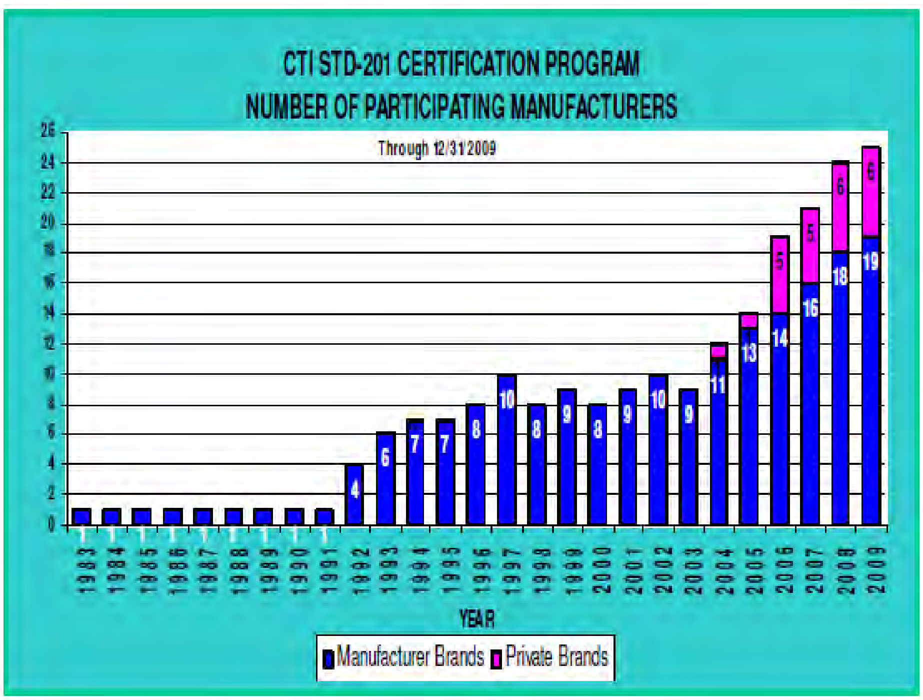
The CTI licenses multiple test agencies for field testing for all cooling towers according to ATC-105 under a balanced committee-supervised program, accessible to any qualified organization to apply. This ensures that agencies participating in the program are qualified in terms of both personnel and equipment and that they are conducting themselves in an independent third party manner. The certification program according to STD-201 applies to the standardized product lines most relevant to HVAC and light industrial applications. The STD-201 governed certification program operates similarly to AHRI in licensing a single independent testing organization to conduct the specific testing required for certification.

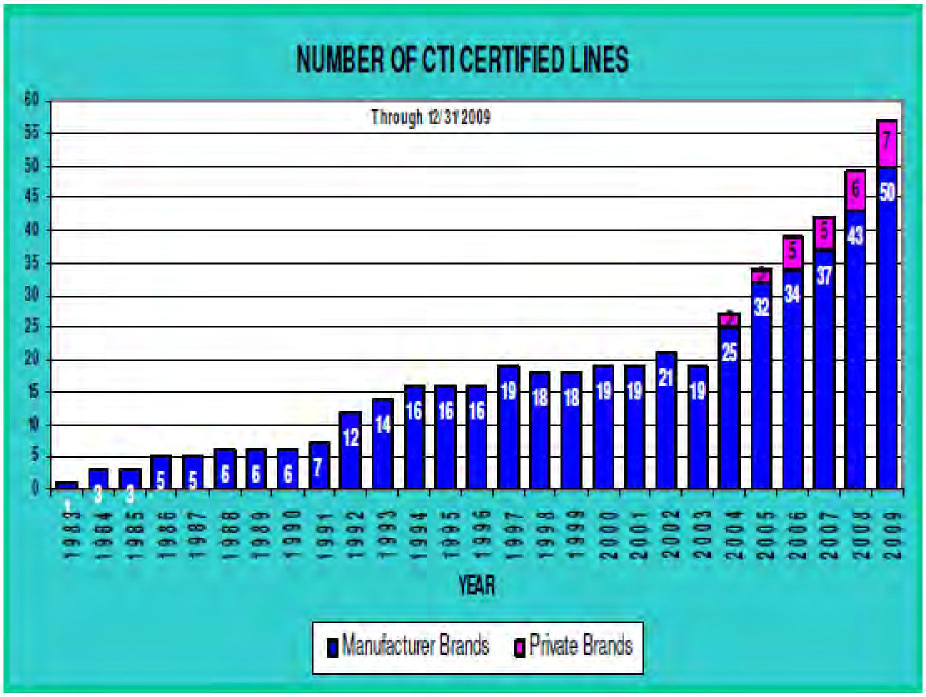
Rejection of the consensus-based CTI Standards and certification program would also suggest the need for rejection of many AHRI Standards, such as AHRI 550/590 for chillers, along with their certification programs.

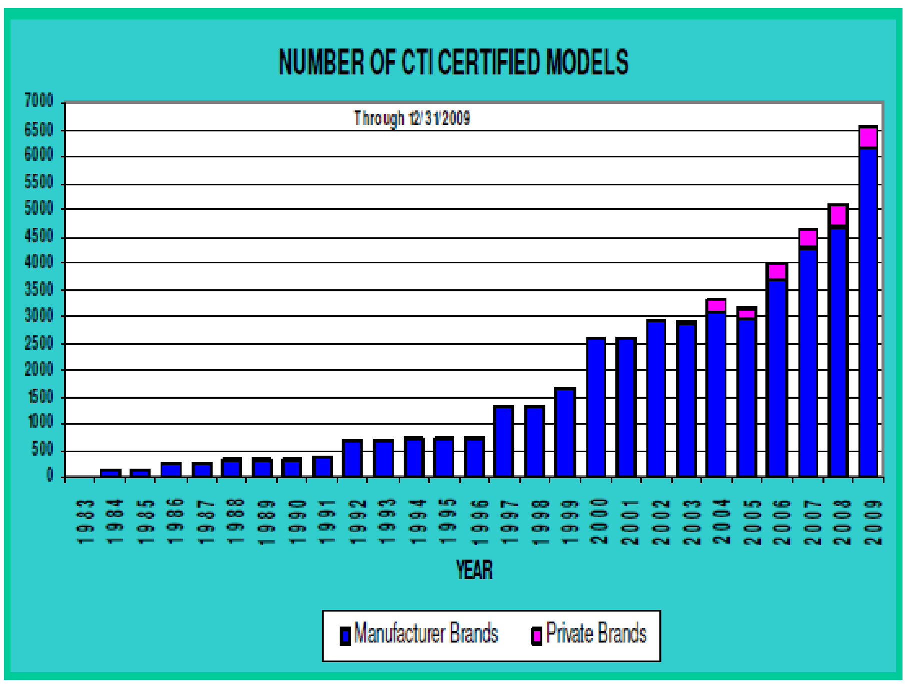
Inclusion of certification requirements in Standard 90.1 has resulted in a significant increase in the number of manufacturers that offer certified cooling tower product lines as well as a corresponding increase in both the number of certified product lines and individual tower models. Certified product lines include a wide variety of designs, encompassing axial fan, centrifugal fan, induced draft, forced draft, counterflow, crossflow, open circuit, and closed circuit cooling towers.

This positive effect is illustrated in the charts below. Inclusion of these requirements in the IECC will help to continue this positive momentum towards a level playing field with products meeting represented performance and increasing energy efficiency. This will be accomplished by providing the Authorities Having Jurisdiction (AHJ) requirements that can be enforced for the energy efficiency requirements for cooling towers as well as air cooled condensers and liquid to liquid heat exchangers.

The latest edition of STD-201 (09) along with a file describing the CTI Certification Program is included with this submission for ICC review.







Analysis: The CTI standard STD 201 was available and reviewed by the Energy Code Development Committee as part of the Baltimore hearings. It should be noted that the 2004 edition was reviewed. As part of the public comment, it is proposed to change the edition to the 2009 edition. AHRI 460 was included in code change proposal EC191-09/10 and considered under that code change.

Final Action: AS AM AMPC____ D

EC195-09/10
Table 503.2.3(2), Chapter 6

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

1. Revise as follows:

TABLE 503.2.3(2)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Water source water to water (cooling mode)	<135,000 Btu/h	All	86°F entering water	10.6 EER	ISO-13256-2
Groundwater source water to water (cooling mode)	<135,000 Btu/h	All	59°F entering water	16.3 EER	ISO-13256-2
Ground source Brine to water (cooling mode)	<135,000 Btu/h	All	77°F entering water	12.1 EER	ISO-13256-2
Water source water to water (heating mode)	<135,000 Btu/h (cooling capacity)	---	68°F entering water	3.7 COP	ISO-13256-2
Groundwater source water to water (heating mode)	<135,000 Btu/h (cooling capacity)	---	50°F entering water	3.1 COP	ISO-13256-2
Ground source brine to water (heating mode)	<135,000 Btu/h (cooling capacity)	---	32°F entering water	2.5 COP	ISO-13256-2

(No change to portions of table or footnotes not shown)

2. Add new standards to Chapter 6 as follows:

ISO International Organization for Standardization
1, rue de Varembe, Case postale 56,
CH-1211
Geneve, Switzerland

ISO 13256-2 (1998) Water-Source Heat Pumps—Testing and Rating for Performance- Part 2: Water-to-Water and Brine-to-Water Heat Pumps

Reason: This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. Due to the timing of the code development process and ASHRAE standards processes this proposal was submitted in anticipation that by the final action hearings the work to update the standard would be complete.

Water-to-water heat pumps are systems used in many buildings covered by the IECC and ASHRAE 90.1. These heat pumps use water to carry cooling and heating through the building. In recent years, the demand for water to water heat pumps has increased significantly. However, the IECC has no minimum energy efficiency requirements for this equipment. This proposal establishes for the first time a product class for water-to-water heat pumps. The intent is to recognize the technology by requiring minimum energy efficiency standards. Cooling EERs and heating COPs are proposed for products with cooling capacities below 135,000 Btu/h at standard rating conditions listed in ISO standard 13256-2.

Cost Impact: The code change proposal could increase the cost of construction to the degree that units of this nature previously having unregulated minimum efficiency will now have to satisfy these minimum requirements.

Analysis: A review of the standard(s) proposed for inclusion in the code, ISO 13256-2-98, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: Majette-EC-59-T. 503.2.3(2)

Public Hearing Results

Note: The following analysis was not in the Code Change monograph but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf :

Analysis: Review of the proposed new standard indicated that, in the opinion of ICC staff, the standard did comply with ICC standards criteria.

Committee Action: **Approved as Submitted**

Committee Reason: The proposal adds new categories of equipment, although there are few examples of such equipment being manufactured. These provisions allow the code to anticipate the growth in these equipment markets.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Ronald Majette, representing U.S. Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 503.2.3(2)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	~~Heating Section Type~~	Subcategory or Rating Condition	Minimum Efficiency[a]	Test Procedure[b]
Water source water to water (cooling mode)	<135,000 Btu/h	~~All~~	86°F entering water	10.6 EER	ISO-13256-2
Groundwater source water to water (cooling mode)	<135,000 Btu/h	~~All~~	59°F entering water	16.3 EER	ISO-13256-2
Ground source Brine to water (cooling mode)	<135,000 Btu/h	~~All~~	77°F entering water	12.1 EER	ISO-13256-2
Water source water to water (heating mode)	<135,000 Btu/h (cooling capacity)	—	68°F entering water	3.7 COP	ISO-13256-2
Groundwater source water to water (heating mode)	<135,000 Btu/h (cooling capacity)	~~—~~	50°F entering water	3.1 COP	ISO-13256-2
Ground source brine to water (heating mode)	<135,000 Btu/h (cooling capacity)	—	32°F entering water	2.5 COP	ISO-13256-2

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: There are currently no provisions in the IECC that regulate the minimum efficiency of the covered equipment. This public comment is to align the formatting of the proposal's table with the current table formatting in the IECC. This proposal will also bring consistency with ASHRAE Standard 90.1, which is adopted by reference in the IECC.

Final Action: AS AM AMPC____ D

EC198-09/10
503.2.7 (New), Table 503.2.7 (New)

Proposed Change as Submitted

Proponent: Ronald Majette, US Department of Energy

Add new text and table as follows:

503.2.7 Kitchen Exhaust Systems. Replacement air introduced directly into the exhaust hood cavity shall not exceed 10% 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 503.2.7 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 system(s) 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 503.2.7
MAXIMUM NET EXHAUST FLOW RATE, CFM PER LINEAR FOOT OF

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. This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. Due to the timing of the code development process and ASHRAE standards processes this proposal was submitted in anticipation that by the final action hearings the work to update the standard would be complete.

The proposal basically outlaws "short-circuit" hoods. Research by the American Gas Association
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 503.2.7 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.

ICCFILENAME: Majette-EC-10-503.2.7-

Public Hearing Results

Committee Action: Disapproved

Committee Reason: Although the proposal would have been consistent with related ASHRAE standards, the text was not coordinated with the requirements of the International Mechanical Code.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Submitted.

Commenter's Reason: The reason given for disallowing the proposal is invalid.

The proposed table effectively requires using listed hood(s) if the total kitchen exhaust flow rate is over 5000 cfm, because the maximums in 503.2.7 are lower than the minimums in IMC table 507.13.1. On first impression this may appear to conflict with the IMC. However, IMC 507.1 exception 1 allows the use of listed hoods rather than complying with the minimums in 507.13.1.

Section 507.13.1 in the 2009 IMC can still be used for unlisted hoods. There is no conflict because there is no table in the IMC for listed hoods. Hoods in kitchens with lower total exhaust flow rates can still be built up (unlisted) and use the IMC table minimums.

Public Comment 2:

Ronald Majette, representing U.S. Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

503.2.7 Kitchen Exhaust Systems. ~~Replacement air introduced directly into the exhaust hood cavity shall not exceed 10% of the hood exhaust airflow rate~~. Kitchen ventilation and exhaust systems shall be in accordance with the *International Mechanical Code* and this section. Kitchen ventilation systems which deliver conditioned supply air ~~delivered~~ to any space containing a kitchen hood shall not ~~exceed~~ be capable of exceeding the greater of the following:

1. The ventilation rate required to meet the space ~~heating or cooling~~ conditioning load; or
2. The hood exhaust flow minus the available transfer air from adjacent spaces. For the purposes of this section, ~~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.

Where the total ~~kitchen hood~~ exhaust airflow rate of kitchen hoods in the space is greater than 5,000 cfm; each hood shall have a maximum exhaust rate ~~in accordance with Table 503.2.7~~ not exceeding 110 percent of the minimum exhaust rate required by the *International Mechanical Code* and the ventilation system shall ~~meet one of~~ provide the following:

1. ~~At least 50 percent of all~~ Replacement air that is not less than 50 percent of the transfer air that would otherwise be exhausted;
2. Demand ventilation systems ~~on at least 75 percent of the exhaust air~~ that are capable of a ~~at least~~ 50 percent or greater reduction in exhaust and replacement air system airflow rates for not less than 75 percent of the exhaust air. The demand ventilation system shall include ~~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; or
3. Listed energy recovery devices with a sensible heat recovery effectiveness of not less than ~~at least~~ 40 percent ~~on at least~~ for not less than 50 percent of the total exhaust air~~flow~~.

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~~ with the highest duty rating located under the hood or hood section.

> **Exception**: Where not less than ~~at least~~ 75 percent of ~~all~~ the replacement air provided by the kitchen ventilation and exhaust system is transfer air that would otherwise be exhausted, the provisions of this section shall not apply.

Delete Table 503.2.7 in its entirety.

Commenter's Reason: The initial code change submittal was recommended for disapproval (D) 6-5 at the first hearing. The reason for disapproval was the lack of coordination with the IMC. The public comment provides the necessary coordination with the IMC and clearly retains the primary authority for such systems in the IMC, but then where the IECC is adopted provides an additional consideration to reduce energy use as documented in the reason to the original code change. DOE has had this public comment available for interested parties to comment on for the first 6 months of 2010 and received input during that time that supports the suggested changes above to the original code change and recommended further enhancements that DOE attempted to implement. DOE believes it has done what the committee considered necessary at the first hearing to make the change work with the ICC family of codes and as such the change should be approved.

Final Action: AS AM AMPC____ D

EC203-09/10
503.2.8 (New)

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

Add new text as follows:

503.2.8 Laboratory Exhaust Systems. Buildings with laboratory exhaust systems having a total exhaust rate greater than 5,000 cfm shall be provided with:

1. A VAV laboratory exhaust and room supply system capable of reducing exhaust and makeup air flow rates to the minimum required in the *International Mechanical Code*
2. A heat recovery system to precondition makeup air from laboratory exhaust that has a percentage that the exhaust and makeup air flow rates can be reduced from design conditions plus a percentage *sensible recovery effectiveness* totaling at least 50 percent.
3. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust air flow rate capable of being heated and cooled to the design temperatures in Section 302.1.

Reason: For consistency with Standard 90.1. This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. Due to the timing of the code development process and ASHRAE standards processes this proposal was submitted in anticipation that by the final action hearings the work to update the standard would be complete.

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

ICCFILENAME: Majette-EC-11-503.2.8

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee understood that the proposal was coordinated with the IMC and would increase energy savings, but they were unconvinced that real costs of the change were not clear and may not be justified based on the savings. The committee felt this was a niche issue that didn't need to be addressed in the code at this time.

Assembly Action: **Approved as Submitted**

Individual Consideration Agenda

This code change proposal is on the agenda for individual consideration because the proposal received a successful assembly action. Note that the assembly action, Approved as Submitted, will be the initial motion on the floor for consideration when this item is called. In addition, several public comments have been received.

Public Comment 1:

Ronald Majette, representing U.S. Department of Energy and Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

503.2.8 Laboratory Exhaust Systems. Buildings with laboratory exhaust systems having an individual or aggregate ~~total~~ exhaust rate greater than 5,000 cfm shall be in accordance with the International Mechanical Code and shall be provided with:

1. A VAV laboratory exhaust and room supply system capable of reducing exhaust and makeup air flow rates to the minimum required in the *International Mechanical Code;*
2. A heat recovery system to precondition makeup air from laboratory exhaust that has a percentage that the exhaust and makeup air flow rates can be reduced from design conditions plus a percentage sensible recovery effectiveness totaling at least 50 percent; and
3. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust air flow rate capable of being heated and cooled to the design temperatures in Section 302.1.

Commenter's Reason: The code change received an assembly floor action for approval as submitted (ASF) and has been revised for clarification and to reinforce that the IMC must still be consulted in all cases, not just the case of where VAV is being applied, both of which were issues raised at the first hearing. This public comment is also based on input received from interested parties over the past 6 months that this public comment was posted by DOE in an effort to secure additional input. During that time no adverse comment suggesting was received that the change not be approved.

The IECC code development committee, while noting that this change maintains consistency with ASHRAE 90.1, did not feel that this criterion needed to be in the code because the savings might not be justified and the hoods constituted a niche issue. As is the case with kitchen exhaust systems, lab exhaust systems are generally on or off and when on they can be performing no needed function thereby wasting energy or when performing the needed function can be exhausting heating or cooling energy that can be reclaimed. These systems have exhaust rates comparable with kitchen exhaust systems if not greater and should receive the same consideration.

An integral part of laboratory ventilation systems, fume hoods are a major contributor to making typical laboratories four- to five-times more energy intensive than typical commercial buildings (LBNL). As of 1989 there were over 1 million fume hoods in the US (EPA) and it is certain there are more today. Based on these data such hoods appear to be more than a niche market and do appear to be a significant energy component of commercial buildings, a component that is currently not addressed in the IECC, but is addressed in the IMC from a health and safety standpoint. As we look to address energy efficiency in buildings we must look to capture opportunities that are not currently addressed in the code.

As to energy savings, VAV systems are readily available from manufacturers of such systems. In an article entitled "Energy-Saving Exhaust Systems" *By: Brad C. Cochran & Jeff D. Reifschneider From Lab Design and Furnishings, Published: 4/7/2009,* the article documents savings of $0.50 per cfm per year savings going from constant volume to VAV. In a study of a typical laboratory exhaust system constant volume systems consumed 814 Mwh/year at a cost of $122,000 (@$0.12 per Kwh) and VAV in the same application consumed 321 Mwh/year at a cost of $48,000 per year. These are significant energy and cost savings. This change should be approved because the code does not currently address these systems, they are clearly being addressed in other energy standards, fume hoods are not a niche market and as shown clearly offer significant opportunity for energy use and operating cost reductions.

Public Comment 2:

Richard Grace, Fairfax County, VA, Virginia Plumbing and Mechanical Inspectors Association (VPMIA), Virginia Building Code Officials Association, ICC Region VII requests Disapproval.

Commenter's Reason: Although not completely opposed to this code change, I see some issues with it. The first is that the requirements outlined in this code change are specific to requirements found in the IMC, not the IECC. The IECC should not dictate prescriptive mechanical requirements. By doing so, these requirements may easily be overlooked, or in some jurisdictions, not even be adopted at all. These requirements need to be addressed in the IMC to be effective, not the IECC. Second, where a laboratory exhaust system is considered hazardous or conveys flammable fumes, an ERV is not permitted per IMC 514.2, #1 and #2. This proposed change does not exempt these hoods from energy recovery. Third, IECC 503.2.6 already dictates the parameters for required energy recovery systems. Lastly, the proponents reason statement for this proposed change it to attempt to provide consistency between the IECC and AHSRAE 90.1-2010. The 2010 edition of this standard is not complete. Introducing this language into the IECC at this time would be premature.

Final Action: AS AM AMPC____ D

EC204-09/10
503.2.8, Table 503.2.8

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

1. Revise as follows:

503.2.8 Piping insulation. All piping serving as part of a heating or cooling system shall be thermally insulated in accordance with Table 503.2.8 based on the expected operating hours of the HVAC system commensurate with the building type.

Exceptions:

1. Factory-installed piping within HVAC equipment tested and rated in accordance with a test procedure referenced by this code.
2. Factory-installed piping within room fan-coils and unit ventilators tested and rated according to AHRI 440 (except that the sampling and variation provisions of Section 6.5 shall not apply) and 840, respectively.
3. Piping that conveys fluids that have a design operating temperature range between ~~55~~ 60°F (13°C) and 105°F (41°C).
4. Piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.
5. ~~Runout piping not exceeding 4 feet (1219 mm) in length and 1 inch (25 mm) in diameter between the control valve and HVAC coil.~~ Strainers, control valves, and balancing valves associated with piping 1 inch or less in diameter.
6. Direct buried piping that conveys fluids at or below 60°F (13°C)

Delete and substitute as follows:

~~TABLE 503.2.8~~
~~MINIMUM PIPE INSULATION~~
~~(thickness in inches)~~

~~FLUID~~	~~NOMINAL PIPE DIAMETER~~	
	~~≤1.5"~~	~~>1.5"~~
~~Steam~~	~~1 1/2~~	~~3~~
~~Hot water~~	~~1 1/2~~	~~2~~
~~Chilled water, brine or refrigerant~~	~~1 1/2~~	~~1 1/2~~

~~For SI: 1 inch = 25.4 mm.~~
~~a. Based on insulation having a conductivity (*k*) not exceeding 0.27 Btu per inch/h · ft^2 · °F.~~
~~b. For insulation with a thermal conductivity not equal to 0.27Btu · inch/h · ft^2 · °F at a mean temperature of 75°F, the minimum required pipe thickness is adjusted using the following equation;~~
~~$T = r[(1+t/r)^{K/k}-1]$~~

~~where:~~

~~*T* = Adjusted insulation thickness (in).~~
~~*r* = Actual pipe radius (in).~~
~~*t* = Insulation thickness from applicable cell in table (in).~~
~~*K* = New thermal conductivity at 75°F (Btu · in/hr · ft^2 · °F).~~
~~*k* = 0.27 Btu · in/hr · ft^2 · °F.~~

TABLE 503.2.8
MINIMUM PIPE INSULATION THICKNESS
(thickness in inches)[a]

Fluid Operating Temperature Range (°F) and Usage	Insulation Conductivity		Nominal Pipe or Tube Size(in)				
	Conductivity Btu·in./(h·ft^2·°F)[b]	Mean Rating Temperature, °F	≤1	1 to <1-1/2	1-1/2 to <4	4 to <8	≥8
>350 °F	**0.32-0.34**	**250**					
Low Use (<4,400 h/yr)			2.5	3.0	3.0	4.0	4.0
High Use (≥4,400 h/yr)			4.5	5.0	5.0	5.0	5.0
251 – 350°F	**0.29 – 0.32**	**200**					
Low Use (<4,400 h/yr)			2.5	2.5	3.0	3.0	3.0
High Use (≥4,400 h/yr)			3.0	4.0	4.5	4.5	4.5
201 -250°F	**0.27 – 0.30**	**150**					
Low Use (<4,400 h/yr)			1.5	1.5	2.0	2.0	2.0
High Use (≥4,400 h/yr)			2.5	3.0	3.0	3.5	3.5
141 – 200°F	**0.25 – 0.29**	**125**					
Low Use (<4,400 h/yr)			1.0	1.5	1.5	1.5	1.5
High Use (≥4,400 h/yr)			2.5	2.5	2.5	2.5	2.5
105 – 140°F	**0.22 – 0.28**	**100**					
Low Use (<4,400 h/yr)			1.0	1.0	1.0	1.5	1.5
High Use (≥4,400 h/yr)			1.5	1.5	1.5	2.0	2.0
40 - 60°F	**0.22-0.28**	**100**					
Low Use (<4,400 h/yr)			0.5	0.5	1.0	1.0	1.0
High Use (≥4,400 h/yr)			0.5	0.5	1.0	1.0	1.0
<40°F	**0.22 – 0.28**	**100**					
Low Use (<4,400 h/yr)			0.5	1.0	1.0	1.0	1.5
High Use (≥4,400 h/yr)			1.0	1.0	1.0	1.5	1.5

a. For piping smaller than 1½” and located within interior partitions, reduction of these thicknesses by 1” shall be permitted (before thickness adjustment required in footnote a) but not to thicknesses below 1”.

b. For piping smaller than 1½” and located within interior partitions, reduction of these thicknesses by 1” shall be permitted (before thickness adjustment required in footnote a) but not to thicknesses below 1”. For insulation outside the stated conductivity range, the minimum thickness (*T*) shall be determined as follows:

$$T = r\{(1 + t/r)^{K/k} - 1\}$$

where

T = minimum insulation thickness (in.),
r = actual outside radius of pipe (in.),
t = insulation thickness listed in the table for applicable fluid temperature and pipe size,
K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu·in./h·ft2·°F); and
k = the upper value of the conductivity range listed in the table for the applicable fluid temperature.

c. For direct-buried heating and hot water system piping, reduction of these thicknesses by 1.5” shall be permitted (before thickness adjustment required in footnote a) but not to thicknesses below 1”.

Reason: This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. Due to the timing of the code development process and ASHRAE standards processes this proposal was submitted in anticipation that by the final action hearings the work to update the standard would be complete.

Cost Impact: The code change proposal would increase or decrease the cost of construction in some but not all instances.

ICCFILENAME: Majette-EC-12-503.2.8

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal was disapproved for a variety of reasons. The first issue was that the proposed text, including the table footnotes, was unclear which will not result in consistent enforcement. There were numerous corrections needed to clarify the text. Also of concern was the larger sizes would not fit inside many wall cavities as is now done in the market.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Ronald Majette, representing U.S. Department of Energy, Steve Ferguson, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

503.2.8 Piping insulation. All piping serving as part of a heating or cooling system shall be thermally insulated in accordance with Table 503.2.8 ~~based on the expected operating hours of the HVAC system commensurate with the building type~~.

Exceptions:

1. Factory-installed piping within HVAC equipment tested and rated in accordance with a test procedure referenced by this code.
2. Factory-installed piping within room fan-coils and unit ventilators tested and rated according to AHRI 440 (except that the sampling and variation provisions of Section 6.5 shall not apply) and 840, respectively.
3. Piping that conveys fluids that have a design operating temperature range between 60°F (~~13~~ 15°C) and 105°F (41°C).
4. Piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.
5. Strainers, control valves, and balancing valves associated with piping 1 inch or less in diameter.
6. Direct buried piping that conveys fluids at or below 60°F (~~13~~ 15°C)

TABLE 503.2.8
Minimum Pipe Insulation Thickness
(thickness in inches)[a]

Fluid Operating Temperature Range (°F) and Usage	Insulation Conductivity		Nominal Pipe or Tube Size(in)				
	Conductivity Btu·in./(h·ft²·°F)[~~b~~]	Mean Rating Temperature, °F	<1	1 to <1-1/2	1-1/2 to <4	4 to <8	≥8
>350 °F	**0.32-0.34**	**250**	4.5	5.0	5.0	5.0	5.0
~~Low Use (<4,400 h/yr)~~	~~2.5~~	~~3.0~~	~~3.0~~	~~4.0~~	~~4.0~~		
~~High Use (≥4,400 h/yr)~~	~~4.5~~	~~5.0~~	~~5.0~~	~~5.0~~	~~5.0~~		
251 – 350°F	**0.29 – 0.32**	**200**	3.0	4.0	4.5	4.5	4.5
~~Low Use (<4,400 h/yr)~~	~~2.5~~	~~2.5~~	~~3.0~~	~~3.0~~	~~3.0~~		
~~High Use (≥4,400 h/yr)~~	~~3.0~~	~~4.0~~	~~4.5~~	~~4.5~~	~~4.5~~		
201 -250°F	**0.27 – 0.30**	**150**	2.5	2.5	2.5	3.0	3.0
~~Low Use (<4,400 h/yr)~~	~~1.5~~	~~1.5~~	~~2.0~~	~~2.0~~	~~2.0~~		
~~High Use (≥4,400 h/yr)~~	~~2.5~~	~~3.0~~	~~3.0~~	~~3.5~~	~~3.5~~		
141 – 200°F	**0.25 – 0.29**	**125**	1.5	1.5	2.0	2.0	2.0
~~Low Use (<4,400 h/yr)~~	~~1.0~~	~~1.5~~	~~1.5~~	~~1.5~~	~~1.5~~		
~~High Use (≥4,400 h/yr)~~	~~2.5~~	~~2.5~~	~~2.5~~	~~2.5~~	~~2.5~~		
105 – 140°F	**0.21 – 0.28**	**100**	1.0	1.0	1.5	1.5	1.5
~~Low Use (<4,400 h/yr)~~	~~1.0~~	~~1.0~~	~~1.0~~	~~1.5~~	~~1.5~~		
~~High Use (≥4,400 h/yr)~~	~~1.5~~	~~1.5~~	~~1.5~~	~~2.0~~	~~2.0~~		
40 - 60°F	**0.21-0.27**	**75**	0.5	0.5	1.0	1.0	1.0
~~Low Use (<4,400 h/yr)~~	~~0.5~~	~~0.5~~	~~1.0~~	~~1.0~~	~~1.0~~		
~~High Use (≥4,400 h/yr)~~	~~0.5~~	~~0.5~~	~~1.0~~	~~1.0~~	~~1.0~~		
<40°F	**0.20 – 0.26**	**75**	0.5	1.0	1.0	1.0	1.5
~~Low Use (<4,400 h/yr)~~	~~0.5~~	~~1.0~~	~~1.0~~	~~1.0~~	~~1.5~~		
~~High Use (≥4,400 h/yr)~~	~~1.0~~	~~1.0~~	~~1.0~~	~~1.5~~	~~1.5~~		

a. For piping smaller than 1½ inch (38 mm) and located in partitions within *conditioned spaces*, reduction of these thicknesses by 1 inch (25 mm) shall be permitted (before thickness adjustment required in footnote a) but not to thicknesses less than 1 inch (25 mm).

b. For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows:

$$T = r\{(1 + t/r)^{K/k} - 1\}$$

Where:

T = minimum insulation thickness,
r = actual outside radius of pipe,
t = insulation thickness listed in the table for applicable fluid temperature and pipe size,
K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu x in/h x·ft² x °F) and
k = the upper value of the conductivity range listed in the table for the applicable fluid temperature.

c. For direct-buried heating and hot water system piping, reduction of these thicknesses by 1 ½ inches (38 mm) shall be permitted (before thickness adjustment required in footnote ~~a~~ b) but not to thicknesses less than 1 inch (25 mm).

(Portions of code change proposal not shown remain unchanged)

Commenter's Reason: (Ronald Majette) The proposal was recommended for disapproval (D) at the first hearing because the proposed text, including the table footnotes, were unclear and as such would not result in consistent enforcement, there were numerous corrections needed to clarify the text and that larger pipe sizes with insulation would not fit inside many wall cavities as can now be accommodated in the market. The public comment prepared by DOE was available for input by interested parties for the first 6 months of 2010 and DOE encouraged public input, including if DOE should even pursue submitting or not submitting a public comment. No input was received from anyone on this public comment.

DOE feels it important to retain consistency with ASHRAE Standard 90.1 that is referenced in the IECC as one reason to approve this change. As to the reasons for disapproval, footnotes a and c do not appear unclear and interestingly footnote b is in the IECC now in concept. That footnote simply allows the designer to get credit for more an insulating product that has a thermal conductivity different than that used as a basis for the table but unlike the present footnote addresses the critical issue that thermal insulation conductivity increases with temperature. This is a significant flaw in the current code in that it only addresses the variability of insulation thickness but not the thermal properties of the insulation as service temperatures of the piping change.

The corrections needed to clarify the table were attempted at the first hearing via a floor amendment to address comments that had been received after the posting of the proposed code changes in the Fall of 2009; most notably the inability to readily address hours of operation in plan review. Those corrections were substantial but all were needed to enhance the change to ensure its accuracy and usability. At the time there was some concern the committee could follow those floor amendments.

This public comment provides those changes now in advance of the public hearings and as such there should be ample time to study what is proposed. Regarding the comment concerning piping with insulation not fitting in walls it is interesting to note that the current code in not as effectively separating HVAC piping temperatures in many cases would actually take up more space with the pipe and pipe insulation than what is proposed. The situation where the proposed provisions would have an impact is on high temperature steam systems where insulation would rise from 3 in. to 5 in. such that more room for the pipe would be necessary. With that said, how many high pressure steam pipes are installed within walls that are part of the building envelope assembly? If some are they could make an additional 4 in. of space for the insulation, or as allowed by footnote b, simply use better insulation and reduce the insulation thickness. As noted above the additional thickness on such piping is needed in part because the current code does not reflect the decrease in thermal conductivity with an increase in temperature. It is also worth noting that 5 in. pipe insulation is readily available and must be demanded for and being applied in the market now. If walls or other building assemblies were an issue it is not likely the market would demand or provide these insulation products now.

(Steve Ferguson) This Public Comment, submitted by ASHRAE, is intended to modify EC-204 so that it is aligned with the comparable published requirements of ASHRAE Standard 90.1-2010 as approved by the Society's Board of Directors. In the period between the October 2009 Development Hearings in Baltimore and the July 1, 2010 deadline for Charlotte Final Action Hearing public comments, ASHRAE has continued to develop its piping insulation requirements for the 2010 version. A second public review on ASHRAE's Addendum "bi" was conducted based on modifications resulting from comments received during the first public review. This public comment to EC-204 reflects numerous public comments to ASHRAE requesting simplification of the original "bi" proposal in the interests of better code compliance and enforcement. The ASHRAE SSPC-90.1 and its Mechanical Subcommittee have found that these piping insulation requirements are cost-effective based on the SSPC 90.1's economic criteria, and are practical with respect to piping insulation material availability and application concerns.
ASHRAE recommends that EC-204 be Approved as Modified by this Public Comment (AMPC.)

Final Action: AS AM AMPC____ D

4

EC207-09/10
503.2.8.1 (New)

Proposed Change as Submitted

Proponent: Howard Ahern, Plumberex, Palm Springs, CA

Add new text as follows:

503.2.8.1 Protection of piping insulation. Piping Insulation exposed to weather shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind by means including, aluminum, sheet metal, painted canvas, or plastic cover or other protection suitable for outdoor service. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material. Adhesives tape shall not be permitted.

Reason: Outdoor Piping Insulation needs to be protected from weather, physical damage or from UV deterioration. Pipe insulation in outdoor locations is typically protected by an aluminum or sheet metal jacket, painted canvas, plastic cover, or coating that is water retardant and UV resistant.

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. 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. Protection can also keep silted pipe insulation from commonly separating thus saving additional energy cost. This simple common sense proposal is cost-effective as it will save energy and will prolong insulation life reducing replacement.

This proposal will save building energy cost following the same initiative being taken by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) to improve energy efficiency levels by 30% in the **ASHRAE 90.1 2007 Section 6.4.4.1.1** commercial building standards. It also reflects the energy efficiency improvement approved by Congress American Recovery and Reinvestment Act of 2009 (ARRA).

ASHRAE 90.1 2007 Section 6.4.4.1.1:

Piping Insulation exposed to weather shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind but not limited to the following

A. Piping Insulation exposed to weather shall be suitable for outdoor service e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.

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

ICCFILENAME: Ahern-EC-2-503.2.8.1

Public Hearing Results

Committee Action: **Approved as Modified**

Modify the proposal as follows:

503.2.8.1 Protection of piping insulation. Piping Insulation exposed to weather shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, ~~and~~ wind and shall provide ~~by means including, aluminum, sheet metal, painted canvas, or plastic cover or other protection suitable for outdoor service. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides~~ shielding from solar radiation that can cause degradation of the material. Adhesives Adhesive tape shall not be permitted.

Committee Reason: The committee approved this change to be consistent with its actions on EC110-09/10. The modification was to improve the grammar of the sentences. The provision provides appropriate protection for piping insulation exposed in exterior installations.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Richard Grace, Fairfax County, VA, representing Virginia Plumbing and Mechanical Inspectors Association (VPMIA), Virginia Building Code Officials Association, ICC Region VII requests Disapproval.

Commenter's Reason: As much as I think it is important to maintain the integrity of piping insulation (installed outdoors or indoors), this code change just doesn't get us there. The first statement alone leaves enforcement and interpretation of this section completely up to each authority having jurisdiction, and there will not be consistency among them. "Shall be protected from damage, including . . ." What method of protection can possibly be used to protect the piping insulation from all manners of "damage"? Not only must the piping insulation be protected from sunlight, moisture (does hail fall under this category?), wind (does this include hurricanes or tornados?), and solar radiation, but it must also be protected from maintenance personnel who might either step on it, poke with a screwdriver, run into when they lose their balance, or even run into it with their vehicles. Additionally, "damage" can be caused by lawn mowers, weed whackers, rodents, and many other creative ways. The only possible way to protect the piping insulation from all of those elements would be to encase the entire system in concrete.

Final Action: AS AM AMPC____ D

EC212-09/10
504.5

Proposed Change as Submitted

Proponent: John R. Addario, PE, New York State Department of State – Division of Code Enforcement and Administration

Revise as follows:

504.5 Pipe insulation. For automatic-circulating hot water and heat traced systems, piping shall be insulated with 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h x ft^2 x °F (1.53 W per 25 mm/m^2 x K). The first 8 feet (2438 mm) of piping in ~~noncirculating~~ non-hot-water-supply temperature maintenance systems served by equipment without integral heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h x ft^2 x °F (1.53 W per 25 mm/m^2 x K).

Reason: The intent of this section is to require systems that maintain hot water temperature to be properly insulated. Heat traced systems, like circulating systems, should be required to limit the amount of energy they consume by requiring a minimum amount of insulation. This proposed change includes heat trace systems within the intent of the code. This proposed change also renames the reference from *noncirculating* to *hot water supply temperature maintenance* in order to recognize heat trace systems .

Cost Impact: The code change proposal will not increase the cost of construction.

Filename: Addario-EC-3-504.5

Public Hearing Results

Committee Action: **Approved as Modified**

Modify the proposal as follows:

504.5 Pipe insulation. For automatic-circulating hot water ~~and~~ or heat traced systems, piping shall be insulated with 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h x ft^2 x °F (1.53 W per 25 mm/m^2 x K). The first 8 feet (2438 mm) of piping in non-hot-water-supply temperature maintenance systems served by equipment without integral heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h x ft^2 x °F (1.53 W per 25 mm/m^2 x K).

Committee Reason: The change brings under the IECC standards heat traced systems. Without the change, uninsulated heat trace systems can be installed. The modification more accurately states the intended meaning of the proponent.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

John R. Addario, New York State Department of State, Division of Code Enforcement and Administration requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

504.5 Pipe insulation. For automatic-circulating hot water or heat traced systems, piping shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h x ft^2 x °F (1.53 W per 25 mm/m^2 x K). The first 8 feet (2438 mm) of piping in non-hot-water-supply temperature maintenance systems served by equipment without integral heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h x ft^2 x °F (1.53 W per 25 mm/m^2 x K).

> **Exception:** Heat traced piping systems shall meet the insulation thickness requirements per the manufactures installation instructions. Untraced piping within a heat traced system shall be insulated with not less than 1 inch (25mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h x ft^2 x °F (1.53 W per 25 mm/m^2 x K)

Commenter's Reason: The committee approved the proposal as modified, with the comment that the proponent would verify that all heat trace manufactures could comply with the required insulation values. This modification complies with the committee request and provides consistency for insulation requirements between the manufactures. Heat trace systems sizing is based on a fixed heat loss per foot of piping for a given size, therefore some manufactures may rely on a slight difference in insulation thickness for heat traced systems. This modification addresses that difference, while requiring the piping within the system that has no heat tracing to comply with the code required minimum insulation values.

Final Action: AS AM AMPC____ D

EC216-09/10
504.7, 504.7.1, 504.7.2, 504.7.3

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

Revise as follows:

504.7 Pools, hot tubs and spas (Mandatory). Pools, hot tubs and spas shall ~~be provided with energy-conserving measures in accordance~~ comply with Sections 504.7.1 through 504.7.3.

504.7.1 ~~Pool h~~Heaters. All ~~pool~~ heaters shall be equipped with a readily *accessible* on-off switch to allow shutting off the heater without adjusting the thermostat setting. ~~Pool h~~ Heaters fired by natural or LP gas shall not have continuously burning pilot lights.

504.7.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on ~~swimming pool~~ heaters and pumps.

Exceptions:

1. Public health standards require 24-hour pump operation.
2. Pumps are required to operate solar- and waste-heat-recovery ~~pool heating~~ systems.

504.7.3 ~~Pool c~~Covers. Heated pools, hot tubs and spas shall be ~~equipped~~ provided with a vapor-retardant ~~pool~~ cover ~~on or at the water surface~~. Pools, hot tubs and spas capable of being heated to more than 90°F (32°C) shall ~~have a pool~~ be provided with a cover ~~with~~ having a minimum insulation value of R-12.

~~**Exception:** Pools deriving over 60 percent of the energy for heating from site-recovered energy or solar energy source.~~

Reason: Clarification. The current text does not apply to hot tubs and spas and it should. The text in 504.7.3 has been revised to be applied during inspection prior to approval of the subject pool, hot tub or spa. As currently written, one could interpret the requirements as enforceable after a use permit has been issued. It is not likely code officials could, nor would want to, enforce the cover provisions in a post-occupancy condition as suggested by the current text. The exception for solar or site recovered energy has been eliminated simply because there is no rationale why a pool, hot tub or spa getting 59% of its energy from non-renewables should not be exempt and one getting 61% from renewable should. Also, how would this last provision even be determined in plan review and capable of being readily enforced.

Cost Impact: The proposed change will not increase the cost of construction other than pools that were heated with solar or site recovered energy systems will now require the use of a pool cover.

ICCFILENAME: Majette-EC-16-504.7

Public Hearing Results

Committee Action: **Approved as Submitted**

Committee Reason: Consistent with the action taken on EC124-09/10, the committee approved this change. The committee expressed concern about the use of renewable energy sources and whether any exception should be provided.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Jennifer Hatfield, representing Association of Pool & Spa Professionals requests Approval as Submitted.

Replace the proposal as follows:

504.7 Pools and inground permanently installed spas (Mandatory). Pools and inground permanently installed spas shall ~~be provided with energy-conserving measures in accordance~~ comply with Sections 504.7.1 through 504.7.3.

504.7.1 ~~Pool~~ Heaters. All ~~pool~~ heaters shall be equipped with a readily *accessible* on-off switch that is mounted outside of the heater to allow shutting off the heater without adjusting the thermostat setting. ~~Pool~~ Gas-fired heaters ~~fired by natural gas or LPG~~ shall not ~~have continuously burning~~ be equipped with constant burning pilot lights.

504.7.2 Time switches. Time switches or other control method that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on all ~~swimming pool~~ heaters and pumps. Heaters, pumps and motors that have built in timers shall be deemed in compliance with this requirement.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and waste-heat-recovery pool heating systems.

504.7.3 ~~Pool~~ Covers. Heated pools and inground permanently installed spas shall be ~~equipped~~ provided with a vapor-retardant ~~pool~~ cover ~~on or at the water surface~~. ~~Pools capable of being heated to more than 90ºF (32ºC) shall have a pool cover with a minimum insulation value of R-12.~~

Exception: Pools deriving over ~~60~~ 70 percent of the energy for heating from site-recovered energy, such as a heat pump or solar energy source computed over an operating season**.**

Commenter's Reason: We believe we are staying with the intent of the original proposal, but making clarifications that are needed, specifically this comment does the following:

1. The original proposal added hot tubs and spas to the energy requirements under section 504.7. This comment seeks to clarify exactly what type of hot tubs and spas must meet the requirements under 504.7. There are inground permanently installed spas and portable electric spas, i.e. hot tubs. Inground permanently installed spas have their own set of standards they must meet and portable electric spas have a different set of standards, see for example ANSI/APSP-3 Standard for Permanently Installed Residential Spas and ANSI/APSP-6 Standard for Portable Spas. That same rationale applies to energy efficient requirements. Portable electric spas must meet their own set of energy efficient requirements separate from pools and inground permanently installed spas that are built on site. Factory built portable spas are stand alone appliances that are a pre-assembled unit that must be tested as a unit, in accordance with their own set of safety and energy efficient standards. Factory built portable spas must be certified to the UL 1563 standard in order to meet safety requirements such as the federal Virginia Graeme Baker Pool & Spa Safety Act suction entrapment avoidance requirements. Further, most portable spa manufacturers are now meeting California Energy Code (Title 20) energy efficient requirements – these California requirements are currently being developed into an ANSI/APSP approved standard (APSP-14, Energy Efficiency for Portable Spas) and are referenced in federal energy legislation that is slated to pass Congress later this summer to be incorporated into DOE regulations. Therefore, portable spas have their own energy efficiency requirements to meet and need to be considered separate from other installations. This comment makes this needed clarification.

   It should also be pointed out that many building departments do not consider a factory built portable spa under their purview since it is an appliance and not always a permitted item. Requiring factory built portable spas to follow federal regulations will help to ensure manufacturers meet these requirements. This language provides clarity for the code official to distinguish between an "inground permanently installed spa" and a "portable spa/hot tub."
2. This comment makes slight adjustments to the wording found in 504.7.1, but does not change in the intent of the original proposal. These changes are consistent with the language found in both the Florida Energy & Conservation Code, and in Title 24 of the California Energy Code (provides pump and heater requirements for pools and inground spas). Making these changes ensures all documents use the same words for the same meaning, so to provide clarity and consistency. This language is also found in the draft APSP-15 Energy Efficiency Standard for Residential Pools and Inground Spas, slated for ANSI approval in 2011.

   The comment also provides clarification under 504.7.2 "Time Switches." The language maintains the intent of the requirement while allowing solid-state timers and digital controllers (other control method) to be used in addition to tradition mechanical switches. It ensures that "all" heaters and pumps be included in the requirement and clarifies that equipment with onboard time clocks and controls meet the requirement. Some modern heaters and pumps include built-in controls to program operating times, and some include the ability to control other equipment, in all cases the full intent is achieved.
3. The comment removes the R-12 cover requirement. The proposal clarified that hot tubs and spas must also meet this requirement, but as previously discussed, with regard to factory built portable spas, they must meet their own unique set of standards and cover requirements are part of the test protocol found in Section 1604, Title 20 of the CEC, which is referenced in the federal legislation and the draft ANSI/APSP-14 standard; therefore, the R-12 requirement should not be applied to factory built portable spas. The R-12 requirement should also be removed for pools and inground spas for the following reasons:
   a. Water evaporation has the most significant negative impact on energy conservation. The most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. The R value has no relevance to evaporation and it is only one way to measure heat retention and should not be the only method specified. The code language should strive for performance language setting the goal for what needs to be accomplished without specifying how it is to be done. This inhibits technical innovation.

b. The R value for a cover is extremely difficult to measure. Most quoted numbers are calculations based on "hoped for" values. The largest heat loss on a cover are the gaps that are not sealed allowing heated water to escape. These seams for spas or gaps between the cover and deck for pools can negate any relevance of the R factor. R value calculations simply do not address this.

c. The R-12 requirement is not feasible for pools and inground permanently installed spas as there are no R 12 value pool covers in the market today for those applications. There appears to be no data or studies that give credence to why the R-12 value was applied to pools in the first place (was added in 2009).

d. Many inground pool and inground spas are equipped with automatic covers. These covers are usually in place every time the pool is not in use. As mentioned previously, evaporative heat loss is the primary culprit. Automatic covers solve that problem and reduce a significant amount of heat loss; at the same time they provide critical safety barrier protection (barrier protection is required by many states and how those requirements interconnect with energy efficient covers should be considered). While an automatic cover is not wanted or possible on every pool, adding an R-12 requirement would prevent automatic covers from being installed in many cases, which would actually result in a higher amount of energy loss, since the pool would not be covered when not in use much of the swimming season resulting in significant evaporative heat loss. This would not accomplish the goal of the energy code and would needlessly harm the automatic cover market in states that adopt this code. There are no automatic cover options that have an R 12 value.

4. The original proposal removed the exception found in 504.9.3, this comment seeks to put it back with slight changes. We understand that water evaporation has the most significant negative impact on energy conservation and that the most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. However, requiring covers to be installed on a heated pool becomes problematic as there is no guarantee it will be used after the final permit and if it is not used, the increased energy efficiency will not occur. A cover is a temporary, movable device that could be viewed as beyond the purview of a building code. For those consumers who may not want a cover and will not use it after the final permit, adding back in the exception encourages use of renewable heating devices to ensure some level of energy efficiency and conservation. The clarification that heat pumps also fall under this category and that the percentage is computed over an operating season provides for clarity. The increase in percentage provides for a higher requirement in order to opt out of the cover requirement. These changes are consistent with the Florida Energy & Conservation Code.

Public Comment 2:

Jennifer Hatfield, Association of Pool & Spa Professionals requests Approval as Submitted.

Replace the proposal as follows:

504.7 Pools, inground permanently installed spas, and factory built portable spas (Mandatory). Pools and inground permanently installed spas shall ~~be provided with energy-conserving measures in accordance~~ comply with Sections 504.7.1 through 504.7.3. Factory built portable spas shall comply with section 504.7.4.

504.7.1 ~~Pool~~ Heaters. All ~~pool~~ heaters shall be equipped with a readily *accessible* on-off switch that is mounted outside of the heater to allow shutting off the heater without adjusting the thermostat setting. ~~Pool~~ Gas-fired heaters ~~fired by natural gas or LPG~~ shall not ~~have continuously burning~~ be equipped with constant burning pilot lights.

504.7.2 Time switches. Time switches or other control method that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on all ~~swimming pool~~ heaters and pumps. Heaters, pumps and motors that have built in timers shall be deemed in compliance with this requirement.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and waste-heat-recovery pool heating systems.

504.7.3 ~~Pool~~ Covers. Heated pools and inground permanently installed spas shall be ~~equipped~~ provided with a vapor-retardant ~~pool~~ cover ~~on or at the water surface~~. ~~Pools capable of being heated to more than 90ºF (32ºC) shall have a pool cover with a minimum insulation value of R-12.~~

Exception: Pools deriving over ~~60~~ 70 percent of the energy for heating from site-recovered energy, such as a heat pump or solar energy source computed over an operating season.

504.7.4 Factory built portable spas and swim spas. Factory built portable electric spas and swim spas shall require less than the maximum allowed power calculated by the formula $5(V^{2/3})$ watts when tested as follows: Where V is the fill Volume (B) of the spa in gallons.

1. Minimum continuous testing time shall be 72 hours.
2. The spa shall be filled with water to the halfway point between the bottom of the skimmer basket opening and the overflow level of the spa. In the absence of a wall skimmer, the fill volume is 6 inches below the overflow level of the spa.
3. The water temperature of the spa or spa potion of a combination swim spa shall be a minimum of 100°F, for the duration of the test. The water temperature of the swim spa or swim portion of a combination swim spa shall be a minimum of 85°F, for the duration of the test.
4. The ambient air temperature shall be a maximum of 63°F for the duration of the test.
5. The specified cover shall be used during the test.
6. The test shall start when the water temperature has been at 102°F, ± 2°F, (at 87°F, ± 2°F for swim spas) for at least a four hour stabilizing period.
7. Record the total energy use for the period of test, starting at the end of the first heating cycle after the stabilization period specified in (F), and finishing at the end of the first heating cycle after 72 hours has elapsed.
8. Exception: For spas without heaters, substitute heating cycle with filter or purge cycle.
9. The unit shall remain covered and in the default operation mode during the test. Energy-conserving circulation functions, if present, must not be enabled if not appropriate for continuous, long-term use. The minimum filtration rate shall be 12 water turns within a 24 hour peiod. Ancillary equipment including, but not limited to lights, audio systems, and water treatment devices, shall remain connected to the mains but may be turned off during the test if their controls are user accessible.
10. The measured standby power (Pmeas) shall be normalized (Pnorm) to a temperature difference of 37°F using the equation~~,~~:

Pnorm = Pmeas (ΔTstd / ΔTmeas)

Where:

Pmeas = measured standby power during test (E/t)
ΔTstd = 37°F
ΔT meas = T water avg – T air avg
T water avg = Average water temperature during test
T air avg = Average air temperature during test.

11. Data required shall include: spa identification (make, model); volume of the unit in gallons; maximum allowed power and normalized standby power (Pnorm, in watts).

Commenter's Reason: We believe we are staying with the intent of the original proposal, but making clarifications that are needed, specifically this comment does the following:

1. The original proposal added hot tubs and spas to the energy requirements under section 504.7. This comment seeks to clarify exactly what type of hot tubs and spas must meet the requirements under 504.7. There are inground permanently installed spas and portable electric spas, i.e. hot tubs. Inground permanently installed spas have their own set of standards they must meet and portable electric spas have a different set of standards, see for example ANSI/APSP-3 Standard for Permanently Installed Residential Spas and ANSI/APSP-6 Standard for Portable Spas. That same rationale applies to energy efficient requirements. Portable electric spas must meet their own set of energy efficient requirements separate from pools and inground permanently installed spas that are built on site. Factory built portable spas are stand alone appliances that are a pre-assembled unit that must be tested as a unit, in accordance with their own set of safety and energy efficient standards. Factory built portable spas must be certified to the UL 1563 standard in order to meet safety requirements such as the federal Virginia Graeme Baker Pool & Spa Safety Act suction entrapment avoidance requirements. Further, most portable spa manufacturers are now meeting California Energy Code (Title 20) energy efficient requirements – these California requirements are currently being developed into an ANSI/APSP approved standard (APSP-14, Energy Efficiency for Portable Spas) and are referenced in federal energy legislation that is slated to pass Congress later this summer. Therefore, portable spas have their own energy efficiency requirements to meet and need to be considered separate from other installations.
2. The APSP-14 standard is slated to be ANSI approved by 2011 in order to incorporate into DOE regulations if the federal legislation passes. It will also be submitted as a proposal to the 2015 IECC. Recognizing that most portable spa manufacturers are already meeting the CEC requirements and due to the fact the proposed federal requirements and APSP-14 standard are not yet approved, this comment clarifies that inground permanently installed spas must meet the current requirements and adds a new section for portable spas. The new section for portable spas inserts the test method found in the CEC regulations for portable spa energy efficiency. It appears the intent of the original proposal was to make sure portable spas (hot tubs) also had to meet energy efficient requirements, this comment stays true to that intent, but recognizes that these factory built assembly unit appliances have their own unique set of requirements that must be followed. This comment ensures that the requirements factory built portable spa manufacturers must meet, follow what is already a California energy regulation and what is slated to become a federal energy regulation and an ANSI approved energy efficient standard. The test protocol in Title 20 includes all aspects of the portable spa, including the portable spa cover and heating elements.
3. It should also be pointed out that many building departments do not consider a factory built portable spa under their purview since it is an appliance and not always a permitted item. Requiring factory built portable spas to follow federal regulations will help to ensure manufacturers meet these requirements. This language provides clarity for the code official to distinguish between an "inground permanently installed spa" and a "portable spa/hot tub," at the same time making sure the factory built portable spas that may require a permit do meet section 1604, Title 20, CEC requirements.
4. This comment makes slight adjustments to the wording found in 504.7.1, but does not change in the intent of the original proposal. These changes are consistent with the language found in both the Florida Energy & Conservation Code, and in Title 24 of the California Energy Code (provides pump and heater requirements for pools and inground spas). Making these changes ensures all documents use the same words for the same meaning, so to provide clarity and consistency. This language is also found in the draft APSP-15 Energy Efficiency Standard for Residential Pools and Inground Spas, slated for ANSI approval in 2011.
5. The comment also provides clarification under 504.7.2 "Time Switches." The language maintains the intent of the requirement while allowing solid-state timers and digital controllers (other control method) to be used in addition to tradition mechanical switches. It ensures that "all" heaters and pumps be included in the requirement and clarifies that equipment with onboard time clocks and controls meet the requirement. Some modern heaters and pumps include built-in controls to program operating times, and some include the ability to control other equipment, in all cases the full intent is achieved.
6. The comment removes the R-12 cover requirement. The proposal clarified that hot tubs and spas must also meet this requirement, but as previously discussed, with regard to factory built portable spas, cover requirements are part of the test protocol found in Section 1604, Title 20 of the CEC; therefore, the R-12 requirement should not be applied to factory built portable spas. The R-12 requirement should also be removed for pools and inground spas for the following reasons:
    a. Water evaporation has the most significant negative impact on energy conservation. The most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. The R value has no relevance to evaporation and it is only one way to measure heat retention and should not be the only method specified. The code language should strive for performance language setting the goal for what needs to be accomplished without specifying how it is to be done. This inhibits technical innovation.
    b. The R value for a cover is extremely difficult to measure. Most quoted numbers are calculations based on "hoped for" values. The largest heat loss on a cover are the gaps that are not sealed allowing heated water to escape. These seams for spas or gaps between the cover and deck for pools can negate any relevance of the R factor. R value calculations simply do not address this.
    c. The R-12 requirement is not feasible for pools and inground permanently installed spas as there are no R 12 value pool covers in the market today for those applications. There appears to be no data or studies that give credence to why the R-12 value was applied to pools in the first place (was added in 2009).
    d. Many inground pool and inground spas are equipped with automatic covers. These covers are usually in place every time the pool is not in use. As mentioned previously, evaporative heat loss is the primary culprit. Automatic covers solve that problem and reduce a significant amount of heat loss; at the same time they provide critical safety barrier protection (barrier protection is required by many states and how those requirements interconnect with energy efficient covers should be considered). While an automatic cover is not wanted or possible on every pool, adding an R-12 requirement would prevent automatic covers from being installed in many cases, which would actually result in a higher amount of energy loss, since the pool would not be covered when not in use much of the swimming season resulting in significant evaporative heat loss. This would not accomplish the goal of the energy code and would

needlessly harm the automatic cover market in states that adopt this code. There are no automatic cover options that have an R 12 value.

7. The original proposal removed the exception found in 504.9.3, this comment seeks to put it back with slight changes. We understand that water evaporation has the most significant negative impact on energy conservation and that the most effective way to increase energy efficiency is to keep water from evaporating/escaping from the pool or spa. However, requiring covers to be installed on a heated pool becomes problematic as there is no guarantee it will be used after the final permit and if it is not used, the increased energy efficiency will not occur. A cover is a temporary, movable device that could be viewed as beyond the purview of a building code. For those consumers who may not want a cover and will not use it after the final permit, adding back in the exception encourages use of renewable heating devices to ensure some level of energy efficiency and conservation. The clarification that heat pumps also fall under this category and that the percentage is computed over an operating season provides for clarity. The increase in percentage provides for a higher requirement in order to opt out of the cover requirement. These changes are consistent with the Florida Energy & Conservation Code.

Final Action: AS AM AMPC____ D

EC217-09/10

202 (New), 505.1, 505.2 (New), Tables 505.2(1)-(2) (New), Chapter 6 (New)

Proposed Change as Submitted

Proponent: Ronald Majette, representing US Department of Energy

1. Add new definitions as follows:

GENERAL PURPOSE ELECTRIC MOTOR (SUBTYPE I). Any electric motor that meets the definition of "general purpose" motor as codified by the Department of Energy in 10 CFR 431.

GENERAL PURPOSE ELECTRIC MOTOR (SUBTYPE II). Any electric motor incorporating the design elements of a general purpose electric motor (subtype I) that are configured as:

U-frame motor,
Design C motor,
Close-coupled pump motor,
Footless motor,
Vertical solid shaft normal thrust motor (tested in a horizontal configuration)
8 –pole motor (900 rpm), or
Poly-phase motor with voltage no more than 600 volts (other than 230 or 460 volts).

2. Revise as follows:

505.1 General (Mandatory). This section covers electric motors, lighting system controls, the connection of ballasts, the maximum lighting power for interior applications and minimum acceptable lighting equipment for exterior applications.

Exception: Lighting within dwelling units where 50 percent or more of the permanently installed interior light fixtures are fitted with high-efficacy lamps.

3. Add new text and tables as follows:

505.2 Electric motors. Electric motors manufactured alone or as a component of another piece of equipment shall comply with Table 505.2(1) for *general purpose electric motors (subtype I)* and Table 505.2(2) for *general purpose electric motors (subtype II)*.

Fire pump motors and NEMA Design B, general purpose electric motors with a power rating of more than 200 horsepower, but no more than 500 horsepower shall have a minimum nominal full load efficiency as shown in Table 505.2(2)

TABLE 505.2(1)
MINIMUM NOMINAL FULL LOAD EFFICIENCY FOR 60 HZ NEMA GENERAL PURPOSE ELECTRIC MOTORS (SUBTYPE I) RATED 600

Minimum Nominal Full Load Efficiency (%)								
	Open Drip-Proof Motors				Totally Enclosed Fan Cooled Motors			
Number of Poles	2	4	6	8	2	4	6	8
Synchronous Speed (RPM)	3600	1800	1200	900	3600	1800	1200	900
Motor Horsepower								
1.0	NR	82.5	80.0	74.0	75.5	82.5	80.0	74.0
1.5	82.5	84.0	84.0	75.5	82.5	84.0	85.5	77.0
2.0	84.0	84.0	85.5	85.5	84.0	84.0	86.5	82.5
3.0	84.0	86.5	86.5	86.5	85.5	87.5	87.5	84.0

Minimum Nominal Full Load Efficiency (%)								
	Open Drip-Proof Motors				Totally Enclosed Fan Cooled Motors			
5.0	85.5	87.5	87.5	87.5	87.5	87.5	87.5	85.5
7.5	87.5	88.5	88.5	88.5	88.5	89.5	89.5	85.5
10.0	88.5	89.5	90.2	89.5	89.5	89.5	89.5	88.5
15.0	89.5	91.0	90.2	89.5	90.2	91.0	90.2	88.5
20.0	90.2	91.0	91.0	90.2	90.2	91.0	90.2	89.5
25.0	91.0	91.7	91.7	90.2	91.0	92.4	91.7	89.5
30.0	91.0	92.4	92.4	91.0	91.0	92.4	91.7	91.0
40.0	91.7	93.0	93.0	91.0	91.7	93.0	93.0	91.0
50.0	92.4	93.0	93.0	91.7	92.4	93.0	93.0	91.7
60.0	93.0	93.6	93.6	92.4	93.0	93.6	93.6	91.7
75.0	93.0	94.1	93.6	93.6	93.0	94.1	93.6	93.0
100.0	93.0	94.1	94.1	93.6	93.6	94.5	94.1	93.0
125.0	93.6	94.5	94.1	93.6	94.5	94.5	94.1	93.6
150.0	93.6	95.0	94.5	93.6	94.5	95.0	95.0	93.6
200.0	94.5	95.0	94.5	93.6	95.0	95.0	95.0	94.1
250.0	94.5	95.4	95.4	94.5	95.4	95.0	95.0	94.5
300.0	95.0	95.4	95.4	NR[b]	95.4	95.4	95.0	NR
350.0	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
400.0	95.4	95.4	NR	NR	95.4	95.4	NR	NR
450.0	95.8	95.8	NR	NR	95.4	95.4	NR	NR
500.0	95.8	95.8	NR	NR	95.4	95.8	NR	NR

a. Nominal efficiencies shall be established in accordance with NEMA Standard MG1.
b. NR = no requirement

TABLE 505.2(2) MINIMUM NOMINAL FULL LOAD EFFICIENCY OF GENERAL PURPOSE ELECTRIC MOTORS (SUBTYPE II AND DESIGN B)[a]

Minimum Nominal Full Load Efficiency (%)								
	Open Drip-Proof Motors				Totally Enclosed Fan Cooled Motors			
Number of Poles	2	4	6	8	2	4	6	8
Synchronous Speed (RPM)	3600	1800	1200	900	3600	1800	1200	900
Motor Horsepower								
1.0	NR	82.5	80.0	74.0	75.5	82.5	80.0	74.0
1.5	82.5	84.0	84.0	75.5	82.5	84.0	85.5	77.0
2.0	84.0	84.0	85.5	85.5	84.0	84.0	86.5	82.5
3.0	84.0	86.5	86.5	86.5	85.5	87.5	87.5	84.0
5.0	85.5	87.5	87.5	87.5	87.5	87.5	87.5	85.5
7.5	87.5	88.5	88.5	88.5	88.5	89.5	89.5	85.5
10.0	88.5	89.5	90.2	89.5	89.5	89.5	89.5	88.5
15.0	89.5	91.0	90.2	89.5	90.2	91.0	90.2	88.5
20.0	90.2	91.0	91.0	90.2	90.2	91.0	90.2	89.5

Minimum Nominal Full Load Efficiency (%)								
	Open Drip-Proof Motors				Totally Enclosed Fan Cooled Motors			
25.0	91.0	91.7	91.7	90.2	91.0	92.4	91.7	89.5
30.0	91.0	92.4	92.4	91.0	91.0	92.4	91.7	91.0
40.0	91.7	93.0	93.0	91.0	91.7	93.0	93.0	91.0
50.0	92.4	93.0	93.0	91.7	92.4	93.0	93.0	91.7
60.0	93.0	93.6	93.6	92.4	93.0	93.6	93.6	91.7
75.0	93.0	94.1	93.6	93.6	93.0	94.1	93.6	93.0
100.0	93.0	94.1	94.1	93.6	93.6	94.5	94.1	93.0
125.0	93.6	94.5	94.1	93.6	94.5	94.5	94.1	93.6
150.0	93.6	95.0	94.5	93.6	94.5	95.0	95.0	93.6
200.0	94.5	95.0	94.5	93.6	95.0	95.0	95.0	94.1
250.0	94.5	95.4	95.4	94.5	95.4	95.0	95.0	94.5
300.0	95.0	95.4	95.4	NR[b]	95.4	95.4	95.0	NR
350.0	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
400.0	95.4	95.4	NR	NR	95.4	95.4	NR	NR
450.0	95.8	95.8	NR	NR	95.4	95.4	NR	NR
500.0	95.8	95.8	NR	NR	95.4	95.8	NR	NR

a. Efficiencies shall be established in accordance with NEMA Standard MG1.
b. NR = no requirement

4. Add new standard as follows:

NEMA National Electrical Manufacturers Association
1300 North 17th Street, Suite 184
Rosslyn, VA 22209

ANSI/NEMA MG 1-93 Motors and Generators

Reason: This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. Due to the timing of the code development process and ASHRAE standards processes this proposal was submitted in anticipation that by the final action hearings the work to update the standard would be complete. Note also that motor efficiency is currently covered in Standard 90.1-07, is not included in the IECC and for consistency should be included.

Section 313 of the Energy Independence and Security Act of 2007 (EISA 2007) mandates that the efficiency of general purpose motors (manufactured or imported) that are rated at 1.0 horsepower and larger be increased for motors manufactured on or after December 19, 2010. In addition, there are new efficiency standards that are required for larger motors that may be used by commercial/ industrial customers (sized greater than 200 horsepower and less than or equal to 500 horsepower). These updated motor efficiency standards have been vetted, analyzed, and agreed to by motor manufacturers.

According to a March 21, 2007 press release by the American Council for an Energy- Efficient Economy (ACEEE) and the National Electrical Manufacturers Association (NEMA), the new motor efficiency standards will create a cumulative national energy savings of 8 quadrillion Btus over 20 years (2010 to 2030), with a net energy cost savings to commercial and industrial consumers of almost $500 million. These clarifying changes to Standard 90.1 will not affect the estimate of these savings.

Adding this clarifying information to the IECC will help designers, end-use customers, and code officials with motor specifications and verifications.

Cost Impact: The code change proposal will not increase the cost of construction as the provisions covered in the proposal are addressed in Federal rules, just as many of the HVAC equipment efficiencies are now in the IECC.

Analysis: A review of the standard(s) proposed for inclusion in the code, ANSI/NEMA MG 1-93, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before September 24, 2009.

ICCFILENAME: Majette-EC-22-505-

Public Hearing Results

Note: The following analysis was not in the Code Change monograph but was published on the ICC website at http://www.iccsafe.org/cs/codes/Documents/2009-10cycle/ProposedChanges/Standards-Analysis.pdf :

Analysis: Review of the proposed new standard indicated that, in the opinion of ICC staff, the standard did not comply with ICC standards criteria, Sections 3.6.2.11 and 3.6.3.2.

Committee Action: **Disapproved**

Committee Reason: The proposal was disapproved because the committee felt that the change was not clearly enforceable as currently written. In addition they felt that energy used for fire pumps should not be regulated by the code. Finally, the proposed referenced standard does not comply with ICC policy for referenced documents.

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, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Submitted.

Commenter's Reason: This proposal will bring IECC into agreement with EISA 2007 federal law and ASHRAE/IESNA 90.1. These requirements will be mandated as part of federal law regardless of if they are in the code or not. By adding them to the IECC, all of the information will be available in one document.

Final Action: AS AM AMPC____ D

EC219-09/10
101.4.3, 505.1

<u>Proposed Change as Submitted</u>

Proponent: Ronald Majette, representing US Department of Energy

Revise as follows:

101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building 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 building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
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. Reroofing for roofs where neither the sheathing nor the insulation is exposed. 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. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
7. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
8. Alterations that replace only the bulb ~~and~~ <u>or</u> ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

505.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications and minimum acceptable lighting equipment for exterior applications.

Exception: Lighting within dwelling units where 50 percent or more of the permanently installed interior light fixtures are fitted with high-efficacy lamps.

<u>The *alteration* of lighting systems in any building *space* or exterior area shall comply with the lighting power requirements of Section 505 applicable to the space or area being altered and the automatic shutoff requirements of Section 505.2.2.2. Such *alterations* shall include all luminaires that are added, replaced or removed. This requirement shall also be met for *alterations* that involve the replacement of lamps and ballast combinations.</u>

<u>**Exception:** *Alterations* that involve less than 10 percent of the connected lighting load in a *space* or area and do not increase the installed lighting power.</u>

Reason: For consistency with Standard 90.1. This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010. Due to the timing of the code development process and ASHRAE standards processes this proposal was submitted in anticipation that by the final action hearings the work to update the standard would be complete.

These changes clarify when controls are required to comply when lighting systems are altered. The current code requires that only controls that are replaced must meet specific requirements for that type of control. The proposed change requires that controls be changed or added to meet the primary lighting control requirement of automatic control when the lighting fixtures in the space are retrofit. This is simpler, makes spaces comply more completely with the code and will save additional energy.

Cost Impact: The proposal will decrease the cost of construction.

ICCFILENAME: Majette-EC-18-505.1

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee found the proposal would be difficult to enforce and would create a penalty of requiring significant retrofit of a lighting system when only part of it is being remodeled. The change would act to discourage upgrades rather the encourage them.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Ronald Majette, representing U.S. Department of Energy requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

101.4.3 Additions, alterations, renovations or repairs.

Additions, alterations, renovations or repairs to an existing building, building 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 building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
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. Reroofing for roofs where neither the sheathing nor the insulation is exposed. 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. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
7. ~~Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.~~

~~8.~~ 7. Alterations that replace only the bulb or ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

505.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications and minimum acceptable lighting equipment for exterior applications.

Exception: Lighting within dwelling units where 50 percent or more of the permanently installed interior light fixtures are fitted with high-efficacy lamps.

505.1.1 Alterations. The *alteration* of lighting systems in any building *space* or exterior area shall comply with the lighting power requirements of Section 505 applicable to the space or area being altered and the automatic shutoff requirements of Section 505.2.2.2. Such *alterations* shall include all luminaires that are added, replaced or removed. This requirement shall also be met for *alterations* that involve the replacement of lamps and ballast combinations.

Exception: *Alterations* that involve less than 10 percent of the connected lighting load in a *space* or area and do not increase the installed lighting power shall be exempt from the alteration requirements.

Commenter's Reason: For consistency with Standard 90.1. This proposal is based on ongoing analysis efforts within ASHRAE designed to create a Standard 90.1-2010 that is 30% better than Standard 90.1-2004 in response to Federal legislation. Paralleling those efforts and considering that the IECC Chapter 5 is intended to be technically compatible with that standard to facilitate adoption and implementation, DOE is interested in keeping Chapter 5 of the 2012 IECC aligned with ANSI/ASHRAE/IESNA Standard 90.1-2010.

This public comment strikes an exception in Section 101.4.3 that contradicted the exception proposed in Section 505.1.1 for alternations.

These changes clarify when controls are required to comply when lighting systems are altered. The current code requires that only controls that are replaced must meet specific requirements for that type of control. The proposed change requires that controls be changed or added to meet the primary lighting control requirement of automatic control when the lighting fixtures in the space are retrofit. This is simpler, makes spaces comply more completely with the code and will save additional energy.

Final Action: AS AM AMPC____ D

EC225-09/10

Tables 505.6.2(1) and 505.2(2)

Proposed Change as Submitted

Proponent: Richard Heinisch, Acuity Brands Lighting, Inc.

Revise table as follows:

TABLE 505.6.2(1)
EXTERIOR LIGHTING ZONES

Lighting Zone	Description
0	Undeveloped areas within national parks, state parks, forest land, rural areas, and other undeveloped areas as defined by the local land use planning authority
1	Developed areas of national parks, state parks, forest land, and rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas
4	High activity commercial districts in major metropolitan areas as designated by the local land use planning authority

TABLE 505.6.2(2)
INDIVIDUAL LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

		Zone 0	**Zone 1**	**Zone 2**	**Zone 3**	**Zone 4**
Base Site Allowance (base allowance may be used in tradable or non-tradable surfaces)		**No Base Site in Zone 0**	500 W	600 W	750 W	1300 W
	Uncovered Parking Areas					
		No Tradable Surface allowances in Zone 0				
	Parking areas and drives		0.04 W/ft^2	0.06 W/ft^2	0.10 W/ft^2	0.13 W/ft^2
	Building Grounds					
Tradable Surfaces (Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas may be traded.)	Walkways less than 10 feet wide		0.7 W/linear foot	0.7 W/linear foot	0.8 W/linear foot	1.0 W/linear foot
	Walkways 10 feet wide or greater Plaza areas Special Feature Areas		0.14 W/ft^2	0.14 W/ft^2	0.16 W/ft^2	0.2 W/ft^2
	Stairways		0.75 W/ft^2	1.0 W/ft^2	1.0 W/ft^2	1.0 W/ft^2
	Pedestrian Tunnels		0.15 W/ft^2	0.15 W/ft^2	0.2 W/ft^2	0.3 W/ft^2
	Landscaping		0.04 W/ft^2	0.05 W/ft^2	0.05 W/ft^2	0.05 W/ft^2
	Building Entrances and Exits					
	Main entries		20 W/linear foot of door width	20 W/linear foot of door width	30 W/linear foot of door width	30 W/linear foot of door width

		Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
	Other doors		20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width
	Entry Canopies		0.25 W/ft^2	0.25 W/ft^2	0.4 W/ft^2	0.4 W/ft^2
	Sales Canopies					
	free standing and attached		0.6 W/ft^2	0.6 W/ft^2	0.8 W/ft^2	1.0 W/ft^2
	Outdoor Sales					
	Open areas (including vehicle sales lots)		0.25 W/ft^2	0.25 W/ft^2	0.5 W/ft^2	0.7 W/ft^2
	Street frontage for vehicle sales lots in addition to "open area" allowance		No allowance	10 W/linear foot	10 W/linear foot	30 W/linear foot

(Remainder of table unchanged)

Reason: This change adds an exterior zone 0 to cover very low light requirement areas. This will help eliminate excessive use of light in areas where none is needed other than for location marking type. Prior to this, the choices for users were zone 1 or 3 which both have higher than needed allowances. The single 60 W luminaire per location allows the use of small HID from higher pole locations (i.e. at parking) and would allow incandescent in locations where cold weather inhibits the use of CFL technology.

Cost Impact: The code change proposal will not increase the cost of construction and will, in fact, decrease costs by keeping designers from over lighting Zone 0 sites.

ICCFILENAME: Heinisch-EC-1-T. 505.6.2(1)-(2)

Public Hearing Results

Committee Action: Disapproved

Committee Reason: The committee disapproved the proposal because it opened a series of issues, including one of safety in these areas. Parts of the proposal included unclear text. There was a concern regarding the term 'undeveloped areas' and whether such 'areas' were appropriate to include in the IECC which addresses building construction.

Assembly Action: None

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Richard Heinisch, Acuity Brands, Inc. representing himself, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE 505.6.2(2)
INDIVIDUAL LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

		Zone 1	Zone 2	Zone 3	Zone 4
	Building Grounds				
Tradable Surfaces (Lighting power densities for	Walkways less than 10 feet wide	0.7 W/linear foot	0.7 W/linear foot	0.8 W/linear foot	1.0 W/linear foot

		Zone 1	Zone 2	Zone 3	Zone 4
uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas may be traded.)	Walkways 10 feet wide or greater Plaza areas Special Feature Areas	0.14 W/ft^2	0.14 W/ft^2	0.16 W/ft^2	0.2 W/ft^2
	Stairways	0.75 W/ft^2	1.0 W/ft^2	1.0 W/ft^2	1.0 W/ft^2
	Pedestrian Tunnels	0.15 W/ft^2	0.15 W/ft^2	0.2 W/ft^2	0.3 W/ft^2
	Landscaping	0.04 W/ft^2	0.05 W/ft^2	0.05 W/ft^2	0.05 W/ft^2

(Remainder of table unchanged)

Commenter's Reason: While the commenter agrees that it is questionable that Tables 505.6.2(1) and 505.6.2(2) need a lighting zone 0 covering "Undeveloped areas", landscaping still needs to be added so that users of the code may stop using the higher LPD's allowed under 'Special Feature Areas" for these areas.

Final Action: AS AM AMPC____ D

EC230-09/10
506 (New)

Proposed Change as Submitted

Proponent: Steve Ferguson, representing The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

Add new text as follows:

SECTION 506
OTHER EQUIPMENT

506.1 General. This section covers the minimum efficiency of other equipment.

506.2 Dry-type transformer efficiency This section applies to all building power distribution *systems* and only to equipment described below.

506.2.1 New buildings Equipment installed in new buildings shall comply with the requirements of this section as shown in Table 506.2.1.

506.2.2 Addition to existing buildings Equipment installed in *additions* to *existing buildings* shall comply with the requirements of this section.

506.2.3 Alterations to existing buildings Alterations to building service equipment or systems shall comply with the requirements of this section applicable to those specific portions of the building and its systems that are being altered.

506.2.3.1 New equipment with alterations. Any new equipment subject to the requirements of this section that is installed in conjunction with the *alterations*, as a direct replacement of existing equipment shall comply with the specific requirements applicable to that equipment.

Exceptions to 506.3.1.2: Compliance shall not be required for the relocation or reuse of existing equipment at the same site.

506.2.4 Low Voltage Dry-Type Distribution Transformers. Low voltage dry-type transformers shall comply with the provisions of the Energy Policy Act of 2005 where applicable, as shown in Table 506.2.4. Transformers that are not included in the scope of the Energy Policy Act of 2005 have no performance requirements in this section, and are listed for ease of reference below as exceptions.

TABLE 506.2.4
MINIMUM NOMINAL EFFICIENCY LEVELS FOR NEMA CLASS I LOW VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS[a]

Single Phase Transformers		Three Phase Transformers	
kVA[ab]	**Efficiency (%)[bc]**	**kVA[ab]**	**Efficiency (%)[bc]**
15	97.7	15	97.0
25	98.0	30	97.5
37.5	98.2	45	97.7
50	98.3	75	98.0
75	98.5	112.5	98.2
100	98.6	150	98.3
167	98.7	225	98.5
250	98.8	300	98.6
333	98.9	500	98.7
		750	98.8
		1000	98.9

a. A low voltage distribution transformer is a transformer that is air-cooled, does not use oil as a coolant, has an input voltage <= 600 Volts, and is rated for operation at a frequency of 60 Hertz.
b. kiloVolt-Amp rating.

c. Nominal efficiencies shall be established in accordance with the NEMA TP-1 2002 test procedure for low voltage dry-type transformers. Class I Low Voltage Dry-Type is a National Electrical Manufacturers Association (NEMA) design class designation.

Exceptions to Table 506.2.4:

Transformers that meet the Energy Policy Act of 2005 exclusions based on NEMA TP-1 definition:

1. Special purpose applications
2. Not likely to be used in general purpose applications
3. Transformers with multiple voltage taps where the highest tap is at least 20 percent more than the lowest tap.

Products meeting these criteria and exempted from 506.3.1 include the following: drive transformer, rectifier transformer, auto-transformer, uninterruptible power system transformer, impedance transformer, regulating transformer, sealed and nonventilating transformer, machine tool transformer, welding transformer, grounding transformer, or testing transformer.

Reason: This addition will save energy and make the IECC consistent with ASHRAE 90.1-2007. Also, it will ensure that IECC complies with the federal Energy Policy Act of 2005, which require the transformer efficiencies shown in the tables.

Transformers are an integral part of the electric distribution system. They are used to lower the voltage of electricity from utility primary circuits to customer secondary circuits. For many commercial buildings, the electricity from the local electric distribution company is provided at 277 Volts (single phase) and 480 Volts (3 phase). However, most, if not all, commercial facilities have a need for electricity to be supplied at 120 Volts (single phase) or 208 Volts (3 phase) to operate certain equipment, such as computers, printers, copiers, kitchen equipment, etc. Low voltage dry-type transformers, which are purchased by the building owner, are used for this purpose.

According to NEMA and DOE statistics, commercial facilities currently use about 11,000,000 low voltage dry-type transformers in their facilities. Annual domestic shipments are 314,000 units per year. There are other types of transformers, such as medium voltage dry-type and liquid-filled, but the medium-voltage units are far less commonly used (about 3,500 shipped per year) and the liquid-filled are predominantly used by electric distribution companies on the “utility side” of the electric meter. For the medium-voltage dry-type and liquid-filled units, the US Department of Energy (DOE) will be deciding on national energy efficiency standards by the fall of 2007.

Under the Energy Policy Act of 2005, new national minimum efficiency standards went into effect for low voltage dry-type transformers manufactured on or after January 1, 2007. The law refers to Table 4-2 of the National Electrical Manufacturers Association (NEMA) publication NEMA TP-1 Guide for Determining Energy Efficiency for Distribution Transformers (2002).

These standards will result in energy savings for commercial buildings. According to an analysis performed by DOE in 2004 and summarized in the July 29, 2004 edition of the Federal Register (Volume 69, No. 145, pages 45376-45417), the standards shown in the proposed Table 8.1, the Department estimated that national efficiency standards for low voltage dry-type transformers would save 4.74 quads of primary energy over 28 years (2007 to 2035). In terms of cumulative electric site energy savings, that is roughly equivalent to 596 Billion kWh over 28 years, or 21.3 Billion kWh per year. The value is lower in the first 10 years (under 15 Billion kWh per year) and higher in the later years (over 27 Billion kWh per year) as more older units are replaced as the years progress.

These savings are based on NEMA test conditions of 35% of nameplate loads. It should be noted that studies have shown that many dry type transformers have typical loads in the 20-30% range, or lower. The lower the % load, the lower the energy savings from higher efficiency transformers (in many cases). To account for current sales of high efficiency dry-type transformers (there are some state mandates in effect) and to account for actual loading patterns, it is safe to assume an annual average savings of 10 Billion kWh.

According to the EEI Statistical Yearbook, in 2004, the commercial sector of the US economy consumed 1,230,425 GigaWatt-hours. This is equal to 1,230,425,000 MegaWatt-hours, or 1,230,425,000,000 kWh (1.23 Trillion kWh, or 1,230 Million kWh). With savings of 10 Billion kWh per year, the national dry-type low voltage transformer energy efficiency standard will save 10/1230 or 0.8% of the electricity used at commercial facilities.

In terms of economics, in 2004, DOE calculated that the mean payback for low voltage dry-type transformers would range, based on the size of the transformer analyzed, from 0.6 to 1.7 years, with mean life cycle cost savings ranging from $1,777 to $6,761 over a 28 year estimated lifetime. It should be noted that the prices of transformers have increased quite dramatically over the past three years (nearly doubling, in some cases), but the mean paybacks should still be less than 4-5 years for most end-use customers.

Adding this information to the next version of ASHRAE 90.1 will help designers, end-use customers, and code officials with transformer specifications and verifications. These standards have been vetted and analyzed and agreed to by transformer manufacturers.

Cost Impact: The code change proposal will not increase the cost of construction.

ICCFILENAME: Ferguson-EC-6-506

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal references a standard without actually including a correct reference for Chapter 6 of the code. The standard was said not to comply with ICC policy regarding referenced documents.

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, representing The American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

SECTION 506
OTHER EQUIPMENT

506.1 General. This section covers the minimum efficiency of other equipment.

506.2 Dry-type transformer efficiency. This section applies to all building power distribution *systems* and only to equipment described below.

506.2.1 New buildings. Equipment installed in new buildings shall comply with the requirements of this section as shown in Table ~~506.2.1~~ 506.2.4

506.2.2 Addition to existing buildings Equipment installed in *additions* to *existing buildings* shall comply with the requirements of this section.

506.2.3 Alterations to existing buildings Alterations to building service equipment or systems shall comply with the requirements of this section applicable to those specific portions of the building and its systems that are being altered.

506.2.3.1 New equipment with alterations. Any new equipment subject to the requirements of this section that is installed in conjunction with the *alterations*, as a direct replacement of existing equipment shall comply with the specific requirements applicable to that equipment.

~~**Exceptions to 506.3.1.2**~~ **506.2.3.2. Relocated equipment.** Compliance shall not be required for the relocation or reuse of existing equipment at the same site.

506.2.4 Low Voltage Dry-Type Distribution Transformers. Low voltage dry-type transformers shall comply with the provisions of the Energy Policy Act of 2005 where applicable, as shown in Table 506.2.4. ~~Transformers that are not included in the scope of the Energy Policy Act of 2005 have no performance requirements in this section, and are listed for ease of reference below as exceptions.~~

TABLE 506.2.4
MINIMUM NOMINAL EFFICIENCY LEVELS FOR NEMA CLASS I LOW VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMERS[a]

Single Phase Transformers		Three Phase Transformers	
kVA[a,b]	Efficiency (%)[b,c]	kVA[a,b]	Efficiency (%)[b,c]

a. A low voltage distribution transformer is a transformer that is air-cooled, does not use oil as a coolant, has an input voltage of less than or equal to 600 Volts, and is rated for operation at a frequency of 60 Hertz.
b. kiloVolt-Amp rating.
c. Nominal efficiencies shall be established in accordance with the ~~NEMA TP-1 2002~~ DOE 10 CFR 431, subpart K, test procedure for low voltage dry-type transformers. ~~Class I Low Voltage Dry-Type is a National Electrical Manufacturers Association (NEMA) design class designation.~~

Exceptions to Table 506.2.4:

Transformers that meet the Energy Policy Act of 2005 exclusions based on ~~NEMA TP-1~~ DOE 10 CFR 431 definition:

1. Special purpose applications
2. Not likely to be used in general purpose applications
3. Transformers with multiple voltage taps where the highest tap is at least 20 percent more than the lowest tap.

Products meeting these criteria and exempted from ~~506.3.1~~ Section 506.2 include the following: drive transformer, rectifier transformer, auto-transformer, uninterruptible power system transformer, impedance transformer, regulating transformer, sealed and nonventilating transformer, machine tool transformer, welding transformer, grounding transformer, or testing transformer.

(Renumber subsequent sections)

(*Portions of the proposal not shown remain unchanged.)*

Add new standards to Chapter 6 as follows:

DOE

10 CFR 431, Subpart K (2006) **Uniform Test Method for Measuring the Energy Consumption of Distribution Transformers.**

(*Portions of the code change proposal not shown remain unchanged)*

Commenter's Reason: Changes will refer to federal standards rather than documents that do not meet ICC CP #28. Other changes are editorial

Analysis: The 10 CFR 431, Subpart K was not reviewed or considered by the Energy Code Development Committee prior to the Baltimore hearings and it was not considered by the hearing attendees at the time of the code development hearings. Please note that the 2009 IECC does reference Subpart E of this DOE regulation. Section 3.6.3.1 of Council Policy # 28, *Code Development,* requires that new standards be introduced in the original code change proposal, therefore, the introduction of a new standard via a public comment is not in accordance with the process required by CP # 28 for adding new standards to the code.

Final Action: AS AM AMPC____ D

EC231-09/10
202 (New)

Proposed Change as Submitted

Proponent: John R. Addario, PE, New York State Department of State – Division of Code Enforcement and Administration

Add new definition as follows:

THERMAL BLOCK. Total Building Performance Approach - One or more HVAC zones (not necessarily contiguous) that are modeled as a single entity. HVAC zones in a thermal block must share the same space-type classification, and must be served by the same HVAC system or by the same kind of HVAC system. All of the HVAC zones within the thermal block that are adjacent to an exterior wall must face the same orientation or their orientations must differ by less than 45°.

Reason: This proposed change adds a needed definition for a thermal block as referenced in the Total Building Performance approach. The definition is consistent with ASHRAE 90.1.

Cost Impact: The code change proposal will not increase the cost of construction.

FILENAME: ADDARIO-EC-2-202

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal is only presented as a definition, but within the proposed definition are technical code requirements that should be placed in the body of a regulatory chapter, not in Chapter 2.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

John R. Addario, New York State Department of State, Division of Code Enforcement and Administration, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**THERMAL BLOCK.** Total Building Performance Approach - One or more HVAC zones (not necessarily contiguous) that are modeled as a single entity. HVAC zones in a thermal block must share the same space-type classification, and must be served by the same HVAC system or by the same kind of HVAC system. All of the HVAC zones within the thermal block that are adjacent to an exterior wall must face the same orientation or their orientations must differ by less than 45°.~~

506.5.2 Thermal blocks. The *standard reference design* and *proposed design* shall be analyzed using identical thermal blocks as required in Section 506.5.1.1, 506.2.2 or 506.5.2.3. A thermal block shall be one or more HVAC zones (not necessarily contiguous) that are modeled as a single entity. HVAC zones in a thermal block shall share the same space-type classification, and shall be served by the same HVAC system or by the same kind of HVAC system. All of the HVAC zones within the thermal block that are adjacent to an exterior wall shall face the same orientation or their orientations must differ by less than 45°.

Commenter's Reason: This proposed change adds a needed definition for a thermal block as referenced in the Total Building Performance approach. This modification addresses the committee concerns in regards to possible confusion of adding the definition of thermal block to section 202. A thermal block can either apply to building envelope characteristics or HVAC zoning in the building performance approach. This modification addresses that by moving the definition/requirements to Section 506. This proposed change is similar to the requirements for a thermal blocks found in ASHRAE 90.1-2007.

Final Action: AS AM AMPC____ D

RE2-09/10

N1101.2-N1101.9, N1102 and N1103

Proposed Change as Submitted

Proponent: Jeff Harris, Alliance to Save Energy and Ronald Majette, US Department of Energy

1. Revise as follows:

N1101.2 Compliance. Compliance shall be demonstrated by ~~either~~ meeting the requirements of the *International Energy Conservation Code* ~~or meeting the requirements of this chapter. Climate zones from Figure N1101.2 or Table N1101.2 shall be used in determining the applicable requirements from this chapter~~. For consistency and convenience, the relevant administrative provisions, supplemental definitions, prescriptive and mandatory requirements of the *IECC* applicable to buildings regulated by this code are reprinted below. For the Simulated Performance Alternative, buildings regulated by this code shall comply with *IECC* Section 405. Solely for the purpose of compliance with this section, in the event of any conflicts in definitions or referenced standards between the *IECC* and *IRC*, the respective definition or referenced standard from the *IECC* shall control.

2. Delete Sections N1101.2.1-N1101.9, N1102 and N1103 in their entirety (including all tables), and reprint the following sections of the IECC, coordinated with the section numbering of the IRC:

(1) IECC Chapter 1 Administration (all Sections, except Sections 101.1-101.2, 101.4.6, and 101.5)
(2) IECC Chapter 2 Definitions (all Sections)
(3) IECC Chapter 3 Climate Zones (all Sections)
(4) IECC Chapter 4 Residential Energy Efficiency (Sections 401-404)
(5) IECC Chapter 6 Referenced Standards (All Standards).

Reason (Harris) : This proposal is intended to permanently resolve the growing inconsistencies between the *IECC* (which is referenced by the *IBC*) and the *IRC* by referencing a single set of energy efficiency requirements for all three codes (the *IECC*) and reprinting those requirements directly in Chapter 11 of the *IRC*. The proposal also makes code compliance and enforcement more uniform and streamlined.

The Problem. The problem of an inconsistent *IRC* and *IECC* , where the *IRC* energy provisions are weaker and less rigorous than the *IECC*, is well-known. The *IECC* and *IRC* are reviewed by two different code development committees. Proposals must be heard twice (using substantially more resources and prolonging the hearings by days), and the outcome is frequently different. It is then up to the code officials at the Final Action Hearing to sort through the two committees' differing opinions and decide on the best course. As long as there are two codes and two committees, inconsistency will continue to grow, creating problems for jurisdictions that seek to implement a single set of energy efficiency requirements for residential buildings.

The Solution. This proposal presents a reasonable long-term solution for code consistency and uniform enforcement. Just as *IBC* Chapter 13 references the *IECC* for its energy efficiency requirements, *IRC* Chapter 11 would reference the *IECC*. To preserve the convenience of a single-volume residential code, ICC would reprint the relevant sections of the *IECC* in chapter 11 of the *IRC*. In subsequent cycles, as the *IECC* is updated, the *IRC* Chapter 11 would be automatically (and identically) updated by virtue of the reference to the *IECC*.
The general approach of replacing the *IRC* energy chapter with the *IECC* has already been tested in several states. In fact, the *IRC* already references the *IECC* for the performance path (N1101.2), so any state that adopts the *IRC* already automatically adopts the requirements of the *IECC* as a compliance option. Several states have already taken the step suggested by this proposal by exclusively referencing the *IECC* for energy efficiency requirements. The new appendix will add even more convenience to this solution.

The *IECC* Is the Best Single Energy Efficiency Standard. The *IECC* is recognized in federal law and nationwide as the comprehensive model energy code for all residential and commercial buildings. More than two thirds of states have adopted the *IECC* as their mandatory statewide energy code. National, state and local policymakers are demanding a substantially improved level of energy efficiency in building energy codes to meet the nation's security, environmental and energy cost needs. At the same time, building officials demand uniformity and consistency in the International family of codes.
Under the federal Energy Policy Act of 1992, the US Department of Energy (DOE) is required to review each new version of the *IECC* and determine if it is an improvement in energy efficiency over previous versions. (*IRC* Chapter 11 does not undergo such a rigorous assessment by DOE, so it is not clear whether it would meet the same high standard for energy efficiency improvement.) States are also required by federal law to undertake a review of the state energy code and determine whether state energy efficiency requirements meet the stringency of the *IECC* every time the Department of Energy makes a determination on the updated *IECC*.
The *IECC* also serves as the basis for federal tax credits for energy efficient homes, energy efficiency standards for federal buildings, and qualification for FHA mortgages. The *IECC* is also referenced in LEED and many other state and federal programs.
Most recently, the adoption of the 2009 *IECC* was designated by Congress as a threshold requirement for states to receive $3.2 billion in State Energy Program funds through the American Recovery and Reinvestment Act (Stimulus Bill). None of these programs even references the *IRC*. For all these reasons, the *IECC* is the logical selection as the single energy efficiency standard for the International Codes.

The Benefits of the *IECC* as the Single Energy Efficiency Standard

- **True Consistency**. This proposal fixes inconsistencies between the *IRC* and the *IECC*/*IBC* that have developed over time, and ensures consistency in the future. Even if all code change proposals in the current cycle were 100% consistent, the *IECC* and *IRC* would still be different because of changes made in earlier editions, and would likely be different in the future because two separate committees are reviewing the same code language.

This proposal does not expand or reduce the number of compliance options available to builders. It simply consolidates them in the most reasonable place. The energy efficiency requirements of the *IBC*, *IRC* and *IECC* would be unified into a single set of requirements that comply with all three codes and ensures that all three codes meet the same energy efficiency and building quality standards in the future.

- **Proposals Reviewed and Approved By a Balanced Committee of Experts.** The *IECC* is currently developed by a committee that it is populated by experts in building energy efficiency and where no organization has more than one voting seat.
- **Streamlined Enforcement**. Once all three I-codes have a unified set of energy efficiency requirements, enforcement will become much simpler. A builder complying with the *IRC* Chapter 11 will automatically meet the requirements of the *IBC* and *IECC*. Builders will only need to follow one set of requirements, and code officials can enforce a single set of requirements.
-

Less Complicated Code Hearings. This proposal would eliminate a good deal of redundancy in the current code development process by centralizing the energy efficiency requirements in a single committee. Rather than force proponents and code officials to endure hours – even days – of the same testimony before two different committees, this proposal would streamline the process and yield a more consistent result.

Reason (Majette): The proposed change is intended to eliminate inconsistencies between the IECC and IRC, the two primary codes that relate to residential buildings, and reduce the significant burden of maintaining two similar but not quite identical codes in the ICC's code development process. It does so by eliminating the nearly duplicative provisions of IRC Chapter 11 and replacing them with a reference to the IECC.

This approach is consistent with the way the IBC (Chapter 13) references the IECC for energy efficiency requirements, but to accommodate residential builders' need for a single-volume code solution, the portions of the IECC relevant to one- and two-family dwellings and townhouses three stories or less above grade will be reprinted for convenience in place of the current Chapter 11 text.

The consolidation of the ICC's two residential energy efficiency codes around the IECC is appropriate for the following reasons:

- The IECC is the unambiguous standard of reference that DOE, by Congressional mandate, establishes for its energy code determinations. The Energy Policy Act of 1992 (EPAct-92) requires DOE to evaluate each new version of the IECC to determine whether it will save energy in residences. Because the IRC energy chapter differs in substantive ways from the IECC, DOE is unable to recognize it as an equivalent code.
- The IECC is the unambiguous standard of reference for DOE's evaluations of state energy codes. EPAct-92 requires that states, following any DOE determination that a new version of the IECC saves energy, certify to DOE whether it is appropriate to upgrade their code(s) to meet or exceed that new IECC version.
- The IECC is the predominant residential building energy code in the U.S. About two-thirds of the states reference or are based on some version of the IECC.
- The IECC is the predominant standard of reference for residential above-code programs in the U.S. It serves as the baseline for federal tax credits for energy efficient homes, energy efficiency standards for federal buildings, and qualification for FHA mortgages. It is also referenced in LEED and many other state and federal programs and has been used as the primary source for baseline assumptions in RESNET's home energy rating systems.
- The IECC is the unambiguous threshold for states seeking State Energy Program funds made available by the American Recovery and Reinvestment Act of 2009.
- Because the IRC currently lags behind the IECC in overall energy efficiency, DOE cannot provide compliance tools and support for states that adopt it.
- Maintaining both the IECC and the IRC energy chapter in the ICC's code development process represents a near doubling of efforts by interested parties and ICC staff, with the typical outcome that the IRC energy chapter cannot be used in any of the programs listed above.

This proposal would eliminate the duplicative efforts, eliminate confusion within state governments, streamline code enforcement and the necessary training and tool development, lessen the bureaucratic load on the U.S. DOE, guarantee true consistency between the IECC and the IRC, and sustain the availability of the IRC as a single-volume residential code.

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

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: Harris-RE-1-Majette-RE-1-N1101.2, N1101.9

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proponent's intent with this code change proposal is to utilize the provisions of the International Energy Conservation Code and remove the present provisions of Chapter 11 of the IRC. The committee feels that the energy provisions of the IRC should be decided upon by a committee composed of people that understand the unique characteristics of light-frame residential construction. Therefore, the provisions of Chapter 11 should stay and remain under the control of the IRC B/E Committee.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

Shaunna Mozingo, City of Westminster requests Approved as Modified by this Public Comment.

Modify the proposal as follows:

CHAPTER 11
ENERGY EFFICIENCY

SECTION N1101: GENERAL

The text of this chapter is extracted from the 2009 edition of the International Energy Conservation Code and has been modified where necessary to conform to the scope of application of the International Residential Code for One- and Two-Family Dwellings. The section numbers appearing in parentheses after each section number are the section numbers of the corresponding text in the International Energy Conservation Code.

N1101.1 Scope.
This chapter regulates the energy efficiency for the design and construction of buildings regulated by this code.

N1101.2 Compliance. Compliance shall be demonstrated by ~~either~~ meeting the requirements of the International Energy Conservation Code. ~~For consistency and convenience, the relevant administrative provisions, supplemental definitions, prescriptive and mandatory requirements of the IECC applicable to buildings regulated by this code are reprinted below. For the Simulated Performance Alternative, buildings regulated by this code shall comply with IECC Section 405. Solely for the purpose of compliance with this section, in the event of any conflicts in definitions or referenced standards between the IECC and IRC, the respective definition or referenced standard from the IECC shall control.~~

Delete Sections N1101.2.1-N1101.9, N1102 and N1103 in their entirety (including all tables), and reprint the following sections of the IECC, coordinated with the section numbering of the IRC and the numbering of the IECC sections in parenthesis as stated in N1101 General above:

(1) IECC Chapter 1 Administration (all Sections, except Sections 101.1-101.2, 101.4.6, and 101.5)
(2) IECC Chapter 2 Definitions applicable to buildings regulated by the IRC ~~(all Sections)~~
(3) IECC Chapter 3 Climate Zones ~~(all Sections)~~
(4) IECC Chapter 4 Residential Energy Efficiency (Sections 401-404)
(5) IECC Chapter 6 Referenced Standards applicable to buildings regulated by the IRC ~~(All Standards).~~

Commenter's Reason: Out of concern of ultimate federal preemption, and similar with what we do with federally preempted accessibility, we should look to harmony with the DOE endorsed IECC process for inclusion in the IRC. DOE appears to be happy with the IECC process to date and the codified performance. It appears that they are not happy with the energy levels established in the IRC. Some believe that the homeowner has the right to accept lower performance as a choice but this may be contrary to national policy. Washington says that it is important enough that they will preempt us if we do not provide for the level of performance they deem. This is big and therefore needs to be addressed in some fashion and we feel that this is the best way to handle it; take the code that they agree is performing, and just cut and paste it right into the IRC so that there can be no more question to its legitimacy.

Furthermore, it is widely understood that the IRC is adopted as a "stand-alone" document allowing a home owner or builder to purchase one book and be able to find most of the requirements to construct a dwelling that would comply under that code. With the exception of things like Referenced Standards a person need not look much further than the IRC for their residential code requirements. These code requirements however need to be consistent with the code requirements in the other building codes such as the Plumbing, Fuel Gas, Mechanical, and Energy Codes. The individual sections of the IRC that deal with these other code requirements need to be identical to the codes themselves so that dwellings built by different builders in any one jurisdiction will be held to the same standards no matter which book they decide to buy.

The International Codes (I-codes) need to be internally consistent. These I-codes provide the foundation for the building codes adopted by most jurisdictions. Although adopting entities can, and do, amend the I-codes, the adopting jurisdictions expect a set of model codes that are internally consistent. The 2009 IECC and IRC energy requirements are identical in most areas and that is mostly due to the fact that a few people spent countless hours prior to the 2009 final action hearings going through every single code change proposal submitted for both the IECC and the IRC to figure out where they differed, create public comments to bring them back together and then spent even more hours at the hearings themselves, paying attention to every single item heard and making sure that testimony was given to bring the codes back into alignment. This development cycle again introduced many potential inconsistencies. These inconsistencies are substantial enough to affect code usability. To be effective and enforceable, the IECC and IRC need to be consistent.

The modification proposed in this public comment reflects some verbiage that is already used in the IRC in Chapter 24, Fuel Gas, except that the words "International Fuel Gas Code" have been changed to "International Energy Conservation Code". There is precedence in the IRC already for this language and the Colorado Chapter of ICC believes that while it is imperative to have the energy provisions of the codes be heard by one Energy Committee and that should be the IECC Committee, there is no reason that the appropriate residential requirements found in the IECC can not be copied into the IRC for convenience to IRC users.

We would strongly recommend approval of RE2. While we were successful in overturning the committee action in our floor vote for RE4, we were disappointed that the IRC would then only reference the IECC without the reprint for convenience. We understand that it will take a 2/3 vote to overturn the committee action of disapproval to get the As Modified by Public Comment on this vote and it would definitely be easier to just go with the RE4 proposal since the standing action going into these hearings is As Submitted from the Floor; however, we feel strongly that the reprint of applicable sections of the IECC is important enough to try again on this proposal.

Final Action: AS AM AMPC____ D

RE4-09/10
Chapter 11

Proposed Change as Submitted

Proponent: Guy Tomberlin, Fairfax County, VA, representing Plumbing and Mechanical Inspectors/VA Building and Code Officials and ICC Region 7

1. Delete without substitution as follows:

Delete the current text of Chapter 11 in its entirety with the exception of Section N1101.1.

2. Add new text as follows:

N1101.2 Requirements. Buildings shall be designed and constructed in accordance with Chapter 4 of the *International Energy Conservation Code*.

Reason: The process has become far too cumbersome trying to keep these two documents coordinated. The there should not be two different sets of rules, that simply goes against the foundation of the energy code. The International Code Council already has a similar situation as this recommended practice set in place and it is working quite well with the International Fuel Gas Code and the International Residential Code Chapter 24 provisions. Maintaining consistency between the commercial and residential provisions should not be a membership function and it is not reasonable for the members to be responsible for this administrative task. It has become extremely time consuming, not to mention nearly impossible, just trying to cover all the changes applicable to both codes and then come back the next code cycle and attempt to coordinate. In the current process one code or the other is behind a complete cycle while proponents work feverishly to try to catch up. Now with the new policies in place, for the code development hearings between print editions, the current system will equal 3 years of inconsistent regulations. The make–up of the IECC Code Development Committee could easily be altered to accommodate all the interested parties. An added benefit to this proposal would be the time savings during the code change process by just by having a single committee hear all the energy proposals.

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: TOMBERLIN-RE-1-CHAPTER 11-2

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proponent's intent with this code change proposal is to utilize the provisions of the International Energy Conservation Code and remove the present provisions of Chapter 11 of the IRC. The committee feels that the energy provisions of the IRC should be decided upon by a committee composed of people that understand the unique characteristics of light-frame residential construction. Therefore, the provisions of Chapter 11 should stay and remain under the control of the IRC B/E Committee.

Assembly Action: **Approved as Modified**

Modify the proposal as follows:

N1101.2 Requirements. Buildings shall be designed and constructed in accordance with ~~Chapter 4 of~~ the *International Energy Conservation Code*.

Reason for Modification: Replacing Chapter 11 with a reference to only Chapter 4 of the IECC would make it difficult to include the provisions of Chapter 3 that should be applicable as well.

Individual Consideration Agenda

This code change proposal is on the agenda for individual consideration because the proposal received a successful assembly action. Note that the assembly action, Approved as Modified, will be the initial motion on the floor for consideration when this item is called. In addition, public comments were received on this code change proposal.

Public Comment 1:

Craig Conner, Building Quality, Rick Fortner, City of Norfolk, Shaunna Mozingo, City of Westminster, CO, representing Colorado Chapter of ICC, Bill Prindle, ICF International, Maureen Traxler, City of Seattle, requests Approval as Modified by Assembly Floor Action.

Commenters' Reason: (Craig Conner) As approved at the first hearing, there are numerous differences between the residential energy requirements in the IECC and the IRC. These differences are so large that they will make this part of the I-code family difficult to adopt and enforce. The IRC referencing the IECC is a simple change that will align the two codes just like the IBC references the IECC. Unlike the labor-intensive effort to keep the two codes in alignment by making sure the details passed by the two separate committees are identical, this simple reference will not need to be updated in future years.

It is important that the IRC be a standalone code. The presumption is that the ICC will make the "publication decision" to reprint the residential portion of the IECC in the IRC in order to make the IRC more usable. This publication decision is preferable to a code change that makes a one-time copy of the IECC residential requirements into an IRC appendix. Such an appendix would have to be maintained and updated over time by code changes decided by different committees (IECC and IRC-BE) and would inevitably fall out of alignment again.

(Rick Fortner) The Virginia Building Code Officials Association supports the action taken by the floor assembly in Baltimore for the following reasons:

It is redundant to have two separate codes addressing the same issue especially with the difficulty of trying to keep the two separate energy codes consistent. Additionally, having two separate codes dealing with the same thing makes it difficult for Code Officials to determine which code takes precedence. Issues of interpretation between the two codes are confusing and can become ongoing issues of debate.

This issue was corrected with the inclusion of the International Fuel Gas Code into the International Residential Code and since doing so has worked extremely well. The International Energy Conservation Code already has provisions for residential energy conservation so there is no need to have a separate residential energy section in the IRC.

(Shaunna Mozingo) Out of concern of ultimate federal preemption, and similar with what we do with federally preempted accessibility, we should look to harmony with the DOE endorsed IECC process for inclusion in the IRC. DOE appears to be happy with the IECC process to date and the codified performance. It appears that they are not happy with the energy levels established in the IRC. Some believe that the homeowner has the right to accept lower performance as a choice but this may be contrary to national policy. Washington says that it is important enough that they will preempt us if we do not provide for the level of performance they deem. This is big and therefore needs to be addressed in some fashion and we feel that this can be handled by just referring to code that they already agree is performing, the IECC.

Code requirements need to be consistent with the code requirements in the other building codes such as the Plumbing, Fuel Gas, Mechanical, and Energy Codes. If we are not successful in getting RE2 passed at these final action hearings then we feel that the only way to achieve this true consistency is by passing RE4 and just removing the IRC energy provisions and require the user to comply with the IECC for residential buildings that would be constructed under the IRC.

While we were successful in overturning the committee action in our floor vote for RE4, we were disappointed that the IRC would then only reference the IECC without the reprint for convenience and hope that ICC will see the value in re-printing it somewhere in the book for convenience purposes even though it will likely not be in Chapter 11.

(Bill Prindle) *RE4 should be approved as modified by assembly action.*

As everyone who uses both the IECC and IRC and/or participates in the current code development process realizes, having energy conservation requirements in the IRC that differ from the IECC present a continuing problem that must be resolved.

A series of proposals submitted by a number of different stakeholders this cycle were aimed at addressing the fundamental problems created by the IRC's divergence from the IECC in terms of energy efficiency (specifically proposals RE1 through RE4). As individual proponents of two of these proposals (RE1 and RE2), we support the floor action recommending approval as modified for RE4 and, as modified, believe that RE4 is the best solution to the problem.

Last code cycle, a similar proposal by the Energy Efficient Codes Coalition received over 60% of the vote at the Final Action Hearing. Unfortunately, this was insufficient to overturn the IRC Committee. In this cycle, the IRC committee voted 6 to 5 not to approve this proposal. However, assembly action overturned the IRC Committee on this issue. As a result, approval as modified will only take a majority vote at the upcoming Final Action Hearing.

RE4 as modified is intended to permanently resolve the growing inconsistencies between the IECC (which is also referenced in the IBC) and the IRC by referencing a single set of energy efficiency requirements for all three codes – the IECC. The proposal also makes code compliance and enforcement more uniform and streamlined.

It should be recognized that code consistency is a major objective of the ICC Code Development process. According to Section 1.3.1 of the ICC Code Development Process CP#28-05, "The provisions of all Codes shall be consistent with one another so that conflicts between the Codes do not occur." This section also provides that "Duplication of content or text between Codes shall be limited to the minimum extent necessary for practical usability of the Codes …." This code proposal will serve to accomplish this objective in the most efficient manner.

The Problem: The problem of an inconsistent IRC and IECC, where the IRC energy provisions are weaker and less rigorous than the IECC, is well-known. The IECC and IRC are reviewed by two different code development committees. Proposals must be heard twice (using substantially more resources and prolonging the hearings by days), and the outcome is frequently different. It is then up to the code officials at the Final Action Hearing to sort through the two committees' differing opinions and decide on the best course. As long as there are two codes and two committees, inconsistency will continue to grow, creating problems for jurisdictions that seek to adopt and implement a single national model energy code for residential buildings.

The Solution: This proposal presents the best long-term solution for code consistency and uniform enforcement. Just as IBC Chapter 13 references the IECC for its energy efficiency requirements, IRC Chapter 11 would reference the IECC. If deemed helpful, to preserve the convenience of a single volume residential code, ICC can choose to reprint the relevant sections of the IECC at the end of the IRC. In subsequent cycles, as the IECC is updated, IRC Chapter 11 would be automatically (and identically) updated by virtue of the reference to the IECC.

The general approach of replacing the IRC energy chapter with a reference to the IECC has already been tested in several states. In fact, the IRC already references the IECC for the performance path (N1101.2), so any state that adopts the IRC already automatically adopts the requirements of the IECC as a compliance option. Several states have already taken the step suggested by this proposal by exclusively referencing the IECC for energy efficiency requirements.

The IECC Is the Best Single Energy Efficiency Standard: The IECC is recognized in federal law and nationwide as the comprehensive model energy code for all residential and commercial buildings. Many states have adopted the IECC as their mandatory statewide energy code. National, state and local policymakers are demanding a substantially improved level of energy efficiency in building energy codes to meet the nation's security, environmental and energy cost needs. At the same time, building officials demand uniformity and consistency in the International family of codes.

Under the federal Energy Policy Act of 1992, the US Department of Energy (DOE) is required to review each new version of the IECC and determine if it is an improvement in energy efficiency over previous versions. (IRC Chapter 11 does not undergo such a rigorous assessment by DOE. Nonetheless, DOE has indicated that the 2009 IRC is not as energy efficient as the 2009 IECC.) States are also required by federal law to undertake a review of the state energy code and determine whether state energy efficiency requirements meet the stringency of the IECC every time the Department of Energy makes a determination on the updated IECC.

The IECC also serves as the basis for federal tax credits for energy efficient homes, energy efficiency standards for federal buildings, and qualification for FHA mortgages. The IECC is also referenced in LEED and many other state and federal programs. Most recently, the adoption of the 2009 IECC was designated by Congress as a threshold requirement for states to receive $3.2 billion in State Energy Program funds through the American Recovery and Reinvestment Act (Stimulus Bill). None of these programs even references the IRC.

For all these reasons, the IECC is the logical selection as the single energy efficiency standard for the International Codes.

The Benefits of the IECC as the Single Energy Efficiency Standard:

True Consistency: This proposal fixes inconsistencies between the IRC and the IECC/IBC that have developed over time, and ensures consistency in the future. Even if all code change proposals in the current cycle were 100% consistent, the IECC and IRC would still be different because of changes made in earlier editions, and would likely be different in the future because two separate committees are reviewing the same code language. This proposal does not expand or reduce the number of compliance options available to builders. It simply consolidates them in the most reasonable place.

The energy efficiency requirements of the IBC, IRC and IECC would be unified into a single set of requirements that comply with all three codes and ensures that all three codes meet the same energy efficiency and building quality standards in the future.

Proposals Reviewed and Approved By a Balanced Committee of Expert Stakeholders and Code Officials Chosen by the ICC: The IECC is currently developed by a committee that it is populated by experts in building energy efficiency and where no organization has more than one voting seat.

Streamlined Enforcement: Once all three I-codes have a unified set of energy efficiency requirements, enforcement will become much simpler. A builder complying with the IRC Chapter 11 will automatically meet the requirements of the IBC and IECC. Builders will only need to follow one set of requirements, and code officials can enforce a single set of requirements.

Less Complicated Code Hearings: This proposal would eliminate a good deal of redundancy in the current code development process by centralizing the energy efficiency requirements in a single committee. Rather than force proponents and code officials to endure hours – even days – of the same testimony before two different committees, this proposal would streamline the process and yield a more consistent result.

(Maureen Traxler) There are many reasons for approval of this proposal as modified by the assembly action. It will provide consistency between the IRC and the IECC which will mean simpler and more consistent enforcement for jurisdictions, and simpler compliance and more predictability for builders and owners. With all the energy conservation provisions in one code, we will also avoid duplication and save many hours at the code hearings because the same issues will not be heard by two separate code development committees. Energy conservation is increasingly important, and IECC provides a higher standard. Compliance with the IECC is practical and achievable--many states and local jurisdictions, including Washington, apply the IECC or a higher standard to residential construction.

Using the IECC as the sole energy code brings other advantages. The IECC is recognized in federal law as the minimum standard for many programs, and the IRC doesn't meet that standard. The IECC is the standard used for homes to qualify for federal tax credits and for FHA mortgages. The 2009 IECC was a threshold requirement for states to receive American Recovery and Reinvestment Act economic stimulus funds. The US Department of Energy provides compliance tools for the IECC but, because the IRC energy provisions are not equivalent to the IECC, it will not provide similar support for the IRC.

The floor vote in Baltimore was almost 75% in favor of this proposal. RE4 will maintain consistency because energy provisions will not be contained in the IRC, so only one CDC will hear all energy proposals.

Public Comment 2:

Chris Baumgartner, Basin Electric Power Cooperative, Marty Barnhardt, San Isabel Electric Association, representing Steffes Corporation, Robert J. Graveline, Utility Shareholders of North Dakota, Robin Hanson, Hanson Plumbing and Heating Inc, Randy Hauck, Verendrye Electric Cooperative, Inc., David Henderson, Morgan County Rural Electric Association, Tom Holt, East River Electric Power Cooperative, Paul Keleher, Paul Keleher Electrical Services, Richard Irwin, Patriot Electric, Ron Kurtz, Dimplex North America Limited, Charles Labine, Labine Electric Inc, Dave Maxwell, Vernon Electric Cooperative, Joe Rothschiller, Steffes Corporation, Sharon Stratton, TPI Corporation, Daryl L. Tabor, Darryl Tveitbakk, Northern Municipal Power Agency, Gary A. Wiens, Montana Electric Cooperatives Association, request Disapproval.

Commenter's Reason: (Chris Baumgartner) Basin Electric Power Cooperative, with the intention of supporting the most efficient and practical building methods available for its more than 2-million member consumers, requests a **Disapproval of RE4-09/10** (the removal of chapter 11 of the RE).

- Construction purposes and required designs differ greatly between residential and commercial structures (e.g. heating/cooling loads, air requirements, occupancy patterns, lighting requirements, etc…). Short cuts, like combining the codes, will no doubt diminish the importance of these unique building characteristics and lessen the overall quality and value of the building.
- Very few (if any) codes adequately cover both residential and commercial building structures.
- Combining the commercial and residential codes will allow for unnecessary energy losses in both residential and commercial structures --- the code needs to deal with the uniqueness of each application to be most effective and increase efficiencies.

The current system is working well….contractors/builders understand the requirement differences involving commercial structures and single-family homes and use the code reference effectively.

(Marty Barnhardt) The fact that a single family residential dwelling (IRC codes address) is significantly different in both structure and function from a multi-family in a multiple story family residential structure, a commercial or industrial building which IECC codes address. Multi-family structures are usually constructed in and/or around environments that vary drastically from single family residential homes. The physical structure is different and they are usually located in a more populated and commercially developed environment rather than further away from the density of population. They often have to be located where they are close to amenities available to a population that may not have the flexibility to travel unless it is public transportation.

To assume that they have the same energy requirements and therefore should be governed by the same codes is ludicrous. It is just for this reason that it is imperative that there continue to be two different codes for officials to refer to. The difference in occupancy and air return requirements alone should be reason enough to disapprove this proposal.

(Robert J. Graveline) On behalf of the Utility Shareholders of North Dakota (USND) and it's nearly 3,000 members who have the common interest of owning shares of stock in the three utility companies supplying energy to customers in North Dakota, urge defeat of proposals offered to prohibit the use of electric resistance heat except in very few, limited applications. Our state is a typical sparsely populated rural area which enjoys the benefits of fairly priced electricity, and as such, electric heat is frequently chosen as the energy source for new homes. Adoption of this proposal would severely restrict choices of our small town and rural citizens in planning and building new homes.

Adoption of this rule prohibiting electric heat options will give an undue advantage to certain businesses and utility organizations that supply heating appliances and gas energy into competitive market places. Quite simply, not every small community has access to gas; and fuel oil and propane prices ebb and flow with world market prices for crude oil. Proponents of this change should simply ask themselves what types of heating options remain for the northern plains of America.

Further, proponents of this idea should offer suggestions on how to get fuel oil to flow and propane to vaporize when outside temperatures hover around 40 degrees below zero F. Furthermore, idea proponents must understand not everyone who needs a new home can afford ground source heat pumps, nor are either air or ground source heat pumps efficient or sufficient at the temperature extremes of North Dakota.
The USND urges defeat of this proposal.

(Robin Hanson) Single family homes and multi-family 3+ story homes should be addressed differently by codes. Different air requirements and considerations.

(Randy Hauck) This code change allows for your committee to circumvent the decision of the IRC.

(David Henderson) Currently, single family residential dwellings are addressed by IRC codes, and 3-story multi-family, commercial or industrial buildings are addressed by IECC codes. The proposer of RE4 Chapter 11 states that there shouldn't be two different codes for officials to refer to and that it's too cumbersome to maintain them both. Using this logic, we should designate one speed limit for all highways in the United States, whether they're two-lane, four-lane, interstates, etc., so law enforcement authorities would only have to enforce one speed limit and wouldn't get confused.

Single family residential buildings have a completely different purpose than multi-family/commercial buildings. They are different types of buildings, both physically and in their use and objectives. Safety issues, occupancy levels, air return requirements and construction environments vary widely between the two classes. Combining the two codes for the sake of simplicity makes no sense

(Tom Holt) The argument presented by the proposed that the current rules for single family residential buildings, as addressed by the IRC, should be thrown out and covered by the IECC which is for 3-story multi family, commercial, and industrial buildings because it is hard to keep track of two separate codes is confusing. These are completely different building types with differing uses, energy use patterns and construction techniques.

There are not 'two sets of rules' to follow. There is one set of rules to follow based on the building type you are dealing with.

Keeping track of changes in one code or two requires equal administrative effort and having a code specific to the type of structure makes understanding the effects of the changes easier.

The ICC has well established rules and procedures for code changes and updates that have worked well.

This proposal should be voted down.

(Paul Keleher) Residential structures are very different from commercial, institutional and most other non-residential buildings, and therefore should be regulated by separate requirements. The simplicity suggested by this proposal would only serve to create more confusion as the requirements are utilized.

(Richard Irwin) Electric Thermal Storage (ETS) – Is a heating technology where renewable or off-peak electricity is stored as heat in dense ceramic brick core, for use when needed, 24 hr. a day. For the U.S. to capitalize on its investment in renewable energy and the <u>SMAM GRID</u>, lots of thermal storage is needed. ETS is the most effective way of storing this heat; <u>we need</u> to do this to limit our dependency on fossil fuels.

<u>Customer Benefits:</u>

1. Clean, safe, no carbon emissions, quiet, little or <u>no</u> maintenance.
2. Reduces consumers heating cost by as much as 75%.
3. It acts as a <u>thermal battery</u> for electric storage.
4. It is a <u>Green Power Heat Source!</u>
5. <u>Off Peak / TOU</u> pricing - is here and expanding in most states offering consumers a <u>low cost</u> to heat their homes.

<u>Power Co.</u> + <u>Smart Card Benefits:</u>

1. Used to <u>load shape and load shift</u> since 1970.
2. Improves system reliability and power quality.
3. ETS can yield a 70% carbon emissions reductions.
4. A proven 20+ year life cycle as a thermal battery.

(Ron Kurtz) In a world where renewable energy becomes a more significant energy source, this proposal will severely limit electric resistance heating, one of the few zero-emission heating sources. Please consider the following:

1. Next-generation "passive homes" pioneered in Germany use zoned electric resistance heating. These low energy homes use electric resistance heating because it is the only heating source that can easily heat one zone without affecting or overheating other parts of the home that do not require additional heat.

2. Europeans have been using electric storage heating as a method of storing energy since the 1950s. Renewables such as wind power produce energy most efficiently at night and not always when it's needed. Electric thermal storage can store this energy for another time at a fraction of the cost of electric battery storage.
3. Energy storage is a critical part of creating an efficient Smart Grid electrical network. Eliminating electric storage heating eliminates the electric utility's only cost effective tool for winter energy storage.
4. Off-peak energy storage is less-expensive and produces less CO_2 than natural gas in some jurisdictions.
5. Europe has not restricted electric resistance heating in this general far-reaching way even though it is farther down the net-zero emissions road because electric resistance heating is clean at its end-use point. It is the generation source that is the weakness. "Don't throw out the baby with the bathwater".

Although the intent is positive, the result of this code change reduces our flexibility to develop low carbon emission solutions and must be disapproved.

(Charles Labine) In this part of the country, electric resistance heat is very affordable and convenient for our customers. Many parts of this area do not have natural gas available. Fuel oil & LP Gas are too expensive to use. We have many days in our winter that temperatures are below zero. So we cannot use only heat pumps. I think it is unreasonable to even think about prohibiting electric resistance heat.

(Dave Maxwell) Single family residential buildings fall under a different energy code than 3-story multi-family, commercial and industrial buildings for good reason. The differences include:

- Physical
- Built in and around completely different environments with different objectives
- Different occupancy
- Different air return requirements

Single family residential buildings should not be governed by the same building codes as 3-story multi-family, commercial or industrial buildings.

(Joe Rothschiller) Single family residential buildings, which the IRC codes address, are completely different from 3-story multi-family, commercial or industrial building, which IECC codes address, and therefore should not be governed by the same building codes. Not only are they physically different, they are usually constructed in and around completely different environments and with different objectives. They have different occupancy and air return requirements, etc.

The proposer states there shouldn't be two different energy codes for officials to refer to and that it is too cumbersome to maintain them both. Again, they are different types of buildings and that is why there are more than one code book to refer too. Just because it makes something easier, does not mean it is right.

(Sharon Stratton) It may seem rational to put all energy efficiency and conservation codes in one place as suggested by this proposal; however, one must take into account the fact that the scope, intent and goals of the 2009 International Residential Code (IRC) and the 2009 International Energy Conservation Code are, by their own definitions, very different.

The IRC states it is a **"complete,** comprehensive code regulating the construction of single-family houses, two-family houses (duplexes) and buildings consisting of three or more townhouse units."\ "This comprehensive, **stand-alone residential code** establishes minimum regulations for one- and two-family dwellings and townhouses using **prescriptive** provisions." [2]

The IECC states, "it should be noted that the definition of a residential building in this code is unique for this code. In this code, a residential building is an R-2, R-3 or R-4 building three stories or less in height.,,3 Further, the IECC provides flexibility by allowing the builder to use either a Prescriptive or Performance related provisions to be in compliance with energy efficiency standards.

The IRC code is "founded on principles intended to establish provisions consistent with the scope of a residential code that adequately protects public health, safety and welfare; 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 type or classes of materials, products or methods of construction.",[4]

The IECC 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 type or classes of materials, products or methods of construction.",[5]

The IRC provisions offer "an international forum for **residential construction professionals** to discuss **prescriptive** code requirements?[2]

The IECC provisions offer "an international forum for **energy professionals** to discuss **performance and prescriptive** code requirements.[6]

The IRC is a model code regulation that is designed to "safeguard the public health and safety in all communities." [2]

The IECC is a model code regulation that is designed to result in "optimal utilization of fossil fuel and non-depleteable resources in all communities.",[6]

The IRC disapproved this proposal stating that "the energy provisions of the IRC should be decided upon by a committee **composed of people that understand the unique characteristics of light-frame residential construction"** and therefore the provisions should remain under the control of the IRC B/E Committee.[7]

The IRC presently allows the builder and consumer the option to use either Ch. 11 of the IRC or the IECC to meet the energy-efficiency-related requirements for buildings.[8]

Based on the foregoing reasons, voting members of the ICC should disapprove proposed code change RE4.

[1]2009 International Residential Code, "Effective Use of the International Residential Code," p. v (emphasis added).
[2]2009 International Residential Code, "Introduction," p. iii (emphasis added)
[3]2009 International Energy Conservation Code, "Effective Use of the International Energy Conservation Code," p. v (emphasis added).
[4]2009 International Residential Code, "Development," p. iii
[5]2009 International Energy Conservation Code, "Development" p. iii.
[6]2009 International Energy Conservation Code, "Introduction", p. iii.
[7]2009 ICC Public Hearing Results, RE4-09/10, "Committee Reason," p. 513
[8]2009 International Residential Code, Chapter 11, NII 01.2, p. 455 (emphasis added).

(Daryl Tabor) It is UNACCEPTABLE to consider a "Single family residence" (IRC code), the same as a "commercial/industrial building", or a "high-rise, 80 unit Apartment/Condo residential building" (IECC Code)

Our single story house has a climatic exposure surface distance, different that a 20 story building. We have 1 ground surface exposure, versus the 20th floor on the high-rise property. These, plus thousands more, require differing assessments and codes.

These type properties SHOULD NOT be co-mingles, not only due to their inherent differences, but for SAFETY reason. No s ingle " code manager" can effectively understand/adhere to multiple building designs, characteristics, and nuances, and still provide "utmost Public Safety:.

(Darryl Tveitbakk) The use of one code for residential, commercial, and industrial buildings is not appropriate. These are very different structures and require separate codes.

Making code modifications easier for the committee is not a good reason to attempt to place everything into one chapter.

(Gary Wiens) Following is our rationale for requesting disapproval of RE4-9/10:

This proposal directly circumvents the decision of the committee that voted down the proposal to ban electric heat in residential buildings by the IRC committee.

When some electric cooperatives in Montana had a surplus of electricity they promoted electric heat. Consumers pay a rate that is significantly lower in cost than propane and natural gas. This heat rate is at least one third the cost of propane. Note also that the price volatility of fossil fuels makes it difficult to budget for fixed income home owners.

Montana's electric cooperatives serve in counties with some of the lowest per capita incomes anywhere in the United States. Substantial numbers of electric co-op members have electric heat. Having to completely change their heating source because of such a ban would cause a financial hardship.

With the price of propane and natural gas being so volatile, as we all know, it is hard to budget, and when you have it as your heating source in our winter climates, that is extremely hard on families to choose between heating your home or feeding your family.

Electric Heat is more energy efficient than gas or propane.

Electric Heat is safer and cleaner. For example, propane tanks must be installed in a basement or in the yard near the house.

Groups are pushing for there to be more electric vehicles. It is difficult to understand the logic of taking away the electricity from people to heat their homes in our harsh winters and push for using that same electricity for vehicles.

It is economically difficult for many of our members to install heat pumps because of the initial costs of installing a heat pump.

Most of our resistive heating is designed for dual fuel applications. In other words the resistive heating can be shut down and the fossil fuel turned on automatically. This allows peak shaving reducing the need for more power generation.

Electric heat is easier and cheaper to install especially in new additions or home remodels.

Home and business owners like electric heat because it is easy to zone different rooms or working spaces. You can reduce the temperature in rooms less used allowing energy savings not easily achieved with fossil fuel heating systems.

Final Action: AS AM AMPC____ D

RE5-09/10
N1102.3.7

Proposed Change as Submitted

Proponent: Garrett A. Stone, Brickfield Burchette Ritts & Stone, representing Cardinal Glass Industries

Add new text as follows:

N1102.3.7 Maximum fenestration U-factor and SHGC. The area-weighted average maximum fenestration U-factor permitted using trade-offs under this code shall be 0.48 in Zones 4 and 5 and 0.40 in Zones 6 through 8 for vertical fenestration, and 0.75 in zones 4 through 8 for skylights. The area weighted average maximum fenestration SHGC permitted using trade-offs under this code in Zones 1 through 3 shall be 0.50.

Reason: This proposal will make the *IECC* and *IRC* consistent by inserting the trade-off maximum from the IECC into the *IRC*.

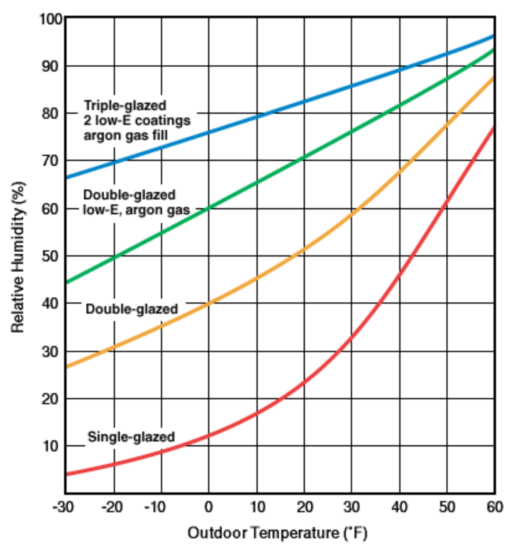
Given that windows are the weakest energy efficiency link in the building envelope, it is critical that we get windows right in homes. The best windows are typically about R -3 – less efficient than an un -insulated wall. The fenestration trade-off maximums proposed here are simple, mandatory limits that ensure all new homes contain high-quality, cost-effective windows. This objective is important to save energy and reasonably preserve comfort in all climate zones. These limits will result in windows that resist condensation in colder climates and block unwanted solar gain in warmer climates. Peak demand and HVAC sizing will also be reduced. In short, the limits are necessary to make sure that reasonable windows are not traded away with enormous unintended negative consequences.

The Limits Allow Sufficient Flexibility: The proposed provision allows considerable flexibility for builders to install decorative glass, glass block, and other fenestration products, while maintaining a baseline performance for the home's overall glazing – this flexibility comes from the fact that the provision is satisfied based on area-weighted average SHCG or U-factor. As a result, not all products need to individually meet the limits; only the area weighted average of all products in the home is required to meet the designated limit. Flexibility is further enhanced because the limit in each climate zone is one value – in northern climates the limit is based on U-factor and in southern climates on SHGC. Thus, there is substantial room and flexibility for the builder to use products that are exceptions. The limits are modest numbers that are achievable by most glazing products currently on the market in each climate zone. The *IRC and IECC* currently employs a number of other mandatory measures (including a mandatory maximum fenestration air leakage number) to ensure that the minimum code house is reasonably constructed –this proposal is no different.

The Limits Facilitate Ease of Compliance: These trade-off limits are effective and easy to understand and comply with. They have been successfully applied under the *IECC* for the past few years. All states that have already adopted the 2006 or 2009 *IECC*s have adopted these maximums without amendment. They are also already built in "under the hood" for compliance software such as REScheck.

The Limits Protect the Consumer and Builder. The trade-off limits are a key safety net and homeowner protection in a code that allows unlimited glazing area in the Prescriptive and Total UA compliance paths (indeed, the adoption of the maximums in the first place was in part a response to the elimination of glazing restrictions in 2004). By ensuring good windows, consumers are protected from higher energy bills, condensation and discomfort – while builders are protected from call-backs on these fronts.

The Limits Result in Improved Condensation Resistance. Efficient windows as required by the proposed limits will improve condensation resistance. The following chart is found on the Efficient Window Collaborative (EWC) website (www.efficientwindows.org). It shows the condensation potential for different window types.

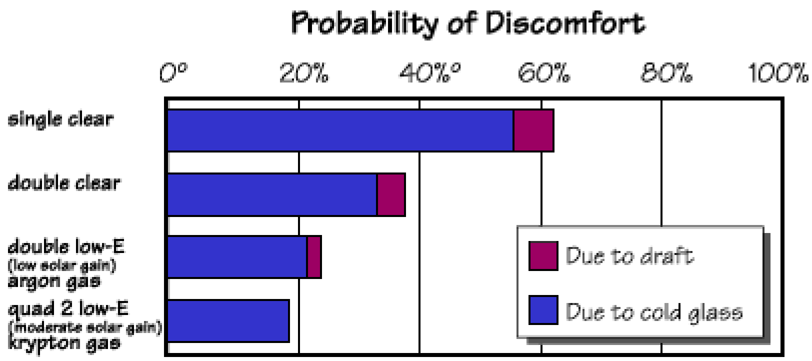


Note: Condensation occurs above the lines for each product type

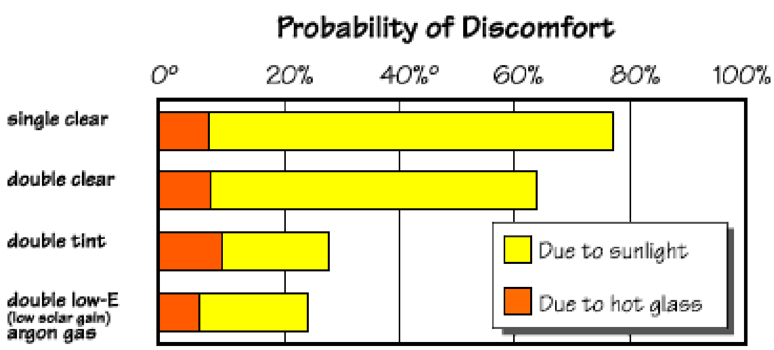
According to the chart, a typical double-glazed low-e window can withstand a 0 degree outdoor temperature and 60% relative humidity inside before condensation will begin to collect. By contrast, a regular double-glazed window can only withstand 40% humidity at the same outdoor temperature. In other words, a low-e window has a 50% more effective ability to resist condensation. A single-glazed window is far worse – it can withstand less than 15% humidity at the same temperature – a virtual guarantee of damaging condensation. The fenestration maximums substantially reduce the likelihood of condensation in the colder months, reducing call-back and consumer dissatisfaction and enhancing durability and long-term benefits for the homeowner.

The Limits Result in More Comfortable Homes and Less Energy Use. Without adequate occupant comfort, any perceived energy savings will be instantly lost when an occupant adjusts the thermostat to correct their discomfort. Relatively small changes in window U-factors and SHGCs can have a disproportionate impact on occupant comfort. Everyone has experienced discomfort at some point due to poor windows. Hot spots created by high solar gain in the summer and cold or drafty glass in the winter months can force an occupant to adjust the thermostat to compensate. The charts below, again displayed on the EWC website, show that the likelihood of significant occupant discomfort can double or triple, depending on the type of glass installed.

For example, the following graph shows the probability of discomfort during winter from poorer windows ranging from over 60% with single pane clear windows and almost 40% with double pane clear windows. This risk declines to almost 20% with a low-e window as specified by the limits for northern climates. This problem is due to the cold window -- at zero degrees outdoors, the single pane glass is less than 20 degrees on the inside surface, the double clear glass is slightly over 40 degrees, while the low-e glass is approaching 60 degrees. Obviously, the warmer the interior glass surface, the less likelihood of discomfort.

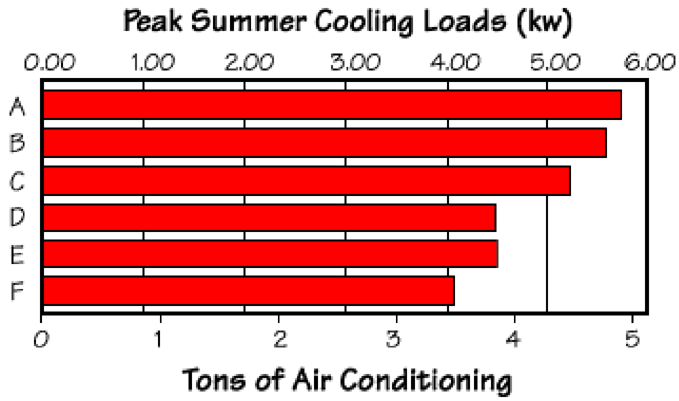


Similarly, the following graph from the same source shows the probability of discomfort during summer from sunlight and hot glass. The potential comfort problem from bad windows is even worse in the summer. The summertime probability of discomfort ranges from almost 80% with single clear and over 60% with double clear declining to almost 20% with windows as specified by the proposed limits.



The Limits Reduce Peak Demand and HVAC Sizing. By requiring efficient windows, the limits create immediate cost savings for the builder by permitting the downsizing of heating and cooling equipment. On a national policy level, high-quality windows can help reduce the strain on both the electric grid and gas transmission system and delay the need to build peak generation.

The following chart, also from the EWC website, shows the potential for saving peak demand and reducing HVAC sizing for different window types. Window F is the low SHGC, low U-factor window that would satisfy the window maximums across the country (by contrast, window A is a single pane window). As is readily apparent, improved windows are crucial to lower peak cooling loads and smaller HVAC sizes (with lower costs). Trade-offs against other building components, even if one believed that they saved the same amount of energy, would clearly lose these benefits.



As shown above, the fenestration limits in the *IECC* serve an important role in ensuring residential energy efficiency and meeting national policy goals. We recommend that the fenestration maximums be adopted in the *IRC* to correct the *IRC*/*IECC* inconsistency.

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: Stone-RE-1-N1102.3.7

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Maximum fenestration U-factors and SHGC values are an unnecessary restriction on energy conservation design. Such an approach limits the flexibility the designer should be given through the UA alternative. The argument that this deals with minimum comfort levels is spurious. The homeowner will remedy that issue.

Assembly Action: **None**

Individual Consideration Agenda

This item is on the agenda for individual consideration because public comments were submitted.

Public Comment 1:

Shaunna Mozingo, City of Westminster and Gary Pringey of Colorado Code Consulting representing the Colorado Chapter of ICC requests Approval as Submitted.

Commenter's Reason: The fenestration trade-off maximums proposed by this code change are simple, mandatory limits that will help ensure that new homes constructed per the 2012 *IRC* will contain fenestration units that are cost-effective based on the energy performance of the units. The proposed limits will result in all fenestration in the home being better built and providing better energy performance including resisting condensation forming on glazing in colder climate zones and blocking unwanted solar gain in warmer climate zones.

As pointed out by the original proponent, the proposed limits apply to the area-weighted average maximum of the fenestration. That will allow individual fenestration units to exceed these maximum U-factors or maximum SHGC when used in combination with other fenestration units that have better performing U-factors or SHGC. It is the area-weighted average of all the installed fenestration products that must not exceed these proposed limits. These area-weighted average maximum values have been successfully applied by jurisdictions that have adopted either the 2006 or 2009 editions of the *IECC*.

The Colorado Chapter of ICC recommends approval as submitted of this section, which has already been in the IECC for some time.

Public Comment 2:

Bill Prindle, the Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy (ACEEE); Garrett Stone, Brickfield, Burchette, Ritts & Stone; Steven Rosenstock, Edison Electric Institute Approval as Submitted.

Commenter's Reason: *RE5 should be approved as submitted* for the reasons set forth in the original proposal and below (see also the reason statement for our public comment on EC97).

Like Section 402.5 of the IECC, the proposed new Section N1102.3.7 establishes simple minimum mandatory performance requirements for fenestration products that ensure all new homes contain high-quality, cost-effective windows that save energy, resist condensation in colder climates and block unwanted solar gain in warmer climates, and provide reasonable comfort. Without the protection of Section N1102.3.7, fenestration values can be traded away to levels unacceptable in modern building practice. For example, without the maximums, cold, uncomfortable windows with high condensation (including even single pane windows) could be used in colder climates, and windows with no solar protection could be used in hot climates. Given our nation's high priority for energy efficiency and virtually no cost to achieve these maximum values, Section 1102.3.7 should be added to the IRC to make it consistent with Section 402.5, which has been in the IECC since 2004.

Despite the fact that this proposal will make the IRC consistent with the IECC on this important subject and address objectives of reducing: (i) peak demand, (ii) the size of HVAC systems, (iii) condensation and (iv) homeowner discomfort, the IRC committee rejected this proposal. The committee did not address any of these issues in its reason statement except comfort, focusing almost exclusively on maintaining complete window design flexibility. While design flexibility is important, it does not trump all of these other considerations. After all, the limits on flexibility are relatively modest -- most windows will meet these maximums with ease. For example, 89% of the windows rated by NFRC have an SHGC below 0.40 and this proposal merely requires a maximum 0.50 in southern climates. Similarly, in northern climate zones, the 0.40 U-factor maximum is met by 79% of the millions of window types rated by NFRC. Those windows that do not meet these requirements are typically used in specialized, limited applications (such as glass block and decorative glass) – in these cases, the weighted average approach will allow these windows to be used since their poor performance can be offset by the remaining windows in the home with better performance characteristics. As for the comfort issue, the committee is correct that the homeowner will remedy the comfort issue – however, in order to remedy the comfort issue, the homeowner will likely need to adjust the thermostat, which will use more energy and defeat the purpose of the code.

In upholding and retaining the requirements of Section 402.5 in previous code cycles, the IECC Committee stated:

> 2006/07 (EC58 and EC59) – "Therefore, the limits are needed to assure that other factors created by windows, such as moisture condensation and creation of hot spots do not cause a need to adjust the thermostat a great degree."
>
> 2004/05 (EC36) – "There is concern with removing the SHGC requirements in the warmer climate zones. The committee also supported keeping these values because the performance path can be used to accept other values and products which may not be possible under the prescriptive path. This limitation was placed in the IECC to help offset the fact that the window area limitations were eliminated by EC48-03/04 in the last code cycle. The area weighted average can also be used so that products which may not meet these hard limits can be used in conjunction with other openings which would offset their performance."

These reasons carry equal weight for the IRC. It should be noted that these mandatory maximum values are far less stringent than the prescriptive values in the code and are, by definition, cost effective. The proposal should be approved as submitted.

Public Comment 3:

Craig Conner, Building Quality requests Disapproval.

Commenter's Reason: These limits affect the ability to trade off and limit design flexibility. However these limits do not affect energy use, since the tradeoffs are to be energy neutral. Therefore this is a constraint on flexibility without any resulting energy savings.

The code process has aligned the IECC and IRC by deleting these limits. They should not be reinstated.

Final Action: AS AM AMPC____ D

RE7-09/10
N1103.4

<u>Proposed Change as Submitted</u>

Proponent: John R. Addario, P.E., NYS Department of State-Division of code Enforcement and Administration

Revise as follows:

N1103.4 ~~Circulating~~ Hot water <u>supply temperature maintenance</u> systems. All circulating service hot water <u>and heat traced</u> piping shall be insulated to at least R-2. ~~Circulating~~ Hot water systems shall include an automatic or *readily accessible* manual switch that can turn off the hot water circulating pump <u>or heat trace system</u> when the system is not in use.

Reason: The intent of this section is to require systems that maintain system hot water temperature to be properly insulated. Heat traced systems, like circulating systems, should be required to limit the amount of energy they consume by requiring a minimum amount of insulation. This proposed change includes heat trace systems within the intent of the code and renames the title to include both types of systems.

Cost Impact: The code change proposal will not increase the cost of construction.

Public Hearing:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: Addario-RE-1-N1103.4

<u>Public Hearing Results</u>

Committee Action: **Disapproved**

Committee Reason: The committee was concerned that reference to a heat trace system would introduce a system that has not been carefully defined.

Assembly Action: **None**

<u>Individual Consideration Agenda</u>

This item is on the agenda for individual consideration because a public comment was submitted.

Public Comment:

John R. Addario New York State Department of State – Division of Code Enforcement and Administration requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

N1103.4 Hot water supply temperature maintenance systems. All circulating service hot water and heat traced piping shall be insulated to at least R-2. Hot water systems shall include an automatic or *readily accessible* manual switch that can turn off the hot water circulating pump or heat trace system when the system is not in use.

> <u>**Exception:** Heat traced piping systems shall meet the insulation thickness requirements per the manufactures installation instructions. Untraced piping within a heat traced system shall be insulated to at least R-2.</u>

Commenter's Reason: The Energy Code Committee approved the companion change to this proposal in the IECC. This modification complies with the committee request and provides consistency for insulation requirements between the manufactures. Heat trace systems sizing is based on a fixed heat loss per foot of piping for a given size, therefore manufactures require a slight difference in insulation thickness for heat traced systems. This modification addresses that difference, while requiring the piping within the system that has no heat tracing to comply with the code required minimum insulation values.

The intent of this section is to require systems that maintain system hot water temperature to be properly insulated. Heat traced systems, like circulating systems, should be required to limit the amount of energy they consume by requiring a minimum amount of insulation. This proposed change includes heat trace systems within the intent of the code and renames the title to include both types of systems.

Final Action: AS AM AMPC____ D