INTERNATIONAL CODE COUNCIL
2009/2010 CODE DEVELOPMENT CYCLE

PROPOSED CHANGES TO THE
2009 EDITIONS OF THE

INTERNATIONAL BUILDING CODE®

INTERNATIONAL ENERGY CONSERVATION CODE®

INTERNATIONAL EXISTING BUILDING CODE®

INTERNATIONAL FIRE CODE®

INTERNATIONAL FUEL GAS CODE®

INTERNATIONAL MECHANICAL CODE®

INTERNATIONAL PLUMBING CODE®

INTERNATIONAL PRIVATE SEWAGE DISPOSAL CODE®

INTERNATIONAL PROPERTY MAINTENANCE CODE®

INTERNATIONAL RESIDENTIAL CODE®

INTERNATIONAL WILDLAND-URBAN INTERFACE CODE®

INTERNATIONAL ZONING CODE®

October 24 2009 – November 11, 2009
Hilton Baltimore
Baltimore, MD

ICC
INTERNATIONAL
CODE COUNCIL®

First Printing

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INTRODUCTION

The proposed changes published herein have been submitted in accordance with established procedures and are distributed for review. The publication of these changes constitutes neither endorsement nor question of them but is in accordance with established procedures so that any interested individuals may make their views known to the relevant code committee and others similarly interested. In furtherance of this purpose, the committee will hold an open public hearing at the date and place shown below for the purpose of receiving comments and arguments for or against such proposed changes. Those who are interested in testifying on any of the published changes are expected to be represented at these hearings.

This compilation of code change proposals is available in electronic form only. As part of ICC's green initiative, ICC will no longer print and distribute this document. The compilation of code change proposals will be posted on the ICC website, and CD copies will be distributed to all interested parties on our list.

2009 ICC CODE DEVELOPMENT HEARINGS

These proposed changes will be discussed in public hearings to be held on October 24, 2009 through October 31, 2009 and November 4-11, 2009 at the Hilton Baltimore, Baltimore, Maryland. The code committees will conduct their public hearings in accordance with the schedule shown on page xxxii.

REGISTRATION AND VOTING

All members of ICC may vote on any assembly motion on proposed code changes to all International Codes. **For identification purposes, eligible voting members must register, at no cost, in order to vote.** The registration desk will be open in the lobby of the convention center according to the following schedule:

Friday, October 23rd	3:00 pm to 6:00 pm
Saturday, October 24th through Wednesday November 11th	7:30 am to 5:00 pm

Council Policy #28-Code Development (page xii) requires that ICC's membership records regarding ICC members reflect the eligible voters 10 days prior to the start of the Code Development Hearings. This process includes new as well as changes to voting status. Section 5.7.4 of CP #28 (page xix) reads as follows:

> **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 member 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.

As such, new membership application as well as renewal applications must be received by ICC's Member Services Department by October 14, 2009. These records will be used to verify eligible voter status for the Code Development Hearings. Members are strongly encouraged to review their membership records for accuracy well in advance of the hearings so that any necessary changes are made prior to the October 14, 2009 deadline. For information on application for new membership and membership renewal, please go to www.iccsafe.org/membership/join.html or call ICC Member Services at 1-888-ICC SAFE (422-7233)

It should be noted that a corporate member has a single vote. Only one representative of a corporate member will be issued a voting badge. ICC Staff will be contacting corporate members regarding who the designated voting representative will be.

ADVANCED REGISTRATION

You are encouraged to advance register by filling out the registration form available at www.iccsafe.org/codesforum.

CODE DEVELOPMENT PROCESS CHANGES

As noted in the posted Advisory Statement of February 4, 2009, the revised Code Development Process includes maintaining the current 3-year publication cycle with a single cycle of code development between code editions. The schedule for the 2009/2010 Code Development Cycle is the transitional schedule for the revised code development process. As noted, there will be two Final Action Hearings in 2010—one for the modified Group A, and one for the modified Group B. The codes that will comprise the Group A and Group B hearings will be announced prior to the Code Development Hearings in Baltimore. See the Code Development Process Notes included with the Schedule on page viii.

PROCEDURES

The procedures for the conduct of the public hearing are published in *Council Policy #28-Code Development (CP#28)* ("Procedures") on page xii. The attention of interested parties is specifically directed to Section 5.0 of the Procedures. These procedures indicate the conduct of, and opportunity to participate in the ICC Code Development Process. Please review these procedures carefully to familiarize yourself with the process.

There have been a number of revisions to the procedures. Included among these revisions are the following:

Section 2.3: **Supplements:** ICC will no longer produce a Supplement to each edition of the I-Codes. A new edition of the I-Codes will be based upon activity of a single code change cycle.

Section 3.3.3: **Multiple code change proposals:** A proponent is not permitted to submit multiple code changes to one section of a code unless the subject matter of each proposal is different.

Section 4.5.1: **Administrative update of standards:** Updating of standards without a change to code text (administrative update) shall be a code change proposal dealt with by the Administrative Code Development Committee. The updating of standards procedures have also changed. See discussion on updating of standards on page vi.

Section 4.7: **Code change posting:** All code change proposals are required to be posted on the ICC website 30 days before the code development hearings. Published copies will not be provided.

Section 5.2.2: **Conflict of interest:** Clarification is added that a committee member who steps down from the dais because of a conflict of interest is allowed to provide testimony from the floor on that code change proposal.

Section 5.4.6.2: **Proponent rebuttal testimony:** Where the code change proposal is submitted by multiple proponents, only one proponent of the joint submittal to be allotted additional time for rebuttal.

Section 5.5.2: **Modifications:** The chair rules a modification in or out of order. The chair's decision is final. No challenge in a point of order is allowed for this ruling.

Section 5.7.3: **Assembly Actions:** Several changes have been made to assembly actions. See explanation page v

Section 7.3.8.2: **Initial motion at final action hearings:** A successful assembly action becomes the initial motion at the final action hearings. See explanation page v.

ASSEMBLY ACTION

The procedures regarding assembly action at the Code Development Hearings have been revised to place more weight on the results of that action (see Section 5.7 of CP #28 on page viii). Some important items to note regarding assembly action are:

- A successful assembly action now requires a 2/3 majority rather than a simple majority.
- After the committee decision on a code change proposal is announced by the moderator, any one in the assembly may make a motion for assembly action.
- After a motion for assembly action is made and seconded, the moderator calls for a floor vote in accordance with Section 5.7.2. *No additional testimony will be permitted.*
- A successful assembly action becomes the initial motion considered at the Final Action Hearings. This also means that the required vote at the Final Action Hearings to uphold the assembly action is a simple majority.

MULTIPLE PART CODE CHANGE PROPOSALS

It is common for ICC to receive code change proposals for more than one code or more than 1 part of a code that is the responsibility of more than one committee. For instance, a code change proposal could be proposing related changes to the text of IBC Chapter 4 (IBC-General), IBC Chapter 7 (IBC-Fire Safety), and the IFC Chapter 27 (IFC). When this occurs, a single committee will now hear all of the parts, unless one of the parts is a change to the IRC, in which case the respective IRC committee will hear that part separately.

ADMINISTRATIVE CODE DEVELOPMENT COMMITTEE

A new committee for the 2009/2010 Code Change Cycle and going forward is the Administrative Code Development Committee. This committee will hear code change proposals to the administrative provisions of the I-Codes (Chapter 1 of each code.) The purpose of this committee is to achieve, inasmuch as possible, uniformity in the administrative provisions of all I-Codes when such uniformity is warranted.

ANALYSIS STATEMENTS

Various proposed changes published herein contain an “analysis” that appears after the proponent’s reason. These comments do not advocate action by the code committees or the voting membership for or against a proposal. The purpose of such comments is to identify pertinent information that is relevant to the consideration of the proposed change by all interested parties, including those testifying, the code committees and the voting membership. Staff analyses customarily identify such things as: conflicts and duplication within a proposed change and with other proposed changes and/or current code text; deficiencies in proposed text and/or substantiation; text problems such as wording defects and vagueness; background information on the development of current text; and staff’s review of proposed reference standards for compliance with the Procedures. Lack of an analysis indicates neither support for, nor opposition to a proposal.

REFERENCE STANDARDS

Proposed changes that include the addition of a reference to a new standard (i.e. a standard that is not currently referenced in the I-Codes.) will include in the proposal the number, title and edition of the proposed standard. This identifies to all interested parties the precise document that is being proposed and which would be included in the referenced standards chapter of the code if the proposed change is approved. Proponents of code changes which propose a new standard have been directed to forward copies of the standard to the Code Committee and an analysis statement will be posted on the ICC website indication the status of compliance of the standard with the ICC referenced standards criteria in Section 3.6 of CP #28 (see page xiv). (See the ICC Website page xi) The analysis statements for referenced standards will be posted on or before September 24, 2009. This information will also be published and made available at the hearings.

REFERENCED STANDARDS UPDATES

At the end of the agenda of the Administrative Code Development Committee is a code change proposal that is an administrative update of the referenced standards contained in the I-Codes. This code change proposal, ADM39-09/10 contains a list of standards for which the respective promulgators have indicated that the standard has been updated. The codes that these standards appear in are indicated beside each listed referenced standard. This update will then apply to every code in which the standard appears.

It should be noted that in accordance with Section 4.5.1 of CP #28 (see page xvi), standards promulgators have until December 1, 2011 to finalize and publish any updates to standards in the administrative update. If the standard is not finalized by December 1, 2011, the code will be revised to reference the previously listed year edition of that standard.

MODIFICATIONS

Those who are submitting modification for consideration by the respective Code Development Committee are required to submit a Copyright Release in order to have their modifications considered (Section 3.3.4.5 of CP #28). It is preferred that such release be executed in advance – the form is at http://www.iccsafe.org/cs/codes/publicforms.htm. Copyright release forms will also be available at the hearings. Please note that an individual need only sign one copyright release for submittals of all code change proposals, modification, and public comments in this code change cycle for which the individual might be responsible. **Please be sure to review Section 5.5.2 of CP #28 for the modification process.** The Chair of the respective code development committee rules a modification in or out of order. That ruling is final, with no challenge allowed. The proponent submitting a modification is required to supply 20 printed copies. The minimum font size must be 12 point.

CODE CORRELATION COMMITTEE

In every code change cycle, there are code change proposals that are strictly editorial. The Code Correlation Committee approves all proposals deemed editorial. A list of code correlation committee actions will be posted on the ICC website by September 24, 2009.

2009/2010 ICC CODE DEVELOPMENT SCHEDULE

<table>
<tr><th>STEP IN CODE DEVELOPMENT CYCLE</th><th colspan="2">DATE</th></tr>
<tr><td>DEADLINE FOR RECEIPT OF APPLICATIONS FOR CODE COMMITTEES</td><td colspan="2">January 2, 2009</td></tr>
<tr><td>DEADLINE FOR RECEIPT OF CODE CHANGE PROPOSALS</td><td colspan="2">June 1, 2009</td></tr>
<tr><td>WEB POSTING OF “PROPOSED CHANGES TO THE I-CODES”</td><td colspan="2">August 24, 2009</td></tr>
<tr><td>DISTRIBUTION DATE OF “PROPOSED CHANGES TO THE I-CODES” (Limited distribution – see notes)</td><td colspan="2">October 3, 2009</td></tr>
<tr><td>CODE DEVELOPMENT HEARING (CDH)

ALL CODES – see notes</td><td colspan="2">October 24 2009 – November 11, 2009
Hilton Baltimore
Baltimore, MD</td></tr>
<tr><td>WEB POSTING OF “REPORT OF THE PUBLIC HEARING”</td><td colspan="2">December 16, 2009</td></tr>
<tr><td>DISTRIBUTION DATE OF “REPORT OF THE PUBLIC HEARING” (Limited distribution – see notes)</td><td colspan="2">January 11, 2010</td></tr>
<tr><td colspan="3">IN ACCORDANCE WITH THE NEW CODE DEVELOPMENT PROCESS (see notes), THE CODES WILL BE SPLIT INTO TWO GROUPS WITH SEPARATE PUBLIC COMMENT DEADLINES AND FINAL ACTION HEARINGS</td></tr>
<tr><td></td><td>GROUP A
(see notes)</td><td>GROUP B
(see notes)</td></tr>
<tr><td>DEADLINE FOR RECEIPT OF PUBLIC COMMENTS</td><td>February 8, 2010</td><td>July 1, 2010</td></tr>
<tr><td>WEB POSTING OF PUBLIC COMMENTS “FINAL ACTION AGENDA”</td><td>March 15, 2010</td><td>August 26, 2010</td></tr>
<tr><td>DISTRIBUTION DATE OF PUBLIC COMMENTS “FINAL ACTION AGENDA” (Limited distribution see notes)</td><td>April 16, 2010</td><td>September 27, 2010</td></tr>
<tr><td>FINAL ACTION HEARINGS (FAH)</td><td>May 14 – 23, 2010
Dallas, TX</td><td>Oct 28 – Nov 1, 1020
Charlotte, NC</td></tr>
<tr><td>ANNUAL CONFERENCES</td><td colspan="2"><u>October 24 – November 11, 2009</u>
2009 ICC Annual Conference and Code Development Hearing
Balitmore, MD

<u>October 25 – November 1, 2010</u>
2010 ICC Annual Conference and Final Action Hearing
Charlotte, NC</td></tr>
<tr><td>RESULTING PUBLICATION</td><td colspan="2">2012 – I-Codes
(available April, 2011)</td></tr>
</table>

Code Development Process Notes:

As noted in the posted Advisory Statement of February 4, 2009, the revised Code Development Process includes maintaining the current 3-year publication cycle with a single cycle of code development between code editions. Implemented as follows:

- Transitional Process – 2009/2010 only
  - Single Code Development Hearing (CDH) for all codes in 2009
  - Two Final Action Hearings (FAH) in 2010 – modified Groups A and B (see below)
  - Public 2012 edition in April, 2011
- New Process – 2012/2013 and going forward
  - Code Committee application deadline (all codes); June 1, 2011
  - Codes split into two groups: Group A and Group B
  - Group A: IBC; IFGC; IMC; IPC; IPSDC
    - Code change deadline: January 3, 2012
    - Code Development Hearing: April/May 2012
    - Final Action Hearing: October/November 2012 (in conjunction with Annual Conference)
  - Group B: Admin (Ch. 1 of I-Codes); IEBC; IECC; IFC; IPerfC; IPMC; IRC; IWUIC; IZC
    - Code change deadline: January 3, 2013
    - Code Development Hearing: April/May 2013
    - Final Action Hearing: October/November 2013 (in conjunction with Annual Conference)
  - Publish 2015 edition in April, 2014
  - Repeat for subsequent editions

2009/2010 Cycle Notes:

- Revised code change deadline of June 1st posted on March 19th

- Distribution date: Complimentary code development cycle document distribution will be limited to CD's mailed to those who are on ICC's code change document mailing list.

- Code Development Hearings: The Baltimore Code Development Hearings will include 12 I-Codes (no changes to the ICC Performance Code. The hearings will be held in the conventional two track format with the hearings split before and after the Annual Conference during the periods of October 24 – 31 and November 4 – 11. The specific codes and hearing order to be determined based on code change volume.

- Final Action Hearing Groupings: Final Action Hearing logistics dictate that the hearings will not be split along established Group A and B codes (see above) due to hotel commitments which limit the amount of hearing time at the October/2010 FAH versus the May/2010 FAH. Tentatively, the May/2010 FAH will include Group A codes plus certain Group B codes to be determined based on code change volume.

2009/2010 STAFF SECRETARIES

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 1-888-ICC-SAFE, ext. 3317 FAX: 562/699-4522 krobinson@iccsafe.org	Ed Wirtschoreck ICC Chicago District Office 1-888-ICC-SAFE, ext 4317 FAX: 708/799-0320 ewirtschoreck@iccsafe.org	Kim Paarlberg ICC Indianapolis Field Office 1-888-ICC-SAFE, ext 4306 FAX: 708/799-0320 kpearlberg@iccsafe.org	Alan Carr ICC NW Resource Center 1-888-ICC-SAFE, ext 7601 FAX: 425/637-8939 acarr@iccsafe.org

IEBC	IECC	IFC	IFGC
BethTubbs ICC Northbridge Field Office 1-888-ICC-SAFE, ext 7708 FAX: 419/ 730-6531 btubbs@iccsafe.org	Dave Bowman ICC Chicago District Office 1-888-ICC-SAFE, ext 4323 FAX: 708/799-0320 dmeyers@iccsafe.org	Bill Rehr/ Beth Tubbs ICC Chicago District Office 1-888-ICC-SAFE, ext 4342 FAX: 708/799-0320 brehr@iccsafe.org btubbs@iccsafe.org	Gregg Gress ICC Chicago District Office 1-888-ICC-SAFE, ext 4343 FAX: 708/799-0320 ggress@iccsafe.org

IMC	ICC PC	IPMC	IPC/IPSDC
Gregg Gress ICC Chicago District Office 1-888-ICC-SAFE, ext 4343 FAX: 708/799-0320 ggress@iccsafe.org	BethTubbs ICC Northbridge Field Office 1-888-ICC-SAFE, ext 7708 FAX: 419/ 730-6531 btubbs@iccsafe.org	Ed Wirtschoreck ICC Chicago District Office 1-888-ICC-SAFE, ext 4317 FAX: 708/799-0320 ewirtschoreck@iccsafe.org	Fred Grable ICC Chicago District Office 1-888-ICC-SAFE, ext 4359 FAX: 708/799-0320 fgrable@iccsafe.org

IRC-Building/Energy	IRC Mechanical	IRC Plumbing	IWUIC
Larry Franks/ Dave Bowman ICC Northbridge Field Office 1-888-ICC-SAFE, ext 5279 FAX: 205/592-7001 lfranks@iccsafe.org dbowman@iccsafe.org	Gregg Gress ICC Chicago District Office 1-888-ICC-SAFE, ext 4343 FAX: 708/799-0320 ggress@iccsafe.org	Fred Grable ICC Chicago District Office 1-888-ICC-SAFE, ext 4359 FAX: 708/799-0320 fgrable@iccsafe.org	Bill Rehr ICC Chicago District Office 1-888-ICC-SAFE, ext 4342 FAX: 708/799-0320 brehr@iccsafe.org

IZC	ADMINISTRATIVE Chapter 1 All Codes Except IRC
Ed Wirtschoreck ICC Chicago District Office 1-888-ICC-SAFE, ext 4317 FAX: 708/799-0320 ewirtschoreck@iccsafe.org	Dave Bowman ICC Chicago District Office 1-888-ICC-SAFE, ext 4323 FAX: 708/799-0320 dbowman@iccsafe.org

SCOPING REVISIONS – WITHIN THE IBC

The 2009/2010 Staff Secretaries assignments on page ix indicate which chapters of the International Building Code are generally within the responsibility of each IBC Code Committee. However, within each of these IBC Chapters are subjects that are most appropriately maintained by another IBC Code Committee. For example, the provisions of Section 3008.1 deal with occupant evacuation elevators. Therefore, even though Chapter 30 is within the responsibility of the IBC General Committee, this section would most appropriately be maintained by the IBC Means of Egress Committee. The following table indicates responsibilities by IBC Code Committees other than the main committee for those chapters, for code changes submitted for the 2009/2010 Cycle.

SECTION	CHAPTER MAINTAINED BY	SECTION MAINTAINED BY	CODE CHANGES
403.2.3	IBC-General	IBC-Structural	E5 Part I (Heard by IBC-MOE)
403.5.1	IBC-General	IBC-Structural	E5 Part I (Heard by IBC-MOE)
403.5.2	IBC-General	IBC-Means of Egress	G46
403.5.4	IBC-General	IBC-Structural	E5 Part I (Heard by IBC-MOE)
403.5.4	IBC-General	IBC-Means of Egress	G47
403.6.1	IBC-General	IBC-Means of Egress	G48, G49
408.3.8	IBC-General	IBC-Structural	E5 Part I (Heard by IBC-MOE)
410.5.3.1	IBC-General	IBC-Structural	E5 Part I (Heard by IBC-MOE)
419.3.0	IBC-General	IBC-Means of Egress	G79
1505.1.0	IBC-Structural	IBC-Fire Safety	S10, S11
1505.8.0	IBC-Structural	IBC-Fire Safety	S12, S13
1507.16.0	IBC-Structural	IBC-Fire Safety	S10, S11
1508.1.0	IBC-Structural	IBC-Fire Safety	S24
1508.2.0	IBC-Structural	IBC-Fire Safety	S25
1509.0.0	IBC-Structural	IBC-General	S26, S27
1509.6.(new)	IBC-Structural	IBC-General	S28
1704.15.0	IBC-Structural	IBC-Fire Safety	S126, S127,S128
3007.1.0	IBC-General	IBC-Means of Egress	G48,G157
3007.2.(new)	IBC-General	IBC-Means of Egress	G158, G159
3007.2.0	IBC-General	IBC-Means of Egress	G160
3007.3.(new)	IBC-General	IBC-Means of Egress	G158, G161
3007.4.(new)	IBC-General	IBC-Means of Egress	G162
3007.4.2	IBC-General	IBC-Means of Egress	G163
3007.4.3	IBC-General	IBC-Means of Egress	G176
3007.5.1.(NEW)	IBC-General	IBC-Means of Egress	G164
3007.7.1	IBC-General	IBC-Means of Egress	G165, G166
3007.8.0	IBC-General	IBC-Means of Egress	G167
3008.1.0	IBC-General	IBC-Means of Egress	G168, G170
3008.1.1	IBC-General	IBC-Means of Egress	G169
3008.10.0	IBC-General	IBC-Means of Egress	G174
3008.10.1	IBC-General	IBC-Means of Egress	G175
3008.11.3	IBC-General	IBC-Means of Egress	G176
3008.11.5	IBC-General	IBC-Means of Egress	G177
3008.3.(NEW)	IBC-General	IBC-Means of Egress	G165, G166
3008.4.(NEW)	IBC-General	IBC-Means of Egress	G171
3008.4.0	IBC-General	IBC-Means of Egress	G46
3008.7.0	IBC-General	IBC-Means of Egress	G172
3008.9.0	IBC-General	IBC-Means of Egress	G173
3401.4.0	IBC-General	IBC-Structural	G190
3401.4.1	IBC-General	IBC-Structural	G191
3401.4.3	IBC-General	IBC-Structural	G190
3401.5.(NEW)	IBC-General	IBC-Structural	G192

SECTION	CHAPTER MAINTAINED BY	SECTION MAINTAINED BY	CODE CHANGES
3402.1.0	IBC-General	IBC-Structural	G193
3403.4.1	IBC-General	IBC-Structural	G190
3404.4.1	IBC-General	IBC-Structural	G190
3405.1.1	IBC-General	IBC-Structural	G192
3405.2.0	IBC-General	IBC-Structural	G193, G194
3405.2.1	IBC-General	IBC-Structural	G193, G190
3405.2.2	IBC-General	IBC-Structural	G193
3405.2.3	IBC-General	IBC-Structural	G193, G195
3405.3.0	IBC-General	IBC-Structural	G193
3405.4.0	IBC-General	IBC-Structural	G193, G194
3405.5.0	IBC-General	IBC-Structural	G196
3408.4.0	IBC-General	IBC-Structural	G190, G197
3408.4.0	IBC-General	IBC-Structural	G190
403.2.3	IBC-General	IBC-Structural	E5 Part I (Heard by IBC-MOE)
403.5.1	IBC-General	IBC-Structural	E5 Part I (Heard by IBC-MOE)
403.5.2	IBC-General	IBC-Means of Egress	G46
403.5.4	IBC-General	IBC-Structural	E5 Part I (Heard by IBC-MOE)
403.5.4	IBC-General	IBC-Means of Egress	G47
403.6.1	IBC-General	IBC-Means of Egress	G48, G49
408.3.8	IBC-General	IBC-Structural	E5 Part I (Heard by IBC-MOE)
410.5.3.1	IBC-General	IBC-Structural	E5 Part I (Heard by IBC-MOE)
419.3.0	IBC-General	IBC-Means of Egress	G79

ICC WEBSITE – WWW.ICCSAFE.ORG

While great care has been exercised in the publication of this document, errata to proposed changes may occur. Errata, if any, identified prior to the Code Development Hearings will be posted on the ICC website at http://www.iccsafe.org. Users are encouraged to periodically review the ICC Website for updates to errata to the 2009/2010 Code Development Cycle Proposed Changes. Additionally, analysis statements for code changes which propose a new referenced standard will be updated to reflect the staff review of the standard for compliance with Section 3.6 of the Procedures.

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. ` 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 motion 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.

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

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 2009/2010 Staff Secretaries on page ix. This is done in order to facilitate coordination among the International Codes which is one of the fundamental principles of the International Codes.

Listed in this cross index are proposed code changes that include sections of codes or codes other than those listed on page ix. For example, IBC Section 402.16.5 is proposed for revision in Part II of code change F58-09/10, which is to be heard by the IFC Committee. This section of the IBC is typically the responsibility of the IBC General Committee as listed in the table of 2009/2010 Staff Secretaries. It is therefore identified in this cross index. Another example is Section 905.4 of the International Fire Code. The International Fire Code is normally maintained by the IFC Committee, but Section 905.4 will be considered for revision in proposed code change G31-09/10 and will be placed on the IBC General Committee agenda. In some instances, there are other subsections that are revised by an identified code change that is not included in the cross index. For example, numerous sections in Chapter 10 of the International Fire Code would be revised by the proposed changes to Chapter 10 of the IBC. This was done to keep the cross index brief enough for easy reference.

This information is provided to assist users in locating all of the proposed code changes that would affect a certain section or chapter. For example, to find all of the proposed code changes that would affect Chapter 7 of the IBC, review the proposed code changes in the Volume 1 monograph for the IBC Fire Safety Committee (listed with a FS prefix) then review this cross reference for Chapter 7 of the IBC 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 monograph table of contents for location)**
ADM	Administrative
E	International Building Code - Means of Egress
EB	International Existing Building Code
EC	International Energy Conservation 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
PC	ICC Performance Code
P	International Plumbing Code
PSD	International Private Sewage Disposal 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
Z	International Zoning Code

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708.1	E5 – Part I
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R703.7.4.1	FS156 Part II
R703.11.2	FS156 Part II
R703.11.2.1	FS156 Part II
R703.11.2.2	FS156 Part II
R703.11.2.3	FS156 Part II
R703.12	FS150 Part II, FS151 Part II
703.12.1	FS150 Part II, FS151 Part II
R802.1.3	S201-09/10, Part II
R802.1.3.1	S201-09/10, Part II
R802.1.3.2	S201-09/10, Part II
R802.1.3.3	S201-09/10, Part II
R803.2.1	S200-09/10, Part II
R806.1	G146 Part II
R806.2	G145 Part II
R903.2.2	S3-09/10, Part II
R903.4	S2-09/10, Part III (heard by IRC Plumbing)
R903.4.1	S2-09/10, Part III (heard by IRC Plumbing)
Table R905.2.4.1(2)	S14-09/10, Part II
R905.2.7.2	S15-09/10, Part II
R905.2.8.5 (New)	S16-09/10, Part II
R905.3.3.3	S15-09/10, Part II
R905.4.3.2 (New)	S15-09/10, Part II
R905.4.5.1 (New)	S17-09/10, Part II
R905.5.3.2 (New)	S15-09/10, Part II
R905.6.3.2 (New)	S15-09/10, Part II
R905.7.3.2 (New)	S15-09/10, Part II
R905.8.3.2 (New)	S15-09/10, Part II
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R905.10.5.1 (New)	S15-09/10, Part II
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R1003.9.3 (New)	S182-09/10, Part II
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R1005.7	M117 PII
R1004.2	M119 PII
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N1101.4.2.1(New)	EC2 Part II
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N1101.7	EC28
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N1102.2.2.1(New)	EC64 Part II
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Table N1102.4.2	EC26 Part II, EC59 Part II
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N1102.4.1.1(New)	EC79 Part II
N1102.4.1.2 (New)	EC79 Part II
N1102.4.2	EC81, EC82, EC83, EC86, EC90

IRC (continued)	
N1102.4.2.1.1 (New)	EC80 Part II
N1102.4.2.1.1 (New)	EC87 Part II
N1102.4.3	EC79 Part II, EC89 Part II
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N1103.1.1	EC101 Part II
N1103.1.3 (New)	EC100 Part II
N1103.2.1	EC103 Part II
N1103.2.2	EC103, EC104, EC107 (All Part II)
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N1103.2.3	EC103 Part II, EC109 Part II,
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N1103.4.1	EC112 Part II
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N1103.5 (New)	EC119 Part II
N1103.5.1	EC99 Part II
N1103.6	EC120 Part II
T N1103.6 (New)	EC121 Part II
N1103.8	EC124 Part II
N1103.9	EC125 Part II
N1103.10 (New)	EC126 Part II
N1104 (New)	EC131 Part II
N1104.1	EC127, EC129, EC130 (All Part II)
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M1401.1	M9 PII
M1407.1	M121 PII
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Table P2605.1	P70 Part II
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Table P2608.4	P7 Part II
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P2708.4 (New)	P53 Part II
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P2709.2.2	P54 PartII
P2709.2.4 (New)	P55 PartII
P2713.1	P40 Part II, P41 Part II
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P2724.1 (New)	P61 Part II
P2803.6	P62 Part II
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P2803.6.1	P64 Part II
P2801.1.2	EC122 Part II
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P2801.5.1	P67 Part II
P2801.5.3 (New)	P158 Part II
P2901.1	P87 Part II
P2902.1	P102 Part II
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P2902.3.3	P103 Part II
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P2902.4.2	P94 Part II
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P2902.5.4.1	P99 Part II
P2902.5.5	P94 Part II
P2902.6	P90 Part II
P2903.3.1	P157 Part II
P2903.5	P72 Part II
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P2903.9.5	P86 Part II
P2903.11 (New)	P75 Part II
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P2905.19.1(New)	P70 Part II
P2905.19.2 (New)	P70 Part II
P2908.1	P108 Part II
P2908.2	P108 Part II
P3001.4 (New)	P109 Part II
P3002.3.1	P111 Part II
P3003.9.2	P110 Part II
P3003.14.2	P110 Part II
P3003.19	P36 Part II
P3007.3.2.1 (New)	P114 Part II
P3007.3.3 (New)	P115 Part II
P3007.3.3.1 (New)	P115 Part II
P3007.3.3.2 (New)	P115 Part II
P3007.3.5	P116 Part II
P3009 (New)	P152 Part II
P3103.4	P124 Part II
P3103.5	P159 Part II
P3111.2	P128 Part II
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P3113.4.1	P131 Part II
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P3201.2	P136 Part II
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Appendix H	G2 Part II
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Appendix L	G204 Part II

INT. WILDLAND-URBAN INTERFACE CODE	
Chapter 1	ADM1 Part X
101.3	ADM3
102.4	ADM4
115 (New)	ADM16 Part I
Chapter 15	ADM39
INTERNATIONAL ZONING CODE	
Chapter 1	ADM1 Part XI
101.2	ADM3
112 (New)	ADM16 Part I
Chapter 14	ADM39

2009/2010 ICC CODE DEVELOPMENT HEARING SCHEDULE

October 24 – November 11, 2009

Hilton Baltimore

Unless noted by "Start no earlier than X am/pm," each Code Committee will begin immediately upon completion of the hearings for the prior Committee. Thus the actual start times for the various Code Committees are tentative. The hearing volume is higher than previous cycles. The schedule anticipates that the hearings will finish by the times noted as "Finish" for each track and each week.

CODE DEVELOPMENT HEARINGS: OCTOBER 24 - 31

	Saturday October 24	Sunday October 25	Monday October 26	Tuesday October 27	Wednesday October 28	Thursday October 29	Friday October 30	Saturday October 31
TRACK 1	Start 8 am IWUIC IFC End 8 pm	Start 10 am IFC End 8 pm	Start 8 am IFC IRC-Energy (Start no earlier than 1 pm) End 8 pm	Start 8 am IRC – Energy End 8 pm	Start 8 am IRC-Building (Start no earlier than 8 am) End 8 pm	Start 8 am IRC- Building End 8 pm	Start 8 am IRC – Building Admin (Start no earlier than 3 pm) End 8 pm	Start 8 am Admin Finish 3 pm
TRACK 2	Start 8 am IBC- Structural End 8 pm	Start 10 am IBC- Structural End 8 pm	Start 8 am IBC- Structural End 8 pm	Start 8 am IBC- Structural End 8 pm	Start 8 am IECC (Start no earlier than 8 am) End 8 pm	Start 8 am IECC End 8 pm	Start 8 am IECC End 8 pm	Start 8 am IECC Finish 8 pm

ANNUAL CONFERENCE: NOVEMBER 1 - 4

CODE DEVELOPMENT HEARINGS: NOVEMBER 4 - 11

	Wednesday November 4	Thursday November 5	Friday November 6	Saturday November 7	Sunday November 8	Monday November 9	Tuesday November 10	Wednesday November 11
TRACK 1	Start 8 am IPM/ZC IEBC IBC-Fire Safety End 5 pm	Start 8 am IBC-Fire Safety End 8 pm	Start 8 am IBC – Fire Safety IBC – General (Start no earlier than 3 pm) End 8 pm	Start 8 am IBC - General End 8 pm	Start 10 am IBC – General IBC – Egress (Start no earlier than 3 pm) End 8 pm	Start 8 am IBC - Egress End 8 pm	Start 8 am IBC - Egress End 8 pm	Start 8 am IBC - Egress Finish 12 pm
TRACK 2	Start 8 am IPC/IPSDC End 5 pm	Start 8 am IPC/IPSDC End 9 pm	Start 8 am IMC (Start no earlier than 8 am) End 9 pm	Start 8 am IMC IRC- Plumbing/ Mechanical (Start no earlier than 1 pm) End 9 pm	Start 10 am IRC – Plumbing/ Mechanical End 9 pm	Start 8 am IRC – Plumbing/ Mechanical IFGC (Start no earlier than 8 am) Finish 9 pm	NO HEARINGS TRACK 2 COMPLETED	

Notes:
1. Hearing times may be modified at the discretion of the Chairman. Breaks will be announced.
2. Proposed code changes submitted to the International Wildland-Urban Interface Code (IWUIC) to be heard by the IFC Committee.
3. Proposed code changes submitted to the International Zoning (Z) and Property Maintenance (PM) Codes to be heard by the IPM/Z Committee.
4. "Admin" is a new code committee who will hear changes that affect coordination of Chapter 1 of all the I-Codes, except the IRC, and referenced standards updates.

2009/2010 PROPOSED CHANGES TO THE INTERNATIONAL CODES

Registration
Delegate

INTERNATIONAL CODE COUNCIL

2009 Annual Conference and Code Development Hearings
Hearings: October 24–31 and November 4–11
Hilton Baltimore
Conference: November 1–4
Baltimore Convention Center

FIRST NAME AND M.I. | LAST NAME/SURNAME

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☐ Golf Tournament (per person)** Handicap ______	$75	$75	$125	$125
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1:15 pm–4:15 pm
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ID Number ______________

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2009/2010 PROPOSED CHANGES TO THE INTERNATIONAL ENERGY CONSERVATION CODE

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International Code Council

TENTATIVE ORDER OF DISCUSSION

2009/2010 PROPOSED CHANGES TO THE INTERNATIONAL ENERGY CONSERVATION CODE

The following is the tentative order in which the proposed changes to the code will be discussed at the public hearings. Proposed changes which impact the same subject have been grouped to permit consideration in consecutive changes.

Proposed change numbers that are indented are those which are being heard out of numerical order. Indentation does **not** necessarily indicate that one change is related to another. Proposed changes may be grouped for purposes of discussion at the hearing at the discretion of the chair.

- ADM24-09/10
- ADM25-09/10
- ADM26-09/10
- ADM27-09/10
- ADM28-09/10
- ADM29-09/10
- EC65-09/10
- ADM30-09/10
- ADM31-09/10

EC1-09/10, Part I
EC2-09/10, Part I
EC3-09/10
EC4-09/10, Part I
EC5-09/10
EC6-09/10
EC7-09/10
EC8-09/10
EC9-09/10
EC10-09/10

- EC13-09/10, Part I
- EC14-09/10
- EC15-09/10
- EC19-09/10, Part I
- EC25-09/10, Part I
- EC16-09/10, Part I

EC11-09/10, Part I

- EC232-09/10

EC12-09/10
EC17-09/10, Part I
EC18-09/10, Part I
EC20-09/10
EC21-09/10, Part I
EC22-09/10, Part I
EC23-09/10, Part I
EC24-09/10
EC26-09/10, Part I
EC27-09/10, Part I
EC28-09/10, Part I
EC29-09/10, Part I
EC30-09/10, Part I
EC31-09/10, Part I
EC32-09/10, Part I
EC33-09/10
EC34-09/10, Part I
EC35-09/10, Part I
EC36-09/10, Part I
EC37-09/10
EC38-09/10, Part I
EC39-09/10, Part I
EC40-09/10, Part I
EC41-09/10, Part I
EC42-09/10, Part I
EC43-09/10, Part I
EC44-09/10
EC45-09/10, Part I
EC46-09/10, Part I
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EC51-09/10
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EC57-09/10, Part I
EC58-09/10I, Part I
EC59-09/10, Part I
EC60-09/10, Part I
EC61-09/10
EC62-09/10
EC63-09/10, Part I
EC64-09/10, Part I
EC65-09/10
EC66-09/10, Part I
EC67-09/10
EC68-09/10, Part I
EC69-09/10, Part I
EC70-09/10
EC71-09/10, Part I
EC72-09/10, Part I
EC73-09/10, Part I
EC74-09/10, Part I
EC75-09/10
EC76-09/10, Part I
EC77-09/10, Part I
EC78-09/10, Part I
EC79-09/10, Part I
EC80-09/10, Part I
EC81-09/10, Part I
EC82-09/10, Part I
EC83-09/10, Part I
EC84-09/10, Part I
EC85-09/10
EC86-09/10, Part I
EC87-09/10, Part I
EC88-09/10
EC89-09/10, Part I
EC90-09/10, Part I
EC91-09/10, Part I
EC92-09/10, Part I
EC93-09/10
EC94-09/10
EC96-09/10, Part I
EC97-09/10
EC98-09/10, Part I
EC99-09/10, Part I
EC100-09/10, Part I
EC101-09/10, Part I
EC102-09/10, Part I
EC103-09/10, Part I
EC104-09/10, Part I
EC105-09/10
EC106-09/10, Part I
EC107-09/10, Part I
EC108-09/10
EC109-09/10, Part I
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EC111-09/10
EC112-09/10, Part I
EC113-09/10
EC114-09/10, Part I
EC115-09/10, Part I
EC116-09/10, Part I
EC117-09/10, Part I
EC118-09/10, Part I
EC119-09/10, Part I
EC120-09/10, Part I
EC121-09/10, Part I
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EC123-09/10, Part I
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EC125-09/10, Part I
EC126-09/10, Part I
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EC229-09/10
EC230-09/10
EC231-09/10

EC1–09/10
Table 301.1, Figure 301.1; IRC Table N1101.2, Figure N1101.2

Proponent: Thomas F. Johnson, Code Official for the Town of Durham, NH, representing the NH Seacoast Code Officials Association and NH Building Officials Association

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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~~
6A All

(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 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.

(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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: JOHNSON(THOMAS)-EC-1-T. 301.1-RE-1-T. N1101.2

EC2–09/10

303.1.1.2 (New); IRC N1101.4.2.1 (New)

Proponent: Craig Conner, Building Quality, representing self

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Part I – IECC

Add new text as follows:

<u>**303.1.1.2 Insulated sheathing R-value mark**. Where R-values for multiple sheathing thicknesses are printed on insulated sheathing, the actual R-value shall be printed on the insulated sheathing board in lettering at least two times the height of any other R-value or thickness. Alternatively, the installed insulated sheathing R-value shall be listed on the insulation certification required in Section 303.1.1</u>

Part II – IRC

Add new text as follows:

<u>**N1101.4.2.1 Insulated sheathing R-value mark.** Where R-values for multiple sheathing thicknesses are printed on insulated sheathing, the actual R-value shall be printed on the insulated sheathing board in lettering at least two times the height of any other R-value or thickness. Alternately, the installed insulated sheathing R-value shall be listed on the insulation certification required in section N1101.4.2.</u>

Reason: Sheets of insulated sheathing routinely carry tables of multiple R-values printed on the sheet, where the R-value for a variety of thicknesses is displayed on every sheet. Verifying compliance would be easier if the actual R-value for the specific product installed was clear at a glance. This can be accomplished through an enlarged font for the actual R-Value, or through the installer certificate

Cost Impact: The code change proposal will increase the cost of construction, but ease inspection for compliance.

PART I – IECC

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

PART II – IRC ENERGY

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

ICCFILENAME: CONNER-EC-6-303.1.1.2.DOC

EC3–09/10

202 (New), 303.1.3, Table 303.1.3(3)

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.

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

ICCFILENAME: STONE-EC-3-202-303.1.3

EC4–09/10
303.1.4; IRC N1101.6

Proponent: Jesse J. Beitel, Hughes Associates, Inc., representing The Extruded Polystyrene Foam Association

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

303.1.4 Insulation product rating. The thermal resistance (*R*-value) of insulation shall be determined in accordance with the U.S. Federal Trade Commission *R*-value rule (CFR Title 16, Part 460, May 31, 2005) in units of h x ft^2 x °F/Btu at a mean temperature of 75°F (24°C). <u>Foam plastic products that contain a captive blowing agent shall report the thermal resistance (*R*-value) after aging for180 days at ambient conditions (75°F (24°C) and 50% relative humidity or aging for 90 days at 140°F (60°C) prior to thermal conductivity testing and reporting.</u>

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1101.6 Insulation product rating. The thermal resistance (*R*-value) of insulation shall be determined in accordance with the CFR Title 16, Part 460 in units of h · ft^2 · °F/Btu at a mean temperature of 75°F (24°C). <u>Foam plastic products that contain a captive blowing agent shall report the thermal resistance (R-value) after aging for 180 days at ambient conditions (75°F (24°C) and 50% relative humidity or aging for 90 days at 140°F (60°C) prior to thermal conductivity testing and reporting.</u>

Reason: The new language improves the clarity and the enforceability of the Code requirement by specifying the specific aging requirements prior to testing. Currently, there are several different procedures for aging, making the comparison of *R*-values confusing. This language will level the playing field and ensure that thermal performance reported is that which will exist over time.

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: BIETEL-EC-1-303.1.4.DOC

EC5–09/10
302, 302.1, 303, 401.2, 401.3, 402.2.12, 403.6, 403.10, 501.3, 501.4, 502.2, 502.2.1, 502.3, 503.2.1, 503.4

Proponent: Ronald Majette, representing US Department of Energy

1. Delete without substitution:

~~SECTION 302~~
~~DESIGN CONDITIONS~~

~~**302.1 Interior design conditions.** The interior design temperatures used for heating and cooling load calculations shall be a maximum of 72ºF (22ºC) for heating and minimum of 75ºF (24ºC) for cooling.~~

2. Revise as follows:

403.6 Equipment sizing (Mandatory). Heating and cooling equipment shall be sized in accordance with Section M1401.3 of the *International Residential Code*. The interior design temperatures used for heating and cooling load calculations shall be a maximum of 72ºF (22ºC) for heating and minimum of 75ºF (24ºC) for cooling.

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. 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.The~~ an interior design temperature~~s used for heating and cooling load calculations shall be a maximum of~~ no more than 72ºF (22ºC) for heating and ~~minimum of~~ no less than 75ºF (24ºC) for cooling.

3. Delete without substitution:

~~SECTION 303~~
~~MATERIALS, SYSTEMS AND EQUIPMENT~~

~~**303.1 Identification.** Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this code.~~

~~**303.1.1 Building thermal envelope insulation.** An *R*-value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and *R*-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled *R*-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and *R*-value of installed thickness shall be *listed* on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.~~

~~**303.1.1.1 Blown or sprayed roof/ceiling insulation.** The thickness of blown-in or sprayed roof/ceiling insulation (fiberglass or cellulose) shall be written in inches (mm) on markers that are installed at least one for every 300 square feet (28 m^2) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers a minimum of 1 inch (25 mm) in height. Each marker shall face the attic access opening. Spray polyurethane foam thickness and installed *R*-value shall be *listed* on certification provided by the insulation installer.~~

~~**303.1.2 Insulation mark installation.** Insulating materials shall be installed such that the manufacturer's *R*-value mark is readily observable upon inspection.~~

~~**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) 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(1)~~
~~DEFAULT GLAZED FENESTRATION U-FACTOR~~

~~FRAME TYPE~~	~~SINGLE PANE~~	~~DOUBLE PANE~~	~~SKYLIGHT~~	
			~~Single~~	~~Double~~
~~Metal~~	~~1.20~~	~~0.80~~	~~2.00~~	~~1.30~~
~~Metal with Thermal Break~~	~~1.10~~	~~0.65~~	~~1.90~~	~~1.10~~
~~Nonmetal or Metal Clad~~	~~0.95~~	~~0.55~~	~~1.75~~	~~1.05~~
~~Glazed Block~~	~~0.60~~			

~~**TABLE 303.1.3(2)**~~
~~**DEFAULT DOOR U-FACTORS**~~

~~**DOOR TYPE**~~	~~**U-FACTOR**~~
~~Uninsulated Metal~~	~~1.20~~
~~Insulated Metal~~	~~0.60~~
~~Wood~~	~~0.50~~
~~Insulated, nonmetal edge, max 45% glazing, any glazing double pane~~	~~0.35~~

~~**TABLE 303.1.3(3)**~~
~~**DEFAULT GLAZED FENESTRATION SHGC**~~

~~**SINGLE GLAZED**~~		~~**DOUBLE GLAZED**~~		~~**GLAZED BLOCK**~~
~~**Clear**~~	~~**Tinted**~~	~~**Clear**~~	~~**Tinted**~~	
~~0.8~~	~~0.7~~	~~0.7~~	~~0.6~~	~~0.6~~

~~**303.1.4 Insulation product rating.** The thermal resistance (*R*-value) of insulation shall be determined in accordance with the U.S. Federal Trade Commission *R*-value rule (CFR Title 16, Part 460, May 31, 2005) in units of h x ft^2 x°F/Btu at a mean temperature of 75°F (24°C).~~

4. Add new text and tables as follows:

401.3 Materials, systems, and equipment.

401.3.1 Identification. Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this code.

401.3.1.1 Building thermal envelope insulation. An *R*-value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and *R*-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled *R*-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and *R*-value of installed thickness shall be *listed* on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

401.3.1.1.1 Blown or sprayed roof/ceiling insulation. The thickness of blown-in or sprayed roof/ceiling insulation (fiberglass or cellulose) shall be written in inches (mm) on markers that are installed at least one for every 300 square feet (28 m^2) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers a minimum of 1 inch (25 mm) in height. Each marker shall face the attic access opening. Spray polyurethane foam thickness and installed *R*-value shall be *listed* on certification provided by the insulation installer.

401.3.1.2 Insulation mark installation. Insulating materials shall be installed such that the manufacturer's *R*-value mark is readily observable upon inspection.

401.3.1.3 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 401.3.1.3(1) or 401.3.1.3(2). 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. Products lacking such a labeled SHGC shall be assigned a default SHGC from Table 401.3.1.3(3).

TABLE 401.3.1.3(1)
DEFAULT GLAZED FENESTRATION U-FACTOR

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

TABLE 401.3.1.3(2)
DEFAULT DOOR U-FACTORS

DOOR TYPE	U-FACTOR
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

TABLE 401.3.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC

SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
Clear	Tinted	Clear	Tinted	
0.8	0.7	0.7	0.6	0.6

401.3.1.4 Insulation product rating. The thermal resistance (*R*-value) of insulation shall be determined in accordance with the U.S. Federal Trade Commission *R*-value rule (CFR Title 16, Part 460, May 31, 2005) in units of h x ft^2 x°F/Btu at a mean temperature of 75°F (24°C).

502.2 Specific insulation requirements (Prescriptive). Opaque assemblies shall comply with Table 502.2(1). Materials shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this code. The thermal resistance (*R*-value) of insulation shall be determined in accordance with the U.S. Federal Trade Commission *R*-value rule (CFR Title 16, Part 460, May 31, 2005) in units of h _ ft2 _ °F/Btu at a mean temperature of 75°F (24°C).

An *R*-value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and *R*-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled *R*-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and *R*-value of installed thickness shall be *listed* on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site. Insulating materials shall be installed such that the manufacturer's *R*-value mark is readily observable upon inspection.

Insulation applied to the exterior of basement walls, crawlspace walls and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (153 mm) below grade.

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.

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.

The thickness of blown-in or sprayed roof/ceiling insulation (fiberglass or cellulose) shall be written in inches (mm) on markers that are installed at least one for every 300 square feet (28 m2) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers a minimum of 1 inch (25 mm) in height. Each marker shall face the attic access opening. Spray polyurethane foam thickness and installed *R*-value shall be *listed* on certification provided by the insulation installer.

502.3 Fenestration (Prescriptive). Fenestration shall comply with Table 502.3(1). *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)~~ Table 502.3. 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. Products lacking such a labeled SHGC shall be assigned a default SHGC from Table ~~303.1.3(3)~~.

TABLE 502.3(1)
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION
(No change to the table)

TABLE ~~303.1.3(1)~~ 502.3(2)
DEFAULT GLAZED FENESTRATION U-FACTOR

FRAME TYPE	**SINGLE PANE**	**DOUBLE PANE**	**SKYLIGHT**	
			Single	**Double**
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

TABLE ~~303.1.3(2)~~ 502.3(3)
DEFAULT DOOR U-FACTORS

DOOR TYPE	**U-FACTOR**
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

TABLE ~~303.1.3(3)~~ 502.3(4)
DEFAULT GLAZED FENESTRATION SHGC

SINGLE GLAZED		**DOUBLE GLAZED**		**GLAZED BLOCK**
Clear	**Tinted**	**Clear**	**Tinted**	
0.8	0.7	0.7	0.6	0.6

6. Delete without substitution:

~~**303.2 Installation.** All materials, systems and equipment shall be installed in accordance with the manufacturer's installation instructions and the *International Building Code*.~~

7. Revise as follows:

401.2 Compliance. <u>All materials, systems and equipment shall be installed in accordance with the manufacturer's installation instructions and the *International Building Code*.</u> Projects shall comply with 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).

8. Add new text as follows:

<u>**501.3 Installation.** All materials, systems and equipment shall be installed in accordance with the manufacturer's installation instructions and the *International Building Code*.</u>

9. Relocate and renumber as follows:

~~**303.2.1 Protection of exposed foundation insulation.** Insulation applied to the exterior of basement walls, crawlspace walls and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (153 mm) below grade.~~

<u>**402.2.12 Protection of exposed foundation insulation.** Insulation applied to the exterior of basement walls, crawlspace walls and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (153 mm) below grade.</u>

~~**303.3 Maintenance information.** Maintenance instructions shall be furnished for equipment and systems that require preventive maintenance. Required regular maintenance actions shall be clearly stated and incorporated on a readily accessible label. The label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product.~~

<u>**403.10 Maintenance information.** Maintenance instructions shall be furnished for equipment and systems that require preventive maintenance. Required regular maintenance actions shall be clearly stated and incorporated on a readily accessible label. The label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product.</u>

10. Add new text as follows:

<u>**501.4 Maintenance information.** Maintenance instructions shall be furnished for equipment and systems that require preventive maintenance. Required regular maintenance actions shall be clearly stated and incorporated on a readily accessible label. The label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product.</u>

Reason: The proposal merely moves and rearranges text so that specific provisions are found in correct and logical locations. Section 302 relates only to interior design conditions, which is unrelated to the topic of Chapter 3 (Climate Zones). The content of Section 302 is more relevant to Section 403.6 and 503.2.1 and is proposed to be located therein alongside the related topics of load calculations and equipment sizing. The content in Section 303 not related to climate zones and is more appropriate in Chapters 4 and 5 at locations where it is relevant.

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

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

ICCFILENAME: Majette-EC-64-Ch 3-4-5-

EC6–09/10
202

Proponent: Michael P. Burnetter, PE, New York State Department of State, representing Division of Code Enforcement and Administration

Revise definition as follows:

CONDITIONED SPACE. An area or room ~~within a building being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent *conditioned space*.~~ which is within the thermal envelope of a building heated or cooled using fossil or electric fuel as the energy source.

Reason: The definition change is to eliminate confusion and gaming of the code as the 2009 IECC allows for an un-insulated duct passing through a space, or having a small outlet in any duct, to define that space of any size as conditioned. In NYS, the New York Research and Development Authority (NYSERDA) has identified this as a problem causing much confusion in their Energy Star Homes program. The thermal envelope is what should define conditioned space since a well installed thermal envelope will equate the temperature within a building to all be "conditioned" even if unintentional which is simply acknowledged here. This will then build consistency in the code as this approach is used in Section 403.2 (see the Exception). This change will help to make the code more consistent with other sections as well.

Cost Impact: Providing clarity of purpose should lower the design costs of a building involving this type of space.

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

ICCFILENAME: BURNETTER-EC-2-CH 2

EC7–09/10
202

Proponent: Ronald Majette, representing US Department of Energy

1. Revise definition as follows:

CONDITIONED FLOOR AREA. The ~~horizontal projection of the floors associated with~~ gross floor area of the *conditioned space*.

2. Add new definition as follows:

GROSS FLOOR AREA. The sum of the floor areas of the spaces within the building, including basements, mezzanine and intermediate-floored tiers, and penthouses with a headroom height of 7.5 ft or greater. It is measured from the exterior faces of exterior walls or from the centerline of walls separating buildings, but excluding covered walkways, open roofed-over areas, porches and similar spaces, pipe trenches, exterior terraces or steps, chimneys, roof overhangs, and similar features.

Reason: For consistency with ASHRAE Standard 90.1. The term as presented is not precise in that it does not fully represent the area associated with ramps.

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

Analysis: This will create a different definition for the same term that is currently in the IBC.

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

ICCFILENAME: MAJETTE-EC-34-202-REDONE

EC8–09/10
202 (New)

Proponent: Ronald Majette, representing US Department of Energy

Add new definition as follows:

FLOOR. That portion of the building, other than slab on grade, that has conditioned space above and is horizontal or tilted at an angle of less than 60 degrees from horizontal.

Reason: For consistency with ASHRAE Standard 90.1-07. Since floors are currently undefined, it is difficult to determine when sloped surfaces must meet either the floor or wall requirements in the code. This proposal eliminates any confusion or need for interpretation on this issue.

Cost Impact: The code change will decrease the cost of construction associated with those assemblies that previously would have been considered walls under the ICC and would now be considered floors.

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

ICCFILENAME: MAJETTE-EC-35-202

EC9–09/10
202

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.

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

ICCFILENAME: MAJETTE-EC-79-202

EC10–09/10
202

Proponent: Ron Nickson, representing the National Multi Housing Council

Revise definition as follows:

RESIDENTIAL BUILDING. For this code, includes <u>R-2,</u> R-3<u>, and R-4</u> buildings~~, as well as R-2 and R-4 buildings three stories or less in height above grade~~.

Reason: To allow the energy provisions of Chapter 4 for residential occupancies to apply to all residential occupancies without any restriction on building height. Building height is controlled in either the IRC or IBC based on the type of construction and building area. The energy performance of a residential building is not a function of the building height, but rather a function of the building components that make up the building envelope and the performance of the systems within the structure for heating, cooling, light and water heating. The primary occupancy impacted by this change would be an R-2. Currently R-2 buildings three-stories or less in height fall under the provisions of Chapter 4. R-2 buildings four-or-more stories in height are covered by Chapter 5 for commercial buildings. Typically buildings four-or-less stories in height are wood frame, whereas taller buildings will have either a concrete or steel frame. Energy wise, they function the same and the provisions of Chapter 4 of the IECC would be applicable to all of the buildings except for those which have central HVAC systems. Section 403.7 of the IECC addresses the issue by directing the code user to Sections 503 (Building Mechanical Systems) and 504 (Service Water Heating) in the commercial portion of the IECC.

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

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

ICCFILENAME: NICKSON-EC-3-202

EC11–09/10
Chapter 4; IRC Chapter 11

Proponents: David Cohan, representing Northwest Energy Codes Group; Eric Makela, Britt/Makela Group, representing Northwest Energy Codes Group; Chuck Murray, Washington State CTED Energy Policy Division, representing Northwest Energy Codes Group

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Revise as follows:

401.2 Compliance. Projects shall comply with 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, including Section 402.1.3, (prescriptive) and Section 406 or
2. Section 405 (performance) with the annual energy cost of the proposed design 10 percent less than the annual energy cost of the standard reference design.

401.3 Additions. Additions to an existing dwelling unit shall comply with Sections 401.2 and 406.1.

~~401.3~~ 401.4 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 tested ACH50 for envelope air leakage and also the tested CFM for duct leakage if applicable. 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

CLIMATE ZONE	FENESTRATION *U*-FACTOR	Skylight *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[h]	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[j]	~~0.75~~ 0.65	0.30	30	13	4 / 6	13	0	0	0
3	0.50[j]	~~0.65~~ 0.55	0.30	30	13	5 / 8	19	5/13[i]	0	5 / 13
4 except Marine	0.35	~~0.60~~ 0.55	NR	38	20 or 13+5[h] ~~13~~	13 / 17 [5 / 10]	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	~~0.35~~ 0.32	~~0.60~~ 0.55	NR	38	20 or 13+5 [h]	13 / 17	30[f]	10/13	10,2ft	10/13
6	~~0.35~~ 0.32	~~0.60~~ 0.55	NR	49	20 or 13+5[h]	15 / 19	30[f]	15/19	10,4ft	10/13
7 and 8	~~0.35~~ 0.32	~~0.60~~ 0.55	NR	49	21	19 / 21	38[f]	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	FRAME WALL *U*-Factor	MASS WALL *U*-FACTOR[b]	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	~~1.20~~ NR	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	~~0.75~~ 0.65	0.035	0.082	0.165	0.064	0.360	0.477
3	0.5	~~0.65~~ 0.55	0.035	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	~~0.60~~ 0.55	0.030	~~0.082~~ 0.060	0.141	0.047	0.059	0.065

5 and Marine 4	~~0.35~~ 0.32	~~0.60~~ 0.55	0.030	0.060	0.082	0.033	0.059	0.065
6	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	0.060	0.060	0.033	0.059	0.065
7 and 8	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	0.057	0.057	0.033	0.059	0.065

402.1.3 *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.

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.~~

402.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table 402.1.1 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 independent from the installer of the insulation shall inspect the air barrier and insulation.

TABLE ~~402.4.2~~ 402.4.1.1
AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls ~~is~~ shall be installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier ~~are~~ shall be filled or ~~repaired~~ sealed. Air permeable insulation ~~is~~ shall not be used as a sealing material. Air permeable insulation ~~is~~ shall be 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 are insulated and the~~.~~ junction of the foundation and sill plate ~~is~~ 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 air barrier.
Floors (including above garage and cantilevered floors)	Insulation ~~is~~ shall be installed to maintain permanent contact with underside of subfloor decking. An 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 cut to fit, or narrow cavities are filled by spayed/blown insulation.~~ Insulation to be installed in non-standard framing cavity spaces shall be cut to fit the cavity or the cavity shall be insulated with insulation that will readily conform to the cavity.
Garage separation	Air sealing ~~is~~ shall be provided ~~between~~ for the assemblies ~~the~~ separating the garage ~~and~~ from conditioned spaces.
Recessed lighting	Recessed light fixtures that penetrate the building 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 to fit around wiring and plumbing without compression in exterior walls, or sprayed/blown insulation 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 air barrier installed separating them from the ~~exterior wall~~ showers and tubs.
Electrical / phone box on exterior walls	The required 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.~~

~~**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.~~

~~**Exception:** Residential occupancies other than one- and two-family dwellings shall follow Section 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 no greater less than seven four air changes per hour (ACH) in zones 1 to 3 and three ACH in zones 4 to 8 when tested with a blower door at a pressure of 33.5 psf 50 Pascals(50 Pa) using ASHRAE 119~~. ~~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. Where required by the *code official*, an *approved* independent party shall perform the building envelope air leakage testing.~~

402.4.1.2 Testing. The dwelling shall be tested and found to have an air leakage rate not exceeding seven air changes per hour (ACH50) in climate zones 1 and 2 and five ACH50 in climate zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 50 Pascals (50 Pa) in accordance with ASHRAE 119 by a party *approved* by the *code official.* Where required by the *code official*, testing shall be conducted by an *approved* party independent from 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 testing attesting to the accuracy of the values and provided to the *code official*. Testing shall be performed any time after rough in and creation of all penetrations of the *building thermal envelope*

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed~~;~~ beyond the weatherstripping or other infiltration control measures that will be installed;
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 infiltration control measures that will be installed;
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.

Exceptions:

1. Dwelling units of multi-family residential buildings with more than four individual units shall be exempted from the testing requirement if they satisfy the requirements 402.1.1.
2. Additions less than 1,000 square feet.
3. Projects that are unsuccessful in complying with the maximum air leakage performance standards shall, at the approval of the code official and, in the presence of either the code official or designated third party:
   3.1. Determine that all identifiable air leakage openings have been sealed, and
   3.2. Conduct a blower door test

The certificate required in section 401.4 shall note the tested air leakage rate of the home and that the home did not comply with the air leakage performance standard.

402.4.1.3 Sampling. For groups of five or more homes of the same model, with no variations in foundation and construction which will be tested for air leakage during the same sixty-day period, the code official may elect to test less than 100 percent, but not less than 20 percent of the homes. If any tested home fails to meet the maximum air leakage requirement stated in Section 402.4.1.2 then the code official shall have all homes tested until a minimum of three consecutive homes pass the test.

Exception: The first three homes built of the same model, with no variations in foundation and construction.

~~**402.4.2.2 Visual inspection for buildings other than one- and two family dwellings 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.~~

402.4.2 Fireplaces. New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.

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*.

Duct tightness shall be verified by ~~either of~~ the following:

~~1.~~ ~~Postconstruction 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 ft2 (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 ~~6~~ 4 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~~ 3 cfm (113.3 L/min) per 100 ft2 (9.29 m2) of *conditioned floor area*.

Exceptions: Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.

SECTION 405
SIMULATED PERFORMANCE ALTERNATIVE
(Performance)

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 Changes Per Hour (ACH50)	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]

	assuming no energy recovery Climate Zone 1 -2: ACH50 = 7 Climate Zone 3 -8: ACH50 = 5	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

2. Add new section as follows:

SECTION 406
ADDITIONAL PRESCRIPTIVE EFFICIENCY MEASURES

406.1 Additional efficiency measures. Each dwelling unit shall include two of the measures described in Table 406.1. Single-family dwelling units greater than or equal to 4,000 square feet in floor area shall include three measures described in Table 406.1.

Exceptions:

1. Projects installing a ground or water source heat pump with minimum COP meeting the requirements of Table 503.2.3(2). Single-family dwelling units greater than or equal to 4,000 square feet in floor area shall include one additional measure.
2. Additions less than 1000 square feet shall include one measure from Table 406.1.

TABLE 406.1
ADDITIONAL EFFICIENCY MEASURES
(SELECT TWO MEASURES BASED ON CLIMATE ZONE).

CLIMATE ZONES 1, 2 and 3	
MEASURE	
1	HIGH EFFICIENCY HVAC SYSTEM: SEER 15 Air Conditioner
2	HIGH EFFICIENCY WATER HEATING: Tankless Gas Water Heater for all water heater end uses, EF-0.82, Capacity 1 Gallon
3	SOLAR HOT WATER Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems
4	CEILING AND WINDOWS OPTION 1: R-38 Ceiling and the following window characteristics: Zone 1: U-factor 0.45, SHGC .25 Zone 2: U-factor 0.45, SHGC .25 Zone 3: U-factor 0.35, SHGC ,25
5	CEILING AND WINDOWS OPTION 2: R-30 Ceiling with radiant barrier and the following window characteristics: Zone 1: U-factor 0.45, SHGC .25 Zone 2: U-factor 0.45, SHGC .25 Zone 3: U-factor 0.35, SHGC ,25
6	HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM: All heating and cooling system components installed inside the conditioned space. All combustion equipment shall be direct vent or sealed combustion. Not qualifying: Systems utilizing electric resistant heat, including baseboard and furnace, as the primary heat source.
7	SMALL HOUSING UNIT:

	Housing units less than 1300 square feet in floor area with less than 220 square feet of fenestration.

CLIMATE ZONES 4, MARINE 4, 5 and 6	
MEASURE	
1	HIGH EFFICIENCY HVAC SYSTEM: Gas, propane or oil-fired furnace or boiler with minimum AFUE of 90% and SEER 14 Air Conditioner, or Air-source heat pump with minimum HSPF of 8.5
2	HIGH EFFICIENCY BUILDING ENVELOPE: Zone 4: Attic R-49, Vaults R-38 or Glazing U-0.30 Zone 4 Marine and 5: Walls: R-20+R5, Attic R-49, Vaults R-38 or Attic R-49, Vaults R-38 and Glazing U-0.30 or Glazing U-0.25. Zone 6: Walls: R-20+R5, Attic R-49, Vaults R-38 or Attic R-60 Vaults R-49 and Glazing U-0.30 or Glazing U-0.25.
3	ENVELOPE UA: The proposed building envelope shall have a total UA at least 15% less than the code target UA as calculated using Table 402.1.4 and Section 402.1.4 Total UA alternative.
4	REDUCED AIR LEAKAGE ENVELOPE: Envelope leakage of an ACH50 of 2.5 or less when tested with a blower door at a pressure difference of 50 pascals. Testing shall follow the requirements in Section 402.4.1.2.
5	HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM: All heating and cooling system components installed inside the conditioned space. All combustion equipment shall be direct vent or sealed combustion. Not qualifying: Systems utilizing electric resistant heat, including baseboard and furnace, as the primary heat source.
6	HIGH EFFICIENCY WATER HEATING. Water heating system includes one of the following: Gas, propane or oil water heater with a minimum EF of 0.80 or Electric Heat Pump Water Heater with a minimum COP of 2.
7	SOLAR HOT WATER Solar water heating supplementing a minimum standard water heater. Solar heater will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems
8	SMALL HOUSING UNIT: Housing units less than 1300 square feet in floor area with less than 220 square feet of fenestration.

CLIMATE ZONES 7 and 8	
MEASURE	
1	HIGH EFFICIENCY HVAC SYSTEM: Gas propane or oil-fired furnace or boiler with minimum AFUE of 90 percent and SEER 14 air conditioner, or Air-source heat pump with minimum HSPF of 8.5
2	HIGH EFFICIENCY BUILDING ENVELOPE: Walls: R-20+R5, Attic R-60, Vaults R-38 or Walls: R-20, Attic R-60 Vaults R-38 and Glazing U-0.30, or

	Glazing U-0.25.
3	ENVELOPE UA: The proposed building envelope shall have a total UA at least 15 percent less than the code target UA as calculated using Table 402.1.4 and Section 402.1.4 Total UA alternative**.**
4	REDUCED AIR LEAKAGE ENVELOPE: Envelope leakage of an ACH50 of 2.5 or less when tested with a blower door at a pressure difference of 50 pascals. Testing shall follow the requirements in Section 402.4.1.2.
5	HIGH EFFICIENCY HVAC DISTRIBUTION SYSTEM: All heating and cooling system components installed inside the conditioned space. All combustion equipment shall be direct vent or sealed combustion. Not qualifying: Systems utilizing electric resistant heat, including baseboard and furnace, as the primary heat source.
6	HIGH EFFICIENCY WATER HEATING: Water heating system includes one of the following: Gas, propane or oil water heater with a minimum EF of 0.80 or Electric Heat Pump Water Heater with a minimum COP of 2.
7	SOLAR HOT WATER Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems
8	SMALL HOUSING UNIT: Housing units less than 1300 square feet in floor area with less than 220 square feet of fenestration.

PART II – IRC BUILDING/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~~ Sections N1101 through N1104 and Section N1105. Climate zones from Figure N1101.2 or Table N1101.2 shall be used in determining the applicable requirements from this chapter.

2. Add new text as follows:

N1101.2.1 Additions. Additions to an existing dwelling unit shall comply with Section N1101.2.

3. 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. 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 tested ACH50 for envelope air leakage and also the tested CFM for duct leakage if applicable. 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 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 base board heaters.

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION *U*-FACTOR	Skylight[b] *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[h]	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~~ 0.65	~~0.35j~~ 0.30	30	13	3 / 4	13	0	0	0
2	0.65[j]	~~0.75~~ 0.55	~~0.35j~~ 0.30	30	13	4 / 6	13	0	0	0
3	0.50[j]	~~0.65~~ 0.55	~~0.35j~~ 0.30	30	13	5 / 8	19	5/13[i]	0	5 / 13
4 except Marine	0.35	~~0.60~~ 0.55	NR	38	20 or 13+5[h] ~~13~~	13 / 17 [5 / 10]	19	10 / 13	10, 2 ft	10/13
5 and Marine 4	~~0.35~~ 0.32	~~0.60~~ 0.55	NR	38	20 or 13+5 [h]	13 / 17	30[f]	10/13	10,2ft	10/13
6	~~0.35~~ 0.32	~~0.60~~ 0.55	NR	49	20 or 13+5[h]	15 / 19	30[f]	~~10/13~~ 15/19	10,4ft	10/13
7 and 8	~~0.35~~ 0.32	~~0.60~~ 0.55	NR	49	21	19 / 21	~~30[g]~~ 38[f]	~~10/13~~ 15/19	10,4ft	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~~ NR	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.65	~~0.75~~ 0.65	0.035	0.082	0.165	0.064	0.360	0.477
3	0.5	~~0.65~~ 0.55	0.035	0.082	0.141	0.047	0.091[c]	0.136
4 except Marine	0.35	~~0.60~~ 0.55	0.030	~~0.082~~ 0.060	0.141	0.047	0.059	0.065
5 and Marine 4	~~0.35~~ 0.32	~~0.60~~ 0.55	0.030	0.060	0.082	0.033	0.059	0.065
6	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	0.060	0.060	0.033	0.059	0.065
7 and 8	~~0.35~~ 0.32	~~0.60~~ 0.55	0.026	0.057	0.057	0.033	0.059	0.065

(Footnotes remain unchanged)

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 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 joists junction.~~
~~12. Other sources of infiltration.~~

4. Add new text as follows:

N1102.4.1.1 Installation. The components of the *building thermal envelope* as listed in Table N1102.1 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. Where required by the *building official*, an *approved third* party from the installer of the insulation shall inspect the air barrier and insulation.

5. Revise as follows:

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~~ shall be installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier ~~are~~ shall be filled or ~~repaired~~ sealed. Air permeable insulation ~~is~~ shall not be used as a sealing material. Air permeable insulation ~~is~~ shall be 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 are insulated and the~~.~~ junction of the foundation and sill plate ~~is~~ 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 air barrier.
Floors (including above garage and cantilevered floors)	Insulation ~~is~~ shall be installed to maintain permanent contact with underside of subfloor decking. An 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 cut to fit, or narrow cavities are filled by spayed/blown insulation.~~ Insulation to be installed in non-standard framing cavity spaces shall be cut to fit the cavity or the cavity shall be insulated with insulation that will readily conform to the cavity.
Garage separation	Air sealing ~~is~~ shall be provided ~~between~~ for the ~~assemblies~~ ~~the~~ separating the garage ~~and~~ from conditioned spaces.
Recessed lighting	Recessed light fixtures that penetrate the building 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 to fit around wiring and plumbing without compression in exterior walls, or sprayed/blown insulation 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 air barrier installed separating them from the ~~exterior wall~~ showers and tubs.
Electrical / phone box on exterior walls	The required 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.~~

6. Delete without substitution:

~~**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.** Tested air leakage is less than 7 ACH when tested with a blower door at a pressure of 50 pascals (0.007 psi). 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.~~

7. Add new text as follows:

N1102.4.1.2 Testing. The dwelling shall be tested and found to have an air leakage rate not exceeding seven air changes per hour (ACH50) in climate zones 1 and 2 and five ACH50 in climate zones 3 through 8. Testing shall be conducted with a blower door at a pressure of 50 pascals (50 Pa) in accordance with ASHRAE 119 by a party *approved* by the *building official.* Where required by the *building official*, testing shall be conducted by an *approved* party independent from 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 testing attesting to the accuracy of the values and provided to the *building official*. Testing shall be performed any time after rough in and creation of all penetrations of the *building thermal envelope*

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed beyond the weatherstripping or other infiltration control measures that will be installed;
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed that will be installed;
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;
7. Supply and return registers, if installed at the time of the test, shall be fully opened.

Exceptions:

1. Dwelling units of multi-family residential buildings with more than four individual units shall be exempted from the testing requirement if they satisfy the requirements of Section N1102.4.1.1.
2. Additions less than 1,000 square feet.
3. Projects that are unsuccessful in complying with the maximum air leakage performance standards shall, at the approval of the code official and, in the presence of either the code official or designated third party:
   - 3.1. Determine that all identifiable air leakage openings have been sealed, and
   - 3.2. Conduct a blower door test.

The certificate required in Section N1101.9 shall note the tested air leakage rate of the dwelling unit and that the dwelling unit did not comply with the air leakage performance standard.

N1102.4.3 Sampling. For groups of five or more dwelling units of the same model, with no variations in foundation and construction which will be tested for air leakage during the same sixty-day period, the building official may elect to test less than 100 percent, but not less than 20 percent, of the homes. If any tested home fails to meet the maximum air leakage requirement stated in Section N1102.4.1.2 then the building official shall have all homes tested until a minimum of three consecutive homes pass the test.

Exception: The first three homes built of the same model, with no variations in foundation and construction.

8. Revise as follows:

N1103.2.2 Sealing. Ducts, air handlers, 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.~~ ~~Post-construction test: Leakage 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 12 cfm (5.66 L/s) per 100 ft2 (9.29m2) 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. All register boots shall be taped or otherwise sealed during the test.~~

~~2~~ 1. ~~Rough-in test:~~ Total leakage shall be less than or equal to ~~6~~ 4 cfm (~~2.83~~ 1.89 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 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 (~~1.89~~ 1.42 L/s) 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*.

SECTION N1103
SYSTEMS

N1103.2 Ducts

N1103.2.2 Sealing. Ducts, air handlers, 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.~~ ~~Post-construction test: Leakage 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 12 cfm (5.66 L/s) per 100 ft2 (9.29m2) 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. All register boots shall be taped or otherwise sealed during the test.~~

~~2.~~1.~~Rough-in test:~~ Total leakage shall be less than or equal to ~~6~~ 4 cfm (~~2.83~~ 1.89 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 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 (~~1.89~~ 1.42 L/s) 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*.

9. Add new section as follows:

SECTION N1105
ADDITIONAL PRESCRIPTIVE EFFICIENT MEASURES

N1105.1 Additional Efficiency Measures. Each project shall include two of the measures described in Table 1105.1. Single-family dwelling units greater than or equal to 4,000 square feet in floor area shall include three measures described in Table N1105.1.

Exceptions:

1. Projects installing a ground or water source heat pump with minimum COP meeting the requirements of Table 503.2.3(2) of the *International Energy Conservation Code*. Single-family dwelling units greater than or equal to 4,000 square feet in floor area shall include one additional measure.
2. Additions less than 1000 square feet shall include one measure from Table N1105.1.

TABLE N1105.1
ADDITIONAL EFFICIENCY MEASURES
(SELECT TWO MEASURES BASED ON CLIMATE ZONE).

CLIMATE ZONES 1, 2, AND 3	
Measure	
1	HIGH EFFICIENCY HVAC SYSTEM: SEER 15 Air Conditioner
2	HIGH EFFICIENCY WATER HEATING: Tankless Gas Water Heater, EF-0.82, Capacity 1 Gallon
3	SOLAR HOT WATER Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems
4	CEILING AND WINDOWS OPTION 1: R-38 Ceiling and the following window characteristics: Zone 1: U-factor 0.45, SHGC .25 Zone 2: U-factor 0.45, SHGC .25 Zone 3: U-factor 0.35, SHGC ,25
5	CEILING AND WINDOWS OPTION 2: R-30 Ceiling with radiant barrier and the following window characteristics: Zone 1: U-factor 0.45, SHGC .25 Zone 2: U-factor 0.45, SHGC .25 Zone 3: U-factor 0.35, SHGC ,25
6	HIGH EFFICIENCY HVAC DISTRIBUITON SYSTEM: All heating and cooling system components installed inside the conditioned space. All combustion equipment shall be direct vent or sealed combustion. Not qualifying: Systems utilizing electric baseboard heat as the primary heat source.
7	SMALL HOUSING UNIT: Housing units less than 1300 square feet in floor area with less than 220 square feet of fenestration.

CLIMATE ZONE 4, MARINE 4, 5 and 6	
MEASURE	
1	HIGH EFFICIENCY HVAC SYSTEM: Gas, propane or oil-fired furnace or boiler with minimum AFUE of 90% and SEER 14 Air Conditioner, or Air-source heat pump with minimum HSPF of 8.5
2	HIGH EFFICIENCY BUILDING ENVELOPE: Zone 4: Attic R-49, Vaults R-38 or Glazing U-0.30 Zone 4 Marine and 5: Walls: R-20+R5, Attic R-49, Vaults R-38 or Attic R-49, Vaults, R-38 and Glazing U-0.30 or Glazing U-0.25. Zone 6: Walls: R-20+R5, Attic R-49, Vaults R-38 or Attic R-60, Vaults, R-49 and Glazing U-0.30 or Glazing U-0.25.

3	ENVELOPE UA: The proposed building envelope shall have a total UA at least 15% less than the code target UA as calculated using Table N1102.1.2 and Section N1102.1.2 Total UA alternative**.**
4	REDUCED AIR LEAKAGE ENVELOPE: Envelope leakage of an ACH50 of 2.5 or less when tested with a blower door at a pressure difference of 50 pascals. Testing shall follow the requirements in Section N1102.4.1.2.
5	HIGH EFFICIENCY HVAC DISTRIBUITON SYSTEM: All heating and cooling system components installed inside the conditioned space. All combustion equipment shall be direct vent or sealed combustion. Not qualifying: Systems with components located in conditioned crawl spaces and systems utilizing electric resistant heat, including baseboard and furnace, as the primary heat source.
6	HIGH EFFICIENCY WATER HEATING. Water heating system includes one of the following: Gas, propane or oil water heater with a minimum EF of 0.80 or Electric Heat Pump Water Heater with a minimum COP of 2.
7	SOLAR HOT WATER Solar water heating supplementing a minimum standard water heater. Solar heater will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems
8	SMALL HOUSING UNIT: Housing units less than 1300 square feet in floor area with less than 220 square feet of fenestration.

CLIMATE ZONES 7 & 8	
MEASURE	
1	HIGH EFFICIENCY HVAC SYSTEM: Gas propane or oil-fired furnace or boiler with minimum AFUE of 90% and SEER 14 air conditioner, or Air-source heat pump with minimum HSPF of 8.5
2	HIGH EFFICIENCY BUILDING ENVELOPE: Walls: R-20+R5, Attic R-60, Vaults R-38 or Attic R-60 Vaults R-38 and Glazing U-0.30, or Glazing U-0.25.
3	ENVELOPE UA: The proposed building envelope shall have a total UA at least 15% less than the code target UA as calculated using Table N1102.1.2 and Section N1102.1.2 Total UA alternative**.**
4	REDUCED AIR LEAKAGE ENVELOPE: Envelope leakage of an ACH50 of 2.5 or less when tested with a blower door at a pressure difference of 50 pascals. Testing shall follow the requirements in Section N1102.4.1.2.
5	HIGH EFFICIENCY HVAC DISTRIBUITON SYSTEM: All heating and cooling system components installed inside the conditioned space. All combustion equipment shall be direct vent or sealed combustion. Not qualifying: Systems with components located in conditioned crawl spaces and systems utilizing electric resistant heat, including baseboard and furnace, as the primary heat source.
6	HIGH EFFICIENCY WATER HEATING: Water heating system includes one of the following: Gas, propane or oil water heater with a minimum EF of 0.80 or Electric Heat Pump Water Heater with a minimum COP of 2.

7	SOLAR HOT WATER Solar water heating supplementing a minimum standard water heater. Solar water heating will provide a rated minimum savings of 85 therms or 2000 kWh based on the Solar Rating and Certification Corporation (SRCC) Annual Performance of OG-300 Certified Solar Water Heating Systems
8	SMALL HOUSING UNIT: Housing units less than 1300 square feet in floor area with less than 220 square feet of fenestration.

Reason: PART I- The proposal submitted by the Northwest Energy Codes Group (NWECG) increases the efficiency of new residential construction 30% above that of a base-case residence meeting the 2006 IECC. The innovative feature of this proposal is the inclusion of menus from which users must pick a fixed number of items. This approach was successfully incorporated into the Oregon residential code that went into effect in July of 2008. There have been no problems to date implementing that code.
The proposal offers several important benefits:

Provides flexibility for designers and builders;

Contains a limited number of discrete option items that are understandable and enforceable which will result in high compliance rates.

The proposed modifications have broad industry support, are proven energy savers, and appear in several other IECC code change proposals. The NWECG also is proposing to require air leakage testing for the building envelope for residential construction. Reducing air leakage provides significant energy savings especially in Climate Zones 3 and above and requiring air leakage testing has broad industry support. This proposal maintains the Total UA Alternative and also the Simulated Performance Alternative to provide flexibility to the code.

The modifications made to the base case prescriptive requirements in Table 402.1 provide a portion of the energy savings. The Additional Prescriptive Efficiency Measures in Section 406 provide the remainder. The tables in Section 406 were developed by reviewing a wide variety of measures to identify the most promising possibilities for achieving the desired 30% incremental change in efficiency. Next, the basic construct of Table 406.1 was developed and the measures to be included were selected, guided by several important criteria including ease of identification and implementation and applicability to a large percentage of homes. Products that were not broadly familiar were purposefully excluded. Once the measures were selected, they were analyzed in detail to generate a savings estimate for the code change proposal. All of the energy evaluations were conducted using REM/Rate Version 12.43. This is an evaluation tool commonly used to provide IECC simulated performance alternative code compliance documentation. Measures can be added or removed from the table as the IECC evolves or through local amendment which increases the usefulness of the format.

The NWECG proposal includes differentiated treatment of homes by size, a new idea for the IECC. Additional energy efficiency measures are required for larger homes, while small housing is included as an efficiency measure. The housing unit sizes selected were not determined using energy analysis. They represent approximately the smallest and the largest deciles of housing unit sizes in the United States, as reported in the 2003 American Housing Survey. The energy savings for small homes, or increased energy use in large homes, far exceed any measure analyzed in this study.

The NWECG solicited broad industry review and comment to ensure that the proposed changes could be implemented and enforced and achieve the target energy savings. The Energy Systems Laboratory at Texas A&M and Florida Solar Energy Center were consulted to ensure that the measures selected for hot climates were both practical and saved energy. Research studies and individuals with research and field experience were also used to help select measures for colder climates. We urge your support on this proposal.

Reason: PART II- The proposal submitted by the Northwest Energy Codes Group (NWECG) increases the efficiency of new residential construction 30% above that of a base-case residence meeting the 2006 IRC and IECC. The innovative feature of this proposal is the inclusion of menus from which users must pick a fixed number of items. This approach was successfully incorporated into the Oregon residential code that went into effect in July of 2008. There have been no problems to date implementing that code.
The proposal offers several important benefits:

Provides flexibility for designers and builders;

Contains a limited number of discrete option items that are understandable and enforceable which will result in high compliance rates.

This proposal focuses on maintaining the existing format of the 2009 IRC and adding a set of prescriptive measures that allow the code user to select from to achieve the additional energy savings. Modifications were made Table N1102.1 to increase the efficiency of the base building requirements. The proposed modifications have broad industry support, are proven energy savers, and appear in several other IECC code change proposals. Changes are also proposed to align the Solar Heat Gain Coefficient requirements in the IRC with those in the IECC. The NWECG also is proposing to require air leakage testing for the building envelope for residential construction. Reducing air leakage provides significant energy savings especially in Climate Zones 3 and above and requiring air leakage testing has broad industry support. This proposal maintains the Total UA Alternative to provide flexibility to the code.

The modifications made to the base case prescriptive requirements in Table N1102.1 provide a portion of the energy savings. The Additional Prescriptive Efficiency Measures in Section N1105 provide the remainder. The tables in Section N1105 were developed by reviewing a wide variety of measures to identify the most promising possibilities for achieving the desired 30% incremental change in efficiency. Next, the basic construct of Table N1105 was developed and the measures to be included were selected, guided by several important criteria including ease of identification and implementation and applicability to a large percentage of homes. Products that were not broadly familiar were purposefully excluded. Once the measures were selected, they were analyzed in detail to generate a savings estimate for the code change proposal. All of the energy evaluations were conducted using REM/Rate Version 12.43. This is an evaluation tool commonly used to provide IECC simulated performance alternative code compliance documentation. Measures can be added or removed from the table as the IRC evolves or through local amendment which increases the usefulness of the format.

The NWECG proposal includes differentiated treatment of homes by size, a new idea for the IECC. Additional energy efficiency measures are required for larger homes, while small housing is included as an efficiency measure. The housing unit sizes selected were not determined using energy analysis. They represent approximately the smallest and the largest deciles of housing unit sizes in the United States, as reported in the 2003 American Housing Survey. The energy savings for small homes, or increased energy use in large homes, far exceed any measure analyzed in this study.

The NWECG solicited broad industry review and comment to ensure that the proposed changes could be implemented and enforced and achieve the target energy savings. The Energy Systems Laboratory at Texas A&M and Florida Solar Energy Center were consulted to ensure that the measures selected for hot climates were both practical and saved energy. Research studies and individuals with research and field experience were also used to help select measures for colder climates. We urge your support on this proposal.

Cost Impact: The code change proposal will increase the cost of construction. The initial cost of this improvement may be higher, but long-term energy savings outweigh these costs.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICC FILENAME: COHAN-EC-1-CHAPTER 4-RE-1-CHAPTER 11

EC12–09/10
103.1.1, 401, 402, 403, 405

Proponent: Craig Conner, Building Quality, representing self

Revise as follows:

103.1.1 Above code programs. The code official or other authority having jurisdiction shall be permitted to deem a national, state or local energy efficiency program to exceed the energy efficiency required by this code. Buildings approved in writing by such an energy efficiency program shall be considered in compliance with this code. ~~The requirements identified as "mandatory" in Chapters 4 and 5 of this code, as applicable, shall be met.~~

401.1 Scope. This chapter applies to residential buildings.

401.2 Compliance. ~~Projects shall comply with Sections 401, 402.4, 402.5, 403.1, 403.2.2, 403.2.3 and 403.4 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).~~

Compliance shall be demonstrated by meeting the applicable provisions of this chapter.

402.1 General. ~~**(Prescriptive).**~~
402.2 Specific insulation requirements. ~~**(Prescriptive)**~~
402.3 Fenestration. ~~**(Prescriptive)**~~
402.4 Air leakage. ~~**(Mandatory)**~~
~~**402.5 Maximum fenestration *U*-factor and SHGC. (Mandatory).**~~

SECTION 403
SYSTEMS ~~**(Mandatory**~~)

403.1 Controls. ~~**(Mandatory)**~~
403.1.2 Heat pump supplementary heat. ~~**(Mandatory)**~~
403.2 Ducts.
403.2.1 Insulation. ~~**(Prescriptive)**~~
403.2.2 Sealing. ~~**(Mandatory)**~~
403.2.3 Building cavities. ~~**(Mandatory)**~~
403.3 Mechanical system piping insulation. ~~**(Mandatory)**~~
403.4 Circulating hot water systems. ~~**(Mandatory)**~~
403.5 Mechanical ventilation. ~~**(Mandatory)**~~
403.6 Equipment sizing. ~~**(Mandatory)**~~
403.7 Systems serving multiple dwelling units. ~~**(Mandatory)**~~
403.8 Snow melt system controls. ~~**(Mandatory)**~~
403.9 Pools. ~~**(Mandatory)**~~
404.1 Lighting equipment ~~**(Prescriptive).**~~

SECTION 405
SIMULATED PERFORMANCE ALTERNATIVE –
~~(Performance~~)

405.2 Mandatory requirements. Compliance with this Section requires that ~~the mandatory provisions identified in Section 401.2 be met~~ projects comply with Sections 401, 402.4, 402.5, 403.1, 403.2.2, 403.2.3 and 403.4 through 403.9. All supply and return ducts not completely inside the building thermal envelope shall be insulated to a minimum of R-6.

Reason: This creates consistency between the IECC and IRC, corrects erroneous use of the term "*mandatory*", and corrects errors in the IECC concerning what can be traded in the performance section. This change creates a simple listing of the sections that cannot be traded off within the performance approach, as was in energy codes prior to 2006.

The three labels "*mandatory*", "*prescriptive*" and "*performance*" are used to label many sections in IECC, but not used at all in the IRC. Code consistency could be achieved by removing the terms from section headings in the IECC or by adding the terms to the IRC.

The word "*shall*" and the concept of "*mandatory*" is woven throughout the I-codes. It is important that the energy code be correct in its use of the word "*mandatory*" and be consistent with the other I-codes, including the IRC. The IRC definition is ***SHALL**. The term, when used in this code, is construed to mean "mandatory".* Therefore any section with "*shall*" in it implies "*mandatory*". Implying sections with the word "*prescriptive*" are somehow not "*mandatory*" is at the very least confusing, if not outright wrong.

Why are the three labels even in the IECC? The three labels were intended to separate what could or could not be traded off in the performance path. A simpler and clearer way to separate what can and cannot be traded off is to list the sections in one place as was done prior to 2006. Section 405 (Performance) already has a subsection ("Mandatory Requirements") defining what is subject to the performance tradeoff and what is not. The sections that cannot be traded off in the performance calculation should simply be listed under the existing heading "Mandatory Requirements" (Section 405.2) and the multiple unneeded headings can be removed as is shown below.

The existing code incorrectly lists some requirements as "prescriptive", meaning they can be traded off under the performance approach. Requirements incorrectly listed as "tradable" include installing insulation to be permanently attached in the floor and crawlspace (Sections 402.2.6 and 402.2.9), and the crawl space vapor retarder (Section 402.2.9). Permanent attachment of the insulation and important vapor retarders should not be traded away in a performance calculation.

Even if one argued that the three labels were not required in the IRC due to performance being only in IECC only, there are still inconsistencies within the IECC. Most importantly the IECC uses the word "mandatory" incorrectly in respect to the rest of the I-codes. Furthermore, the use of the terms is even inconsistent within the IECC. For example some (but not all) of sections labeled "*prescriptive*" and some (but not all) of the sections labeled "*mandatory*" in the IECC are also included as possible variables in the Performance Section (Section 405). Duct insulation is both "*mandatory*" (Section 405.2) and "*prescriptive*" (Section 403.2).

This change moves the list of requirements that cannot be traded into a single location in the performance section. It removes the mention of mandatory from the above-codes program (which after all are "above code"), removes 19 instances of the use of "*mandatory*", "*prescriptive*" and "*performance*" from section and subsection heading, and corrects errors in labeling requirements that can be traded; all without any change to section or subsection content. No change is made to the IRC, as the two codes are now consistent.

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-2-103.1.1-CH 4.DOC

EC13–09/10

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); IRC 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

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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

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~~ 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:

~~**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 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.

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:

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.

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, 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~~ 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~~ 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 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 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~~ 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)

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 ~~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*~~.

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-65-202-CH 4-IRC R202-CH 11-

EC14–09/10

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, 403.2.3 (New), 403.2.4 (New), 403.4, Table 403.4.2 (new), 403.5, 404 (New), Table 405.5.2(1), Chapter 6

Proponent: Ron Nickson, representing National Multi Housing Council

1. Add new definition as follows:

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where pumps 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

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[~~g,~~ 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 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:

~~**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 Climate Zones 1 and 2, and 3 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*</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 ft^2 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>,</u> <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>,</u> <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</u> <u>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%, but not less than 15%, 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.~~

~~**402.4.3 Fireplaces.** New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.~~

8. Revise as follows:

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*.

> <u>**Exception:** Duct tightness test is not required if the air handler and all ducts are located within *conditioned space*.</u>

Duct tightness shall be verified by either of the following:

1. Postconstruction test: <u>Total</u> leakage ~~to outdoors~~ shall be less than or equal to ~~8~~ <u>4</u> cfm (~~226.5~~ <u>113.3</u> 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*~~.

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 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:

403.2.3 Building cavities (Mandatory). Building framing cavities shall not be used as supply ducts.

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 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

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). Bathrooms and kitchens shall be provided with ventilation that meets the requirements of Section 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.

> **Exception:** If the building is designed to comply with the 3 ACH50 requirement specified in Section 402.4.1.2, the building shall comply with ASHRAE Standard 62.2.

13. Add new text as follows:

SECTION 404
IMPROVED EQUIPMENT EFFICIENCY ALTERNATIVE
(Prescriptive)

404.1 General. 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.

404.2 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.

404.3 Cooling equipment. In Climate Zones 1 and 2, vapor compression air conditioning SEER shall be at least 16.0 and EER at least 12.5. In Climate Zone 3, vapor compression air conditioning SEER shall be at least 15.0 and EER at least 12.5. In Climate 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).

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~~ The applicable natural leakage ACH rate at a pressure of 33.5 psf (50 Pa) as specified in Section 402.4.1.2 including the exception. ~~assuming no energy recovery~~. The mechanical ventilation rate shall be in addition to the natural 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 natural 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~~

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
		~~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 is in addition to the natural 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 independent from the builder and the installer of insulation, air barrier and other sealing materials. ~~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)

15. Add new standard to Chapter 6 as follows:

ASHRAE

ANSI/ASHRAE
Standard 62.2-2007 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

Reason: To add and Exception to Section 403.2.2 that exempts ducts in condition spaces from the requirement for duct sealing. This proposal repositions the current exception, which was deleted by DOE, concerning the exception that ducts do not need to be tested if the ducts and air handler are located within the condition space. Duct leakage is important only if the leakage is to the outside. Air leakage to the inside, if the ducts and air handler are located within the conditioned space, does not create any additional energy usage.

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

Analysis: The only difference between this code change proposal and EC5-09/10 is the added exception in Section 403.2.2.

Analysis: A review of the standard(s) proposed for inclusion in the code, ANSI/ASHRAE Standard 62.2-2007, 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.

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

ICCFILENAME: NICKSON-EC-4-202-CH 4

EC15–09/10

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, 403.2.3 (New), 403.2.4 (New), 403.4, Table 403.4.2 (new), 403.5, 404 (New), Table 405.5.2(1), Chapter 6

Proponent: Ron Nickson, representing National Multi Housing Council

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

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[g, 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.~~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. 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:

~~**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 5 air changes per hour (ACH50) in Climate zones 1 and 2, and 3 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*

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 are exempt from testing.
2. Dwelling units of multi-family residential buildings with more than four individual units shall be excepted from the testing requirements if they satisfy the requirements of Section 402.1.1.

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:

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%, but not less than 1 in 7 or 15%, 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.

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.~~

~~**402.4.3 Fireplaces.** New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.~~

8. 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~~ 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 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*~~.

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 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:

403.2.3 Building cavities (Mandatory). Building framing cavities shall not be used as supply ducts.

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 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

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). Bathrooms and kitchens shall be provided with ventilation that meets the requirements of Section 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.

> **Exception:** If the building is designed to comply with the 3 ACH50 requirement specified in Section 402.4.1.2, the building shall comply with ASHRAE Standard 62.2.

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 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.

404.2 Cooling Equipment. In Climate Zones 1 and 2, vapor compression air conditioning SEER shall be at least 16.0 and EER at least 12.5. In Climate Zone 3, vapor compression air conditioning SEER shall be at least 15.0 and EER at least 12.5. In Climate 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).

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~~ The applicable natural leakage ACH rate at a pressure of 33.5 psf (50 Pa) as specified in Section 402.4.1.2 including the exception. ~~assuming no energy recovery~~. The mechanical ventilation rate shall be in addition to the natural 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 natural 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)~~

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
		~~where:~~ ~~*CFA* = conditioned floor area~~ ~~*Nbr* = number of bedrooms~~ The mechanical ventilation rate is in addition to the natural 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 independent from the builder and the installer of insulation, air barrier and other sealing materials. ~~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)

15. Add new standard to Chapter 6 as follows:

ASHRAE

ANSI/ASHRAE
Standard 62.2-2007 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

Reason: To address issues in the DOE proposal which are of concern to multifamily and would cause a major problem and expense to multi-famliy construction. Specifically:

Section 402.4.1.2 Testing. The NMHC proposed modification adds a second exception exempting multi-family residential properties from the blower door testing requirement. Changes were also made to Section 402.4.1.2.1 Sampling which are necessary if the proposed modification to not require testing of multi-family properties is accepted. It is very difficult if not impossible to obtain accurate and meaningful testing of multifamily properties because of the size of the building, the division of the building into many sub units (apartments), and the construction sequence.

a. Size of the building. The test is impractical because of the size of the building. Blower door testing of the entire building would require more than just the normal blower placed in the door opening of the building. The test would require either one very large blower or many individual blowers at multiple openings to pressurize the building as needed for the test. Even if done, because of the size of the building it would be virtually impossible to determine where the leaks are, or if the leakage problem is a combination of many small leaks or one large leak.
b. Sub units (apartments). Testing of individual apartments, as suggested in the DOE proposal, does not provide any accurate information on the leakage to the outside of the building which is the concerning in sealing up the building. Any leakage of air could just as well be leaking to the apartment next door, to the apartment above or below or to the hallway. Leakage to these areas is of little concern as they are all conditioned spaces and the leakage does not impose a additional load of the heating and cooling system.
c. Construction sequence. In most cases apartment type buildings are completed on a floor by floor bases, with apartments units on the lower floors being completed and in some cases occupied while work is being completed in apartments on the upper floors. This sequencing makes it difficult if not impossible to test the entire building because the different levels of the building completion and occupancy would have an impact of the true building performance during the blower door testing.

NMHC does not oppose the specific inspection requirements currently in the code and specifically detailed in Table 402.4.2 (DOE Table 402.4.1.1) as they, if done properly, will insure that the air barrier is installed.

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

Analysis: The only difference between this code change proposal and EC4-09/10 is the added exception in Section 402.4.1.2 and a slight difference in wording in Section 402.4.1.2.1.

Analysis: A review of the standard(s) proposed for inclusion in the code, ANSI/ASHRAE Standard 62.2-2007, 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.

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

ICCFILENAME: NICKSON-EC-5-202-CH 4

EC16–09/10
103, 202, Chapter 4; IRC R202, N1102, N1103, N1104, N1105 (New)

Proponent: Ken Sagan, representing National Association of Home Builders

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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

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	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	FENESTRATION *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~~ <u>403.4.2</u> **Fireplaces.** New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.

~~402.4.4~~ <u>403.4.3</u> **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~~ <u>403.4.1.2</u>
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~~ <u>403.4.4</u> **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 ~~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 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~~ <u>403.1.3</u> SHGC: From Table ~~403.1.2.1.1~~ <u>403.1.3</u> 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	<u>ACH_{50} from Table 403.1.3</u> ~~Specific leakage area (SLA)[d] = 0.00036 assuming no energy~~ ~~Recovery~~	<u>For residences that are not tested, ACH_{50} shall be 7.</u> <u>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.</u> <u>For residences with mechanical ventilation that are tested in accordance with Section 403.4.1.1,</u> ~~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
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

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, i]	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 = A*s* × *FA* × *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 = 0.093m^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.

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

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	0.55	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

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	0.55	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.

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 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 N110~~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 N110~~2~~3.1.4 (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~~2~~.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^{o}F (32^{o}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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: SAGAN-EC-7-103.2-202-CH 4-RE-1-R202-N1101-N1104

EC17–09/10
202; IRC R202

Proponent: Matthew Dobson, representing Vinyl Siding Institute

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new definition as follows:

SECTION 202
GENERAL DEFINITIONS

<u>**INSULATED SIDING.** A cladding system with integral insulating material, having a minimum thermal resistance of R-2.</u>

PART II – IRC ENERGY

Add new definition as follows:

SECTION R202
DEFINITIONS

<u>**INSULATED SIDING.** A cladding system with integral insulating material, having a minimum thermal resistance of R-2.</u>

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.

PART I – IECC

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

PART II – IRC ENERGY

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

ICCFILENAME: DOBSON-EC-1-202-RB-1-R202

EC18–09/10

404.1.1 (New); IRC N1104.1.1 (New)

Proponents: 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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

404.1.1 Lighting equipment (Mandatory). Fuel gas lighting systems shall not have continuously burning pilot lights.

PART II – IRC BUILDING/ENERGY

Add new text as follows:

N1104.1.1 Lighting equipment. Fuel gas lighting 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 found in the *IECC*. Under a new federal rulemaking, gas cooking equipment will also not be allowed to have continuously burning pilot lights.

There are significant energy savings. Typical gas lights use 18 therms per month, most of that due to the pilot light (about 2,500 Btu/hr for many systems). At a national average cost of $1.20 per therm, the cost to a typical consumer is $21.60 per month, or $259.20 per year. With advanced controls (electronic spark ignition, for example), the standby energy losses are eliminated, and the consumer saves at least $200 per year (assuming lights are turned off 80% of the time. If the lights operate for 50% of the time, the savings are $129.60 per year).

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-28-401.1-N1104.1

EC19 –09/10

202, 401.2, Table 402.1.1, 401.3, Table 402.1.3, Table 402.2.5, Section 402.4, 403.2, 403.4, 403.5, 404, Table 405.5.2(1); IRC Section R202, N1101.9, Table N1102.1, Table N1102.1.2, Table N1102.2.5, N1102.4, N1103.2, N1103.4, N1103.5, N1104

Proponent: Craig Conner, Building Quality, representing self

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Add new definition as follows:

CHAPTER 2
DEFINITIONS

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:

CHAPTER 4
RESIDENTIAL ENERGY EFFICIENCY

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

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	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~~ 0.65	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 Climate Zone 5 and Marine 4, and the same as the frame wall U-factor in Marine Zone 4 and Climate 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

WOOD FRAME *R*-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT *R*-VALUE[a]
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.~~

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.

TABLE ~~402.4.2.1.1~~ 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

COMPONENT	CRITERIA
	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 ~~s~~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.

~~**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 5 air changes per hour (ACH50) in Climate Zones 1 and 2, and 3 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:** Where heating and cooling equipment meets the requirements of Section 404, maximum leakage rate shall be seven air changes per hour (ACH50) in Climate Zones 1 and 2 and five air changes per hour in Climate Zones 3 through 8. Additions less than 1000 ft^2 are exempt from testing. Buildings with more than four dwelling units 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.

402.4.1.2.1 Sampling. The *code official* shall be permitted to require testing of an approved sample of residences constructed by a specific builder, but not less than 1 in 7 residences 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.

~~**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.~~

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, 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~~ 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 ~~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*~~.

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 (9.29 m^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.

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.

403.4 Service hot water systems. Energy conservation measures for hot water service systems shall be in accordance with Sections 403.4.1 and 403.4.2.

~~403.4~~ 404.4.1 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.

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 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
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)[1]

Nominal Diameter of Largest Diameter Pipe in the Run (in.)	3/8	1/2	3/4	> 3/4
Maximum Run Length (ft.)	30	20	10	5

1. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.

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 through 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.

SECTION 404
IMPROVED EQUIPMENT EFFICIENCY ALTERNATIVE

404.1 General (Prescriptive). For new residences, Sections 404.2 and 402.3 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.

404.2 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.

404.3 Cooling equipment. In Climate Zones 1 and 2, vapor compression air conditioning SEER shall be at least 16.0 and EER at least 13. In Climate Zone 3, vapor compression air conditioning SEER shall be at least 15.0 and EER at least 12.5. In Climate 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).

404.3.1 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.

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 (N_{br}+1) where: *CFA* = conditioned floor area N_{br} = 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 (N_{br}+1) where:~~ ~~*CFA* = conditioned floor area~~ ~~N_{br} = 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 ft^2 (9.29 m^2) of *conditioned floor area* at a pressure differential of 0.1 inches w.g. (25 Pa).	Thermal distribution system efficiency shall be as ~~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)

PART II – IRC ENERGY

1. Add new definition as follows:

SECTION 202
DEFINITIONS

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:

CHAPTER 11
ENERGY EFFICIENCY

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+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 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.~~ j. 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.~~

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.

TABLE ~~N1102.4.2.1.1~~ N1102.4.1.1
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~~ 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 5 air changes per hour (ACH50) in Climate Zones 1 and 2, and 3 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: Where heating and cooling equipment meets the requirements of Section N1104, maximum leakage rate shall be seven air changes per hour (ACH50) in Climate Zones 1 and 2 and five air changes per hour in Climate Zones 3 through 8. Additions less than 1000 square feet are exempt from testing. Buildings with more than four dwelling units 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.

N1102.4.1.2.1 Sampling. The *code official* shall be permitted to require testing of an approved sample of residences constructed by a specific builder, but not less than 1 in 7 residences. 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 before the *code official* may permit sampling to resume.

~~**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.~~

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 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*~~.

   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 (9.29 m^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.

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.

N1103.4 Service hot water systems. Energy conservation measures for hot water service systems shall be in accordance with Sections 1103.4.1 and 1103.4.2.

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.

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 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
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 N1103.4.2.

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)[1]

Nominal Diameter of Largest Pipe in the Run (in.)	3/8	1/2	3/4	> 3/4
Maximum Run Length (feet)	30	20	10	5

1. Total length of all piping from the distribution manifold or the recirculation loop to a point of use.

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 N11402.

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 Climate Zones 3 and 4 gas furnace AFUE shall be at least 90 and EER at least 13. 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.

N1104.2 Cooling equipment. In Climate Zones 1 and 2, vapor compression air conditioning SEER shall be at least 16.0 and EER at least 12.5. In Climate Zone 3, vapor compression air conditioning SEER shall be at least 15.0 and EER at least 12.5. In Climate 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.

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.

Reason: This proposal is a key part of increasing the I-code energy efficiency to at least 30% over the 2006 IECC. This proposal includes a number of efficiency upgrades, as well as editorial improvements. These changes have been discussed among a variety of stakeholders and have been improved by that discussion.

Improved heating and cooling equipment efficiency is largest single savings in this proposal. To be consistent with Federal law this proposal allows increased building enclosure air tightness with increased duct tightness as an alternative to higher equipment efficiency.

To its credit the Department of Energy (DOE) actively participated in, encouraged and at times lead the discussion that preceded most parts of this proposal. This proposal is very similar to the DOE proposal. To make it easier to compare the proposals, the only four differences between this proposal and the DOE proposal are noted at the end of this reason statement.

The main changes are as follows, ordered by section-

Where available, tested air tightness results are added to the residence's energy certificate. (Sections 401.3, N1101.9- Certificate.**)**

This proposal includes several upgrades to the building enclose to reduce heat loss and heat gain. (See Tables 402.1.1, 402.1.3, N1102.1, and N1102.1.2.) The U-factor measures conductive heat flow, so a lower U-factors mean less heat flow. Looking at the U-factors already in the code shows that the windows are easily the highest U-factor and therefore the highest heat loss. This proposal reduces window and skylight U-factors in most climate zones. Thermally the weakest part of the opaque building enclose is the walls, as is shown by comparing the wall U-factors to the ceiling and floor U-factors. In this proposal frame wall U-factors are reduced (R-values are increased) in the northern and middle climate zones where heating is most important. These lower wall U-factors could represent a number of construction alternatives; insulated sheathing that covers the framing, ICFs, SIPs, or double wall construction. In a few places the IRC and IECC differ based on changes approved in the last code cycle; therefore the IECC and IRC are made consistent in this proposal by adopting IECC R-values and SHGC into the IRC tables. (Tables 402.1.1, 402.1.3, N1102.1, N1102.1.2.)

R-value equivalences for steel framing in walls are added. (Table 402.2.5, N1102.2.5.)

The redundant listing of items to be air sealed is deleted and the inspection "checklist" table for the air barrier and insulation installation is clarified with a large number of mostly editorial changes. (Sections 402.4.1, N1102.4.1- Building thermal envelope; Tables 402.4.1.1, N1102.4.1.1.)

The allowed air leakage through the building enclosure (infiltration) is reduced significantly. Alternately the allowed air leakage is only moderately reduced if high efficiency heating and cooling equipment is used. Instead of allowing a visual inspection as an alternative to air tightness testing, the proposed code requires both a visual inspection and air tightness testing. Requirements for the testing are clarified. Testing of a sample of the homes, rather than all homes, is allowed if the code official chooses. (Sections 402.4.1.2 N1102.4.1.2 Testing.)

The allowed duct leakage is reduced significantly. Alternately the allowed duct leakage is only moderately reduced or ducts are indoors, provided the residence uses high efficiency heating and cooling equipment. (Sections 403.2.2, N1103.2.2- Sealing.)

New requirements are added for efficient distribution of service hot water. Insulation is required on the hot water pipes that are the most actively used (larger trunk lines, kitchen, …) or in locations with high heat loss (outside conditioned space, in slab, …). Less used pipes must either be insulated or the piping to the water using fixtures must be "short and skinny". Short and skinny pipes mean less heat is lost by "stranded hot water" which usually cools in the piping between periods of use. Because piping is shorter and skinnier, the piping will probably be less expensive. Because less water is moved to provide hot water at the points of water use, the wait time for hot water is also reduced; thereby, providing better service to the home's occupant. (Demand recirculation definition, Sections 403.4, N1103.4- Service hot water systems.)

Ventilation is improved to maintain indoor air quality. Ventilation specified in Section M1507 of the *International Residential Code* is required. Due to the tighter building enclosures combustion equipment is limited to sealed-combustion, induced draft, or power-vented. Some combustion equipment relies on a natural draft, the tendency for warm air to rise up a chimney to vent the combustion products. More efficient equipment sends much less heat up the chimney, weakening the natural draft. The combination of a weaker natural draft and the tighter building enclosure proposed here can lead to back drafting, therefore combustion equipment is required to be sealed combustion, induced draft, or power vented. (Sections 403.5 and N1103.5- Mechanical ventilation.)

High efficiency heating and cooling equipment is specified for new residences. Greater heating equipment efficiency is specified in the climates with larger heating loads. Condensing gas furnaces are required in the north and middle zones. Due to the problem with condensing oil equipment, there is a lesser requirement for oil furnaces. Higher efficiency heat pumps are required. Higher efficiency cooling equipment is specified in the south. Higher efficiency cooling equipment is required for both central and room air conditioners. An adjustment is added for possible increases in Federally required equipment efficiency. (Sections 404, N1104- Improved equipment efficiency alternative; Sections 402.4.1.2 and N1102.4.1.2- Testing; Table 405.5.2(1).)

The minimum fraction of lighting required to be energy efficient (compact fluorescent or equivalent) is increased to 75%. An option for compliance based on either fixtures or bulbs is added to accommodate multi-bulb chandler-type fixtures. (Sections 405.1 and N1105.1- Lighting equipment.)

The base case building enclosure air leakage and duct leakage rates in the performance calculation are adjusted to be consistent with the new minimum leakage rates in this code change. (Table 405.5.2(1).)

The are only four differences between this proposal and DOE's similar proposal:

1) Residences with more than four dwelling units are exempted from the building enclosure air tightness testing. Testing large residential structures for overall air tightness is not practical. These large residential buildings must still comply with the inspection list on air barriers and insulation installation (Sections 402.4.1.2 and N402.4.1.2; Tables 402.4.1.1, N1102.4.1.1)

2) The language allowing the code official to approve testing a sample of a builder's residences rather than every residence was simplified. This still requires air leakage testing, but removes the impractical record keeping related to groups of homes, the similarities between the houses and the confusing 120-day period in DOE's change. (Sections 402.4.1.2.1 and N1102.4.1.2- Sampling.)
3) The required air conditioning efficiency in the most southern zones (zones 1 and 2) is 16 SEER with a 13 EER, as opposed to a 12.5 EER in DOE's proposal. The higher EER matches the EER specified in the current tax credit for energy efficient equipment and Consortium for Energy Efficiency's (CEE) Tier III. A higher EER means better equipment performance during electric utility peak loads on the hottest days. (Sections 404.2, N1104.2)
4) Fossil fueled combustion must be sealed combustion, induced draft, or power vented. Combustion equipment that relies on a natural draft utilizes the wasted heat to get warm air to rise up a chimney. More efficient equipment sends much less heat up the chimney, weakening the natural draft. The combination of a weaker natural draft and the tighter building enclosure proposed here can lead to back drafting, therefore combustion equipment is required to be sealed combustion, induced draft, or power vented to avoid indoor air quality problems. (Sections 403.5 and N1103.5- Mechanical ventilation.)

Approval of this code change will greatly increase the energy efficiency of the I-codes and move significantly towards the goal of an energy code that is at least 30% more energy efficient.

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: CONNER-EC-10-202-401.2 - R202-N1101.9.DOC

EC20–09/10
401.2

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:

401.2 Compliance. Projects shall comply with 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 404.1 and either:

1. Sections 402.1 through 402.3, and 403.2.1 ~~and 404.1 (prescriptive)~~; or
2. Section 405 (performance).

Reason: This proposal is intended to add in the mandatory requirements that can be approved for the IECC in this cycle. This proposal is a placeholder to allow the committee to add all sections, and includes the lighting section 404.1 as a mandatory section.

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-4-401.2

EC21–09/10
401.2.2 (New); IRC N1101.2.2 (New)

Proponent: Ken Sagan, representing National Association of Home Builders (NAHB)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

401.2.2 Compliance testing. Where testing is required to determine air leakage of duct systems, the code official shall be permitted to require random sample testing of no fewer than one in seven homes.

PART II – IRC BUILDING/ENERGY

Add new text as follows:

N1101.2.2 Compliance testing. Where testing is required to determine air leakage of duct systems, the code official shall be permitted to require random sample testing of no fewer than one in seven homes.

Reason: The EPA Energy Star program, an above code program, only requires duct testing on 1 out of every 7 homes because EPA recognizes that once a trained installer understands how to seal a duct they continue to do it correctly on subsequent homes.

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: SAGAN-EC-8-401.2.2-RE-2-N1101.2.2

EC22–09/10
401.3; IRC N1101.9

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

401.3 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 . 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.

PART II – IRC BUILDING/ENERGY

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 . 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: For clarification and to include the results for any duct or infiltration testing, both of which are important to documenting the specifications as built and documenting compliance with the code.

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-63-401.3-N1101.9-

EC23–09/10

401.3; IRC N1101.9

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

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 and signed by the builder or registered design professional and shall constitute such individual's certification of the information contained on the certificate. The certificate shall list:

1. The ~~predominant~~ location and R-values of insulation installed in or on the ceiling/roof, walls, foundation (slab, *basement wall*, crawlspace wall and/or floor), pipes and ducts inside and outside of conditioned space~~s~~;
2. The 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 either list the individual values with associated square footage or the weighted-average value; ~~covering the largest area.~~
3. The tested air leakage and the tested duct leakage where required for compliance;
4. The types and listed wattage for all lamps in permanently installed locations where required for compliance; and
5. ~~The certificate shall list~~ the types, capacities and efficiencies of heating, cooling and service water heating and any related equipment, including fan motor horsepower, controls, mechanical ventilation, economizer or energy recovery ventilation equipment, dehumidification, or pumping 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.~~

PART II – IRC BUILDING/ENERGY

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 and signed by the builder or registered *design professional* and shall constitute such individual's certification of the information contained on the certificate. The certificate shall list:

1. The ~~predominant~~ location and R-values of insulation installed in or on the ceiling/roof, walls, foundation (slab, *basement wall*, crawlspace wall and/or floor), pipes and ducts inside and outside of *conditioned spaces*~~,~~;
2. *T*he 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 either list the individual values with associated square footage or the weighted-average value; ~~covering the largest area.~~
3. The tested air leakage and the tested duct leakage where required for compliance;
4. The types and listed wattage for all lamps in permanently installed locations where required for compliance; and
5. ~~The certificate shall list~~ the types, capacities and efficiencies of heating, cooling and service water heating and any related *equipment*, including fan motor horsepower, controls, mechanical ventilation, economizer or energy recovery ventilation equipment, dehumidification, or pumping 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: The purpose of this proposal is to update the certificate requirements to include recent requirements added to the code and potential new requirements and also to improve the clarity of required information on the certificate. The proposal is also intended to require the certificate to be signed by the responsible party as a certification of the accuracy of the information on the certificate.

Two new sections have been added, including:

1. Testing for air leakage and ducts
2. Lighting

In addition, the section on heating, cooling and service water heating is proposed to be expanded to include various other equipment that are already required as information on construction documents in this section to increase consistency in the information that code officials and builders are using.

Finally, the last two lines were deleted to ensure that any equipment is reported consistently in the heating, cooling and service water heating section of this section.

These proposed modifications to this section are reasonable and will improve the usability and accuracy of the currently required certificate.

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

PART I – IECC

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

PART II – IRC

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

ICCFILENAME: PRINDLE-EC-5-401.3-N1101.9

EC24–09/10
401.3

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.

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

ICCFILENAME: TOMBERLIN-EC-1-401.3

EC25–09/10

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); 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

Proponent: Bill Fay, representing Energy Efficient Coalition

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Revise as follows:

101.3 Intent. This code shall regulate the design and construction of buildings for the effective use <u>and conservation</u> of energy <u>over the useful life of each building</u>. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve <u>this objective</u>. ~~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. <u>Such systems include equipment referred to as an "energy recovery ventilator" (ERV) or as a "heat recovery ventilator" (HRV).</u>

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.~~ 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	Insulation is installed to maintain permanent contact	Air barrier is installed at any exposed edge of

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
and cantilevered floors)	with underside of subfloor decking.	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 l~~L~~eakage ~~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 6 ~~12~~ cfm (226.5~~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 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*.~~

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-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.

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)* = 0.00015~~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.

(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.~~

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. 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.	

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
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.

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.~~

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.

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: FAY-EC-1-101

EC26–09/10

202, 202 (New), 402, 405.2, 502, Table 502.1.2, Table 502.2(1)-(2), Table 502.3, Chapter 6; IRC R202, R202 (New), N1101, N1102, N1103.2.1, Table N1102.4.2

Proponent: Joseph Lstiburek, Building Science Corporation

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Revise as follows:

AIR BARRIER. Material(s) assembled and joined together to provide a barrier to air leakage through the building ~~envelope~~ enclosure. An air barrier may be a single material or a combination of materials.

BUILDING THERMAL ~~ENVELOPE~~ BARRIER. The basement walls, slab, exterior walls, floor, roof, and any other building element that enclose conditioned space. This boundary also includes the boundary between conditioned space and any exempt or unconditioned space.

2. Add new definitions as follows:

AIR-IMPERMEABLE. A material or assembly having an air permeance equal to or less than 0.02 L/s-m^2 at 75 Pa pressure differential tested according to ASTM E 2178 or ASTM E 283.

AIR-PERMEABLE. A material or assembly having an air permeance greater than 0.02 L/s-m^2 at 75 Pa pressure differential tested according to ASTM E 2178 or ASTM E 283.

BUILDING ENCLOSURE. A system or assembly of components that provides environmental separation between the conditioned space and the exterior environment.

3. Revise as follows:

SECTION 402
BUILDING THERMAL ~~ENVELOPE~~ BARRIER

402.1.1 Insulation and fenestration criteria. The building thermal ~~envelope~~ barrier shall meet the requirements of Table 402.1.1 based on the climate zone specified in Chapter 3.

402.1.4. Total UA alternative. If the total building thermal ~~envelope~~ barrier UA (sum of U-factor times assembly area) is less than or equal to the total UA resulting from the U-factors in Table 402.1.3 (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with Table 402.1.1. 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 requirements shall be met in addition to UA compliance.

402.2.6 Floors. Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of the subfloor decking or in contact with the topside of sheathing or insulating sheathing installed on the underside of floor framing.

402.2.11 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 through 8. The minimum wall R-values shall be R-13 in all zones. New wall(s) separating a sunroom from conditioned space shall meet the building thermal ~~envelope~~ barrier requirements.

402.2.3.5 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~~ boundary requirements.

402.4.1 Building ~~thermal envelope~~ enclosure. The building ~~thermal envelope~~ enclosure 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:

402.4.2 Air sealing and insulation. Building ~~envelope~~ enclosure 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~~ enclosure 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~~ enclosure, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances.

402.4.2.2 Visual inspection option. Building ~~envelope~~ enclosure 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.

402.4.5 Recessed lighting. Recessed luminaries installed in the building thermal ~~envelope~~ barrier 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 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 luminaries shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

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: Ducts or portions thereof located completely inside the building thermal ~~envelope~~ barrier.

TABLE 402.4.2
AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	~~Exterior thermal envelope~~ Cavity insulation for framed walls is installed in substantial contact and continuous alignment with ~~building envelope air barrier~~ exterior sheathing or with the interior sheathing or gypsum board. 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.
Floors (including above-garage and cantilevered floors)	~~Insulation~~ Floor framing cavity insulation is installed to maintain permanent contact with underside of subfloor decking or in contact with the topside of sheathing or insulating sheathing installed on the underside of floor framing. Air barrier is installed at any exposed edge of insulation.

(Portions of table not shown remain unchanged)

405.2 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~~ barrier shall be insulated to a minimum of R-6.

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS
(Portions of table and footnotes not shown remain unchanged)

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~~ barrier gross wall area)/(above-grade ~~boundary~~ barrier wall area + 0.5 × below-grade ~~boundary~~ barrier wall area).
F = (Above-grade thermal ~~boundary~~ barrier wall area)/(above-grade thermal ~~boundary~~ barrier wall area + common wall area) or 0.56, whichever is greater.

and where:

Thermal ~~boundary~~ barrier wall is any wall that separates conditioned space from unconditioned space or ambient conditions.
Above-grade thermal ~~boundary~~ barrier wall is any thermal boundary wall component not in contact with soil.
Below-grade ~~boundary~~ barrier wall is any thermal boundary wall in soil contact.
Common wall area is the area of walls shared with an adjoining dwelling unit.

e. Tested ~~envelope~~ enclosure 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 from infiltration.

SECTION 502
BUILDING ~~ENVELOPE~~ ENCLOSURE REQUIREMENTS

502.1.1 Insulation and fenestration criteria. The building thermal ~~envelope~~ barrier 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~~ enclosure provisions of ASHRAE/IESNA 90.1.

Section 502.4.3 Sealing of the building ~~envelope~~ enclosure. Openings and penetrations in the building ~~envelope~~ enclosure 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 covered with an air-impermeable ~~moisture vapor-permeable~~ wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

Section 502.4.8 Recessed lighting. Recessed luminaires installed in the building thermal ~~envelope~~ boundary 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 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 interior wall or ceiling covering.

TABLE 502.1.2
BUILDING ~~ENVELOPE~~ ENCLOSURE REQUIREMENTS OPAQUE ELEMENT, MAXIMUM U-FACTORS
(No change to table contents)

TABLE 502.2(1)
BUILDING ~~ENVELOPE~~ ENCLOSURE REQUIREMENTS - OPAQUE ASSEMBLIES
(No change to table contents)

TABLE 502.2(2)
BUILDING ~~ENVELOPE~~ ENCLOSURE REQUIREMENTS - OPAQUE ASSEMBLIES
(No change to table contents)

TABLE 502.3
BUILDING ~~ENVELOPE~~ ENCLOSURE REQUIREMENTS: FENESTRATION
(No change to table contents)

4. Add new standard to Chapter 6 as follows:

ASTM
E 2178 – 03 Standard Test Method for Air Permeance of Building Materials

PART II – IRC BUILDING/ENERGY

1. Revise as follows:

AIR BARRIER. Material(s) assembled and joined together to provide a barrier to air leakage through the building ~~envelope~~ enclosure. An air barrier may be a single material or a combination of materials.

BUILDING THERMAL ~~ENVELOPE~~ BARRIER. The basement walls, slab, exterior walls, floor, roof, and any other building element that enclose conditioned space. This boundary also includes the boundary between conditioned space and any exempt or unconditioned space.

2. Add new definitions as follows:

AIR-PERMEABLE. A material or assembly having an air permeance greater than 0.02 L/s-m^2 at 75 Pa pressure differential tested according to ASTM E 2178 or ASTM E 283.

BUILDING ENCLOSURE. A system or assembly of components that provides environmental separation between the conditioned space and the exterior environment.

3. Revise as follows:

N1101.1 Scope. This chapter regulates the energy efficiency for the design and construction of buildings regulated by this code.

Exception: Portions of the building ~~envelope~~ that do not enclose conditioned space.

N1101.4 Building thermal ~~Envelope~~ barrier. An R-value identification mark shall be applied by the manufacturer to each piece of building thermal ~~envelope~~ barrier insulation 12 inches 9305 mm) or more wide. Alternatively, the insulation installers shall provide a certification listing the type, manufacturer and R-value of insulation installed in each element of the building thermal ~~envelope~~ barrier. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled R-value, installed density, coverage area and number of bags installed shall be listed on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of area covered and R-value of installed thickness shall be listed on the certificate. The insulation installer shall sign, date and post the certificate in a conspicuous location on the job site.

N1101.7.1 Protection of exposed foundation insulation. Insulation applied to the exterior of basement walls, crawl space walls, and the perimeter of slab-on-grade floors shall have a rigid, opaque and ~~weather~~ water resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend a minimum of 6 inches (152 mm) below grade.

SECTION N1102
BUILDING THERMAL ~~ENVELOPE~~ BARRIER

N1102.1 Insulation and fenestration criteria. The building thermal ~~envelope~~ barrier shall meet the requirements of Table N1102.1 based on the climate zone specified in Table N1101.2.

N1102.1.3 Total UA alternative. If the total building thermal ~~envelope~~ barrier UA (sum of U-factor times assembly area) is less than or equal to the total UA resulting from the U-factors in Table N1102.1.2, (multiplied by the same assembly area as in the proposed building), the building shall be considered in compliance with 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 requirements shall be met in addition to UA compliance.

N1102.2.6 Floors. Floor framing cavity insulation shall be installed to maintain permanent contact with the underside of the subfloor decking or in contact with the topside of sheathing or insulating sheathing installed on the underside of floor framing.

N1102.2.11 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 through 8. The minimum wall R-values shall be R-13 in all zones. New wall(s) separating a sunroom from conditioned space shall meet the building thermal ~~envelope~~ barrier requirements.

N1102.3.5 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~~ boundary requirements.

N1102.4.1 Building ~~thermal envelope~~ enclosure. The building ~~thermal envelope~~ enclosure 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:

N1102.4.2 Air sealing and insulation. Building ~~envelope~~ enclosure 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~~ enclosure tightness and insulation installation shall be considered acceptable when tested air leakage is less than 7 air changes per hour (ACH) when tested with a blower door at a pressure of 50 Pa (0.007 psi). Testing shall occur after rough in and after installation of penetrations of the building ~~envelope~~ enclosure, including penetrations for utilities, plumbing, electrical, ventilation and combustion appliances.

N1102.4.5 Recessed lighting. Recessed luminaries installed in the building thermal ~~envelope~~ barrier 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 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 luminaries shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

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: Ducts or portions thereof located completely inside the building thermal ~~envelope~~ barrier.

TABLE N1102.4.2
AIR BARRIER AND INSULATION INSPECTION

COMPONENT	CRITERIA
Air barrier and thermal barrier	~~Exterior thermal envelope~~ Cavity insulation for framed walls is installed in substantial contact and continuous alignment with ~~building envelope air barrier~~ exterior sheathing or with the interior sheathing or gypsum board. Breaks or joints in the air barrier are filled or repaired. Air-permeable insulation is not used as a sealing material.
Floors (including above-garage and cantilevered floors)	~~Insulation~~ Floor framing cavity insulation is installed to maintain permanent contact with underside of subfloor decking or in contact with the topside of sheathing or insulating sheathing installed on the underside of floor framing. Air barrier is installed at any exposed edge of insulation.

(Portions of table not shown remain unchanged)

Reason: The current language of the building code is inconsistent with terms in the engineering, scientific, technical, educational, building science and "common use" communities. In fact terms and language within the code itself are inconsistently used. "Codespeak" makes it difficult to communicate appropriate requirements and concepts. The I-Codes are likely the most effective educational documents used in the construction industry. It behooves us to use the language in them correctly. If you don't call "things" by their proper names how can you expect users of the documents to execute the actions correctly? The changes proposed in this code change do not change the intent of the sections – they only fix bad physics and bad terms and language. For example one of the worst terms every coined in "codespeak" is "building thermal envelope". No one outside of the coderoom uses that phrase. The correct term is "thermal barrier". Thermal barrier is in fact used correctly in Table 402.4.2 and Table N1102.4.2 but is not used consistently throughout the code. This code change fixes that. Another example, Federal Express uses "envelopes", architects and engineers and builders should use the word "enclosure". And another example, the phrase "air-permeable" is used but not defined. Air-impermeable is defined in the IRC but not in the IECC. Finally, some of the physics is just plane wrong - such as requiring insulation in floors to be in direct contact with the underfloor sheathing. Yes, this is one option, but a better one in cold climates is to have an airspace between the floor sheathing and the top of the cavity insulation as this leads to a warmer floor - yet does not change the heat loss as long as the cavity insulation is in direct contact with a sheathing below it. Isn't physics neat? Also, how do you deal with rigid insulation boards on the underside of insulated floors? This language fixes that.

The current language in Section 502.4.3 is a big error in the governing physics – the air sealing materials do not necessarily have to be vapor permeable. Many air barrier materials are vapor impermeable and are used regularly such as fully adhered membranes or liquid and trowelled applied membranes applied/installed over paperless gypsum sheathing that are covered with exterior insulating sheathing boards. This language fixes that.

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

Analysis: ASTM E 283-04 and ASTM E 2178-03 are currently referenced in the IRC.

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

ICCFILENAME: LSTIBUREK-EC-1-202-402-IRC-R202-N1101.1

EC27–09/10
Tables 402.1.1, 402.1.3 and 402.2.5; IRC Tables N1102.1, N1102.1.2 and N1102.2.5

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-70-T. 402-IRC T. N1102-

EC28–09/10
402.1.1; IRC N1101.7

Proponent: James Bowman, representing American Forest and Paper Association

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

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. Where required, insulation board shall be installed in compliance with its listing and not alter the application of wood structural panels or the lateral force resisting system of the assembly.

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1101.7 Installation. All materials, systems and equipment shall be installed in accordance with manufacturer's installation instructions and the provisions of this code. Insulation board shall be installed to not alter or preclude the approved application of structural panels, or the lateral force resisting system of the assembly.

Reason: With the increased specification of insulation-board only options, it may make the use of WSP more problematic in high-wind and seismic zones, where compliant structural components and connections are crucial. Each of these components must be attached per their listings, engineered designs and comply with structural code provisions of the IBC. This proposal simply reinforces and provides a reference to the need to adhere to pertinent attachment requirements and not use one set of fasteners for multiple panels or otherwise use inadequate attachments. Existing manufacturer's installation instructions don't anticipate and could be construed to allow through nailing if the specified gage and spacing were used. Structural panels must have nailing flush to the panel, not the insulation face if nailed through both layers.

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: BOWMAN-EC3-402.1.1-RE-1-N1101.7

EC29–09/10
Table 402.1.1; IRC Table N1102.1

Proponent: Craig Conner, Building Quality, representing self

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGYCOMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise table as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.30 [c]	30	13	3/4	13	0	0	0
2	0.65j	0.75	0.30 [c]	30	13	4/6	13	0	0	0
3	0.50j	0.65	0.30 [c]	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	21	19/21	38g	15/19	10, 4 ft	10/13

a. through b. (No change)
c. For skylights and thermally isolated sunrooms the maximum SHGC is 0.40.
c. through j. (Reletter)

PART II – IRC ENERGY

Revise table as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHTb 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 AND DEPTH	CRAWL SPACEc WALL R-VALUE
1	1.2	0.75	~~0.35~~ 0.30[c, j]	30	13	3/4	13	0	0	0
2	0.65i	0.75	~~0.35~~ 0.30[c, j]	30	13	4/6	13	0	0	0
3	0.50i	0.65	~~0.35~~ 0.30[c, 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

a. through b. (No change)
c. For skylights and thermally isolated sunrooms the maximum SHGC is 0.40.
c. through k. (Reletter)

Reason: Higher SHGCs are generally associated with high transmission of visible light. Skylights need a higher SHGC to allow for the transmission of more visible light.

Likewise sunrooms are meant to admit sun. Thermally isolated sunrooms are sometimes used only 3 seasons of the year. Sunrooms used to house plants need to admit reasonable levels of sunlight

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

PART I – IECC

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

PART II – IRC ENERGY

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

ICCFILENAME: CONNER-EC-15-T. 402.1.1 - T. N1102.1.DOC

EC30–09/10
Table 402.1.1; IRC Table N1102.1

Proponent: Charles C. Cottrell, North American Insulation Manufacturers (NAIMA)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGYCOMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.~~ <u>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.</u>
b. through j. (No change)

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.~~ <u>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.</u>
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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: COTTRELL-EC-1-T. 402.1.1-T. N1102.1.DOC

EC31–09/10
402.1.1, Table 402.1.1; IRC N1102.1, Table N1102.1

Proponent: Donald J. Vigneau, AIA, Northeast Energy Efficiency Partnerships, Inc.

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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)

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 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.

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: VIGNEAU-EC-1-402.1.1-RE-1-N1102.1

EC32–09/10

Table 402.1.1, Table 402.1.3, 402.3.3 (New); IRC Table N1102.1, Table N1102.1.2, N1102.3.3 (New)

Proponent: Thomas D. Culp, Ph.D., Birch Point Consulting LLC, representing Quanta Technologies, Inc.

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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]	
1	1.2	**(Remainder of table unchanged)**
2	0.65[j]	
3	0.50[j]	
4 except Marine	0.35	
5 and Marine 4	~~0.35~~ <u>0.26</u>	
6	~~0.35~~ <u>0.26</u>	
7 and 8	~~0.35~~ <u>0.26</u>	

(Footnotes remain unchanged)

TABLE 402.1.3
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	
1	1.2	**(Remainder of table unchanged)**
2	0.65	
3	0.50	
4 except Marine	0.35	
5 and Marine 4	~~0.35~~ <u>0.26</u>	
6	~~0.35~~ <u>0.26</u>	
7 and 8	~~0.35~~ <u>0.26</u>	

(Footnotes remain unchanged)

2. Add new text as follows:

<u>**402.3.3 U-factor and SHGC alternative.** Vertical windows with a U-factor of 0.27 and SHGC greater than or equal to 0.35, or a U-factor of 0.28 and SHGC greater than or equal to 0.40, shall be permitted to satisfy the fenestration *U*-factor 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>

PART II – IRC ENERGY

1. Revise tables as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	
1	1.2	**(Rest of table unchanged)**
2	0.65[j]	
3	0.50[j]	
4 except Marine	0.35	
5 and Marine 4	~~0.35~~ <u>0.26</u>	
6	~~0.35~~ <u>0.26</u>	
7 and 8	~~0.35~~ <u>0.26</u>	

(Footnotes remain unchanged)

TABLE N1102.1.2
EQUIVALENT *U*-FACTORS[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	
1	1.2	**(Rest of table unchanged)**
2	0.65	
3	0.50	
4 except Marine	0.35	
5 and Marine 4	~~0.35~~ <u>0.26</u>	
6	~~0.35~~ <u>0.26</u>	
7 and 8	~~0.35~~ <u>0.26</u>	

(Footnotes remain unchanged)

2. Add new text as follows:

N1102.3.3 U-factor and SHGC alternative. Vertical windows with a U-factor of 0.27 and SHGC greater than or equal to 0.35, or a U-factor of 0.28 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 303.1.3(3) shall not be permitted.

Reason: This proposal would significantly increase energy efficiency of windows in the northern climate by lowering the U-factor such that triple glazing will be required. Moving from double to triple glazing does have potentially significant cost implications, with the increase in window cost estimated to be least 15%.[1] However, this change becomes an important component if the code is heading towards a major increase in energy efficiency of first 30%, then 50%.

Therefore, an equally important component is to maximize cost effectiveness by ensuring the widest product flexibility. This is achieved by including both the lower basic U-factor in the table as well as the alternative criteria described in the new section. These alternative criteria are based upon a similar equivalent energy path in the recently announced 2010 Energy Star requirements.[2] This alternate path, based upon an analysis performed by Lawrence Berkeley National Laboratory, allows a U-factor 0.01 higher for SHGC 0.35 and 0.02 higher for SHGC 0.40. This same alternative is included here, and will ensure that a larger range of triple glazed products with various frame and glass types can satisfy the requirement, thus helping to maximize cost effectiveness through economy of scale.

1. "U.S. Department of Energy ENERGY STAR Program, Windows, Doors, and Skylights Draft Criteria and Analysis", D&R International Ltd, August 6, 2008. http://www.energystar.gov/ia/partners/prod_development/archives/downloads/windows_doors/WindowsDoorsSkylights_DraftCriteriaAnalysis_CORRECTED.pdf
2. "ENERGY STAR Program Requirements for Residential Windows, Doors, and Skylights – Version 5.0", U.S. Department of Energy, April 7, 2009. http://www.energystar.gov/ia/partners/prod_development/archives/downloads/windows_doors/WindowsDoorsSkylightsProgRequirements7Apr09.pdf

Cost Impact: The code change proposal will increase the cost of windows by requiring triple glazing in the north. An August 2008 report by D&R International for the U.S. Department of Energy's Energy Star program for Windows, Doors, and Skylights estimated a minimum cost increase of 15%.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: CULP-EC-6-T. 402.1.1-T. 402.1.3-402.3.3-T. N1102.1-T. N1102.1.2-N1102.3.3.DOC

EC33–09/10

Table 402.1.1

Proponent: Jeff Lowinski, Window and Door Manufacturers Association (WDMA)

Revise table 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~~ 0.65	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	21	19/21	38g	15/19	10, 4 ft	10/13

(Footnotes remain unchanged)

Reason: This proposal recommends the same U-factor for fenestration in climate zone 1 as in climate zone 2 to reduce the cooling load energy demand. Granted, a low SHGC is much more effective at reducing cooling energy demand, but improving the U-factor is also important for reducing energy demand. There are windows and doors available that meet the thermal performance requirements proposed and meet other performance requirements of climate zone 1.

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

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

ICCFILENAME: Lowinski-EC-1-T. 402.1.1

EC34–09/10

Table 402.1.1, Table 402.1.3; IRC Table N1102.1, Table N1102.1.2

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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)

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-14-T. 402.1.1-T. N1102.1

EC35–09/10

Table 402.1.1; IRC Table N1102.1

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

Proponent: Jeff Lowinski, representing Window and Door Manufacturers Association (WDMA)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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)

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-16-Lowinski-EC-2-T. 402.1.1-T. N1102.1

EC36–09/10
Table 402.1.1; IRC Table N1102.1

Proponent: Julie Ruth, PE, JRuth Code Consulting, representing the American Architectural Manufacturers Association

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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)

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: RUTH-EC-4-T. 402.1.1-T. N1102.1

EC37–09/10
Table 402.1.1

Proponent: Jeff Lowinski, representing Window and Door Manufacturers Association (WDMA)

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	BASEMENTc WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	~~0.30~~ 0.35	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	~~0.30~~ 0.35	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	~~0.30~~ 0.35	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[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: Skylights provide daylighting as a primary function. Low SHGC values might reduce the amount of daylighting available. WDMA proposes a revision to the maximum SHGC allowed for skylights in residential applications to allow an increase in visible light (daylighting).

Roof-mounted fenestration, such as skylights, provide lighting to the interior of spaces as a primary benefit and compliment lighting from windows and doors. Allowing for a slightly higher maximum SHGC value will preserve a level of natural visible light that is sufficient to maximize the opportunities for occupants to switch off artificial lights.

When the 2006 energy code modifications were being debated, the severe reductions in fenestration SHGC were accepted with the unintended consequence of reducing the availability of qualifying skylights that carry NFRC ratings. Discussion of the amended proposal centered exclusively on windows in walls and reducing cooling energy consumption, without regard to the significant offsetting lighting energy savings unique to natural toplighting with visible transmittance high enough to permit switching off lights even under an overcast sky.

It should also be noted that skylight area as a percentage of roof area is typically 0 to 3%, so the negative heat gain contribution on the average building from skylights is very minor in relation to that of the windows in the average house.

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

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

ICCFILENAME: Lowinski-EC-5-T. 402.1.1

EC38–09/10
Table 402.1.1, Table 402.1.3, 402.3.3 (New); IRC Table N1102.1, Table N1102.1.2, N1102.3.3

Proponent: Thomas S.Zaremba, Roetzel & Andress, representing Pilkington North America

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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
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	0.060	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 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: ZAREMBA-EC-2-T. 402.1.1- RE-1-T. N1102.1

EC39–09/10

Table 402.1.1, Table 402.1.3; IRC Table N1102.1, Table N1102.1.2

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-15-T. 402.1.1-T. N1102.1

EC40–09/10

Table 402.1.1, Table 402.1.3, 402.3.6; IRC Table N1102.1, Table N1102.1.2, N1102.3.6

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise 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	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	0.65[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+5h	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	~~0.60~~	NR	49	20 or 13+5h	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.

(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	0.057	0.057	0.028	0.050	0.065

(Footnotes remain unchanged)

402.3.6 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~~ product shall meet the applicable requirements for U-factor and SHGC in Table 402.1.1. Where more than one unit is being replaced, an area-weighted average of the replacement fenestration products shall be permitted to satisfy the U-factor and SHGC requirements.

> **Exception:** Replacement skylights shall be permitted to have a weighted average U-factor not to exceed 0.60 and an SHGC not to exceed the value prescribed in Table 402.1.1.

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~~	0.35[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~~	0.35e,[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	21	19/21	30g	10/13	10, 4 ft	10/13

b. ~~The fenestration U-factor column excludes skylights.~~ The SHGC column applies to all glazed fenestration.

(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	0.057	0.057	0.033	0.059	0.065

(Footnotes remain unchanged)

N1102.3.6 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~~ product shall meet the applicable requirements for U-factor and solar heat gain coefficient (SHGC)in Table N1102.1. Where more than one unit is being replaced, an area-weighted average of the replacement fenestration products shall be permitted to satisfy the U-factor and SHGC requirements.

Exception: Replacement skylights shall be permitted to have a weighted average U-factor not to exceed 0.60 and an SHGC not to exceed the value prescribed in Table N1102.1.

Reason: This proposal increases energy efficiency by eliminating separate specific skylight requirements in new construction and requiring that skylights meet overall fenestration U-factors on a weighted average basis. Since vertical fenestration maximum U-factors are lower than skylights maximum U-factors in all climate zones (except zone 1), this proposal will serve to produce energy savings in all homes built with skylights. Given that skylights (with R-values often less than R-2) occupy space that would otherwise be filled by a R-30 or R-49 roof, it is important that as much efficiency be captured as possible.

While skylights generally may not meet more stringent vertical fenestration U-factors on an individual unit basis, this is not a problem because the fenestration U-factor requirements can be satisfied on a weighted average basis. As a result, less stringent skylights will be offset by more stringent vertical fenestration. Since there are no limits on fenestration (including skylights) in the prescriptive path, this improvement will serve to ensure that the actual overall fenestration U-factor, including skylights, is lower under the prescriptive path. To illustrate, to meet a 0.35 U-factor fenestration requirement, the builder could install 40 square feet of skylights at a 0.60 U-factor and 360 square feet of vertical fenestration at a 0.32 U-factor. The resulting weighted average U-factor would be 0.348, thereby satisfying a 0.35 U-factor.

The proposed revisions to the replacement fenestration section are also necessary so that replacement fenestration can qualify on a weighted average basis and to permit skylight replacement (since vertical fenestration may not be replaced when skylights are replaced, it is necessary to offer a separate standard in the exception for replacement skylights).

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-9-T. 402.1.1-T. N1102.1

EC41–09/10

Table 402.1.1; IRC Table N1102.1

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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)

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-12-T. 402.1.1-T. N1102.1

EC42–09/10
Table 402.1.1; IRC Table N1102.1

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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~~ <u>0.40</u>	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)

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.

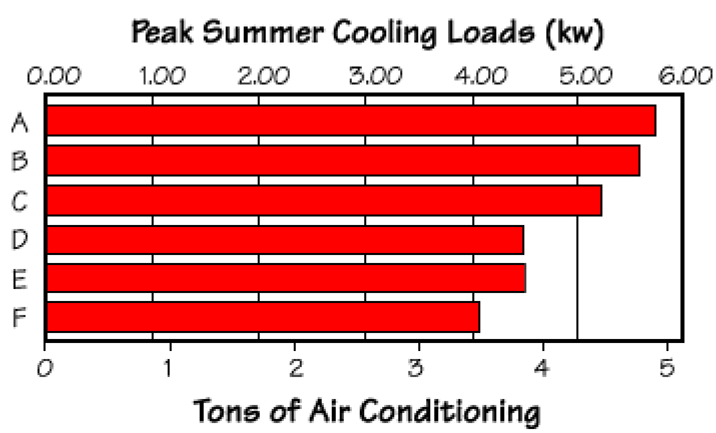
Precedent for a Maximum SHGC Requirement in Climate Zone 4.

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.

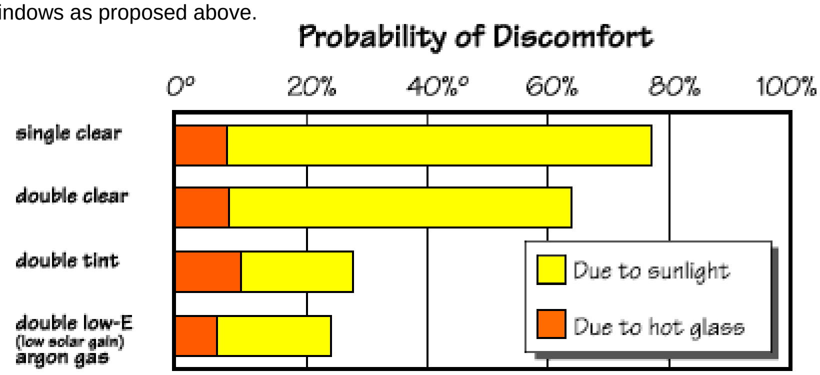
The proposed change would still allow a great deal of flexibility. The SHGC requirements in both ENERGY STAR and the Stimulus Bill apply to *each window*, as opposed to the area-weighted average flexibility allowed by the *IECC*. This proposal sets the *weighted average* at 0.40 SHGC, a level already 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-13-T. 402.1.1-T. N1102.1.DOC

EC43–09/10

Table 402.1.1, Table N1102.1

Proponent: Thomas S. Zaremba, representing Pilkington North America, Inc.

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC. PART II WILL BE HEARD BY THE IRC B/E COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I- IBC ENERGY CONSERVATION

Revise 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 max	30	13	3/4	13	0	0	0
2	0.65[j]	0.75	0.30 max	30	13	4/6	13	0	0	0
3	0.50[j]	0.65	0.30 max	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	0.30 min[k] ~~NR~~	38	20 or 13+5[h]	13/17	30[g]	10/13	10, 2 ft	10/13
6	0.35	0.60	0.30 min[k] ~~NR~~	49	20 or	15/19	30[g]	15/19	10, 4 ft	10/13

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
					13+5[h]					
7 and 8	0.35	0.60	0.30 min[k] ~~NR~~	49	21	19/21	38[g]	15/19	10, 4 ft	10/13

For S1: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors are maximums. ~~and~~ SHGC are maximums(“max”) or minimums (“min”) as noted. 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 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.
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 feet, 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. “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.
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 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.
k. To determine compliance of unlabeled fenestration with min SHGC, the default SHGC shall be 0.27, and use of default SHGC values from Table 303.1.3(3) shall not be permitted.

PART II- IRC BUILDING/ENERGY

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] 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 max0.35[j]	30	13	3/4	13	0	0	0
2	0.65[i]	0.75	0.30max 0.35[j]	30	13	4/6	13	0	0	0
3	0.50[i]	0.65	0.30 max 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	0.30 min[k] NR	38	20 or 13+5[h]	13/17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	0.30 min[k] 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	0.30 min[k] NR	49	21	19/21	30[g]	10/13	10, 4 ft	10/13

a. *R*-values are minimums. *U*-factors are maximums. and SHGC are maximums (“max”) or minimums (“min”) as noted. 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 *R*-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 feet, 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. “13+5” means R-13 cavity insulation plus R-5 insulated 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 than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
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.
i j. For impact-resistant 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 3SHGC shall be 0.40.
j~~k~~. The second *R*-value applies when more than half the insulation is on the interior.
k. To determine compliance of unlabeled fenestration with min SHGC, the default SHGC shall be 0.27, and use of default SHGC values from Table N1101.5(3)shall not be permitted.

Reason:
Part I- The trend in prescriptive SHGCs in the south is clearly downward. The 2006 IECC prescribed a 0.40 SHGC in zones 1-3; the 2007 Supplement lowered that to 0.37; and it was lowered again in 2009 to 0.30 or lower.

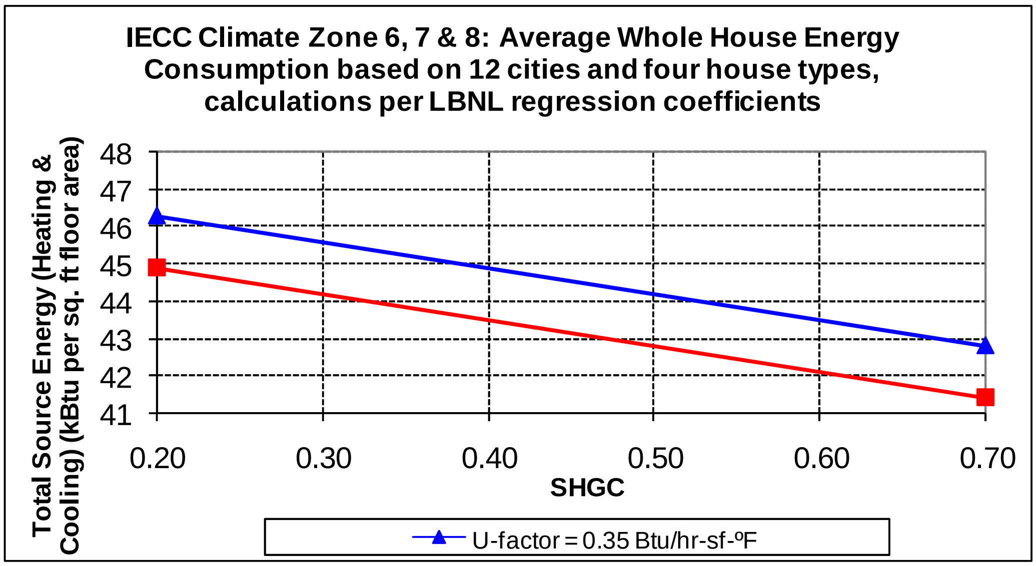
For its full useful life, a 0.40 SHGC window means that it will permanently blocks 60% of the sun's energy while allowing 40% of its energy to pass into a home. Reducing solar gain from 40% to 30% by lowering SHGC to 0.30 makes sense in the south because southern climates are cooling dominated and reducing solar gain in the south reduces cooling loads which saves energy.

The Department of Energy is pressing for even lower SHGC windows in the south. Beginning on January 4, 2010, only windows with a 0.27 or lower SHGC will qualify for DOE's Energy Star Windows Program in zones 1 and 2. These windows will reduce solar gain to only 27%. Since consumers respond to the Energy Star label on windows, DOE's decision to qualify only 0.27 SHGC windows in the south will drive manufacturers in the direction of marketing ultra-low SHGC windows.

This proposal is intended to close a loop hole being created by lowering prescriptive SHGCs in the south, while leaving a "NR" or "No Rating" for SHGC in the north. Unless this loophole is closed, it will result in the code allowing ultra-low SHGC southern windows to be used in the north. This will reduce, rather than increase, energy efficiency. In that regard, window manufacturers distribute products through national networks. That means the current "NR" rating for SHGC in the north will permit national networks not only to market ultra-low SHGC windows in the south, where they make sense, but also in the north where no SHGC requirement currently exists. If ultra-low SHGC windows intended for the south are used in the north, it will increase annual energy consumption, rather than conserve it.

When windows with 0.30 or lower SHGCs are installed in homes in northern climates, they permanently block 70% or more of the sun's free energy from heating those homes all winter long. This means northern homes with low SHGC windows will necessarily burn more fossil fuels in the winter to compensate for the solar gain lost through the use of low SHGC windows. This, in turn, results in increased energy consumption, not increased energy efficiency.

The increase in energy consumption attributable to the use of low SHGC windows in the north is illustrated in the following chart which depicts total energy consumption of four different house types found in 12 northern cities in climate zones 6-8. (See bibliography for details). In simulating the whole house energy use depicted in these graphs, the U-factors were held constant at either 0.35 (blue line) or 0.30 (red line) while SHGC was increased from 0.20 to 0.70. (A 0.20 SHGC window only allows 20% of the sun's energy to enter a home while a 0.70 SHGC window allows 70%). These simulations show that when higher SHGC windows are used in northern homes, the sun's energy significantly reduces a home's total energy use. Conversely, when lower SHGC windows are used, it increases a home's total energy use:



The sun's energy is free and renewable. Using low SHGC windows in the south saves energy. However, using those same windows in the north will increase energy consumption. The minimum SHGC proposed here is intended only to eliminate the northern use of ultra-low SHGC windows mandated in the south. If adopted, this proposal will save energy in the north by using the free and renewable energy of the sun.

Part II- This proposal would make two types of changes: 1- it will harmonize the fenestration provisions of Table N1102.1 of the IRC with the fenestration provisions of Table 402.1.1 of the IECC, and 2- it will add a minimum SHGC in climate zones 5-8. The reasons for harmonizing the fenestration provisions of the IRC with the IECC are obvious and require no further explanation. The reasons supporting the addition of a minimum SHGC in the northern climate zones follow.

The trend in prescriptive SHGCs in the south is clearly downward. In 2006, the IECC prescribed a 0.40 SHGC in zones 1-3; the 2007 Supplement lowered that to 0.37; and it was lowered, again, in 2009 to 0.30 or lower. To harmonize the IRC's southern SHGCs with the 2009 IECC, this proposal lowers SHGC in climate zones 1 through 3 from 0.35 to 0.30.

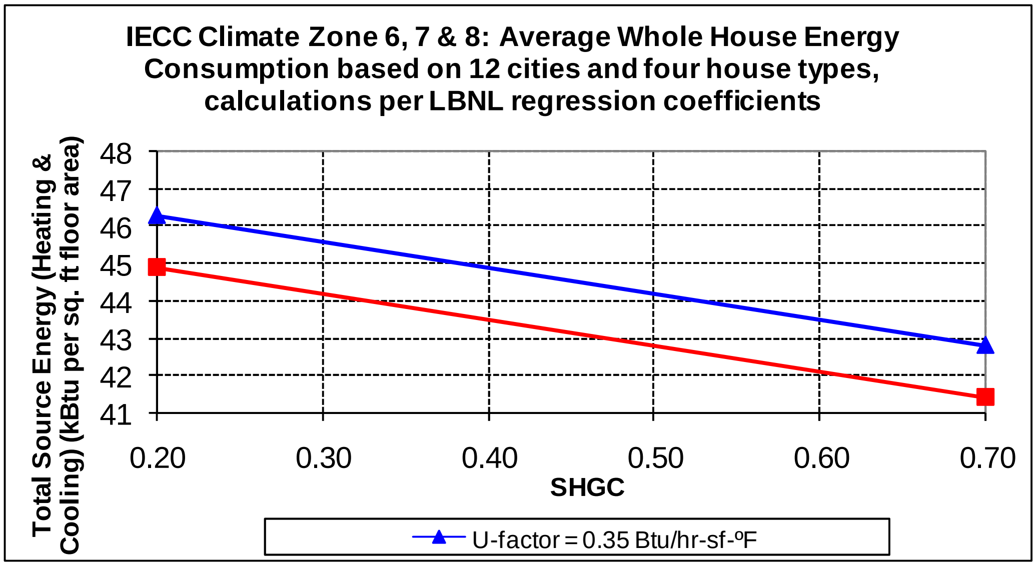
For its entire useful life, a 0.40 SHGC window will permanently block 60% of the sun's energy while allowing 40% of its energy to pass into a home. Reducing solar gain from 40% to 30% by lowering SHGC from 0.40 to 0.30 makes sense in the south because southern climates are cooling dominated and reducing solar gain in the south reduces cooling loads which saves energy.

The Department of Energy is pressing for even lower SHGC windows in the south. Beginning on January 4, 2010, only windows with a 0.27 or lower SHGC will qualify for DOE's Energy Star Windows Program in zones 1 and 2. These windows will reduce solar gain to only 27%. Since consumers respond to the Energy Star label on windows, DOE's decision to qualify only 0.27 SHGC windows in the south will drive manufacturers in the direction of marketing ultra-low SHGC windows.

This proposal is intended to close a loop hole created by lowering prescriptive SHGCs in the south, while leaving a "NR" or "No Rating" for SHGC in the north. Unless this loophole is closed, it will result in the code allowing ultra-low SHGC southern windows to be used in the north. This will reduce, rather than increase, energy efficiency. In that regard, window manufacturers distribute products through national networks. That means the current "NR" rating for SHGC in the north will permit these national networks not only to market ultra-low SHGC windows in the south, where they make sense, but also in the north where no SHGC requirement currently exists. If ultra-low SHGC windows intended for the south are used in the north, it will increase annual energy consumption, rather than conserve it.

When windows with 0.30 or lower SHGCs are installed in homes in northern climates, they permanently block 70% or more of the sun's free energy from heating those homes all winter long. This means northern homes with low SHGC windows will necessarily burn more fossil fuels in the winter to compensate for the solar gain lost through the use of low SHGC windows. This, in turn, results in increased energy consumption, not increased energy efficiency.

The increase in energy consumption attributable to the use of low SHGC windows in the north is illustrated in the following chart which depicts total energy consumption of four different house types found in 12 northern cities in climate zones 6-8. (See bibliography for details). In simulating the whole house energy use depicted in these graphs, the U-factors were held constant at either 0.35 (blue line) or 0.30 (red line) while SHGC was increased from 0.20 to 0.70. (A 0.20 SHGC window only allows 20% of the sun's energy to enter a home while a 0.70 SHGC window allows 70%). These simulations show that when higher SHGC windows are used in northern homes, the sun's energy significantly reduces a home's total energy use. Conversely, when lower SHGC windows are used, it increases a home's total energy use:



The sun's energy is free and renewable. Using low SHGC windows in the south saves energy. However, using those same windows in the north will increase energy consumption. The minimum SHGC proposed here is intended only to eliminate the northern use of ultra-low SHGC windows mandated in the south. If adopted, this proposal will save energy in the north by using the free and renewable energy of the sun.

Bibliography: The graphs were developed using regression equations developed by Lawrence Berkley National Laboratories (LBNL) for DOE in connection with the development of criteria for Energy Star Windows. These reports can be found at: http://windows.lbl.gov/EStar2008/. The graphs display averages of four housing types, (1) existing Furnace – one story, (2) existing Furnace – two story, (3) new Furnace – one story, and (4) new furnace – two story in these twelve (12) northern cities: (1) ME, Portland, (2) MI, Houghton, (3) MN, Duluth, (4) MN, International Falls, (5) MN, Minneapolis, (6) ND, Bismarck, (7) NH, Concord, (8) RI, Providence, (9) SD, Pierre, (10) VT, Burlington, (11) WI, Madison, and (12) WY, Cheyenne. While the annual energy savings resulting from higher SHGC windows is less in climate zone 5 than it is in climate zones 6-8, it still exists.

PART I - IECC

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

PART II - IRC

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

ICCFILENAME: Zaremba-EC-3-T. 402.1.1; RE-2-T. N1102.1

EC44-09/10
Table 402.1.1

Proponent: Ken Sagan, representing National Association of Home Builders (NAHB)

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	SLAB [d] *R*-VALUE & DEPTH	CRAWL SPACE [c] WALL *R*-VALUE
1	1.20	0.75	~~0.30~~ 0.40	30	13	3 / 4	13	0	0	0
2	0.65j	0.75	~~0.30~~ 0.40	30	13	4 / 6	13	0	0	0
3	0.50j	0.60	~~0.30~~ 0.40	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, 2ft	10/13
6	0.35	0.60	NR≥	49	20 or 13+5 [h]	15 / 19	30 [g]	15/19	10, 4ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	38 [g]	15/19	10, 4ft	10/13

(No change to footnotes)

Reason: The purpose of this proposal is to retain the Solar Heat Gain Coefficient (SHGC) of the 2006 IECC and provide a more realistic target that can be compliant with which the products that are readily available in climate zones 1, 2 & 3 can comply. The current market produces very few windows with a solar heat gain coefficient (SHGC) less than 0.35. This makes it difficult for builders to comply with this requirement in the referenced zones. Moreover, there are even fewer doors manufactured with glazing that meets the 0.30 SHGC requirement.

Another concern is when the SHGC is lowered, less daylight passes through the window. This will cause the consumer to demand a greater number of windows or more interior lighting, thus negating the energy savings perceived to be found in the 2009 IECC. The 2009 IECC causes more energy to be consumed, instead of conserving energy, as is the intent of the code.

The lower SHGC's referenced by the IECC introduced a proprietary requirement that severely limits the number of manufacturers that can supply the glass required.

Retaining the original SHGC requirements of the 2006 IECC permits all types of window glass to remain competitive and benefit the builder with lower costs, and provide homeowners with available products that are not limited to a few manufacturers.

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

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

ICCFILENAME: SAGAN-EC-3-T. 402.1.1

EC45–09/10
Tables 402.1.1 and 402.1.3; IRC Tables N1102.1 and N1102.1.2

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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)

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: 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-6-T. 402.1.1-T. N1102.1

EC46–09/10

Table 402.1.1, Table 402.1.3, 402.2.1; IRC Table N1102.1, Table N1102.1.2, N1102.2.1

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

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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~~ <u>60</u>	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.

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.

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-7-T. 402.1.1-T. N1102.1

EC47–09/10

Table 402.1.1, Table 402.1.3, Table 402.2.5; IRC Table N1102.1, Table N1102.1.2, Table N1102.2.5

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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)

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~~ 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[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	WOOD 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~~ 0.057	~~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	0.060	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

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE[a]
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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-10-T. 402.1.1-T. N1102.1

EC48–09/10

Table 402.1.1, Table 402.1.3, Table 402.2.5; IRC Table N1102.1, Table N1102.1.2, Table N1102.2.5

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

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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	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+5 or 13+10~~5[h]~~	15/~~19~~ 20	30[g]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	20+5 or 13+10 ~~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	0.048 ~~57~~	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	0.026	0.0~~48~~ 57	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
R-20+5	R-13+15 or R-19+14 or R-25+13

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE[a]
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)

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
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
<u>R-20</u>	<u>R-13+10 or R-19+8 or R-25+7</u>
R-21	R-13 + 10 or R-19 + 9 or R-25 + 8
<u>R-20+5</u>	<u>R-13+15 or R-19+14 or R-25+13</u>
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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-11-T. 402.1.1-T. N1102.1

EC49–09/10
Table 402.1.1, Table 402.1.3

Proponent: Ken Sagan, representing National Association of Home Builders (NAHB)

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	1.20	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]	0.60	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~~ 19or 13+5[h]	13 / 17	30[g]	10/13	10, 2ft	10/13
6	0.35	0.60	NR≥	49	~~20~~ 19or 13+5[h]	15 / 19	30[g]	15/19	10, 4ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	38[g]	15/19	10, 4ft	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	Crawl Space Wall U-Factor
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.65	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	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~~ 0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	~~0.057~~ 0.060	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.050	0.065

(Footnotes remain unchanged)

Reason: This proposal will retain the original requirements of the 2006 IECC, and will allow multiple products to be used to insulate a home. Permitting all types of insulation to remain competitive will benefit the builder and home owner with lower construction costs.

The increased stringency of the 2009 IECC limits the number of insulation products that were previously available, and thus fails to adequately address all primary building materials in a fair and equitable manner. The blown cellulose and the spray foam used in residences can achieve R-19 in a 2x6 wall cavity but do not typically achieve R-20. Although cellulose and spray foam do not achieve the R-20, they have been proven to be effective in reducing air infiltration and should be considered viable options.

Air infiltration can account for 30% of a building's heating and cooling costs and contributes to problems with moisture and air quality. Reducing the infiltration can significantly cut annual heating and cooling costs, improve building durability and create a healthier indoor environment.

The change to the 2009 IECC excludes products that are widely used in the construction industry and would adversely affect the cost of construction. This change eliminates materials that have a proven track record of providing energy conservation, thus making it economically unreasonable and creating a negative financial impact.

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

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

ICCFILENAME: SAGAN-EC-4-T. 402.1.1-T. 402.1.3

EC50–09/10
Table 402.1.1, Table 402.1.3; IRC Table N1102.1, Table N1102.1.2

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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)

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-8-T. 402.1.1-T. N1102.1.DOC

EC51–09/10
Table 402.1.1, Table 402.1.3

Proponent: Ken Sagan, representing National Association of Home Builders (NAHB)

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	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~~ <u>10/13</u>	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19/21	38g	~~15/19~~ <u>10/13</u>	10, 4 ft	10/13

(No change to footnotes)

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~~ <u>0.059</u>	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.028	~~0.050~~ <u>0.059</u>	0.065

(Footnotes remain unchanged)

Reason: The purpose of this proposal is to retain the basement wall R-values of the 2006 IECC, and provide a more realistic value and cost benefit. The 4-6% saving claimed by the proponent during the 2007/2008 Code Hearings are incorrect and cannot be substantiated. The documented increase in construction costs in the last code cycle, showed costs for installing the higher R-value insulation cannot be justified by the negligible amount of energy savings attained.

The basement wall requirement of the 2009 IECC in Climate Zones 6, 7 and 8 results in increased construction costs. In addition, the provisions in the 2009 IECC may cause basement moisture and health problems for the homeowner.

History has shown that basement moisture problems significantly increased in Minnesota when basement insulation requirements were increased. This additional interior insulation will cause the basement foundation wall to be colder, thus increasing the amount of moisture that condenses on the wall. Ultimately this moisture buildup behind a finished basement wall will result in mold, rot, and insect problems.

Specifically designed and costly moisture resistant designs that are not covered by the IECC will be needed in order to avoid these potential problems. This proposal will retain the basement insulation requirements of the 2006 IECC that are proven to be a method of reducing moisture build-up while providing building envelope insulation.

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

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

ICCFILENAME: SAGAN-EC-1-T. 402.1.1-T. 402.1.3

EC52–09/10
Table 402.1.1, Table 402.1.3

Proponent: Jeff Lowinski, Window and Door Manufacturers Association (WDMA)

Reformat table columns 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~~	~~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	21	19/21	38g	15/19	10, 4 ft	10/13

CLIMATE ZONE	FENESTRATION				CEILING	WALL				FLOOR	SLAB
	WINDOW AND DOOR		SKYLIGHT			WOOD FRAME	MASS	BASEMENT	CRAWL SPACE		
	U-FACTOR[b]	SHGC[b,e]	U-FACTOR[b]	SHGC[b,d]	R-VALUE	R-VALUE	R-VALUE	R-VALUE	R-VALUE	R-VALUE	R-VALUE &DEPTH
1	1.2	0.3	0.75	0.3	NO CHANGE TO VALUES						
2	0.65	0.3	0.75	0.3							
3	0.5	0.3	0.65	0.3							
4 except Marine	0.35	NR	0.6	NR							
5 and Marine 4	0.35	`NR	0.6	NR							
6	0.35	NR	0.6	NR							
7 and 8	0.35	NR	0.6	NR							

~~b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.~~
~~e. There are no SHGC requirements in the Marine Zone.~~

(Portions of table and footnotes not shown 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	0.057	0.057	0.028	0.050	0.065

CLIMATE ZONE	FENESTRATION		CEILING	WALL				
	WINDOW AND DOOR	SKYLIGHT		WOOD FRAME	MASS	FLOOR	BASEMENT	CRAWL SPACE
	U-FACTOR	U-FACTOR	U-FACTOR	U-FACTOR	U-FACTOR	U-FACTOR	U-FACTOR	U-FACTOR
1	1.20	0.75	NO CHANGE TO VALUES					
2	0.65	0.75						
3	0.5	0.65						
4 except Marine	0.35	0.6						
5 and Marine 4	0.35	0.6						
6	0.35	0.6						
7 and 8	0.35	0.6						

(Portions of table and footnotes not shown remain unchanged)

Reason: WDMA suggests reformatting Table 402.1.1 for easier understanding, and by default, reformat complimentary Table 402.1.3. This proposal is intended to be only editorial and to not change any performance requirements. The reformatted table is quicker to use and easier to understand. After revising the format for the fenestration columns, the other columns in the table could be easily revised to follow the format of the fenestration columns.

With the reformatted table, footnotes b and e are proposed to be deleted. Footnote b is no longer needed with the format revisions to the fenestration columns. Footnote e is not needed because there are no SHGC requirements for fenestration in the line items containing the Marine Zone.

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

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

ICCFILENAME: Lowinski-EC-3-T. 402.1.1-T. 402.1.3

EC53–09/10

202; IBC 202; IRC R202

Proponent: Daniel J. Walker, PE, Thomas Associates, Inc., representing National Sunroom Association

THIS IS A 3 PART CODE CHANGE. PARTS I AND II WILL BE HEARD BY THE IECC COMMITTEE. PART III WILL BE HEARD BY THE IRC BUILDING/ENERGY. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise definition as follows:

SUNROOM. A one-story structure attached to a dwelling with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls~~ and roof~~.

PART II – IBC GENERAL

Revise definition as follows:

SUNROOM. A one-story structure attached to a dwelling with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls ~~and roof~~.

PART III – IRC BUILDING/ENERGY

Revise definition as follows:

SUNROOM. A one-story structure attached to a dwelling with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls ~~and roof~~.

Reason: The definition as it is currently written is in conflict with the code text. It has also caused confusion with regard to enforcement for officials. The dividing line for what would be considered a home addition or a sunroom is the limit on vertical glazing to 40% of the wall area in IECC Table 502.3. To allow a sunroom to be defined by both the wall and roof glazing could potentially include structures with less than 40% vertical glazing to be in compliance with the sunroom definition because skylights can be counted toward the total. IRC Section R303.1, exception No. 3 reflects the original intention that the wall fenestration is the only item that is to be counted toward the 40%.

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

PART I – IECC

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

PART II – IBC

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

PART II – IRC

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

ICCFILENAME: WALKER-EC-1-202-RB-5-R202-IBC 202

EC54–09/10

Table 402.1.1, 402.1.2; IRC Table N1102.1, N1102.1.1

Proponent: Matthew Dobson, representing Vinyl Siding Institute

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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 <u>or insulated siding</u>. 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 <u>or insulated siding</u> 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 <u>and insulated siding</u>, 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: DOBSON-EC-2 AND 3 MERGED-402.1.2-RE-1-N1102.1.1.DOC

EC55–09/10
Table 402.1.3; IRC Table N1102.1.2

Proponent: Martha VanGeem, CTL Group, representing Masonry Alliance for Codes and Standards

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC CODE COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

TABLE 402.1.3
EQUIVALENT U-FACTORS
(Portions of table and footnotes not shown remain unchanged)

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~~.

PART II – IRC BUILDING/ENERGY

Revise as follows:

TABLE N1102.1.2
EQUIVALENT U-FACTORS
(Portions of table and footnotes not shown remain unchanged)

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~~.

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: VANGEEM-EC-1-T. 402.1.3-T. N1102.1.2

EC56–09/10

402.1.5 (New), Table 402.1.5 (New); IRC N1102.1.4 (New), Table N1102.1.4 (New)

Proponent: Thomas S. Zaremba, Roetzel & Andress; Thomas D. Culp, Ph.D, Birch Point Consulting LLC; Craig Conner, Building Quality

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text and table as follows:

402.1.5 Alternative prescriptive requirements. If the building thermal envelope and mechanical systems meet the requirements of one path in Table 402.1.5, the building shall be considered in compliance with Section 402.1.1. The prescriptive and mandatory provisions of Section 402, 403 and 404 shall be used in applying the requirements of Table 402.1.5.

TABLE 402.1.5
ALTERNATIVE PRESCRIPTIVE REQUIREMENTS BY COMPONENT[a]

Climate Zone	Path Number	Fenestration U-Factor[b,c]	Skylight U-Factor[b]	Glazed Fenestration SHGC[b,d]	Ceiling R-Value	Wood-frame wall R-Value[e]	Mass Wall R-Value[f]	Floor R-Value[g]	Basement/ Crawl space Wall R-Value[h]	Slab R-Value & Depth[i]	Building Air Tightness (ACH50)[j]	Duct Tightness[k]	Furnace (AFUE) /Heat Pump (HSPF)[l]	Air Conditioning (SEER)[m]	Hot Water Heater[n]
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]	Ceiling R-Value	Wood-frame wall R-Value[e]	Mass Wall R-Value[f]	Floor R-Value[g]	Basement/ Crawl space Wall R-Value[h]	Slab R-Value & Depth[i]	Building Air Tightness (ACH50)[j]	Duct Tightness[k]	Furnace (AFUE) /Heat Pump (HSPF)[l]	Air Conditioning (SEER)[m]	Hot Water Heater[n]
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]	Ceiling R-Value	Wood-frame wall R-Value[e]	Mass Wall R-Value[f]	Floor R-Value[g]	Basement/ Crawl space Wall R-Value[h]	Slab R-Value & Depth[i]	Building Air Tightness (ACH50)[j]	Duct Tightness[k]	Furnace (AFUE) /Heat Pump (HSPF)[l]	Air Conditioning (SEER)[m]	Hot Water Heater[n]
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]	Ceiling R-Value	Wood-frame wall R-Value[e]	Mass Wall R-Value[f]	Floor R-Value[g]	Basement/ Crawl space Wall R-Value[h]	Slab R-Value & Depth[i]	Building Air Tightness (ACH50)[j]	Duct Tightness[k]	Furnace (AFUE) /Heat Pump (HSPF)[l]	Air Conditioning (SEER)[m]	Hot Water Heater[n]
4 except Marine	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	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	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	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
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. For impact rated fenestration in wind-borne debris regions, the maximum U-factor in Climate Zones 1-3 shall be permitted to be 0.15 higher than that specified in Table 402.5.1.

d. There are no SHGC requirements in the Marine Zone.

e. 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 25 percent or less of the exterior, 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 continuous insulation of at least R-2.

f. The second R-value applies when more than half the insulation is on the interior of the mass wall.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. "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.

i. 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.

j. Air tightness shall be demonstrated in accordance with Section 402.4.2.1.

k. "Cond or Tested" means that the duct system shall either be located within conditioned space or tested in accordance with Section 403.2.2. "Reduced Leakage" means that the duct system shall 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 ft2 (9.29 m2) of conditioned floor area, and the total leakage shall be less than or equal to 8 cfm (226.5 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 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 ft2 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.

l. 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.

m. 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.

n. Water heater Energy Factor requirements for Gas (G) and Electric (E) water heaters. "Standard" represents the prevailing minimum efficiency acceptable under federal law.

o. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

PART II – IRC BUILDING/ENERGY

Add new text and table as follows:

N1102.1.4 Alternative prescriptive requirements. If the building thermal envelope and mechanical systems meet the requirements of one path in Table N1102.1.4, the building shall be considered in compliance with Section N1102.1. The other provisions of Section N1102, N1103 and N1104 shall be used in applying the requirements of Table N1102.1.4.

TABLE N1102.1.4
ALTERNATIVE PRESCRIPTIVE REQUIREMENTS BY COMPONENT[a]

Climate Zone	Path Number	Fenestration U-Factor [b,c]	Skylight U-Factor [b]	Glazed Fenestration SHGC [b,d]	Ceiling R-Value	Wood-frame wall R-Value[e]	Mass Wall R-Value[f]	Floor R-Value[g]	Basement/ Crawl space Wall R-Value[h]	Slab R-Value & Depth[i]	Building Air Tightness (ACH50)[j]	Duct Tightness[k]	Furnace (AFUE) /Heat Pump (HSPF)[l]	Air Conditioning (SEER)[m]	Hot Water Heater[n]
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]	Ceiling R-Value	Wood-frame wall R-Value[e]	Mass Wall R-Value[f]	Floor R-Value[g]	Basement/ Crawl space Wall R-Value[h]	Slab R-Value & Depth[i]	Building Air Tightness (ACH50)[j]	Duct Tightness[k]	Furnace (AFUE) /Heat Pump (HSPF)[l]	Air Conditioning (SEER)[m]	Hot Water Heater[n]
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]	Ceiling R-Value	Wood-frame wall R-Value[e]	Mass Wall R-Value[f]	Floor R-Value[g]	Basement/ Crawl space Wall R-Value[h]	Slab R-Value & Depth[i]	Building Air Tightness (ACH50)[j]	Duct Tightness[k]	Furnace (AFUE) /Heat Pump (HSPF)[l]	Air Conditioning (SEER)[m]	Hot Water Heater[n]
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]	Ceiling R-Value	Wood-frame wall R-Value[e]	Mass Wall R-Value[f]	Floor R-Value[g]	Basement/ Crawl space Wall R-Value[h]	Slab R-Value & Depth[i]	Building Air Tightness (ACH50)[j]	Duct Tightness[k]	Furnace (AFUE) /Heat Pump (HSPF)[l]	Air Conditioning (SEER)[m]	Hot Water Heater[n]
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]	Ceiling R-Value	Wood-frame wall R-Value[e]	Mass Wall R-Value[f]	Floor R-Value[g]	Basement/ Crawl space Wall R-Value[h]	Slab R-Value & Depth[i]	Building Air Tightness (ACH50)[j]	Duct Tightness[k]	Furnace (AFUE) /Heat Pump (HSPF)[l]	Air Conditioning (SEER)[m]	Hot Water Heater[n]
4 except Marine	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	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	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	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]	Ceiling R-Value	Wood-frame wall R-Value[e]	Mass Wall R-Value[f]	Floor R-Value[g]	Basement/ Crawl space Wall R-Value[h]	Slab R-Value & Depth[i]	Building Air Tightness (ACH50)[j]	Duct Tightness[k]	Furnace (AFUE) /Heat Pump (HSPF)[l]	Air Conditioning (SEER)[m]	Hot Water Heater[n]
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]	Ceiling R-Value	Wood-frame wall R-Value[e]	Mass Wall R-Value[f]	Floor R-Value[g]	Basement/ Crawl space Wall R-Value[h]	Slab R-Value & Depth[i]	Building Air Tightness (ACH50)[j]	Duct Tightness[k]	Furnace (AFUE) /Heat Pump (HSPF)[l]	Air Conditioning (SEER)[m]	Hot Water Heater[n]
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]	Ceiling R-Value	Wood-frame wall R-Value [e]	Mass Wall R-Value [f]	Floor R-Value [g]	Basement/ Crawl space Wall R-Value [h]	Slab R-Value & Depth [i]	Building Air Tightness (ACH50) [j]	Duct Tightness [k]	Furnace (AFUE) /Heat Pump (HSPF) [l]	Air Conditioning (SEER) [m]	Hot Water Heater [n]
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]	Ceiling R-Value	Wood-frame wall R-Value [e]	Mass Wall R-Value [f]	Floor R-Value [g]	Basement/ Crawl space Wall R-Value [h]	Slab R-Value & Depth [i]	Building Air Tightness (ACH50) [j]	Duct Tightness [k]	Furnace (AFUE) /Heat Pump (HSPF) [l]	Air Conditioning (SEER) [m]	Hot Water Heater [n]
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. For impact rated fenestration in wind-borne debris regions, the maximum U-factor in Climate Zones 1-3 shall be permitted to be 0.15 higher than that specified in Table 402.5.1.

d. There are no SHGC requirements in the Marine Zone.

e. 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 25 percent or less of the exterior, 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 continuous insulation of at least R-2.

f. The second R-value applies when more than half the insulation is on the interior of the mass wall.

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

h. "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.

i. 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.

j. Air tightness shall be demonstrated in accordance with Section 402.4.2.1.

k. "Cond or Tested" means that the duct system shall either be located within conditioned space or tested in accordance with Section 403.2.2. "Reduced Leakage" means that the duct system shall 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 ft2 (9.29 m2) of conditioned floor area, and the total leakage shall be less than or equal to 8 cfm (226.5 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 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 ft2 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.

l. 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.

m. 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.

n. Water heater Energy Factor requirements for Gas (G) and Electric (E) water heaters. "Standard" represents the prevailing minimum efficiency acceptable under federal law.

o. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

Reason: This proposal will provide a significant increase in energy efficiency while also increasing flexibility and cost effectiveness by providing multiple paths in a way that facilitates easy demonstration of compliance. In each climate zone, four sets of equivalent alternative prescriptive requirements are provided. One path focuses on primarily envelope improvements, whereas the other three paths include a combination of improvements in envelope, air tightness, duct tightness, and equipment efficiency. When looking at above-code programs such as Building America, these high efficiency homes invariably include a combination of *all* these factors. The whole building must be considered, and it is wrong to only look at the envelope separately without also considering interactions with air sealing and equipment efficiency.

The four paths provided have been demonstrated to be equivalent in each climate zone through dozens of simulations using both REM/Rate™ and EnergyGuage software, and represent a significant increase in energy efficiency towards ICC's goals.

Additionally, this proposal will help facilitate enforcement, in that the flexibility of this table will lead to increased use of prescriptive options over the more complicated performance path. This table is intended to list the prescriptive description for packages of energy efficiency options that are commonly desired by designers. If using this alternative approach, the builder will simply indicate which of the four paths they are using, and building official will review the prescriptive requirements for that path.

Cost Impact: The code change proposal will increase the cost of construction, but improves cost effectiveness by offering multiple paths of compliance. Alternate choices give more flexibility and competition, improving cost effectiveness.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: ZAREMBA-CULP-CONNER-EC-8-402.1.5-T. 402.1.4-RE-1-N1102.1.4-T. N1102.1.4

EC57–09/10

402.1.5 (New), Table 402.1.5 (New); IRC N1102.1.4 (New), Table N1102.1.4 (New)

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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. <u>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.</u>
b. <u>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.</u>
c. <u>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.</u>

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-17-402.1.5-N1102.1.4

EC58–09/10

402.2.1, 502.2.1; IRC N1102.2.1

Proponent: Larry Wainright, Qualtim, Inc., representing the Structural Building components Industry

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

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. <u>Where the required insulation depth is greater than the ceiling joist depth, no storage shall be permitted.</u>

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.

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).

Where the required insulation depth is greater than the ceiling joist depth, no storage shall be permitted. Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1102.2.1 Ceilings with attic spaces. When Section N1102.1 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 N1102.1.2 and the Total UA alternative in Section N1102.1.3. Where the required insulation depth is greater than the ceiling joist depth, no storage shall be permitted.

Reason: The intent of this provision is to prohibit attic spaces to be used for storage where the insulation would need to be compressed in order to accommodate the storage area, thereby rendering the insulation less effective. The insulation layer needs to be uncompressed to achieve its rated R-value. This provision will help assure the intended R-value is achieved.

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: WAINRIGHT-EC-1-402.2.1-RE-1-N1102.2.1

EC59–09/10

402.2.2 (New), Table 402.4.2, Chapter 6; IRC N1102.2.2 (New), Table N1102.4.2, Chapter 44

Proponent: Craig Conner, Building Quality, representing self

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Add new text as follows:

402.2.2 Performance of loose fill insulation. Loose fill insulation shall provide the required performance at 75 degrees Fahrenheit mean temperature and no less than the required performance at winter design conditions. Performance of loose fill insulation at winter design conditions shall be determined in accordance with ASTM C1373-03.

Exception: Climate Zones 1 through 4.

2. Revise table as follows:

TABLE 402.4.2
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[a].

a. Air permeable insulation shall be permitted to be above the air barrier in attics in Climate Zones 1 through 4. Air permeable insulation shall be permitted to be above the air barrier in attics in Climate Zones 5 through 8 provided the exposed attic insulation meets the requirements of Section 402.2.2.

(Portions of table and footnotes not shown remain unchanged)

3. Add new standard to Chapter 6 as follows:

ASTM
C1373-03 Standard Practice for Determination of Thermal Resistance of Attic Insulation Systems Under Simulated Winter Conditions

PART II – IRC ENERGY

1. Add new text as follows:

N1102.2.2 Performance of loose fill insulation. Loose fill insulation shall provide the required performance at 75 degrees Fahrenheit mean temperature and no less than the required performance at winter design conditions. Performance of loose fill insulation at winter design conditions shall be determined in accordance with ASTM C1373-03.

Exception: Climate Zones 1 through 4.

TABLE N1102.2.2
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[a].

a. Air permeable insulation shall be permitted to be above the air barrier in attics in zones 1 to 4. Air permeable insulation shall be permitted to be above the air barrier in attics in zones 5 to 8 provided the exposed attic insulation meets the requirements of Section N1102.2.2.

(Portions of table and footnotes not shown remain unchanged)

3. Add new standard to Chapter 44 as follows:

ASTM
C1373-03 Standard Practice for Determination of Thermal Resistance of Attic Insulation Systems Under Simulated Winter Conditions

Reason: Low winter temperatures can induce convection in loose fill attic insulation, substantially degrading insulation performance. The use of products designed to perform in a cold winter alleviates this insulation performance problem. This proposed change is modeled on existing Minnesota code.

Testing has shown a significant problem with loose-fill insulation at cold temperatures due to heat loss from convection.
"*The Oak Ridge tests suggest that convection begins to occur at about 50°F mean insulation temperature; the Illinois tests showed performance degradation at about the same point. Both experiments show about 40%-50% loss of R-value at extremely cold temperatures*."[1]

The Oak Ridge publication said
"*Testing with a loose-fill fiberglass insulation clearly showed that, under realistic cold winter conditions, thermal performance of the insulation was reduced considerably because of convective motion developing within t insulation.*"[2a]

Loose-fill fiberglass is a common ceiling insulation. The same publication calls convention for most high-density fiberglass "*negligible*", so a fiberglass insulation that performs well in winter is available.

Why require a second test to demonstrate adequate winter performance in cold climates? Because the existing test does not account for convection and convection has a substantial impact in cold climate winters.

"*In particular, tests of fiberglass insulation with a small-scale heat flowmeter apparatus have never shown any evidence of convective motion. This small-scale apparatus is currently used as a standard method to test insulation, but it appears not to be sensitive to natural convection*."[2b]

Typical uncovered low-density attic insulation, usually fiberglass, is exposed to the attic. Convention extending from the insulation into the attic space degrades the insulation on cold winter days.

"*The cold top surface of the insulation is open to the attic space. Convective motion may occur simultaneously above and within the insulation. When the top surface of the insulation is permeable, the flows in the insulation and in the attic are coupled.*"[2c]

The test proposed here measures performance when it is needed the most, at low winter temperatures in common attic construction. The figure below[2d] illustrates the dramatic effect of temperature on performance of low-density blown insulation. The typical attic is represented by the "*open with joists*" line on the figure, which loses the most performance. Note also the difference between "*closed*" (insulation covered by an air impermeable barrier) and "*open*" (insulation not covered). The figure shows performance drops off dramatically at low temperatures, especially for uncovered insulation.

Several solutions are straightforward- use insulation that is less air permeable (such as high density fiberglass or cellulose), use a greater insulation thickness, or add an air barrier over the insulation. Some fiberglass companies advertise products that meet this proposed requirement as insulation for Minnesota, where this requirement already exists. Their solution is either a higher density product or additional insulation. For example see:

http://www.idimn.com/products/insulation/blowing-wool.php?id=4

http://products.construction.com/Manufacturer/Guardian-Fiberglass-NST3447/products/Loose-Fill-Fiberglass-Insulation-NST10757-P

The use of higher density insulation seems likely to be the most common solution. This change will help ensure that insulation performs in cold Winters.

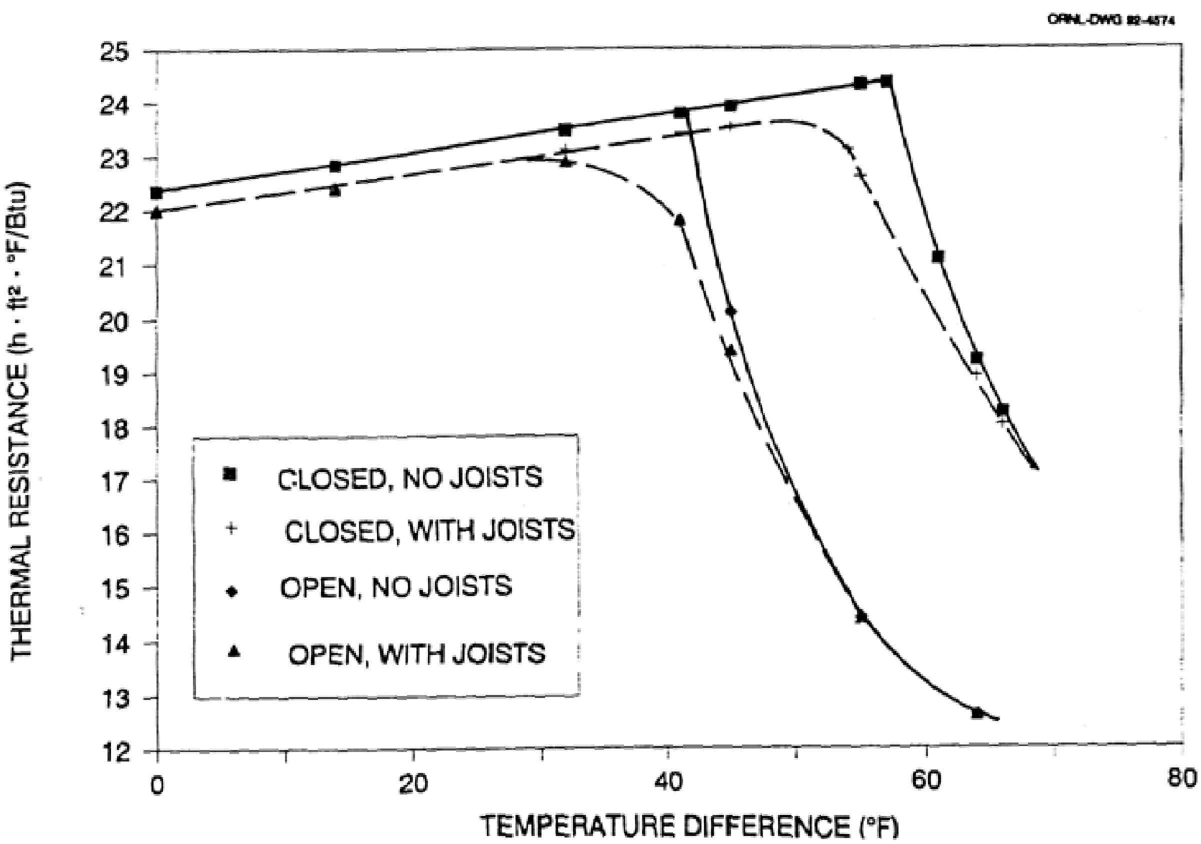


Fig. 4.3. Thermal resistance vs temperature difference in closed and open configurations with and without joists.

1 Energy Design Update, October 1991, page 1

2 Numerical Analysis of Heat Transfer by Conduction and Natural Convection in Loose-Fill Fiberglass Insulation – Effects of Convection on Thermal Performance, Agnes A. Delmas, Kenneth E. Wilkes, April 1992, ORNL/CON-338
(a) page xi, (b) page 2, (c) page 10, (d) page 31.

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 C1373-03, 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.

PART I – IECC

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

PART II – IRC ENERGY

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

ICCFILENAME: CONNER-EC-14-402.2.2 - N1102.2.2.DOC

EC60–09/10

202, 402.2.2; IRC Tables N1102.1, N1102.1.2, N1102.4.2

Proponent: Craig Conner, Building Quality, representing self; Shaunna Mozinga, City of Westminster, representing Colorado Chapter of ICC

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGYCOMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: CONNER-MOZINGO-EC-1-402.2.2-T. N1102.1.DOC

EC61–09/10
402.2.2

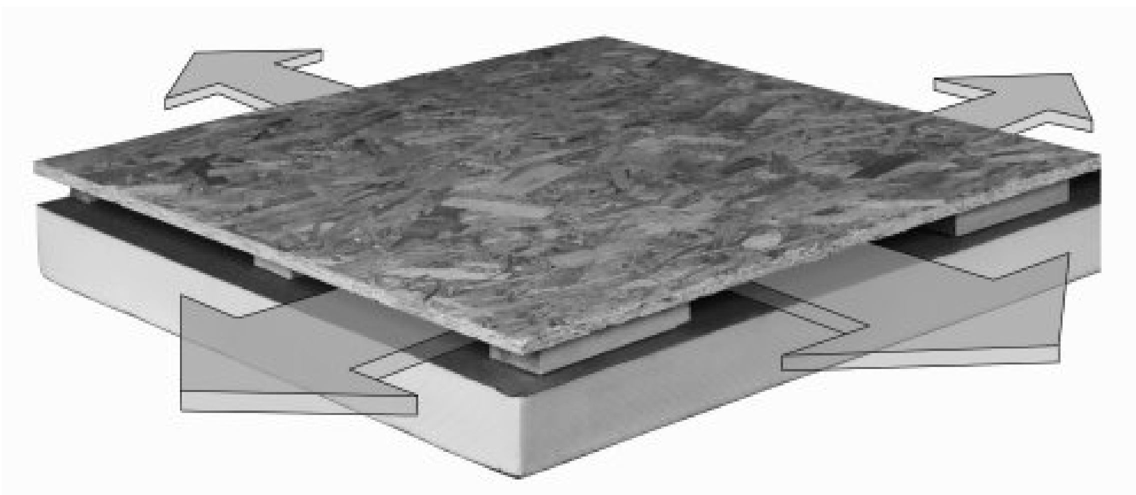
Proponent: Lorraine Ross, Intech Consulting, Inc., representing Polyiso Insulation Manufacturers Association

Revise as follows:

402.2.2 Ceilings without attic spaces. The requirements of Table 402.1.1 shall be met by a combination of insulation installed within the cavity under the roof deck and composite nailbase panels composed of rigid foam insulation that complies with Section 314, a 1, 1.5 or 2 inch airspace and a nailable wood structural panel installed on the topside of the roof deck. Composite panels shall be installed in accordance with manufacturers installation instructions. ~~based on the climate *zone* specified in Chapter 3.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 (46m2) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the *U*-factor alternative approach in Section 402.1.3 and the total UA alternative in Section 402.1.4.~~

Reason: With the widespread availability of composite nail base panels, there is no reason to underinsulate a roof without attic spaces. A combination of insulation installed in the cavity along with insulation installed above the roof deck can easily meet the thermal performance of Table 402.1.

Composite nailbase insulated panels are available in all thicknesses that easily meet the energy code and have been available for many years with proven performance. This is an example of the product. There are spacer strips separating the nailable surface from the rigid insulation.



The use of asphalt shingles and other roof coverings has been successful over these composite insulation panels and the required ventilation is maintained.

This code change proposal also provides an easily installed and inspected insulation system. The nailable surface is composed of OSB or plywood.

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

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

ICCFILENAME: ROSS-EC-1-402.2.2

EC62–09/10
402.2.2

Proponent: Ken Sagan, National Association of Home Builders (NAHB)

Revise as follows:

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 m2) ~~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: The purpose of this proposal is to help alleviate the confusion in the 2009 International Energy Conservation Code (IECC). Without this amendment, the IECC would limit the ceiling areas eligible due to a framing cavity restriction for reduced R-value. The IECC already has a limit (500 sq. ft) for this application. This additional limit adds a calculation to determine the second limit and therefore is more confusing than it is worth. Typically, smaller homes have smaller rafter requirements based on shorter spans. Allowing the proper sized framing material to handle the loads is not only cost-effective, but saves our natural resources. Adding insulation alone can be cost effective. Installing larger rafters in order to meet minimum insulation requirements would not be considered a justified cost and would not be conserving our natural resources.

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

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

ICCFILENAME: SAGAN-EC-2-402.2.2

EC63–09/10
402.2.3 (New); IRC N1102.2.3 (New)

Proponent: Craig Conner, Building Quality, representing self

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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>

PART II – IRC ENERGY

<u>**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.</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.

PART I – IECC

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

PART II – IRC ENERGY

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

ICCFILENAME: CONNER-EC-4-402.2.3-N1102.2.3.DOC

EC64–09/10
402.2.3 (New), Table 402.2.3 (New); IRC N1102.2.2.1 (New), Table N1102.2.2 (New)

Proponent: Dwight Sheldon, Demilec (USA) LLC

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text and table as follows:

402.2.3 Where recessed luminaries, exhaust fans, ducts or flues are installed in a ceiling without an attic space, the roofdeck above the recessed device shall be insulated for condensation control with air impermeable insulation equal to or greater than that prescribed in Table 402.2.3.

TABLE 402.2.3
INSULATION FOR CONDENSATION CONTROL

CLIMATE ZONE	MINIMUM RIGID BOARD OR AIR-IMPERMEABLE INSULATION R-VALUE[a]
2B and 3B tile roof only	0 (none required)
1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

a. Contributes to but does not supersede prescriptive energy requirements.

PART II – IRC BUILDING/ENERGY

Add new text and table as follows:

1102.2.2.1 Where recessed luminaries, exhaust fans, ducts or flues are installed in a ceiling without an attic space, the roofdeck above the recessed device shall be insulated for condensation control with air impermeable insulation equal to or greater than that prescribed in Table 1102.2.2

TABLE 1102.2.2
INSULATION FOR CONDENSATION CONTROL

CLIMATE ZONE	MINIMUM RIGID BOARD OR AIR-IMPERMEABLE INSULATION R-VALUE[a]
2B and 3B tile roof only	0 (none required)
1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

Reason: Recessed luminaries, exhaust fans, ducts and flues often consume most of the space between the ceiling and the roof deck in a ceiling without an attic space (sometimes referred to as roof/ceiling combination, cathedral ceiling or vaulted ceiling), and often do not have adequate insulation between the device and the roof deck to control condensation. This lack of insulation also contributes to significant energy loss in all climates and to ice damming in colder climates. The durability of the structure is compromised if condensation forms on the roof deck which can lead to mold, mildew and rot. Ice damming can lead to bulk water intrusion and substantial damage to the roof and walls.

Cost Impact: The cost for materials for rigid insulation in a ceiling joist cavity is estimated at:
R-10 = $0.80/ft^2$
R-20 = $1.60/ft^2$
R=30 = $2.40/ft^2$

($15 per 32ft^2 sheet, 1" thick, R-5.9 per inch)
A typical recessed luminary should require 1.5ft^2 – 2ft^2

Labor to install the insulation is estimated at less than 5-minutes per recessed luminary or exhaust fan, and about 2 - 5 minutes per 4 lineal feet of duct or flue.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: SHELDON-EC-1-402.2.3-T. 402.2.3-RE-N1102.2.2.1-T. N1102.2.2

EC65–09/10

402.2.4, Chapter 6

Proponent: Rob Pickett, Rob Pickett & Associates, LLC, representing Log Homes Council

1. Revise as follows:

402.2.4 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. The design and construction 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.

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.

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

ICCFILENAME: PICKETT-EC-2-402.2.4

EC66–09/10
Table 402.2.5; IRC Table N1102.2.5

Proponent: Mark Nowak, representing Steel Framing Alliance

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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

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

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: NOWAK-EC-4-T. 402.2.5-RE-1-T. N1102.2.5

EC67–09/10
202 (New), 402.2.7 (New), 502.2.2.1, 502.2.2.2

Proponent: Ronald Majette, representing US Department of Energy

1. Revise definitions as follows:

ABOVE-GRADE WALL. ~~A wall more than 50 percent above grade and enclosing *conditioned space*. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.~~ See Section 402.2.7 for residential buildings and Section 502.2.3 for commercial buildings.

BASEMENT WALL. ~~A wall 50 percent or more below grade and enclosing *conditioned space*.~~ See Section 402.2.7.

2. Add new definition as follows:

BELOW-GRADE WALL. See Section 502.2.3.

3. Add new text as follows:

402.2.7 Above grade walls. Where Section 402.1.1 would require insulation on above grade walls, those walls are those more than 50 percent above grade and enclosing *conditioned space.* This includes between floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and surfaces associated with skylight shafts. Walls not considered above grade walls shall be considered basement walls as covered in Section 402.2.8.

4. Revise as follows:

502.2.2.1 Above-grade walls. Above-grade walls are those walls covered by Section 502.2.3 on the exterior of the building ~~and completely above grade or walls that are more than 15 percent above grade~~ that are not below-grade walls.

502.2.2.2 Below-grade walls. Below-grade walls covered by Section 502.2.4 are ~~basement or first-story walls associated with the exterior of the building that are at least 85 percent below grade~~ those portions of walls associated with the building envelope that are entirely below the finish grade and in contact with the ground.

Reason: For consistency with ASHRAE Standard 90.1. The current definitions are appropriate for application to residential buildings. The revisions related to commercial buildings make it clear which walls are above grade and below grade and most importantly eliminate what appears to be an arbitrary distinction built around a 15/85% ratio of above and below grade.

Cost Impact: The code change proposal could increase or decrease the cost of construction to the degree that the current IECC would consider some walls above or below grade while ASHRAE 90.1-07 would consider them the opposite.

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

ICCFILENAME: MAJETTE-EC-36-202-402.2.7

EC68–09/10
402.2.11, 402.3.5; IRC N1102.2.11, N1102.3.5

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise 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 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.

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 0.70~~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.

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-18-402.2.11-N1102.2.11

EC69–09/10
402.2.12 (New); IRC N1102.2.12 (New)

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

<u>**402.2.12 Common, party, and fire walls.** Whenever continuity of the *building thermal envelope* is broken at walls separating dwelling units in Group R-2 building, including common, party, and fire walls, such walls shall be insulated to a minimum of R-10 on each side of the break in insulation continuity, and the walls shall be air sealed in accordance with Section 402.4.</u>

PART II – IRC BUILDING/ENERGY

Add new text as follows:

<u>**N1102.2.12 Common, party, and fire walls.** Whenever continuity of the *building thermal envelope* is broken at walls separating dwelling units in Group R-2 building, including common, party, and fire walls, such walls shall be insulated to a minimum of R-10 on each side of the break in insulation continuity, and the walls shall be air sealed in accordance with Section N1102.4.</u>

Reason: Feedback we have received from the field is that party/fire walls in Low-Rise Multifamily dwellings are often a source of a considerable waste of energy. The problem is that these common walls are overlooked for their lack of insulation and air sealing, as they are often not considered to be exterior walls or part of the building thermal envelope for the purposes of the codes.

We know, however, from past experience with real-time performance testing of these common walls that they are often direct connections between the outside, unconditioned crawlspaces or basement, and unconditioned attics. This results in potential air infiltration/exfiltration issues, as well as conductive heat loss, since these walls are not insulated. The end result is energy loss and appurtenant utility bill increases and major comfort issues associated with these "cold" walls. This is why the EPA and NYSERDA Energy Star Homes programs require air sealing of these walls as well.

Cost Impact: The code change proposal will increase the cost of construction to the degree that these walls which may not now be insulated and sealed with have to be insulated and sealed. Costs of operation of the building will be reduced a commensurate amount to offset any increase cost of construction.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-76-402.2.12-IRC N1102.2.12

EC70–09/10
202

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~~ <u>less than 60</u> degrees (0.26 rad) ~~or more from vertical~~ <u>from horizontal</u>. 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.

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

ICCFILENAME: MAJETTE-EC-37-202

EC71–09/10

202 (New), 402.3 (New), 402.3.1 (New), Table 402.3(1) (New), Chapter 6 (New); IRC R202 (New), N1102.3 (New), N1102.3.1 (New), Table N1102.3(1) (New), Chapter 44

Proponent: Ronald Majette, US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-66-202-CH 4-IRC R202-CH 11-REDONE

EC72–09/10

103.2, 202 (New), 402.3.3 (New), Table 402.3.3 (New); IRC R106.2, R202 (New), N1102.3.3 (New), Table N1102.3.3 (New)

Proponent: Thomas D. Culp, Ph.D., Birch Point Consulting LLC, representing Aluminum Extruders Council; Vickie Lovell, InterCode Incorporated, representing Association of Industrial Metallized Coaters and Laminators

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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; permanent shading features with 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 text as follows:**

SECTION 202
GENERAL DEFINITIONS

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.

402.3.3 Glazed fenestration SHGC exception. In Climate Zones 1 through 3, permanently shaded vertical fenestration shall be permitted to satisfy the SHGC requirements. The projection factor of an overhang, eave, or permanently attached shading device shall be greater than or equal to the value listed in table 402.3.3 for the appropriate orientation. The minimum projection shall extend beyond each side of the glazing a minimum of 12 inches (0.3 m). Each orientation shall be rounded to the nearest cardinal orientation (+/-45 degrees or 0.79 rad) for purposes of calculations and demonstrating compliance.

TABLE 402.3.3
MINIMUM PROJECTION FACTOR REQUIRED BY ORIENTATION FOR SHGC EXCEPTION

ORIENTATION	PROJECTION FACTOR
North	>=0.40[a]
South	>=0.20
East	>=0.50
West	>=0.50

a. For the north orientation, a vertical projection located on the west-edge of the fenestration with equivalent PF >= 0.15 shall also satisfy the minimum projection factor requirement.

PART II – IRC BUILDING/ENERGY

1. Revise as follows:

R106.2 Site plan or plot plan. The construction documents submitted with the application for permit shall be accompanied by a site plan showing the size and location of new construction and existing structures on the site, ~~and~~ distances from lot lines, and cardinal directions. In the case of demolition, the site plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site or plot. The building official is authorized to waive or modify the requirement for a site plan when the application for permit is for alteration or repair or when otherwise warranted.

2. Add new text as follows:

SECTION R202
DEFINITIONS

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.

N1102.3.3 Glazed fenestration SHGC exception. In Climate Zones 1 through 3, permanently shaded vertical fenestration shall be permitted to satisfy the SHGC requirements. The projection factor of an overhang, eave, or permanently attached shading device shall be greater than or equal to the value listed in table N1102.3.3 for the appropriate orientation. The minimum projection shall extend beyond each side of the glazing a minimum of 12 inches (0.3 m). Each orientation shall be rounded to the nearest cardinal orientation (+/-45 degrees or 0.79 rad) for purposes of calculations and demonstrating compliance.

TABLE N1102.3.3
MINIMUM PROJECTION FACTOR REQUIRED BY ORIENTATION FOR SHGC EXCEPTION

ORIENTATION	PROJECTION FACTOR
North	>=0.40[a]
South	>=0.20
East	>=0.50
West	>=0.50

a. For the north orientation, a vertical projection located on the west-edge of the fenestration with equivalent PF >= 0.15 shall also satisfy the minimum projection factor requirement.

Reason
(Culp): This proposal would promote good shading practice through a prescriptive alternative to the SHGC requirements. The proposed requirements account for orientation differences, based on equivalent shading averaged over the relevant time period for each façade.

To aid enforcement, this proposal puts the requirement on the builder, not the code official, to substantiate projection factor calculations and indicate the cardinal directions on construction documents. Also, projection factor has already been in use for years in both the commercial chapter and ASHRAE 90.1, so this is merely an extension of current practice.

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.

(Lovell): The concept of using shading to reduce heat gain dates back to prehistoric times, when man and beast had the instinctive sense to seek shade during the hottest part of the day. It is integral to the architectural of some of the oldest world cultures. Shading in modern construction offers many possibilities, some yet to be fully explored.

This proposed code change allows for the use of overhangs to meet the solar heat gain coefficient requirements within the IECC. Permanent exterior shading features, such as overhangs are allowed to be used in IECC Chapter 5 as a prescriptive trade-off to meeting SHGC requirements within the code. The calculation for determining the projection factor for overhangs has been in the 2000, 2003, 2006, and 2009 IECC for commercial buildings and has been proven to be very simple to calculate, fitting well into a prescriptive approach. The use of the shading devices was previously allowed under the 2003 IECC and is currently allowed as a trade-off under the commercial provisions of the IECC.

Allowing flexibility in meeting the solar heat gain coefficient through the use of proven shading alternatives will increase the usability of the code for the building and design community while ensuring that the new fenestration is energy efficient. When credit for shading is permitted in the building code, it encourages an integrated approach to building designs, energy use, construction materials, renewable resources particularly as part of urban infrastructure, site and town planning and building design to be considered holistically. It also creates the opportunity for aesthetically pleasing and ingenious designs that might not otherwise be permitted.

Cost Impact:
(Culp)- The code change proposal will not increase the cost of construction. Wider overhangs, eaves, and shading devices will increase the cost relative to windows without shading, but this section is only a voluntary alternative.
(Lovell)-The code change proposal will not increase the cost of construction.

PART I – IECC

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

PART II – IRC ENERGY

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

ICCFILENAME: CULP-EC5-103.2 COMBINED WITH LOVELL EC1-103.2.DOC

EC73–09/10
103.2, 402.3.3 (New), Table 405.5.2(1); IRC R106.2, N1102.3.3 (New)

Proponent: Thomas D. Culp, Ph.D., Birch Point Consulting LLC, representing Quanta Technologies, Inc.

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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; 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 text as follows:

402.3.3. Fenestration SHGC for south-facing glazing. In Climate Zones 5 through 8, fenestration facing within 30 degrees of south shall have a minimum SHGC of 0.30. For compliance with this section, the default SHGC for unlabeled fenestration shall be 0.27, and default SHGC values from Table 303.1.3(3) shall not be permitted.

(Renumber subsequent sections)

3. Revise table as follows:

TABLE 405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

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 and Section 402.3.3 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

(Portions of table and footnotes not shown remain unchanged)

PART II – IRC BUILDING/ENERGY

1. Revise as follows:

R106.2 Site plan or plot plan. The construction documents submitted with the application for permit shall be accompanied by a site plan showing the size and location of new construction and existing structures on the site,~~ and~~ distances from lot lines, and cardinal directions. In the case of demolition, the site plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site or plot. The building official is authorized to waive or modify the requirement for a site plan when the application for permit is for alteration or repair or when otherwise warranted.

2. Add new text as follows:

N1102.3.3. Fenestration SHGC for south-facing glazing. In Climate Zones 5 through 8, fenestration facing within 30 degrees of south shall have a minimum SHGC of 0.30. For compliance with this section, the default SHGC for unlabeled fenestration shall be 0.27, and default SHGC values from Table N1101.5(3) shall not be permitted.

(Renumber subsequent sections)

Reason: As the IECC and IRC move toward major increases in energy efficiency, first 30% and then 50%, we cannot continue to ignore a free source of renewable energy – the sun. Just as lower SHGC is important to reducing cooling loads in southern climates, it is equally important to use higher SHGC windows in northern climates to maximize the use of free solar energy to reduce heating loads that must otherwise be met using fossil fuels. However, there is a profound danger that this renewable energy source will be blocked from entering homes if very low SHGC windows intended for southern climates are allowed to be installed in northern homes, due to the current "No Requirement" or "NR" for northern SHGC.

This proposal would preserve solar access and ensure that northern homeowners capture solar gain all winter long, by requiring a modest minimum SHGC on south-facing exposures. Previous debates about the benefits of higher SHGC in cold climates have often centered on west-facing windows. However, there is no dispute that higher SHGC on south-facing windows saves energy, and in fact, homes have been designed for centuries to capture winter solar gains from south-facing windows. The U.S. Department of Energy has recently announced new criteria for Energy Star which reward higher SHGC in northern climates for all windows, regardless of which way they face.[1] Nonetheless, this proposal is limited to south-facing glazing, and does not change the requirements for west-facing glazing in any way.

Additionally, the minimum SHGC of 0.30 is easily achievable by products available from all of the major low-e glass producers, at the same or even lower cost. It is purposely designed to be a modest requirement which only limits the worst-performing products from being used.

The code must begin to recognize that using the same low SHGC glazing in Phoenix and Boston makes no sense. The benefits are obvious even to our best friends …

1. "ENERGY STAR Program Requirements for Residential Windows, Doors, and Skylights – Version 5.0", U.S. Department of Energy, April 7, 2009. http://www.energystar.gov/ia/partners/prod_development/archives/downloads/windows_doors/WindowsDoorsSkylightsProgRequirements7Apr09.pdf

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: CULP-EC-7-103.2-402.3.3-T. 405.5.2(1)-R106.2-N1102.3.3.DOC

EC74–09/10

402.3.3 (New), 402.3.3.1 (New), 402.3.3.2 (New), Table 402.3.3 (New); IRC N1102.3.3 (New), N1102.3.3.1 (New), N1102.3.3.2 (New), Table N1102.3 (New)

Proponent: Thomas S. Zaremba, representing Roetzel & Andress

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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 ≤ *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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: ZAREMBA-EC-1-402.3.3-N1102.3.3

EC75–09/10
402.3.4

Proponent: Ron Nickson, representing the National Multi Housing Council

Revise as follows:

402.3.4 Opaque door exemption. One side-hinged opaque door assembly per dwelling unit up to 24 square feet (2.22 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 and the total UA alternative in Section 402.1.4.

Reason: This change would allow the exemption for one door, as not having to comply to the insulation and fenestration criteria, to apply to the individual dwelling units in a multifamily structure. The change will allow the same flexibility in the design of R-2 occupancies as is now permitted in the design of R-3 occupancies.

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

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

ICCFILENAME: NICKSON-EC-2-402.3.4

EC76–09/10
402.3.4; IRC N1102.3.4

Proponent: Ken Sagan, National Association of Home Builders (NAHB)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

402.3.4 Opaque door exemption. One opaque side-hinged door assembly ~~side-hinged opaque door~~ ~~assembly up to 24 square feet (2.22 m2) in area is~~ shall be exempted from the *U*-factor requirement in Section 402.1.1. This exemption shall not apply to the U-factor alternative approach in Section 402.1.1 and the total U-factor alternative in Section 402.1.4.

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1102.3.4 Opaque door exemption. One opaque side-hinged door assembly ~~side-hinged opaque door~~ ~~assembly up to 24 square feet (2.22 m2) in area is~~ shall be exempted from the *U*-factor requirement in Section 402.1.1. This exemption shall not apply to the U-factor alternative approach in Section 402.1.1 and the total U-factor alternative in Section 402.1.4

Reason: The current language limits the area of the exempt door allowed in section 402.1.1. Creation of a limitation on the exemption for opaque doors to a single 24 sf. door is arbitrary and restricts options for Architectural doors.

The proposed amendment would allow the reuse of reclaimed and /or salvaged materials as listed in section 603.2 of the ICC 700 the National Green Building Standard.

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

PART I – IECC

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

PART II – IRC BUILDING/ENEGY

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

ICCFILENAME: SAGAN-EC-11-402.3.4-RE-3-N1102.3.4

EC77–09/10

402.3.7 (New), 502.3.3 (New); IRC N1102.3.7 (New)

Proponent: Thomas D. Culp, Ph.D., Birch Point Consulting LLC, representing Aluminum Extruders Council

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGYCOMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

402.3.7 Recycled content credit. Fenestration shall be allowed to have a maximum U-factor 0.05 Btu/h·ft^2·ºF (0.28 W/m2·K) greater than that specified in Table 402.1.1 provided the framing material contains at least 50% recycled content as determined by a nationally recognized certification program, such as the MBDC Cradle to Cradle Certification Program or the ICC Sustainable Attributes Verification and Evaluation Program.

502.3.3 Recycled content credit. Fenestration shall be allowed to have a maximum U-factor 0.05 Btu/h·ft^2·ºF (0.28 W/m2·K) greater than that specified in Table 502.3 provided the framing material contains at least 50% recycled content as determined by a nationally recognized certification program, such as the MBDC Cradle to Cradle Certification Program or the ICC Sustainable Attributes Verification and Evaluation Program.

PART II – IRC ENERGY

Add new text as follows:

N1102.3.7 Recycled content credit. Fenestration shall be allowed to have a maximum U-factor 0.05 Btu/h·ft^2·ºF (0.28 W/m2·K) greater than that specified in Table 402.1.1 provided the framing material contains at least 50% recycled content as determined by a nationally recognized certification program, such as the MBDC Cradle to Cradle Certification Program or the ICC Sustainable Attributes Verification and Evaluation Program.

Reason: We are proposing a new credit for recycled content, in which a credit towards meeting the fenestration U-factor criteria could be earned by using a higher amount of recycled material in the framing of the product. There has been a commendable focus on reducing energy use, but we believe the committee should look more broadly for opportunities to promote both sustainability and energy savings in materials.

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. Additionally, for certain materials, emissions associated with incineration and/or decomposition are of particular concern.

Promoting the use of recycled materials would result in specific embodied energy savings associated with the fenestration product. This is consistent with the goals of the IECC and IRC to promote significant and measurable energy savings, while recognizing equivalent functionality and performance of different product technologies. Although the focus needs to be on overall ecological impact and not just embodied energy savings, the embodied energy savings from the use of recycled materials can by itself be as significant as the energy savings from proposed reductions in U-factor, particularly in the south.

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: CULP-EC-4-402.3.7-N1102.3.7.DOC

EC78–09/10

103.2, 202 (New), 402.3.7 (New), Table 402.3.7 (New), Table 405.5.2(1); IRC R106.1.1, R202 (New), N1102.3.7 (New), Table N1102.3.7 (New)

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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, <u>cardinal directions;</u> insulation materials and their *R*-values; fenestration *U*-factors and SHGCs; area-weighted *U*-factor and SHGC 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:

<u>**VERTICAL GLAZING.** Glazing other than skylights.</u>

<u>**WEST-FACING GLAZING AREA.** The area of vertical glazing facing between 45 degrees south of west and 30 degrees north of west, inclusive.</u>

3. Add new text and table as follows:

<u>**402.3.7 West-facing glazing area.** West-facing glazing area shall not exceed that specified in Table 402.3.7. For multifamily residential buildings, compliance shall be determined on the basis of an average west-facing glazing area per dwelling unit.</u>

TABLE 402.3.7
MAXIMUM ALLOWABLE WEST-FACING GLAZING AREA (ft^2)

CLIMATE ZONE	MAX WEST-FACING GLAZING AREA
1	from Equation 4-1
2	from Equation 4-1
3	from Equation 4-1
4 except Marine	110
5 and Marine 4	110
6	110
7	110
8	110

$$WFGA_{\max} = 110 \times \left(\frac{SHGC_{ref}}{SHGC_{prop}} \right) \quad \textbf{(Equation 4-1)}$$

where

$WFGA_{max}$ = maximum allowable west-facing glazing area (ft^2);
$SHGC_{ref}$ = glazed fenestration SHGC from Table 402.1.1; and
$SHGC_{prop}$ = the proposed glazed fenestration SHGC.

4. 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] = (c) The proposed glazing area; where the proposed glazing area is less than 15% of the conditioned floor area (d) 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)~~ Glazing orientation: Facing the West cardinal orientation, the smaller of the proposed west-facing glazing area, or 110 ft^2 with the remainder equally distributed to the other three cardinal orientations (N, E, & S). U-factor: from Table 402.1.3 SHGC: From Table 402.1 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 Winter (all hours when heating is required) = 0.85[c] External shading: none	As proposed ~~As proposed~~ As proposed As proposed As proposed Same as standard reference design As proposed

(Portions of table and footnotes not shown remain unchanged)

PART II – IRC BUILDING/ENERGY

1. Revise as follows:

R106.1.1 Information on construction documents. *Construction documents* shall be drawn upon suitable material. Electronic media documents are permitted to be submitted when *approved* by the *building official*. *Construction documents* shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the *building official.* Where required by the *building official*, all braced wall lines, shall be identified on the *construction documents* and all pertinent information including, but not limited to, cardinal directions, bracing methods, location and length of braced wall panels, foundation requirements of braced wall panels at top and bottom shall be provided.

2. Add new definitions as follows:

VERTICAL GLAZING. Glazing other than skylights.

WEST-FACING GLAZING AREA. The area of vertical glazing facing between 45 degrees south of west and 30 degrees north of west, inclusive.

3. Add new text and table as follows:

N1102.3.7 West-facing glazing area. West-facing glazing area shall not exceed that specified in Table N1102.3.7. For multifamily residential buildings, compliance shall be determined on the basis of an average west-facing glazing area per dwelling unit.

TABLE N1102.3.7
MAXIMUM ALLOWABLE WEST-FACING GLAZING AREA (ft^2)

CLIMATE ZONE	MAX WEST-FACING GLAZING AREA
1	from Equation 11-1
2	from Equation 11-1
3	from Equation 11-1
4 except Marine	110
5 and Marine 4	110
6	110
7	110
8	110

$$WFGA_{\max} = 110 \times \left(\frac{SHGC_{ref}}{SHGC_{prop}} \right)$$ **(Equation 11-1)**

where

$WFGA_{max}$ = maximum allowable west-facing glazing area (ft^2);
$SHGC_{ref}$ = glazed fenestration SHGC from Table N1102.1.1; and
$SHGC_{prop}$ = the proposed glazed fenestration SHGC.

Reason: The purpose of the proposed change is to reduce detrimental solar gains in IECC-compliant residences.

Currently the code's treatment of such gains is limited to a maximum allowable solar heat gain coefficient (SHGC) in climate zones 1-3. That prescriptive limit, however, applies universally to glazing on all faces of the home, and is unable to distinguish detrimental solar gains from beneficial gains. Its lack of sensitivity to orientation means it is not useful in reducing detrimental solar gains in colder climates because doing so would also reduce advantageous solar heat gains.

The Simulated Performance Alternative of the IECC currently allows a full accounting of the effects of solar gains by orientation, but establishes an atypical baseline assumption of glazing equally distributed to the four cardinal directions.

The proposed change would both establish a prescriptive specification to specifically limit detrimental solar gains and, for the IECC, establish a more typical home configuration as the baseline for simulated performance compliance. It does so by establishing a simple limit on the area of glazing on the west face of a building. Expressing the limit in terms of area (ft^2) rather than percentage (e.g., of total glazing area or floor area) avoids a number of complications in the code and its enforcement, and has the desirable effect of giving builders a great deal of flexibility in meeting the requirements without substantial--if any--additional cost.

The proposed change has the effect of encouraging builders to orient streets and lot layouts to achieve advantageous solar access while being flexible enough to allow a portion of lots to have less favorable orientation to accommodate views, terrain, and the basic necessities of street layout.

Via careful street/lot design and careful choice of home designs for the lots that cannot be advantageously oriented, builders can achieve maximum cooling energy savings at no additional cost. Indeed, because the proposed change reduces peak cooling loads, in many cases the builder may experience lower costs resulting from downsizing of air conditioning equipment.

The details behind the proposal and a thorough analysis of its energy impacts, based on more than 180,000 hourly simulations, is available at:

www.energycodes.gov/codedevelop/pdfs/west-facing-glazing-TSD.pdf

That analysis shows that, depending on the details of the home and the specific approach chosen by the builder to comply with the west-facing glazing area limit, the proposed change will reduce cooling energy consumption by anywhere from a few percent to 15% or more. Peak cooling loads are reduced by a similar amount. Furthermore, there is no detrimental impact on heating energy consumption and the proposed change introduces no perverse incentives.

Cost Impact: The code change proposal will increase the cost of construction in some homes, decrease the cost of construction in other homes, and have no impact on the cost of construction in most homes.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-83-103.2-202-402.3.7-IRC R106.1.1-R202-N1103.3.7-

EC79–09/10

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); IRC 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

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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 Aair 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.

~~**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. ~~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~~ 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)

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. 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-81-402.4-IRC N1102.4-

EC80–09/10

402.4.2.1.1 (New); IRC N1102.4.2.1.1 (New)

Proponent: Mike Moore, Newport Ventures, representing Broan NuTone

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

402.4.2.1.1 Mechanical ventilation requirement. If a dwelling unit of a one- and two-family dwellings or multiple single-family dwellings (townhouses) not more than three stories in height is determined to have an infiltration rate of less than five air changes per hour (ACH) when tested in accordance with Section 402.4.2.1, whole-house mechanical ventilation shall be provided in accordance with Section M1507 of the *International Residential Code*. Any other dwelling unit that is determined to have an infiltration rate of less than five air changes per hour (ACH) when tested in accordance with Section 402.4.2.1 shall be provided with mechanical ventilation in accordance with the *International Mechanical Code*.

PART II – IRC BUILDING/ENERGY

Add new text as follows:

1102.4.2.1.1 Mechanical ventilation requirement. If a dwelling unit of a one- and two-family dwellings or multiple single-family dwellings (townhouses) not more than three stories in height is determined to have an infiltration rate of less than five air changes per hour (ACH) when tested in accordance with Section N1102.4.2.1, whole-house mechanical ventilation shall be provided in accordance with Section M1507.

Reason: Everyone can agree that when homes become “too” tight, they need mechanical ventilation. The question is, “how tight is too tight?” This code change proposal offers five air changes per hour at 50 Pascal as the “too tight” limit, and directs builders to provide mechanical ventilation at this point.

Why is whole-house mechanical ventilation needed?

Indoor air quality has direct impact on the health of building occupants. Poor indoor air quality is listed by the EPA as being the fourth largest environmental threat to our country.[1] A 2007 California study revealed formaldehyde exposure in most new homes is beyond limits recommended by the California Air Resources Board. Multiple studies have shown that relying on window operation to provide ventilation is not sufficient in practice.[2,3] If unchecked, pollutants from cleaning chemicals, finishes, furniture, and occupant activities can cause serious health effects on building occupants. Whole-house mechanical ventilation reduces occupant exposure to such pollutants.

Why 5 ACH 50?

Traditionally, 0.35 natural air changes per hour has been the consensus ventilation rate at which it is believed that sufficient fresh air is being provided to building occupants. This ventilation rate was typically achieved without mechanical ventilation because homes were built without an effective air barrier. As building practices have improved, homes have become tighter, and as homes become tighter, mechanical ventilation must be introduced to provide sufficient levels of ventilation.

ASHRAE Standard 136 was developed to enable calculation of natural air changes per hour as a function of air changes at various pressures. By following the calculation procedures in this standard, it can be shown that a natural infiltration rate of 0.35 air changes per hour is equivalent to somewhere between 7 ACH 50 to 10 ACH 50, depending on the local climatic conditions of the home. Because most dwellings are built this tight, ASHRAE 62.2 requires mechanical ventilation for all homes, with few exceptions. However, based on ASHRAE 136, a conservative code might prescribe whole-house mechanical ventilation for any home with an infiltration leakage rate of 10 ACH 50 or less.

As a second point of reference, California's 2005 Title 24 Chapter 6 requires that, "Continuous mechanical ventilation (either exhaust or supply ventilation) must be installed when the target SLA is below 3.0". California's SLA of 3.0 is roughly equivalent to 6 ACH 50. As a third point of reference, NAHB's National Green Building Standard requires whole-house mechanical ventilation when the infiltration rate falls below 5.0 ACH 50. This requirement provides clear recognition from a consensus standard that whole-house mechanical ventilation should be provided for all homes that meet this threshold.

Based on the previous references, there is broad consensus across states and within consensus standards that whole-house mechanical ventilation should be required when a dwelling's infiltration falls below 5.0 ACH 50.

What states are now requiring whole-house mechanical ventilation?
Several states now require mechanical ventilation in dwellings, including MN, VT, WA, CA, and ME.

References:

1. ASHRAE Standard 62.2-2007 *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*. http://www.ashrae.org/technology/page/548
2. Price, P.N. and M.H. Sherman "Ventilation Behavior and Household Characteristics in New California Houses," April 2006. LBNL-59620 http://epb.lbl.gov/Publications/lbnl-59620.pdf
3. Offermann, F.J., et al., "Window usage, ventilation, and formaldehyde concentrations in new California homes: summer field sessions", in IAQ 2007, Healthy and Sustainable Buildings. 2007, American Society of Heating Refrigerating, and Air Conditioning Engineers, Inc.: Baltimore, MD. p. 497-526 (preprints); http://www.iee-sf.com/pdf/SummerFieldResults.pdf

Cost Impact: Where homes have infiltration rates less than 5.0 ACH 50, and those homes are not already providing whole-house mechanical ventilation, the cost of construction will increase.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MOORE-EC-1-402.4-RE-2-N1102.4.2.1

EC81–09/10

202 (New), 402.4.1, 402.4.2, 402.4.2.1, 402.4.2.2, 402.4.2.3, Table 402.4.2; IRC R202 (New), N1102.4.1, N1102.4.2, N1102.4.2.1, N1102.4.2.2, N1102.4.2.3, Table N1102.4.2

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Add new definition as follows:

<u>**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.</u>

2. Revise as follows:

402.4.1 Building thermal envelope. The *building thermal envelope* shall <u>comply with Section 402.4.2 and</u> 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 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.

COMPONENT	INSULATION INSTALLATION CRITERIA	AIR BARRIER CRITERIA
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.

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. ~~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 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 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-19-202-402.4-R202-N1102.2.4

EC82–09/10

402.4.1, 402.4.2, 402.4.2.1, 402.4.2.2, Table 402.4.2; IRC N1102.4.1, N1102.4.2, N1102.4.2.1, N1102.4.2.2, Table N1102.4.2

Proponent: Theresa Weston, PhD., representing DuPont Building Innovations

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Revise as follows:

402.4.1 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. Junction of the foundation and sill plate.
13. Junction of the top plate and the interior wall.
14. Any exposed edge of insulation.
15. Fireplace walls.

~~12~~.16. Other sources of infiltration.

402.4.2 Air sealing and insulation installation. The components of the *building thermal envelope* listed in Section 402.4.1 shall be installed in accordance with the manufacturer's instructions and following criteria, as applicable to the method of construction:

1. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and alignment with building envelope air barrier.
2. Breaks or joints in the air barrier shall be filled or sealed.
3. Air permeable insulation shall not be used as a sealing material.
4. Air permeable insulation shall be enclosed in an air barrier.
5. Insulation to be installed in non-standard framing cavity spaced shall be cut to fit the cavity or the cavity shall be insulated with insulation that will readily conform to the cavity.
6. Recessed light fixtures that penetrate the building envelope shall be airtight, IC rated, and sealed to the drywall.

Building envelope air tightness and insulation installation shall be demonstrated to comply with ~~one of the following options given by~~ Sections 402.4.2.1 ~~or~~ and 402.4.2.2:

402.4.2.1 Whole building testing ~~option~~. Building envelope tightness and insulation installation shall be considered acceptable when tested to have a maximum specific leakage area (SLA) = 0.00036. Testing shall be in accordance with ASHRAE 119 Section 5.1.~~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.

~~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, backdraft 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~~.

402.4.2.2 Visual inspection ~~option~~. Building envelope tightness and insulation installation shall be considered acceptable when the ~~items~~ areas listed in ~~Table 402.4.2~~ Section 402.4.1 are installed as described in Section 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.

2. Delete table without substitution:

~~**TABLE 402.4.2**~~
~~**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.~~
~~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 crawl spaces 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 sprayed/blown insulation.~~
~~Garage separation~~	~~Air sealing is provided between the garage and conditioned spaces.~~
~~Recessed lighting~~	~~Recessed light fixtures are air tight, 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 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.~~

PART II – IRC BUILDING/ENERGY

1. Revise as follows:

N1102.4.1 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 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 joists junction.
12. Junction of the foundation and sill plate.
13. Junction of the top plate and the interior wall.
14. Any exposed edge of insulation.
15. Fireplace walls.

~~12.~~16. Other sources of infiltration.

N1102.4.2 Air sealing and insulation installation. The components of the *building thermal envelope* listed in Section N1102.4.1 shall be installed in accordance with the manufacturer's instructions and following criteria, as applicable to the method of construction:

1. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and alignment with building envelope air barrier.
2. Breaks or joints in the air barrier shall be filled or sealed.
3. Air permeable insulation shall not be used as a sealing material.
4. Air permeable insulation shall be enclosed in an air barrier.
5. Insulation to be installed in non-standard framing cavity spaced shall be cut to fit the cavity or the cavity shall be insulated with insulation that will readily conform to the cavity.
6. Recessed light fixtures that penetrate the building envelope shall be airtight, IC rated, and sealed to the drywall.

Building envelope air tightness and insulation installation shall be demonstrated to comply with ~~one of the following options given by~~ Sections N1102.4.2.1 ~~or~~ and N1102.4.2.2:

N1102.4.2.1 Whole building testing ~~option~~. ~~Tested air leakage is less than 7 ACH when tested with a blower door at a pressure of 50 pascals (0.007 psi).~~ Building envelope tightness and insulation installation shall be considered acceptable when tested to have a maximum specific leakage area (SLA) = 0.00036. Testing shall be in accordance with ASHRAE 119 Section 5.1. 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.~~

N1102.4.2.2 Visual inspection ~~option.~~ Building envelope tightness and insulation installation shall be considered acceptable when the areas listed in Section N1102.4.1 are installed as described in Section N1102.4.2 ~~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.

2. Delete without substitution:

~~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.~~
~~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 floor.~~
~~Crawlspace 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 sprayed/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 wall~~	~~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~~	~~Fireplace walls include an air barrier.~~

Reason (Part I): This change removes options of either visual inspection or whole building testing and requires both. Air sealing cannot be accomplished without the attention to installation details that visual inspection ensures. But no list of visual inspection areas can cover all leakage points and so whole building testing is needed. This change also seeks to remove redundancies from and provide clarity to the existing code language. Table 402.4.2 which was largely redundant with the list in 402.4.1 is removed. Information in the table that was not redundant was extracted and inserted into the appropriate section of the code. The “testing option” test method and criteria were simplified to be the same those in Table 405.5.2 “air exchange rate” section.

Reason (Part II): This change removes options of either visual inspection or whole building testing and requires both. Air sealing cannot be accomplished without the attention to installation details that visual inspection ensures. But no list of visual inspection areas can cover all leakage points and so whole building testing is needed. This change also seeks to remove redundancies from and provide clarity to the existing code language. Table N1102.4.2 which was largely redundant with the list in N1102.4.1 is removed. Information in the table that was not redundant was extracted and inserted into the appropriate section of the code. The “testing option” test method and criteria were simplified to be the same those in the IECC Table 405.5.2 “air exchange rate” section.

Cost Impact (Part I): The code change proposal will increase the cost of construction.
Cost Impact (Part II): The code change proposal will not increase the cost of construction.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: WESTON-EC-2-402.4-RE-2-N1102.4

EC83–09/10

402.4.1, 402.4.2, 402.4.2.1, 402.4.2.2, Table 402.4.2; IRC N1102.4.1, N1102.4.2, N1102.4.2.1, N1102.4.2.2, Table N1102.4.2

Proponent: Theresa Weston, PhD., representing DuPont Innovations

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Revise as follows:

402.4.1 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. Junction of the foundation and sill plate.
13. Junction of the top plate and the interior wall.
14. Any exposed edge of insulation.
15. Fireplace walls.

~~12.~~16. Other sources of infiltration.

402.4.2 Air sealing and insulation installation. The components of the *building thermal envelope* listed in Section 402.4.1 shall be installed in accordance with the manufacturer's instructions and following criteria, as applicable to the method of construction:

1. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and alignment with building envelope air barrier.
2. Breaks or joints in the air barrier shall be filled or sealed.
3. Air permeable insulation shall not be used as a sealing material.
4. Air permeable insulation shall be enclosed in an air barrier.
5. Insulation to be installed in non-standard framing cavity spaced shall be cut to fit the cavity or the cavity shall be insulated with insulation that will readily conform to the cavity.
6. Recessed light fixtures that penetrate the building envelope shall be airtight, IC rated, and sealed to the drywall.

Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Sections 402.4.2.1 or 402.4.2.2:

402.4.2.1 Whole building testing option. Building envelope tightness and insulation installation shall be considered acceptable when tested to have a maximum specific leakage area (SLA) = 0.00036. Testing shall be in accordance with ASHRAE 119 Section 5.1.~~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.

~~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, backdraft 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~~.

402.4.2.2 Visual inspection option. Building envelope tightness and insulation installation shall be considered acceptable when the ~~items~~ areas listed in ~~Table 402.4.2~~ Section 402.4.1 are installed as described in Section 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.

2. Delete table without substitution:

~~TABLE 402.4.2~~
~~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.~~
~~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 crawl spaces 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 sprayed/blown insulation.~~
~~Garage separation~~	~~Air sealing is provided between the garage and conditioned spaces.~~
~~Recessed lighting~~	~~Recessed light fixtures are air tight, 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 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.~~

PART II – IRC BUILDING/ENERGY

1. Revise as follows:
N1102.4.1 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 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 joists junction.
12. Junction of the foundation and sill plate.
13. Junction of the top plate and the interior wall.
14. Any exposed edge of insulation.
15. Fireplace walls.

~~12.~~16. Other sources of infiltration.

N1102.4.2 Air sealing and insulation installation. The components of the *building thermal envelope* listed in Section N1102.4.1 shall be installed in accordance with the manufacturer's instructions and following criteria, as applicable to the method of construction:

1. Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and alignment with building envelope air barrier.
2. Breaks or joints in the air barrier shall be filled or sealed.
3. Air permeable insulation shall not be used as a sealing material.
4. Air permeable insulation shall be enclosed in an air barrier.
5. Insulation to be installed in non-standard framing cavity spaced shall be cut to fit the cavity or the cavity shall be insulated with insulation that will readily conform to the cavity.
6. Recessed light fixtures that penetrate the building envelope shall be airtight, IC rated, and sealed to the drywall.

Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Sections N1102.4.2.1 or N1102.4.2.2:

N1102.4.2.1 Whole building testing option. ~~Tested air leakage is less than 7 ACH when tested with a blower door at a pressure of 50 pascals (0.007 psi).~~ Building envelope tightness and insulation installation shall be considered acceptable when tested to have a maximum specific leakage area (SLA) = 0.00036. Testing shall be in accordance with ASHRAE 119 Section 5.1. 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.~~

N1102.4.2.2 Visual inspection option. Building envelope tightness and insulation installation shall be considered acceptable when the areas listed in Section N1102.4.1 are installed as described in Section N1102.4.2 ~~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.

2. Delete table without substitution:

~~**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.~~
~~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 floor.~~
~~Crawlspace 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 sprayed/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 wall~~	~~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~~	~~Fireplace walls include an air barrier.~~

Reason
(Part I)- This change seeks to remove redundancies from and provide clarity to the existing code language. Table 402.4.2 which was largely redundant with the list in 402.4.1 is removed. Information in the table that was not redundant was extracted and inserted into the appropriate section of the code. The “testing option” test method and criteria were simplified to be the same those in Table 405.5.2 “air exchange rate” section.
(Part II)- This change seeks to remove redundancies from and provide clarity to the existing code language. Table N1102.4.2 which was largely redundant with the list in N1102.4.1 is removed. Information in the table that was not redundant was extracted and inserted into the appropriate section of the code. The “testing option” test method and criteria were simplified to be the same those in the IECC Table 405.5.2 “air exchange rate” section.

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: WESTON-EC-4-402.4-RE-1-N1102.4

EC84–09/10
402.4.1.1; IRC N1102.4.6

Proponent: Wendy Johnson, Midway City, representing the Utah Chapter of ICC

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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.

PART I – IECC

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

PART II – IRC Energy

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

ICCFILENAME: JOHNSON(WENDY)-EC-1-402.4.1.1-RE-1-N1102.4.6

EC85–09/10
402.4.1, Table 402.4.2

Proponent: Ron Nickson, representing the National Multi Housing Council

Revise as follows:

402.4.1. 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 window, 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 ceiling separating a garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. ~~Common walls between dwelling units.~~

~~10.~~ 9. Attic access openings.
~~11.~~ 10. Rim joists junctions.
~~12.~~ 11. Other sources of infiltration.

TABLE 402.4.2
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.
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 attaché to walls. Exposed earth in unvented crawl spaces is covered with Class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Ducts 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 sprayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned space.
Recessed lighting	Recessed light fixtures are air tight, IC rated, and sealed to drywall. Exception – fixtures in conditioned spaced.
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 wall	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	HV AC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace	Fireplace walls include an air barrier.

Reason: The change would remove the requirement for an air barrier in the common wall between dwelling units. This is not an energy issue in that heat or cooling moving between units does not increase or decrease the building energy usage. The wall separating dwelling units per Section 420.2 has to be a fire partition and the installation of a foreign material into the wall to comply with the requirement for the air barrier would not be in compliance with the fire resistance rating of the fire barrier wall. The construction of a fire barrier that complies with the code will provide most of, if not all of the intent of the requirement that the common wall between dwelling units have an air barrier.

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

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

ICCFILENAME: NICKSON-EC-1-402.4.1

EC86–09/10
Table 402.4.2; IRC Table N1102.4.2

Proponent: Charles C. Cottrell, North American Insulation Manufacturers (NAIMA)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGYCOMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

TABLE 402.4.2
VISUAL AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	<u>Exterior thermal envelope contains a continuous air barrier</u> 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)

PART II – IRC ENERGY

TABLE N1102.4.2
VISUAL AIR BARRIER AND INSULATION INSPECTION COMPONENT CRITERIA

COMPONENT	CRITERIA
Air barrier and thermal barrier	<u>Exterior thermal envelope contains a continuous air barrier</u> 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: COTTRELL-EC-2-T. 402.4.2-T. N1102.4.2.DOC

EC87–09/10
402.4.2.1.1 (New), Chapter 6; IRC N1102.4.2.1.1 (New), Chapter 44

Proponent: Steve Ferguson, representing The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Add new text as follows:

402.4.2.1.1 Mechanical ventilation requirement. If a dwelling unit of a one- and two-family dwelling or multiple single-family dwelling (townhouse) not more than three stories in height is determined to have an infiltration rate of less than five air changes per hour (ACH) when tested in accordance with Section 402.4.2.1, whole-house mechanical ventilation shall be provided in accordance with ASHRAE 62.2. Any other dwelling unit that is determined to have an infiltration rate of less than five air changes per hour (ACH) when tested in accordance with Section 402.4.2.1 shall be provided with mechanical ventilation in accordance with the *International Mechanical Code*.

2. Add new standard to Chapter 6 as follows:

ANSI/ASHRAE

Standard 62.2-2007 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

PART II – IRC BUILDING/ENERGY

1. Add new text as follows:

1102.4.2.1.1 Mechanical ventilation requirement. If a dwelling unit of a one- and two-family dwelling or multiple single-family dwelling (townhouse) not more than three stories in height is determined to have an infiltration rate of less than five air changes per hour (ACH) when tested in accordance with Section N1102.4.2.1, whole-house mechanical ventilation shall be provided in accordance with ASHRAE 62.2.

2. Add new standard to Chapter 6 as follows:

ANSI/ASHRAE

Standard 62.2-2007 Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings

Reason: The purpose of this proposal is to provide modest levels of continuous mechanical ventilation in detached one- and two-family houses and low-rise townhouses in order to provide minimum levels of ventilation.

For health and safety reasons, minimum ventilation is necessary to provide acceptable indoor air quality. Modern homes are much tighter than the building stock and do not provide adequate ventilation through air leakage or infiltration. Occupants do not operating windows to provide minimum ventilation levels. Providing continuous mechanical ventilation is required to provide minimum ventilation rates in current construction.

Substantiation: Ventilation is used to control pollutant concentrations in buildings. These pollutants are emitted from building materials, consumer products, and from occupants themselves. Continuous mechanical ventilation reduces these large concentrations and reduces the large exposures for building occupants.

Because of the effects it has on health, comfort, and serviceability, indoor air quality in our homes is becoming of increasing concern to many people. According to the American Lung Association elements within our homes have been increasingly recognized as threats to our respiratory health. The Environmental Protection Agency lists poor indoor air quality as the forth-largest environmental threat to our country. Asthma is leading serious chronic illness of children in the U.S. Moisture-related construction defects and damage are on the increase in new houses. A 2007 California study revealed formaldehyde exposure in most new homes is beyond limits recommended by the California Air Resources Board. Minimum residential ventilation can improve many of these indoor air quality problems.

ASHRAE Standard 62.2-2007 is the only national consensus standard on residential ventilation rates. ASHRAE, the American Society of Heating, Refrigerating and Air-conditioning Engineers, has been setting minimum ventilation rates for buildings for over 100 years in order to provide acceptable indoor air quality. The rates in this proposal are the minimum rates as incorporated in the current version of Standard 62.2. As an ANSI standard, these rates represent the consensus of a balanced committee and have undergone extensive public review.

Sherman and Hodgson (2002) have shown that the rates in this proposal are barely sufficient to dilute the typical amount of formaldehyde emitted in typical new construction. The consensus of knowledgeable and balanced experts supports the ventilation rates in Standard 62.2-2007. As of the drafting of this proposal, several states have adopted similar ventilation requirements (e.g. MN, VT, WA, CA, ME). Of these, California and Maine have now adopted ASHRAE 62.2 by reference.

Price and Sherman (2006) have shown that occupants of new homes do not operate their windows and doors sufficiently to meet minimum ventilation requirements through controlled openings. While there are 20% of the population who would manage their windows effectively during mild periods, the vast majority of occupants keep their windows closed most of the time and do not get sufficient ventilation from window and door operation.

Sherman and Chan (2006) have reviewed air tightness data. New houses are substantially tighter than the existing stock and do not get enough ventilation through air infiltration and air leakage to meet minimum rates. Walker and Sherman (2006) have shown that the energy costs of meeting ASHRAE Standard 62.2 would be substantially higher for a house that was leaky enough to meet it through infiltration.

The reference to HVI 916 is provided to ensure that fans comply with industry standards for air flow verification. As a point of reference, MN state 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).

Bibliography: ASHRAE Standard 62.2-2007 *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings.* http://www.ashrae.org/technology/page/548

Price, P.N. and M.H. Sherman "Ventilation Behavior and Household Characteristics in New California Houses," April 2006. LBNL-59620 http://epb.lbl.gov/Publications/lbnl-59620.pdf

Sherman, M. H. and A.T. Hodgson. "Formaldehyde as a Basis for Residential Ventilation Rates", 2002. LBNL-49577. http://epb.lbl.gov/Publications/lbnl-49577.pdf

Walker, I. S. and M. H. Sherman "Evaluation of Existing Technologies for Meeting Residential Ventilation Requirements." 2006. LBNL-59998. http://epb.lbl.gov/Publications/lbnl-59998.pdf

Sherman, M.H., Chan W. R., "Building Airtightness: Research and Practice" in Building Ventilation: the state of the art, (Santamouris, Wouters, Eds) Earthscan ISBN-13: 978-1-84407-130-2 pp. 137-162, 2006, http://epb.lbl.gov/Publications/lbnl-53356.pdf

Offermann, F.J., et al., "Window usage, ventilation, and formaldehyde concentrations in new California homes: summer field sessions", in IAQ 2007, Healthy and Sustainable Buildings. 2007, American Society of Heating Refrigerating, and Air Conditioning Engineers, Inc.: Baltimore, MD. p. 497-526 (preprints); http://www.iee-sf.com/pdf/SummerFieldResults.pdf

Cost Impact: The code change proposal will increase the cost of construction modestly by requiring a mechanical fan system rated for continuous operation.

Analysis: A review of the standard(s) proposed for inclusion in the code, ANSI/ASHRAE 62.2-07, 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: FERGUSON-EC-4-402.4.2.1.1-CH 6-RE-1-N1102.4.2.1.1-CH 44

EC88–09/10
Table 402.4.2, Chapter 6

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.

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

ICCFILENAME: PICKETT-EC-3-T. 402.4.2

EC89–09/10
402.4.3, Chapter 6; IRC N1102.4.3

Proponent: Joseph Hill, RA, representing the New York State Department of State

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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

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.

PART I- IECC

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

PART I- IRC

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

ICCFILENAME: HILL-EC-5-402.4.3-RE-1-N1102.4.3

EC90–09/10
402.4.4; IRC N1102.4.4

Proponent: Jeff Burton, Director of Codes and Standards Association of Millwork Distributors, representing Association of Millwork Distributors

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

402.4.4 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 ~~NFRC400 or AAMA/WDMA/CSA101/I.S.2/A440~~ ASTM E283 by an accredited, independent laboratory, and listed and labeled by the manufacturer.

Exception: Site-built windows, skylights and doors.

PART II – IRC ENERGY

Revise as follows:

N1102.4.2 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 ~~NFRC400 or AAMA/WDMA/CSA101/I.S.2/A440~~ ASTM E283 by an accredited, independent laboratory, and listed and labeled by the manufacturer.

Exception: Site-built windows, skylights and doors.

Reason: This action would clarify the code by eliminating two standards and replacing with their referenced source air infiltration standard. Both the NFRC 400 and the AAMA/WDMA/CSA101.I.S.2/A440 reference the 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 their method for testing air infiltration.

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: BURTON-EC-1-402.4.4-RE-1-N1102.4.2

EC91–09/10
402.4.4; IRC N1102.4.4

Proponent: Jeff Lowinski, Window and Door Manufacturers Association (WDMA)

THIS IS A 2 PART CODE CHANGE. PART WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: Lowinski-RE-1-N1102.4.4-EC-402.4.4

EC92–09/10
402.4.5; IRC N1102.4.5

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

402.4.5 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 <u>having an air leakage rate not more than 2.0 cfm (0.944 L/s)</u> ~~meeting ASTM E 283~~ when tested in accordance with ASTM E 283 at <u>a</u> 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.

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1102.4.5 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 <u>having an air leakage rate not more than 2.0 cfm (0.944 L/s)</u> ~~meeting ASTM E 283~~ when tested in accordance with ASTM E 283 at <u>a</u> 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.

Reason: Clarification and consistency with other sections. It is appropriate to provide the criterion first and then the relevant test condition and reference standard. In addition it is not relevant to indicate where the air movement comes from or goes to as the issue of leakage rate is addressed in the standard. In addition the current text refers to sealing the housing and an interior wall yet the current text for testing refers only to ceiling cavity. This is inconsistent and is taken care of in the proposed text.

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-80-402.4.5-IRC N1102.4.5

EC93–09/10
402.4.5, 502.4

Proponent: Ken Sagan, representing National Association of Home Builders (NAHB)

Revise as follows:

402.4.5 Recessed lighting. Recessed luminaires ~~installed in~~ <u>that penetrate</u> the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces, ~~All~~ <u>and</u> ~~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. <u>Recessed luminaires in contact with</u>

insulation shall be listed and labeled as IC-rated. ~~All Recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.~~

502.4.8 Recessed lighting. Recessed luminaires ~~installed in~~ that penetrate the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces, ~~All~~ and ~~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. Recessed luminaires in contact with insulation shall be listed and labeled as IC-rated. ~~All Recessed luminaires shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.~~

Reason: As currently written, this provision requires an IC rated fixture, even in those interior ceilings and walls where insulation contact is not a consideration. If you look closely at the changes shown in the original proposal, the installation of recessed fixtures that "penetrate" the thermal envelope will need to comply with the stated requirements of ASTM E 283, only those recessed fixtures in contact with insulation will need to be IC rated. This is the same as is required by the NEC.

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

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

ICCFILENAME: SAGAN-EC-10-402.4.5-502.4

EC94–09/10
402.5

Proponent: Craig Conner, Building Quality, representing self; Vickie Lovell, InterCode Incorporated, representing the Association of Industrial Metallized Coaters and Laminators

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 404 in Zones 1 through 3 shall be 0.50.~~

Reason: (**Conner)** The limits on U-factor and SHGC trade-offs reduce flexibility without any compensating energy savings. This section was removed from the IRC so its removal from the IECC aligns the two codes. The statement of a limit on trade-offs is often confused with the actual requirement itself (in Table 402.1). The "area-weighted average" calculation in this section is a complication the code does not need.

Reason: (Lovell**)** Limits on fenestration U-factor and SHGC tradeoffs do not promote flexibility and place unfair restrictions on how code compliance can be achieved. Additionally, it causes confusion to designers, code officials and all other users of the code by over-complicating it. It creates a subset of prescriptive requirements in the performance path which is inappropriate and is not consistent with the intent of the performance objectives of the code. Perhaps most importantly, the restrictions on the UA trade-off approach do not save energy. These limitations have already been removed from the IRC and therefore, should be deleted from the IECC in order to maintain consistency, reduce confusion and improve and strengthen the code as it was originally intended.

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-3-Lovell-EC-2-402.5.DOC

EC95–09/10 (Number not used)

EC96–09/10
402.5; IRC N1102.3.6 (New)

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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~~.

PART II – IRC BUILDING/ENERGY

Add new text 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 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.

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.

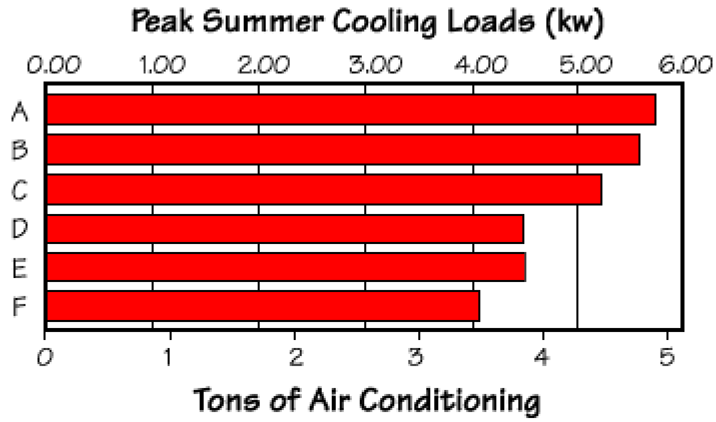
The fenestration trade-off limits currently found in Section 402.5 of the 2009 *IECC* are simple, mandatory measures that ensure all new homes contain high-quality, cost-effective windows that save energy, provide reasonable comfort, resist condensation in colder climates and block unwanted solar gain 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.

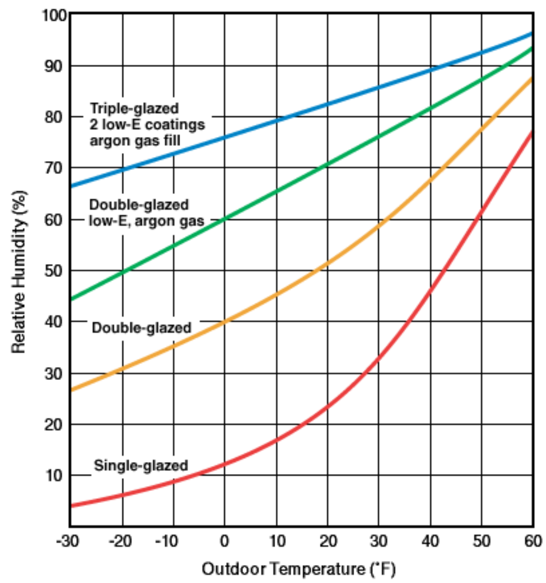
Benefits of Section 402.5 Fenestration Maximums:

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.

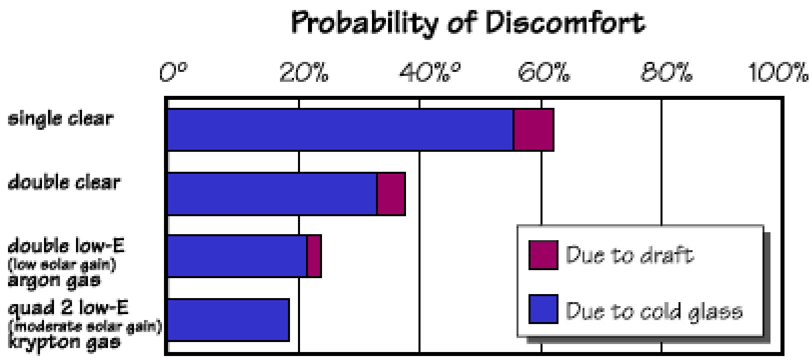


Note: Condensation occurs above the lines for each product type

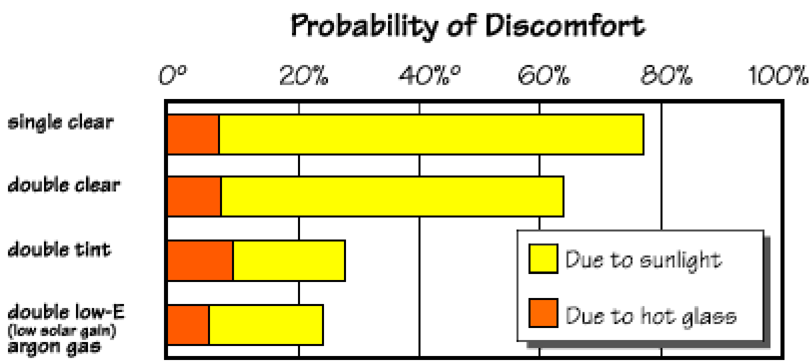
According to the chart, a typical double-glazed low-e window can withstand a 0 degree outdoor temperature and 60% relative humidity inside before condensation will begin to collect. By contrast, a regular double-glazed window can only withstand 40% humidity at the same outdoor temperature. In other words, 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-20-402.5-N1102.3.6

EC97–09/10
402.5

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.

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

ICCFILENAME: SAGAN-EC-6-402.5

EC98–09/10
202, Chapter 6; IRC R202, Chapter 44

Proponent: Theresa Weston, PhD., representing DuPont Building Innovations

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Revise definition as follows:

AIR BARRIER. Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material or a combination of materials. <u>Air barrier materials shall have an air permeance not to exceed 0.004 cfm/ft^2 under a pressure differential of 0.3 in. water (1.57psf) (0.02 L/s.m^2 @ 75 Pa) when tested in accordance with ASTM E 2178</u>.

2. Add new standard to Chapter 6 as follows:

ASTM
<u>E 2178-03</u> <u>Standard Test Method for Air Permeance of Building Materials</u>

PART II – IRC BUILDING/ENERGY

1. Revise definition as follows:

AIR BARRIER. Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material, or a combination of materials. <u>Air barrier materials shall have an air permeance not to exceed 0.004 cfm/ft^2 under a pressure differential of 0.3 in. water (1.57psf) (0.02 L/s.m^2 @ 75 Pa) when tested in accordance with ASTM E 2178</u>.

2. Add new standard to Chapter 44 as follows:

ASTM
<u>E 2178-03</u> <u>Standard Test Method for Air Permeance of Building Materials</u>

Reason: Currently *air barriers* are defined but have no quantitative criteria. The proposed criteria for air barrier materials is used widely across the industry including in ICC-ES AC38 Acceptance Criteria for Water-Resistive Barriers and the Massachusetts State Energy Code (Section 1304.3.1) It originated from the air barrier material requirements of the Canadian Construction Materials Center (CCMC), which have been in effect since 1996.

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

Analysis: In the opinion of ICC staff, proposed referenced standard ASTM E 2178-03 complies with the standards policy given in Section 3.6 of CP28.

PART I – IECC

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

PART II – IRC

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

ICCFILENAME: WESTON-EC-1-202-RB-3-R202

EC99–09/10

202 (New), 403.5.1 (New), Table 403.5.1 (New), Chapter 6; IRC R202 (New), N1103.5.1 (New), Table N1103.5.1 (New), Chapter 44

Proponent: Mike Moore, Newport Ventures, representing Broan NuTone

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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

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
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 ***<u>Savings</u>*** (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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MOORE-EC-2-202-403-RE-1-R202-N1103

EC100–09/10

403.1, 403.1.3 (New); IRC N1103.1, N1103.1.3 (New)

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Revise as follows:

403.1 Controls (Mandatory). At least one thermostat shall be provided for each separate heating and cooling <u>zone as defined by Section 403.1.3</u> ~~system~~.

2. Add new text as follows:

<u>**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:</u>

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.

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-22-403.1-N1103.1

EC101–09/10

202 (New), 403.1.1, Table 403.1.1 (New); IRC R202 (New), N1103.1.1, Table N1103.1.1 (New)

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-21-202-403.1.1-R202-N1103.1.1

EC102–09/10

Table 402.1.3, Table 405.5.2(1); IRC Table N1102.1.2

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC CODE COMMITTEE AND PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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)

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.

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

ICCFILENAME: MAJETTE-EC-71-T. 403.1.3-IRC T. N1102.1.2

EC103–09/10

403.2.1, 403.2.2, 403.2.3; IRC N1103.2.1, N1103.2.2, N1103.2.3

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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 ft² (9.29 m²) 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 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~~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 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.

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 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 square feet (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 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-23-403.2.1-N1103.2.1

EC104–09/10

403.2.2, Chapter 6; IRC N1103.2.2, Chapter 44

Proponent: Craig Conner, Building Quality, representing self

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Add new text as follows:

403.2.2 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 Test for Determining the Air Leakage Rate for HVAC Equipment

PART II – IRC ENERGY

1. Add new text as follows:

N1103.2.2 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 Test for Determining the Air Leakage Rate for HVAC Equipment

Reason: The requirement to "seal" the air handler is already in the IECC/IRC. Because the air inside the handler is under high pressure, even small leaks cause considerable air loss. The manufacturer sealing and testing the air handler in the factory is very cost-effective.

A manufacturer's designation (label) that the air handler is sealed simplifies compliance. Inspection becomes the simple act of verifying that the manufacturer designation is on the air handler. Most manufacturers are already testing at least some of their air handlers for air tightness.

The ASHRAE 193 standard provides the test for the air handler. ASHRAE 193 is expected to be completed before the end of this code cycle. If the ASHRAE 193 standard is not completed before the final action hearing then the reference to that standard cannot be put into the energy 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, 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: CONNER-EC-11-403.2.2 - N1103.2.2.DOC

EC105–09/10
403.2.2, 402.2.3, 403.6, Chapter 6

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.

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

ICCFILENAME: DAVIS-EC1-403.2.2.DOC

EC106–09/10

403.2.2 (New), Chapter 6; IRC N1103.2.2.1 (New), Chapter 44

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-61-403.2.2.1-N1103.2.2.1

EC107–09/10
403.2.2; IRC N1103.2.2

Proponent: Ronald Majette, US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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*.

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 I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-73-403.2.2-IRC N1103.2.2

EC108–09/10

403.2.2, 403.6, 405.6.1, Table 404.5.2(1), Chapter 6

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*~~ <u>ACCA Manual J</u>. 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 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 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 <u>ACCA Manual J-02</u>. ~~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*~~ <u>ACCA Manual J</u>.
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.

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

ICCFILENAME: VIGNEAU-EC-2-403.2.2

EC109–09/10
403.2.3; IRC N1103.2.3

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

403.2.3 Building cavities. Building framing cavities shall not be used as ~~supply~~ ducts or plenums.

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.

PART I – IECC

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

PART II – IRC

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

ICCFILENAME: MAJETTE-EC-75-403.2.3-IRC N1103.2.3-REDONE

EC110-09/10
403.3.1(New)

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.

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

FILENAME: AHERN-EC-1-403.3.1

EC111–09/10
403.4, 403.4 (New), 504.5, 505 (New), Section 505 (New), 505.1 (New)

Proponent: Gregory A. Farmer, PE, ASPE Legislative Committee, ASPE

1. Revise as follows:

403.4 Circulating hot water systems (Mandatory). All circulating service hot water piping shall be externally insulated with material having a thermal resistance rating ~~to at least~~ of not less than R-~~2~~ 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.

2. Add new text as follows:

403.4 Potable water piping insulation (Mandatory). Hot and tempered water main distribution pipes and the branches from such pipes for a developed length of ten branch pipe diameters from the main distribution pipes shall be externally insulated. Cold water pipes located in spaces where conditions could cause condensation to form on the exterior of the pipes shall be externally insulated. The pipe insulation required by this section shall have a thermal resistance rating of not less than R-4.

(Renumber subsequent sections)

3. Revise as follows:

504.5 Pipe insulation. For automatic-circulating hot water systems, piping shall be externally insulated with a material having a thermal resistance rating of not less than R-4. ~~with 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft^2 × °F (1.53 W per 25 mm/m^2 × K).~~ The first 8 feet (2438 mm) of piping in noncirculating systems served by equipment without integral heat traps shall be externally insulated. ~~with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h × ft^2 × °F (1.53 W per 25 mm/m^2 × K)~~. Hot and tempered water main distribution pipes and the branches from such pipes for a developed length of ten branch pipe diameters from the main distribution pipes shall be externally insulated. The pipe insulation required by this section shall have a thermal resistance rating of not less than R-4.

4. Add new text as follows:

SECTION 505
COLD WATER PIPING
(Mandatory)

505.1 Cold water piping condensation control. Cold water pipes located in spaces where conditions could cause condensation to form on the exterior of the pipes shall be externally insulated. The pipe insulation shall have a thermal resistance rating of not less than R-4.

(Renumber subsequent sections)

Reason: Hot water piping losses considerable amounts of heat and wastes energy. Insulation of hot and tempered water piping will reduce energy costs and more than pay for the initial cost of insulation. However, non-circulated branches loss the heat energy regardless of the insulation, therefore it is not necessary to insulate non circulated branch piping, except where they will affect the heat loss in the adjacent circulated main. It is generally accepted in other industries that the temperature decay in non-circulated branch piping from the system temperature to ambient is ten pipe diameters of the branch. Insulation applied to cold water piping will eliminate damage to ceilings and significantly reduce pipe system corrosion due to condensation.

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

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

ICCFILENAME: FARMER-EC1-403.4

EC112–09/10

202 (New), 403.4, 403.4.1, 403.4.2 (New), Table 403.4.2; IRC R202 (New), N1103.4, N1103.4.1, N1103.4.2 (New), Table N1103.4.2 (New)

Proponents: Ronald Majette, US Department of Energy; Craig Conner, Building Quality

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE AND PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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	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.
(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.

PART I – IECC

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

PART II – IRC

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

CCFILENAME: MAJETTE-EC-82-CONNER-EC-13-202-403.4-IRC R202-N1103.4-REDONE

EC113–09/10

403.4 (New), 403.4.1 (New), 403.4.2 (New), 403.4.3, 403.4.4 (New)

Proponents: Edward R. Osann, Potomac Resources, Inc.; Gary Klein, Affiliated International Management, LLC, Representing Alliance for Water Efficiency

1. Add new text as follows:

403.4 Service hot water piping (Mandatory). Service hot water piping shall be installed in accordance with Sections 403.4.1 through 403.4.4.

403.4.1 Pipe insulation. Service hot water piping installed below ground or in a mass floor or *mass wall* in contact with the ground shall be insulated to at least R-3.

403.4.2 Insulation protection. Insulated service hot water piping installed below ground shall be placed within a waterproof channel or conduit.

Exceptions:

1. Where pipe insulation is warranted as waterproof in underground applications in damp soil when installed according to the manufacturer's instructions.
2. Where pipe insulation is warranted as maintaining a value of R-3 in underground applications in damp soil when installed according to the manufacturer's instructions.

2. Revise as follows:

~~403.4~~ 403.4.3 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 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:

403.4.4 Accommodation of pipe insulation. All hot water supply pipe to be insulated shall be strapped or affixed such that insulation is continuous. Building cavities shall be large enough to accommodate the combined diameter of the pipe plus the insulation, plus any other objects in the cavity that the piping must cross.

Reason: Roughly 1/3 of residential indoor per capita water consumption has been found to be attributable to faucets, showers, and baths – applications where warm to hot water is desirable, if not essential.[1] Hot water use represents 15 to 30% of total residential energy bills.[2] It is common practice for residents to draw water from hot water fittings without use until the hot water reaches the desired temperature. Such wait times have the effect of wasting energy and water while reducing consumer satisfaction. This proposal is needed to reduce this common waste of energy and water in residential buildings, and is most practical to achieve in new construction.

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 1 degree F 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. These include morning "rush hour" (getting ready for work and school) and evening plateau (coming home from school and work, preparing, eating, and cleaning up from supper, and getting ready for bed), and of course lunch when people are home during the day.[3 4]

Hot water service pipe insulation is particularly important when piping is installed in a mass floor or wall or is buried. Uninsulated pipe buried in damp conditions loses heat at 4 to nearly 9 times the rate of uninsulated pipes in room temperature air. Adding insulation to buried pipe in damp conditions reduces heat loss by about 90%.[5] Due to the inaccessibility of buried pipe once installed, care must be taken to prevent or slow the degradation of insulation value over time in damp soil conditions.

[1]Mayer, et al, *Residential End Uses of Water*, AWWA Research Foundation, 1999, p. 107.
[2]Klein, Gary, "Greening the Plumbing in Your Home and Business", slide 15 in a presentation made to classes sponsored by Pacific Gas and Electric Company and Southern California Gas Company in 2008 and 2009, Affiliated International Management, LLC.
[3]Klein, Gary, "Hot Water Distribution Research," *Official* Magazine, Sept-Oct 2006, pages 39-44.
[4]Klein, Gary, "Designing 'Green' Hot Water Distribution Systems," *PM Engineer*, July 2008, pages 16-24.
[5]Hiller, Carl, "Hot Water Distribution System Piping Heat Loss Factors, Both In-Air and Buried – Phase II Test Results," paper presented to ASHRAE Annual Meeting, Salt Lake City, June 22, 2008.

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

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

ICCFILENAME: OSANN-EC-1-403.4

EC114–09/10

403.4 (New), 403.4.1 (New), 403.4.2 (New), 403.4.3 (New); IRC N1103.4 (New), N1103.4.1 (New), N1103.4.2 (New), N1103.4.3 (New)

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Add new text as follows:

<u>**403.4 Service water heating (Mandatory)**. Service hot water piping shall be installed in accordance with Sections 403.4.1 through 403.4.3.</u>

<u>**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.</u>

> <u>**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):</u>
>
> 1. <u>Condensing gas service water heating equipment,</u>
> 2. <u>Solar thermal water heating equipment that is designed to provide more than 50 percent of annual hot water requirements from solar heated water,</u>
> 3. <u>Heat pump electric service water heating equipment,</u>
> 4. <u>Tankless demand service gas water heating equipment, or</u>
> 5. <u>Tankless demand service electric heating equipment, where either:</u>
>   - <u>5.1. Heated water is provided through piping that is insulated to R-3 or</u>
>   - <u>5.2. There is no more than a total of 15 linear feet of pipe length to all fixtures being served by each unit.</u>

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.

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-24-403.4-N1103.4

EC115–09/10

403.4; IRC N1103.4

Proponent: Michael Resetar, Armacell LLC; Roger Schmidt, K-Flex USA; Shawn Dunahue, Nomaco Insulation

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

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:

IECC 2000:
Had Table 504.5

SERVICE WATER HEATING TEMPERATURES °F.	PIPE SIZES[a]			
	Noncirculating runouts	Circulating mains and runouts		
	Up to 1[2]	Up to 1.25[2]	1.5[2] to 2[2]	Over 2[2]
170-180	0.5	1.0	1.5	2.0
140-160	0.5	0.5	1.0	1.5
100-130	0.5	0.5	0.5	1.0

For SI: 1 inch = 25.4 mm, °C. = [(°F.)-32]/1.8,
1 Btu per inch/h × ft.2 × °F. = 0.144 W/(m × K).
a Nominal iron pipe size and insulation thickness. Conductivity, *k* @ 0.27

IECC 2003:
Had Table 504.5

SERVICE WATER-HEATING TEMPERATURES (°F)	PIPE SIZES[a]			
	Noncirculating runouts	Circulating mains and runouts		
	Up to 1"	Up to 1.25"	1.5" to 2"	Over 2"
170 -180	**½**	**1**	**1½**	**2**
140 -169	**½**	**½**	**1**	**1½**
100 -139	**½**	**½**	**½**	**1**

For SI: 1 inch = 25.4 mm, °C = [(°F)-32]/1.8,
1 Btuh/inch · ft2 · °F = 0.144 W/(m · K).
a. Nominal iron pipe size and insulation thickness. Conductivity, *k* = 0.27.

IECC 2006:
Removed Table 504.5 and created Section 403 for SYSTEMS (Mandatory)
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 stayed 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%	

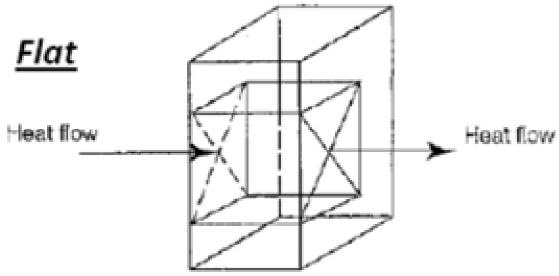
	Summer Performance		Winter Performance	
Conditional Information	**R-3**	**R-4**	**R-3**	**R-4**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	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%	

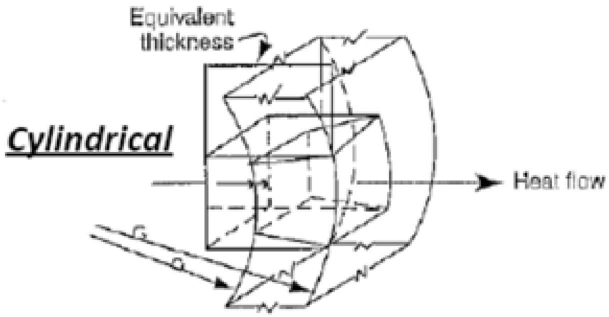
	Summer Performance		Winter Performance	
Conditional Information	**R-2**	**R-4**	**R-2**	**R-4**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	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:





$$R = \frac{r2 \ln(\frac{r2}{r1})}{k}$$

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 = $\dfrac{\textit{Thickness of Material}}{\textit{Material Thermal Conductivity}}$

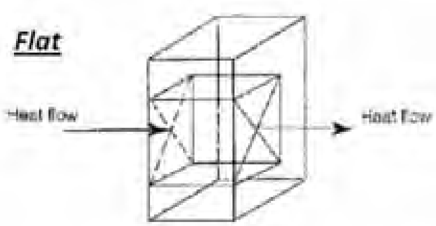
Sheet Insulation Thickness: 2"
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting "R" Value : R-8.0 *(R-8 equals 8 resistance units)*

(*) 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.

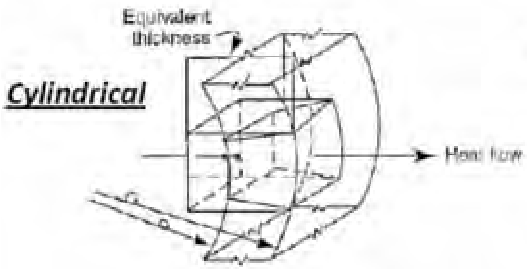


R = $\dfrac{\textit{Thickness of Flat Sheet Material}}{\textit{Material Thermal Conductivity}}$

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:

$$R = \frac{r2\ln\left(\frac{r2}{r1}\right)}{k}$$

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	5.5	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•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:

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:

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

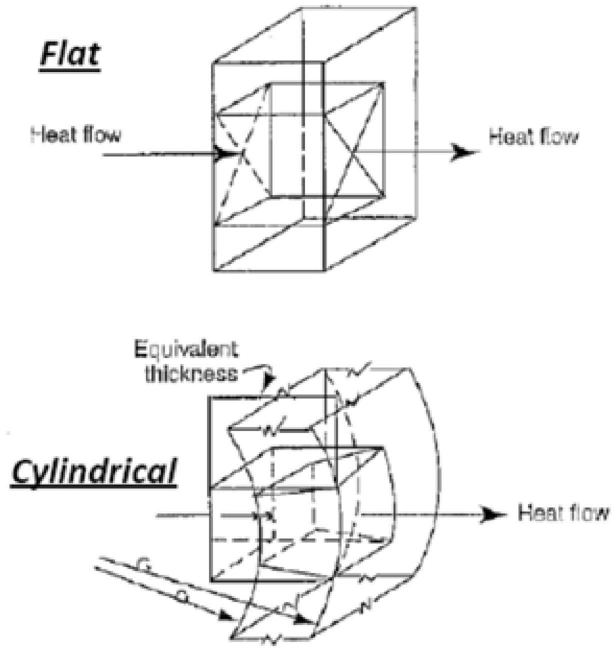
Conditional Information	Summer Performance		Winter Performance	
	R-2	R-3	R-2	R-3
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	1.60
Outer diameter 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%	

Conditional Information	Summer Performance		Winter Performance	
	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%	

Conditional Information	Summer Performance		Winter Performance	
	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:

$$R = \frac{\textit{Thickness of Material}}{\textit{Material Thermal Conductivity}}$$

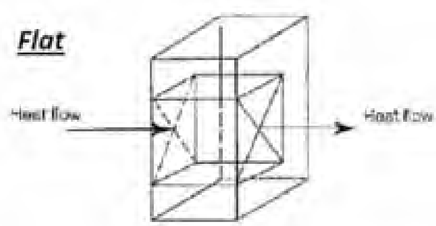
Sheet Insulation Thickness: 2"
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting "R" Value : R-8.0 *(R-8 equals 8 resistance units)*

(*) 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.

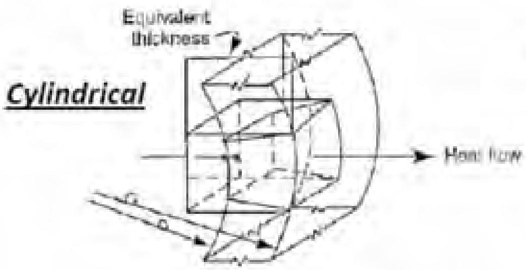


$$R = \frac{\textit{Thickness of Flat Sheet Material}}{\textit{Material Thermal Conductivity}}$$

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	5.5	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•ft²•°F

Cost Impact: Shifting from an R-2 requirement to an R-4 insulation requirement helps achieve 29.4% gain in performance efficiency.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: RESETAR-SCHMIDT-DUNAHUE-EC-1-403.4-RE-2-N1103.4

EC116–09/10
403.4; IRC N1103.4

Proponent: Michael Resetar, Armacell LLC; Roger Schmidt, K-Flex USA; Shawn Dunahue, Nomaco Insulation

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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.

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1103.4 ~~Circulating~~ hot water systems. All ~~circulating service~~ hotwater piping shall be insulated to at least ~~R-2~~ <u>R-4</u>. 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.

<u>Past History:</u>

<u>IECC 2000:</u>
Had Table 504.5

SERVICE WATER HEATING TEMPERATURES °F.	PIPE SIZES[a]			
	Noncirculating runouts	Circulating mains and runouts		
	Up to 1^{2}	Up to 1.25^{2}	1.5^{2} to 2^{2}	Over 2^{2}
170-180	0.5	1.0	1.5	2.0
140-160	0.5	0.5	1.0	1.5
100-130	0.5	0.5	0.5	1.0

For SI: 1 inch = 25.4 mm, °C. = [(°F.)-32]/1.8,
1 Btu per inch/h × ft.2 × °F. = 0.144 W/(m × K).
a Nominal iron pipe size and insulation thickness. Conductivity, *k* @ 0.27

<u>IECC 2003:</u>
Had Table 504.5

SERVICE WATER-HEATING TEMPERATURES (°F)	PIPE SIZES[a]			
	Noncirculating runouts	Circulating mains and runouts		
	Up to 1"	Up to 1.25"	1.5" to 2"	Over 2"
170 -180	**½**	**1**	**1½**	**2**
140 -169	**½**	**½**	**1**	**1½**
100 -139	**½**	**½**	**½**	**1**

For SI: 1 inch = 25.4 mm, °C = [(°F)-32]/1.8,
1 Btuh/inch · ft2 · °F = 0.144 W/(m · K).
a. Nominal iron pipe size and insulation thickness. Conductivity, *k* = 0.27.

<u>IECC 2006:</u>
Removed Table 504.5 and created Section 403 for SYSTEMS (Mandatory)
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"

<u>IRC 2007/2008:</u>
All insulation stayed 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"

<u>IRC 2009/2010:</u> (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"

<u>TARGET:</u>
30% Conservation Savings Achieved shifting from R-2 to R-4

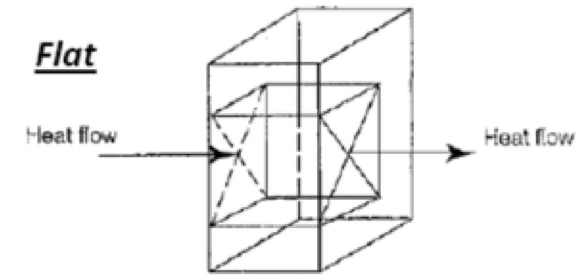
Conditional Information	Summer Performance R-2	Summer Performance R-3	Winter Performance R-2	Winter Performance R-3
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	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%	

Conditional Information	Summer Performance R-3	Summer Performance R-4	Winter Performance R-3	Winter Performance 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%	

Conditional Information	Summer Performance R-2	Summer Performance R-4	Winter Performance R-2	Winter Performance 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.

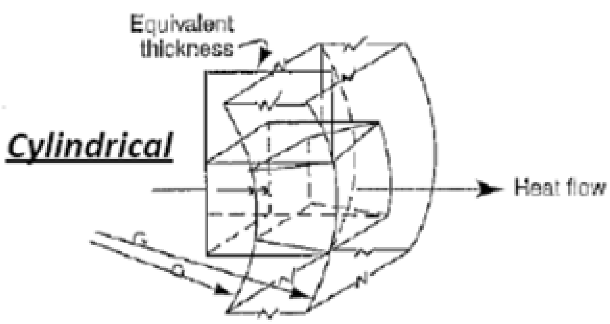


Cylindrical Pipe Insulation “R” value Calculation:

$$R = \frac{r2\ln\left(\frac{r2}{r1}\right)}{k}$$

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:

$$R = \frac{\textit{Thickness of Material}}{\textit{Material Thermal Conductivity}}$$

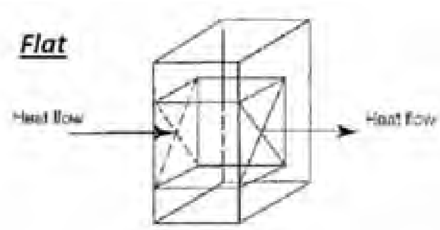
Sheet Insulation Thickness: 2”
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting “R” Value : R-8.0 *(R-8 equals 8 resistance units)*

(*) 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.

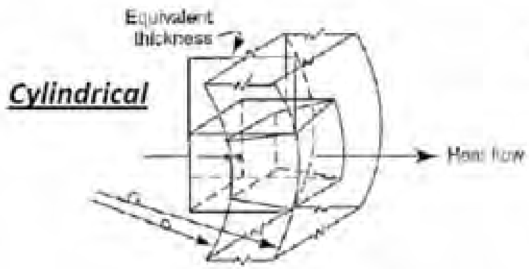


$$R = \frac{\textit{Thickness of Flat Sheet Material}}{\textit{Material Thermal Conductivity}}$$

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:

$$R = \frac{r2\ln\left(\frac{r2}{r1}\right)}{k}$$

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	5.5	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•ft²•°F

Cost Impact: The material cost implications would be minimal and would be recovered (paid back) after a period of months due to system efficiency gains. Labor associated with the installation would remain constant to that of the current requirements.

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:
New Minimum Thickness = 4.6 × Table Thickness
Actual R-Value
For materials with an R-value less than R-4, the minimum insulation thickness shall be increased as follows:
New Minimum Thickness = 4.0 × Table Thickness
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

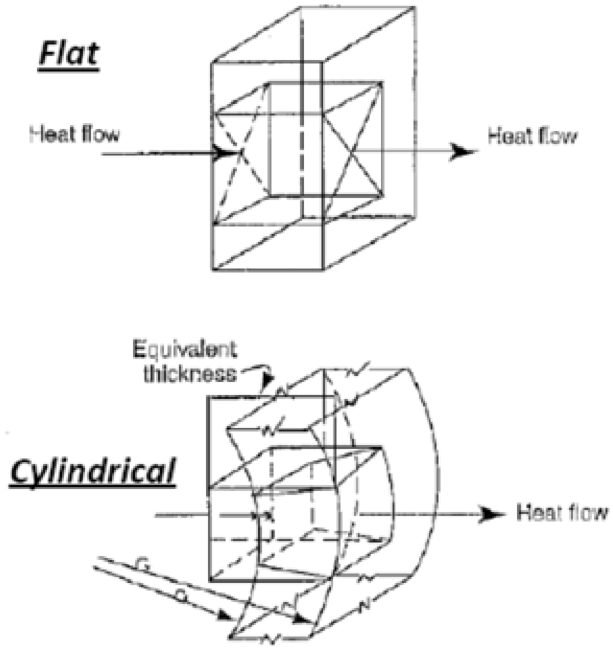
	Summer Performance		Winter Performance	
Conditional Information	**R-2**	**R-3**	**R-2**	**R-3**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	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	
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:

$$R = \frac{\textit{Thickness of Material}}{\textit{Material Thermal Conductivity}}$$

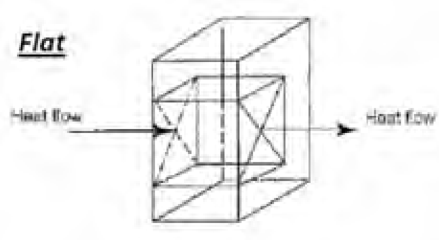
Sheet Insulation Thickness: 2”
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting “R” Value : R-8.0 *(R-8 equals 8 resistance units)*

(*) 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.

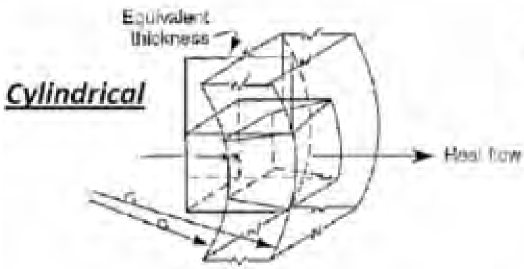


$$R = \frac{\textit{Thickness of Flat Sheet Material}}{\textit{Material Thermal Conductivity}}$$

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 Insulatio
"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	5.5	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•ft²•°F

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: RESETAR-SCHMIDT-DUNAHUE-EC-2-403.4-RE-3-N1103.4

EC117–09/10
403.3; IRC N1103.3

Proponent: Michael Resetar, Armacell LLC; Roger Schmidt, K-Flex USA; Shawn Dunahue, Nomaco Insulation

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

403.3 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~~ R-4.

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1103.3 Mechanical system piping insulation. Mechanical system piping capable of carrying fluids above 105°F (40°C) or below 55°F (13°C) shall be insulated to a minimum of ~~R-3~~ R-4.

Reason: Shifting from an R-3 requirement to an R-4 insulation requirement in 2009/2010 helps achieve an 18.25% gain in performance efficiency and combined with the efficiency gains implemented in the 2007/2008 change from an R-2 to R-3 the combination would achieve a 29.4% gain in efficiency.

IECC 2000:
Had Table 503.3.3.1

PIPING SYSTEM TYPES	FLUID TEMPERATURE RANGE, °F	PIPE SIZES[a]					
		Run outs 2^2[b]	1^2 and less	1¼^2 to 2^2	2½^2 to 4^2	5^2 to 6^2	8^2 and larger
Heating systems							
Steam and hot water high pressure/temperature	306-450	1½	2½	2½	3	3½	3½
Medium pressure/temperature	251-305	1½	2	2½	2½	3	3
Low pressure/temperature	201-250	1	1½	1½	2	2	2
Low temperature	120-200	½	1	1	1½	1½	1½
Steam condensate (for feed water)	Any	1	1	1½	2	2	2
Cooling systems							
Chilled water	40-55	½	½	¾	1	1	1
Refrigerant or brine	below 40	1	1	1½	1½	1½	1½

For SI: 1 inch = 25.4 mm, °C. = [(°F.)-32]/1.8, 1 foot = 304.8 mm.
a For piping exposed to outdoor air, increase insulation thickness by ½ inch.
b Runouts not exceeding 12 feet in length to individual terminal units.

Cold/Chilled Water Temperature: 40^{o}F - 55^{o}F (Insulation Thickness=$^1/_2$”)
Low Temperature: 120°F - 200°F (Insulation Thickness= 1”)

IECC 2003:
Had Table 503.3.3.1

PIPING SYSTEM TYPES	FLUID TEMPERATURE RANGE, EF	PIPE SIZES[a]					
		Runouts up to 2"[b]	1" and less	1.25" to 2"	2.5" to 4"	5" to 6"	8" and larger
HEATING SYSTEMS							
Steam and hot water							
High pressure/temperature	306-450	$1^1/_2$	$2^1/_2$	$2^1/_2$	3	$3^1/_2$	$3^1/_2$
Medium pressure/temperature	251-305	$1^1/_2$	2	$2^1/_2$	$2^1/_2$	3	3
Low pressure/temperature	201-250	1	$1^1/_2$	$1^1/_2$	2	2	2
Low temperature	106-200	$^1/_2$	1	1	$1^1/_2$	$1^1/_2$	$1^1/_2$
Steam condensate (for feed water)	Any	1	1	$1^1/_2$	2	2	2
COOLING SYSTEMS							
Chilled water, refrigerant and brine	40-55	$^1/_2$	$^1/_2$	$^3/_4$	1	1	1
	Below 40	1	1	$1^1/_2$	$1^1/_2$	$1^1/_2$	$1^1/_2$

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, °C = [(°F)-32]/1.8.
a. For piping exposed to outdoor air, increase insulation thickness by 0.5 inch.
b. Runouts not exceeding 12 feet in length to individual terminal units.

Cold/Chilled Water Temperature: 40°F - 55°F (Insulation Thickness= ½”)
Low Temperature: 120°F - 200°F (Insulation Thickness= 1”)

IECC 2006:
Removed Table 503.3.3.1 and created Section 403 for SYSTEMS (Mandatory)
Moved all insulation to R-2
R-2 on Flat Surface calculation is equal a thickness of ½”

IRC 2007/2008:
Increased all insulation to R-3
R-3 on Flat Surface calculation is equal a thickness of ¾"
R-3 on Radial Surface calculation is equal a thickness of ½"

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

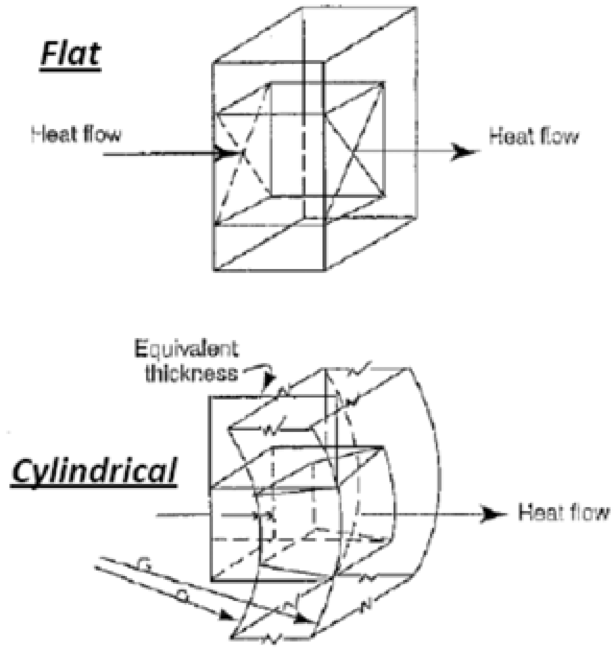
	Summer Performance		Winter Performance	
Conditional Information	**R-2**	**R-3**	**R-2**	**R-3**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	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:

$$R = \frac{\text{Thickness of Material}}{\text{Material Thermal Conductivity}}$$

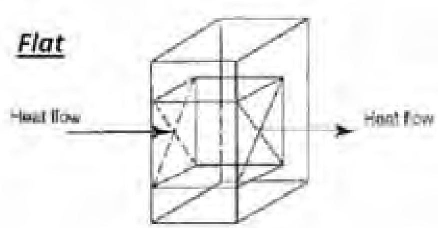
Sheet Insulation Thickness: 2"
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting "R" Value : R-8.0 *(R-8 equals 8 resistance units)*

(*) 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.

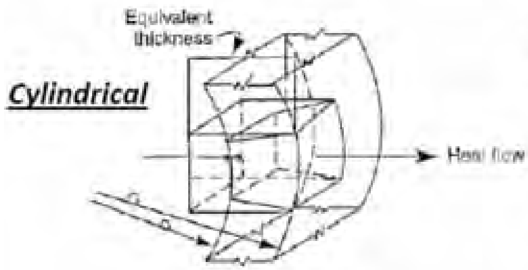


$$R = \frac{\text{Thickness of Flat Sheet Material}}{\text{Material Thermal Conductivity}}$$

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	5.5	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: [illegible] Btu•in/h•ft²•°F

Cost Impact: The material cost implications would be minimal and would be recovered (paid back) after a period of months due to system efficiency gains. Labor associated with the installation would remain constant to that of the current requirements.

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:

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:

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”)

<u>IRC 2006:</u>
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”

<u>IRC 2007/2008:</u>
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”

<u>IRC 2009/2010:</u> (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”

<u>TARGET:</u>
30% Conservation Savings Achieved shifting from R-2 to R-4

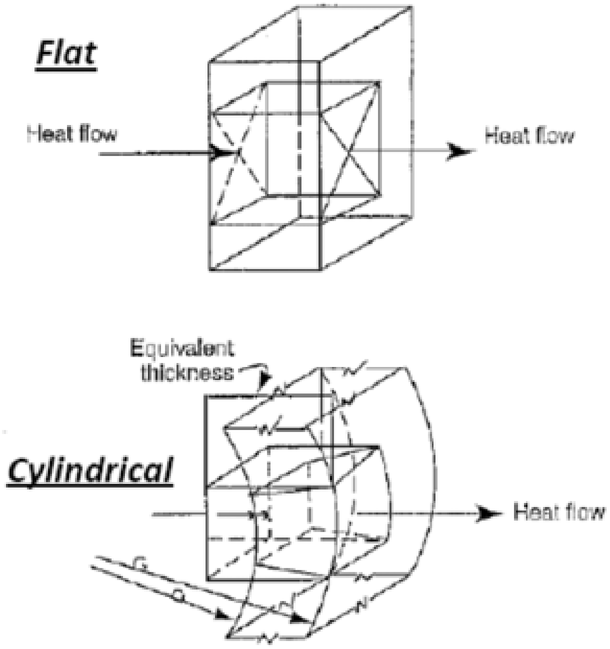
	Summer Performance		Winter Performance	
Conditional Information	**R-2**	**R-3**	**R-2**	**R-3**
Line temperature °F	40.0	40.0	105.0	105.0
Ambient temperature °F	75.0	75.0	40.0	40.0
Thermal conductivity (Btu•in/h•ft2•°F)	0.263	0.263	0.264	0.264
Surface Coeff. External (Btu•in/h•ft2•°F)	1.60	1.60	1.60	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:

$$R = \frac{r2 \ln(\frac{r2}{r1})}{k}$$

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:

$$R = \frac{\text{Thickness of Material}}{\text{Material Thermal Conductivity}}$$

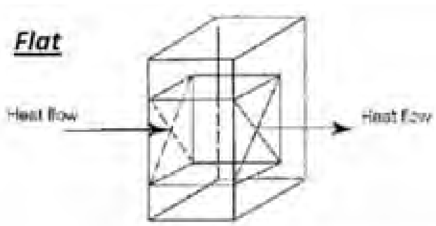
Sheet Insulation Thickness: 2"
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting "R" Value : R-8.0 *(R-8 equals 8 resistance units)*

(*) 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.

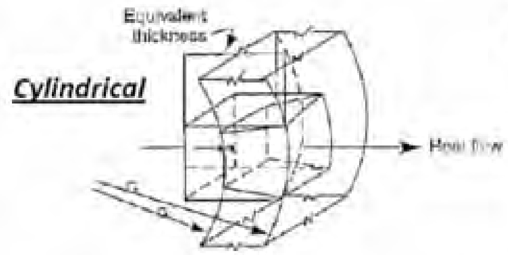


$$R = \frac{\text{Thickness of Flat Sheet Material}}{\text{Material Thermal Conductivity}}$$

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	5.5	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	8.8
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: The material cost implications would be minimal and would be recovered (paid back) after a period of months due to system efficiency gains. Labor associated with the installation would remain constant to that of the current requirements.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: RESETAR-SCHMIDT-DUNAHUE-EC-9-403.3-RE-1-N1103.3

EC118–09/10

403.5 (New), 504.5 (New); IPC 607.4 (New); IRC N1103.4 (New), P2903.11 (New)

Proponent: Ronald L, George, CIPE, CPD, President of Ron George Design & Consulting Services representing himself

THIS IS A 4 PART CODE CHANGE. PARTS I and II WILL BE HEARD BY THE IECC COMMITTEE. PARTS III & IV WILL BE HEARD BY THE IRC BUILDING AND ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Part I - IECC

Add new text as follows:

<u>**403.5 Pipe insulation for direct-burial applications.** Hot water distribution piping and circulating hot water system piping that is direct-buried shall be externally insulated with material having a wall thickness of not less than 1 inch (25.4mm). The insulation shall be closed cell foam plastic, closed cell foam rubber or a material or system approved</u>

by the manufacturer for direct-burial applications. The insulating materials or systems shall be installed, joined and sealed in accordance with the manufacturer's installation instructions. Where insulated piping is located below the building site water table, the insulated piping shall be encased in a waterproof conduit. Insulating materials or systems that are recommended by the manufacturer for submerged water service applications shall not be required to be encased in a waterproof conduit. Where the total developed length of direct-buried hot water distribution and circulating hot water piping does not exceed 20 feet (6100 mm), external insulation shall not be required on direct-buried water distribution piping.

(Renumber subsequent sections)

504.5 Pipe insulation for direct-burial applications. Hot water distribution piping and circulating hot water system piping that is direct-buried shall be externally insulated with material having a wall thickness of not less than 1 inch (25.4mm). The insulation shall be closed cell foam plastic, closed cell foam rubber or a material or system approved by the manufacturer for direct-burial applications. The insulating materials or systems shall be installed, joined and sealed in accordance with the manufacturer's installation instructions. Where insulated piping is located below the building site water table, the insulated piping shall be encased in a waterproof conduit. Insulating materials or systems that are recommended by the manufacturer for submerged water service applications shall not be required to be encased in a waterproof conduit.

(Renumber subsequent sections)

PART II – IPC

Add new text as follows:

607.4 Insulation required for direct-buried piping. Direct-buried hot water distribution piping and circulating hot water piping shall be externally insulated in accordance with Section 504.5 of the *International Energy Code*.

(Renumber subsequent sections)

PART III – IRC

Add new text as follows:

N1103.4 Pipe insulation for direct-burial applications. Hot water distribution piping and circulating hot water system piping that is direct-buried shall be externally insulated with material having a wall thickness of not less than 1 inch (25.4mm). The insulation shall be closed cell foam plastic, closed cell foam rubber or a material or system approved by the manufacturer for direct-burial applications. The insulating materials or systems shall be installed, joined and sealed in accordance with the manufacturer's installation instructions. Where insulated piping is located below the building site water table, the insulated piping shall be encased in a waterproof conduit. Insulating materials or systems that are recommended by the manufacturer for submerged water service applications shall not be required to be encased in a waterproof conduit. Where the total developed length of direct-buried hot water distribution and circulating hot water piping does not exceed 20 feet (6100 mm), external insulation shall not be required on direct-buried water distribution piping.

(Renumber subsequent sections)

PART IV- IRC

P2903.11 Insulation required for direct-buried piping. Direct-buried hot water distribution piping and circulating hot water piping shall be externally insulated in accordance with Section N1103.4.

Reason: I have seen several underground piping installations where long runs of hot water distribution pipes lose significant heat to the soil. I have also seen un-insulated hot and cold water pipes that were installed next to each other in the same trench and heat transfer caused problems with both the hot and cold water systems. In long runs of underground HW piping where cold water and hot water are installed in the same trench and the hot water is circulated, the cold water pipe heats up to close to the hot water distribution temperature. This code change requires insulation for all underground hot water distribution systems and hot water circulating systems so that heat loss to the earth and heat gain by cold water piping is minimized. All types of pipe materials conveying hot water are subject to loss of heat to the soil. The pipe material type does not matter as heat transfer always occurs but the rate of heat transfer varies depending on the type of pipe material.

Cost Impact: Minimal

PARTS I & II– IECC

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

PARTS III & IV – IRC-Building and Energy

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

ICCFILENAME: George-EC-403.5

EC119–09/10

202 (New), 403.5 (New), Chapter 6; IRC R202 (New), N1103.5 (New), Chapter 44

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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

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

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.

PART I – IECC

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

PART II – IRC

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

ICCFILENAME: MAJETTE-EC-68-202-403.5-CH 6-IRC-R202-N1103.5-CH 44

EC120–09/10

403.6, Table 403.6, Chapter 6 (All new); IRC N1103.6, Table N1103.6, Chapter 44 (All new)

Proponent: Craig Conner, Building Quality, representing self

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Add new text as follows:

403.6 Ventilation fan efficiency. Ventilation fans shall be tested and listed by an approved third party and shall meet the requirements of table 403.6.

Exception: Fans integral to tested and listed HVAC equipment.

TABLE 403.6
VENTILATION FAN EFFICIENCY

Fan location	Air flow rate (cfm)	Minimum efficiency[a]	Air flow rate (cfm)
Range hoods	any	2.8 cfm/watt	any
In-line fan	any	2.8 cfm/watt	any
Bathroom, utility room	<= 80	1.4 cfm/watt	<140 cfm
Bathroom, utility room	>80	2.8 cfm/watt	>= 140 cfm

a. When tested in accordance with HVI Standard 916

2. Add new standard to Chapter 6 as follows:

HVI Home Ventilating Institute
1000 North Rand Road
Suite 214
Wauconda, IL 60084

HVI 916-09 HVI Airflow Test Standards

PART II – IRC ENERGY

N1103.6 Ventilation fan efficiency. Ventilation fans shall be tested and listed by an approved third party and shall meet the requirements of table N1103.6.

Exception: Fans integral to tested and listed HVAC equipment.

TABLE N1103.6
VENTILATION FAN EFFICIENCY

Fan location	Air flow rate (cfm)	Minimum efficiency[a]	Air flow rate (cfm)
Range hoods	any	2.8 cfm/watt	any
In-line fan	any	2.8 cfm/watt	any
Bathroom, utility room	<= 80	1.4 cfm/watt	<140 cfm
Bathroom, utility room	>80	2.8 cfm/watt	>= 140 cfm

a. When tested in accordance with HVI Standard 916

2. Add new standard to Chapter 44 as follows:

HVI Home Ventilating Institute
1000 North Rand Road
Suite 214
Wauconda, IL 60084

HVI 916-09 HVI Airflow Test Standards

Reason: Residences continue to get tighter and therefore require more ventilation. The trend towards tighter construction and more mechanical ventilation will likely accelerate with changes made this code cycle.

The requirements in the table are the efficiency portion of the existing Energy Star ventilation fan requirements. The HVA Standard 916 defines a method for testing the efficiency with which a fan moves air. A substantial number of fans from multiple manufacturers can meet these requirements with existing products.

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, 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: CONNER-EC-8-403.6 - N1103.6.DOC

EC121–09/10

403.6, Table 403.6 (New), Chapter 6; IRC N1103.6, Table N1103.6 (New), Chapter 44

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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

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
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 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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-25-403.6-N1103.6

EC122–09/10
403.7 (New), 504.2.1 (New); IRC P2801.1.2 (New)

Proponent: Mike Ashley, CBO, Ashco Consulting & Supply, representing Edward L. Jackson

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC PLUMBING COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I - IECC

Add new text as follows:

403.7 Hot water circulating system required. In group R 1, R 2, R 3, and R 4 occupancies, where the furthest fixture requiring hot water is greater than 8 feet (2438 mm) in developed pipe length from the outlet of the source of hot water, a hot water circulating system shall be installed on the hot water distribution system. The circulating system shall be designed to make hot water available in the hot water distribution system at point that is not greater than 8 feet (2438 mm) in developed pipe length from the fixture requiring hot water. The circulating system pump shall be controlled by an automatic switch. Where point-of-use water heaters are provided for fixtures, a hot water circulating system shall not be required.

504.2.1 Hot water circulating system required. In group R 1, R 2, R 3, and R 4 occupancies, where the furthest fixture requiring hot water is greater than 8 feet (2438 mm) in developed pipe length from the outlet of the source of hot water, a hot water circulating system shall be installed on the hot water distribution system. The circulating system shall be designed to make hot water available in the hot water distribution system at point that is not greater than 8 feet (2438 mm) in developed pipe length from the fixture requiring hot water. The circulating system pump shall be controlled by an automatic switch. Where point-of-use water heaters are provided for fixtures, a hot water circulating system shall not be required.

PART II – IRC-P

Add new text as follows:

P2801.1.2 Hot water circulating system required. Where the furthest fixture requiring hot water is greater than 8 feet (2438 mm) in developed pipe length from the outlet of the source of hot water, a hot water circulating system shall be installed on the hot water distribution system. The circulating system shall be designed to make hot water available in the hot water distribution system at point that is not greater than 8 feet (2438 mm) in developed pipe length from the fixture requiring hot water. The circulating system pump shall be controlled by an automatic switch. Where point-of-use water heaters are provided for fixtures, a hot water circulating system shall not be required.

Reason: Water conservation and energy savings: To date studies have evaluated the water savings potential of instant hot water recirculation systems can result of water savings of up to 40 gallons per day or 15,000 gallons per year. This study utilized a set of assumptions about average plumbing layout, size and water use habits of the household. Mathematical formulas and methodologies were then applied to calculate potential water and energy savings derived from the recirculation systems.

Cost Impact: Average cost of the recirculation pump is $350.00 average water and sewer related saving in yearly cost is $400.00. Water saved 15,000 gallons per household.

PART I – IECC

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

PART II – IRC

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

ICCFILENAME: Ashley-EC-1-504.2.1 & RP2801.1.2

EC123–09/10
403.7 (New); IRC N1103.3 (New)

Proponents: Brian Dean, ICF International; Don Vigneau, Northeast Energy Efficiency Partnerships

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

403.7 Space heating equipment (Mandatory). Electric resistance heating shall not be used for space heating. This includes but is not limited to: electric space heaters, electric furnaces, electric baseboard heaters, electric wall heaters, and electric thermal storage.

Exceptions:

1. Electric resistance heating may be installed in dwelling units with separate zone controls for spaces not exceeding 500 square feet in area, each controlled by an individual thermostat, where:
   1.1. Located in a county with less than 500 heating degree days (HDD); or
   1.2. Located in a county with less than 1,500 HDD and containing less than 1,000 square feet total conditioned floor area; or
   1.3. The dwelling unit has a peak heating rate not more than 6.8 Btu/h-ft2 or 2 Watt/ft2 and is located in any climate zone.
2. Where electric resistance heating is used for air-to-air heat pump supplementary heat in climate zones 1, 2, 3 and 4, excluding 4 Marine.
3. Portable plug-in temporary heaters.

(Renumber subsequent sections)

PART II – IRC ENERGY

Add new text as follows:

N1103.3 Space heating equipment. Electric resistance heating shall not be used for space heating. This includes but is not limited to: Electric Space Heaters, electric furnaces, electric baseboard heaters, electric wall heaters, and electric thermal storage.

Exceptions:

1. Electric resistance heating may be installed in dwelling units with separate zone controls for spaces not exceeding 500 square feet in area, each controlled by an individual thermostat, where:
   1.1. Located in a county with less than 500 heating degree days (HDD); or
   1.2. Located in a county with less than 1,500 HDD and containing less than 1,000 square feet total conditioned floor area; or
   1.3. The dwelling unit has a peak heating rate not more than 6.8 Btu/h-ft2 or 2 Watt/ft2 and is located in any climate zone.
2. Where electric resistance heating is used for air-to-air heat pump supplementary heat in Climate Zones 1, 2, 3 and 4, excluding 4 Marine.
3. Portable plug-in temporary heaters.

Reason: Electric resistance heating is very expensive to operate for a home owner compared to other heating sources. While the DOE states that there are some climates where heat pump heating may not be preferable to electric resistance heating, analysis shows that are very few locations where the savings is less than $100 per year given recent energy prices for a 2000 SF code minimum home. In the table below, it can be seen that homes with very small heating loads with heating degree days less than 250 are the only cases where annual savings from upgrading to a heat pump are less than $100. Therefore the increased cost of heat pump equipment is well worth the investment throughout most of the country.

HDD	City	Electric Resistance	Heat Pump (7.7 HSPF)	Savings
0	Honolulu, HI	$ 0	$ 0	$ 0
0	Hilo, HI	$ 0	$ 0	$ 0
200	Key West, FL	$ 13	$ 4	$ 9
62	Miami, FL	$ 33	$ 12	$ 21
236	W. Palm Beach, FL	$ 59	$ 24	$ 35
697	Tampa, FL	$ 201	$ 82	$ 119
609	Brownsville, TX	$ 217	$ 82	$ 135
1755	Daytona Beach, FL	$ 238	$ 95	$ 142
1437	Phoenix, AZ	$ 277	$ 113	$ 164
884	Corpus Christi, TX	$ 300	$ 118	$ 182
871	Tucson, AZ	$ 388	$ 167	$ 221
1554	Jacksonville , FL	$ 443	$ 195	$ 248
2100	Tallahassee, FL	$ 571	$ 269	$ 302
1308.5	Long Beach, CA	$ 552	$ 197	$ 354
2293	Las Vegas, NV	$ 699	$ 302	$ 397

Source: ICF International analysis with Beacon powered by DOE2.1e

This chart shows the basis for an exception for electric resistance heat in Zone 1 and an exception for air-to-air heat pumps in Zones 2, 3 & 4.

http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12520
DOE Reference:

> "Electric resistance heating converts nearly 100% of the energy in the electricity to heat. However, most electricity is produced from oil, gas, or coal generators that convert only about 30% of the fuel's energy into electricity. Because of electricity generation and transmission losses, electric heat is often more expensive than heat produced in the home or business using combustion appliances, such as natural gas, propane, and oil furnaces. If electricity is the only choice, heat pumps are preferable in most climates, as they easily cut electricity use by 50% when compared with electric resistance heating."

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

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

ICCFILENAME: DEAN-VIGNEAU-EC-1-403.7-N1103.3.DOC

EC124–09/10

403.9, 403.9.1, 403.9.2, 403.9.3; IRC N1103.8, N1103.8.1, N1103.8.2, N1103.8.3

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

403.9 Pools<u>, hot tubs and spas</u> (Mandatory). Pools<u>, hot tubs and spas</u> shall ~~be provided with energy-conserving measures in accordance~~ <u>shall</u> <u>comply</u> with Sections 403.9.1 through 403.9.3.

403.9.1 ~~Pool~~ <u>Heaters</u>. 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 <u>or</u> <u>LP</u> 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~~ <u>Covers</u>. Heated pools<u>, hot tubs and spas</u> shall be ~~equipped~~ <u>provided</u> with a vapor-retardant ~~pool~~ cover ~~on or at the water surface~~. Pools<u>, hot tubs and spas</u> <u>capable of being</u> heated to more than 90°F (32°C) shall ~~have a pool~~ <u>be provided with a</u> cover ~~with~~ <u>having</u> 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.~~

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-77-403.9-IRC N1103.8

EC125–09/10

403.10 (New); IRC N1103.9 (New)

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. AND PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

<u>**403.10 Fireplace systems (Mandatory).** Fireplace systems shall not have continuously burning pilot lights.</u>

PART II – IRC BUILDING/ENERGY

Add new text as follows:

<u>**N1103.9 Fireplace systems.** Fireplace systems shall not have continuously burning pilot lights.</u>

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-26-403.10-N1103.9

EC126–09/10

202 (New), 403.11 (New), Table 405.5.2(1); IRC R202 (New), N1103.10 (New)

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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. <u>Such systems include equipment referred to as an "energy recovery ventilator" (ERV) or as a "heat recovery ventilator" (HRV).</u>

2. Add new definition as follows:

<u>**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.</u>

3. Add new text as follows:

<u>**403.11 *Energy recovery ventilation system* and air leakage supplemental requirements.** The building shall meet the following the requirements:</u>

1. <u>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*.</u>
2. <u>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.</u>

   <u>**Exceptions:**</u>

   1. <u>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.</u>
   2. <u>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.</u>
   3. <u>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%.</u>
   4. <u>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*,</u>
   5. <u>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.</u>

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.~~ <u>with a 70% efficient *energy recovery ventilation system*.</u> <u>Exceptions:</u> <u>1. For multifamily buildings, the specific leakage area shall be 0.00018 with a 70% efficient *energy recovery ventilation system*.</u> <u>2. For buildings subject to the exceptions in section 403.11, SLA = 0.00030, assuming no energy recovery.</u>	~~For residences that are not tested, the same as the standard reference design.~~ <u>*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:</u> <u>1.</u> 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. <u>2.</u> For residences with mechanical ventilation <u>that is not an *energy recovery ventilation system*</u> ~~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 <u>3. For residences with *energy recovery ventilation systems*, the efficiency of the energy or heat recovery ventilation system shall be as proposed.</u>

~~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)

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-27-202-403.11-R202-N1103.10

EC127–09/10

404.1; IRC N1104.1

Proponent: Krista Braaksma, representing Washington State Building Code Council

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

404.1 Lighting equipment (Prescriptive). A minimum of 50 percent of the ~~lamps in~~ permanently installed ~~lighting fixtures~~ luminaires shall be high-efficacy ~~lamps~~ type.

PART II – IRC BUILDING/ENERGY

1104.1 Lighting equipment. A minimum of 50 percent of the ~~lamps in~~ permanently installed ~~lighting fixtures~~ luminaires shall be high-efficacy ~~lamps~~ type.

Reason: The current provision in effect requires use of Compact Fluorescent Lamps, which are not best for all applications and, when forced, result in refit/regression and hampered consumer acceptance. Market and industry data point to the need for alternative solutions to achieve the use of high-efficiency lighting and/or lighting controls.

Codes, to be effective, must be enforceable and sustainable in the long term. The enforcement community is already understaffed and overworked, and the current national and local situation means that the situation will not improve in the foreseeable future. State, city and county building departments as well are too understaffed to take on the additional responsibilities of counting lamps.

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

PART I – IECC

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

PART II – IRC ENERGY

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

ICCFILENAME: BRAAKSMA-EC-2-404.1

EC128–09/10
404.1

Proponent: Joseph Hill, RA, representing the New York State Department of State

Revise as follows:

404.1 Lighting equipment ~~(Prescriptive).~~ <u>(Mandatory)</u>. A minimum of 50 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.

Reason: Per Section 401, Compliance with the Energy Code is relegated to either *Prescriptive*, or *Performance* methodologies. Since there are no similar considerations within Section 405 Simulated *Performance Alternative for* high efficacy lamping, *Section 404.1 Lighting equipment,* the requirements for 50 percent high-efficacy lamps should be made mandatory for the continuity of the code.

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

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

ICCFILENAME: HILL-EC-3-404.1

EC129–09/10
404.1; IRC R202 (New), N1104.1

Proponent: Ronald Majette, representing US Department of Energy

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

404.1 Lighting equipment (Prescriptive). A minimum of ~~50~~ <u>seventy-five</u> percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps<u> or a minimum of seventy-five percent of the permanently installed lighting fixtures shall contain only high efficacy lamps.</u>

<u>**Exception:** Low-voltage lighting.</u>

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: MAJETTE-EC-72-404.1-IRC R202-N1104.1

EC130–09/10
404.1; IRC N1104.1

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

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY CODE COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

404.1 Lighting equipment (Mandatory) ~~(Prescriptive)~~. A minimum of ~~50~~ 60 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1104.1 Lighting equipment. A minimum of ~~50~~ 60 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.

Reason: This proposal is meant to bring increased consistency between the performance and prescriptive path of compliance in the IECC, by requiring all homes no matter what compliance method, to meet this requirement. There is no reason why buildings complying under the performance path should not meet the same requirement, since lighting is currently not included in the simulated performance alternative analysis. This minimum lighting requirement is a cost effective and smart requirement for all homes.

In addition, this proposal has modest increased requirements for the amount of high efficacy lighting that is required in a home. Under U.S. Department of Energy rulemakings and federal legislation, the efficiency standards for general service fluorescent, general service incandescent, incandescent reflector lamps, and fluorescent lamp ballasts will increase in the next few years. More types of efficient lighting technologies, such as LED's, should be available by 2012, providing more options for builders to meet a higher percentage requirement.

This proposal gives the opportunity to have homes start with efficient lighting, even if the homeowners decide to change the lighting in the future. This proposal attempts to balance advancing energy efficiency with local adoption and enforcement issues and consumer backlash from having too high of a percent requirement. In addition, this proposal recognizes that while increased energy efficiency from lighting has the opportunity to save real energy in every home, non-permanent code lighting requirements also do not create permanent long term savings due to the relatively short life of a lamp, type and life of the light fixture and questions regarding the likelihood that a home owner will retain the efficient lamps over the life of the home. In addition, the lifetime savings of this code provision are estimated to be low due, since upcoming federal requirements are expected to require more efficient lighting anyway. This code proposal is simply helping to move American homes in the right direction with more efficient lighting which is simple and cost effective.

The cost of such lighting is minimal -- estimated to be about $20 per home depending on the number of permanently installed lighting fixtures.

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

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: PRINDLE-EC-29-404.1-N1104.1

EC131–09/10

202 (New), 403.5, 404 (New), Table 405.5.2(1), Chapter 6; IRC R202 (New), N1103.5, N1104 (New), Chapter 44 (New)

Proponent: Craig Conner, Building Quality, representing self

THIS IS A 2 PART CODE CHANGE. PART I WILL BE HEARD BY THE IECC COMMITTEE. PART II WILL BE HEARD BY THE IRC BUILDING/ENERGY COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

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
SRCC
OG-300 Operating Guidelines and Minimum Standards for Certifying Solar Water Heating Systems

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.

PART I – IECC

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

PART II – IRC BUILDING/ENERGY

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

ICCFILENAME: CONNER-EC-7-202-404.1-3 - R202-N1104.1-3.DOC

EC132–09/10

405, 405.1, 405.1.1 (New), Table 405.5.2(1)

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 *Nor*) ~~Same as proposed design~~	~~As Proposed~~ As proposed As proposed Same as standard reference ~~Use: gal/day=30 + (10 x *Nor*)~~

(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 <u>or</u> high efficiency equipment.

I say "no" to the argument above. More efficient and affordable buildings need high efficiency in both envelopes <u>and</u> 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

EC133–09/10
405.3, Table 405.3 (New)

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<u>,</u>~~. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.~~ <u>using the source energy factors specified in Table 405.3.</u>

2. Add new table as follows:

<u>TABLE 405.3</u>
<u>SOURCE ENERGY FACTORS FOR ENERGY DELIVERED TO BUILDINGS</u>

<u>ENERGY SOURCE</u>	<u>SOURCE ENERGY FACTOR</u>
<u>Electricity</u>	<u>3.365</u>
<u>Natural Gas</u>	<u>1.092</u>
<u>Fuel Oil/Kerosene</u>	<u>1.158</u>
<u>Gasoline</u>	<u>1.187</u>
<u>LPG</u>	<u>1.151</u>

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.

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

ICCFILENAME: NITTLER-EC-1-T. 405.3

EC134–09/10
405.3, 506.3

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.

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

ICCFILENAME: RANFONE-EC-1-405.3-506.3

EC135–09/10
405.3

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.~~
>
> **<u>Exceptions:</u>**
>
> 1. <u>Jurisdictions that require site energy (1 kWh = 3,413 Btu) rather than energy cost as the metric of comparison.</u>
> 2. <u>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.</u>

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.

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

ICCFILENAME: ROSENSTOCK-EC-1-405.3

EC136–09/10
405.3

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.~~
>
> **<u>Exceptions:</u>**
>
> 1. <u>Jurisdictions that require site energy (1 kWh = 3,413 Btu) rather than energy cost as the metric of comparison.</u>
> 2. <u>Jurisdictions that use both site energy and source energy estimates as the metrics of comparison. In states or localities with renewable portfolio standards or renewable energy goals, the source energy multiplier for electricity shall be 0.0. In other states or localities, the source energy multiplier for electricity shall be based on current and projected values in the locality, state, or region over a future 50 year period. For all other fuels, the source energy multiplier shall be based on energy losses from the production,</u>

importation, flaring, transportation, and distribution losses. 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.

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

ICCFILENAME: ROSENSTOCK-EC-2-405.3

EC137–09/10
Table 405.5.2(1)

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 through 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
- o 3 colors (dark, medium, light)
- o 5 positions (rotated from closed down to open to closed up)

Fabric Drapes
- o 3 colors
- o 4 weave densities (closed, semi-open, open, sheer)

Roller Shades
- o 3 colors

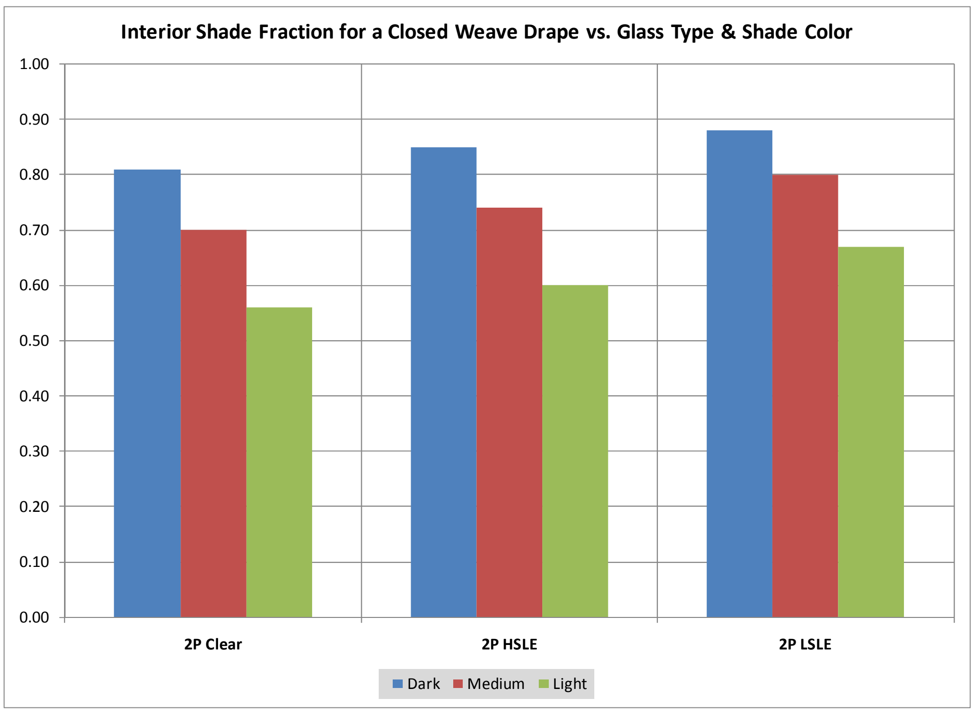
- o 2 density (opaque, translucent)
- Insect Screen (1)

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 $\mathbf{C_1}$ – ($\mathbf{C_2}$*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.

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

ICCFILENAME: LARSEN-EC-1-T. 405.5.2(1)

EC138–09/10
Table 405.5.2(1)

Proponent: Ronald Majette, representing US Department of Energy

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 for other than electric heating without a heat pump. Where the proposed design utilizes electric heating without a heat pump the standard reference design shall be an air source heat pump meeting the requirements of Section 503. Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed

(Portions of table and footnotes not shown remain unchanged)

Reason: The purpose of this code change is restore language from the 2006 IECC that appears to have been inadvertently removed in the 2009 IECC. The language relates to the standard reference design assumptions when electric resistance heating systems are used in the simulated performance alternative. The 2006 IECC sets an air-source heat pump as the standard reference design heating system if electric heating was used in the proposed design. The 2009 IECC effectively reduces energy efficiency in the simulated performance alternative (section 405) compared to the 2006 IECC if electric resistance heating is used in a proposed design as a less efficient system is assumed in the standard design. This reduction in energy efficiency appears to be an unintentional oversight. This proposal does not alter the code if the proposed design has an electric heat pump or any non-electric system.

Cost Impact: The code change proposal will increase the cost of construction to the degree that it precludes the application and use of the simulated performance alternative to establish an energy performance metric that is artificially high and then use that metric as a baseline for verifying code compliance.

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

ICCFILENAME: MAJETTE-EC-69-T. 405.5.2(1)

EC139–09/10
Table 405.5.2(1)

Proponent: Ronald Majette, representing US Department of Energy

Revise table as follows:

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	Thermal distribution system efficiency shall be as ~~As~~ tested or as specified by Table 405.5.2(2) if not tested. Duct insulation shall be as proposed.

(Portions of table and footnotes not shown remain unchanged)

Reason: The purpose of this code change is to clarify that the duct insulation in the proposed design is simply whatever is proposed. The proposed duct insulation is not necessarily the same as the duct insulation in the standard design, but must be at least R-6 as specified in section 405.2. This proposal is not intended to change any requirements.

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

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

ICCFILENAME: MAJETTE-EC-78-T. 405.5.2(1)

EC140–09/10
Table 405.5.2(1)

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.

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

ICCFILENAME: NOWAK-EC-2-T. 405.5.2(1)

EC141–09/10
Table 405.5.2(1)

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.

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

ICCFILENAME: SAGAN-EC-9-T. 405.5.2(1)

EC142–09/10
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)

EC143–09/10
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 table 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 ft^2~~ ~~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 ft^2 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 climate zones 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] External shading: none	Same as standard reference design 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-31-T. 405.5.2(1)

EC144–09/10
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 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, i]	As Proposed Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As Proposed
Cooling systems [g~~, i~~, J]	As Proposed Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As Proposed
Service Water Heating [g, ~~i, j,~~ k]	As Proposed Use: Same as proposed design	As Proposed Use: gal/day=30 + (10 x N_{br})

i. For a proposed design without a proposed heating system, a heating system with the prevailing minimum efficiency shall be assumed for both the standard reference design and the proposed design. For electric resistance 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 minimum efficiency shall be assumed for both the standard reference design and the proposed design.

(Portions of table and footnotes not shown remain unchanged)

Reason: This proposal ensures that the proper notes for the systems are connected to the proper systems. Note “i”, which states that “for electric heating systems, the prevailing minimum efficiency shall be assumed for the standard reference design” is very important to ensure that consistent performance path modeling is conducted for electric heating systems. Previously this note was tied to the cooling systems, however, it should be tied to the heating system as proposed.

In addition note “i” has been modified to clarify that only electric resistance heating systems should have the standard reference design as the prevailing federal minimum efficiency air-source heat pump. This is to ensure that electric heating is not used in the standard reference design as a baseline home for achieving minimum code.

In addition, there is the deletion of footnote “i” and addition of footnote “J” to the cooling system, to clarify the intent of those two notes. The note change has been marked with the capital J to ensure that the lowercase i and j are not confused with the underline, as may have been done in previous code change cycles.

In the service water heating section there is a removal of footnotes i and j, which relate to heating and cooling only and also the addition of the word “Use:” to clarify what the gal/day equation is for.

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-32-T. 405.5.2(1)

EC145–09/10
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
Glazing [a]	Total area [b] =	As proposed
	(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	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N,E,S, & W)	As proposed 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	Same as standard reference design
	Interior shade fraction: Summer (all hours when cooling is required) = ~~0.70~~ 0.90 Winter (all hours when heating is required) = ~~0.85~~ 0.90 [c]	As proposed
	Exterior shading: none	

(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.

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

ICCFILENAME: PRINDLE-EC-33-T. 405.5.2(1)

EC146–09/10

202, Chapter 5

Proponent: Eric Makela, Britt, representing Makela Group; Ken Baker, representing K energy; Craig Conner, Building Quality

1. Add new definitions as follows:

SECTION 202
GENERAL DEFINITIONS

FENESTRATION PRODUCT, FIELD-FABRICATED is a fenestration product including a 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.

2. Revise as follows:

COMMERCIAL ENERGY EFFICIENCY

SECTION 501
GENERAL

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. 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 506, 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.

3. 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	
	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
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
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-0.02~~7~~1	U-0.02~~7~~1	U-0.02~~7~~1	U-0.02~~7~~1	U-0.02~~7~~1
Walls, Above Grade														
Mass	~~U-0.58?~~ Ext U-0.142 Int U-0.094	~~U-0.151~~ Ext U-0.142 Int U-0.094	~~U-0.151~~ Ext U-0.142 Int U-0.094	Ext U-0.123 Int U-0.094	~~U-0.123~~ Ext U-0.110 Int U-0.094	Ext U-0.104 Int U-0.094	Ext U-0.104 Int U-0.085	Ext U-0.090 Int U-0.085	~~U-0.090~~ Ext U-0.078 Int U-0.085	~~U-0.080~~ Ext U-0.078 Int U-0.085	~~U-0.080~~ Ext U-0.078 Int U-0.060	Ext U-0.071 Int U-0.060	~~U-0.071~~ Ext U-0.061 Int U-0.060	~~U-0.071~~ Ext U-0.061 Int U-0.060
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
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
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
Walls, Below Grade														
Below-grade	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	~~C-1.140~~	Ext	Ext	Ext	Ext	Ext	~~C-0.119~~	Ext

wall[a]							Ext C-0.119 Int C-0.063	C-0.119 Int C-0.063	C-0.119 Int C-0.063	C-0.119 Int C-0.063	C-0.119 Int C-0.063	C-0.119 Int C-0.063	Ext C-0.092 Int C-0.060	C-0.092 Int C-0.060
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
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
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
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

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

6	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-6,5c.i.	R-16 R-13+ R-6,5c.i.	R-16 R-13+ R-6,5c.i.	R-16 R-13+ R-13c.i.	R-19 R-13+ R-6,5c.i	R-16 R-13+ R-13c.i	R-16 R-13+ R-13c.i	R-16 R-13+ R-13c.i	R-13 + R-5.6ci R-13+ R-13c.i	R-13 + R-5.6ci R-13+ R-13c.i	R-13 + R-5.6ci R-13+ R-13c.i	R-13 + R-5.6ci R-13+ R-13c.i	R-19 + R-5.6ci R-13+ R-13c.i	R-19 + R-5.6ci R-13+ R-19.5c.i	R-19 + R-5.6ci R-13+ R-13c.i	R-19 + R-5.6ci R-13+ R-26c.i
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 ± 3.8c.i. or R-20	R-13 ± 3.8c.i. or R-20	R-13 + 3.8c.i or R-20	R-13 ± 3.8c.i. or R-20	R-13 ± 3.8c.i. or R-20	R-13 ± 3.8c.i. or R-20	R-13 ± 3.8c.i. 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 c.i.	R-13 + R-7.5 c.i.	R-13 + R-7.5 c.i.	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-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-1.45 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"~~

<u>**TABLE 502.2(2)**</u>
<u>**BUILDING ENVELOPE REQUIREMENTS-OPAQUE ASSEMBLIES**</u>

<u>**ROOFS**</u>	<u>**DESCRIPTION**</u>	<u>**REFERENCE**</u>
<u>R-19+R-11 LS</u> <u>R-25+R-11 LS</u> <u>R-30+R-11 LS</u>	<u>Liner System with thermal spacer block.</u> <u>A continuous membrane is installed below the purlins and uniterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.</u>	<u>ASHRAE/IESNA 90.1 A2.3.2.4 and Table A2.3 including proposed 90.1-2007 Addendum "bb"</u>
<u>**WALLS**</u>	**-**	**-**
<u>R-19</u>	<u>Single layer fiberglass insulation.</u> <u>The layer of R-19 fiberglass insulation is installed continuously perpendicularto the girts and is compressed when the metal skin is attached to the girts.</u>	<u>ASHRAE/IESNA 90.1 A2.3.2.4 and Table A2.3 including proposed 90.1-2007 Addendum "bb"</u>
<u>R-13+R-6.5c.i.</u> <u>R-13+ R-13 c.i.</u> <u>R-13+ R-19.5 c.i</u> <u>R-13+ R-26 c.i</u>	<u>Single layer fiberglass insulation with continuous insulation.</u> <u>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..</u>	<u>ASHRAE/IESNA 90.1 A2.3.2.4 and Table A2.3 including proposed 90.1-2007 Addendum "bb"</u>

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)								
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 505.2.2.3.1.
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 505.2.2.3.1.

502.4 Air leakage (Mandatory)

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 may be located on the inside, outside, or integral with the building envelope; or any combination thereof.

Exception: Building envelopes of buildings in climate Zones 1, 2 and 3.

Section 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.

Section 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. The following assemblies shall comply when all joints are sealed:

1. Assemblies of materials and components that 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.

2. Provided that all joints are sealed and every characteristic in Section 502.4.4.1.1 is met, assemblies that comply with Section 502.4.1.2(2) include, but are not limited to,
   2.1. Concrete masonry walls coated with one application either of block filler and two applications of a paint or sealer coating;
   2.2. A Portland cement/sand parge, stucco or plaster minimum 1/2 in (12 mm) thick.

502.4.1.2.3 Building Test. Testing the completed building and demonstrating that the air leakage rate of the *building envelope* does 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 ~~**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/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).

Exceptions:

1. ~~Site-constructed~~ Field-fabricated fenestration products ~~windows and doors~~ that are ~~weatherstripped or~~ sealed in accordance with Section 502.4.~~3~~1
2. Commercial entrance doors covered by Section 502.4.4.
3. Garage doors shall be permitted to use air leakage determined in accordance with ANSI/ DASMA 105 at standard test conditions.

~~**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.~~

502.4.4 ~~**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 × 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-built fenestration products that are sealed in accordance with Section 502.4.1.

502.4.5 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.

502.4.6 ~~**502.4.4**~~ **Hot gas bypass limitation.** (No change to current text.)

502.4.7 ~~**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~~ that penetrate the air barrier shall be equipped with not less than a Class I motorized, 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.

Such dampers shall be set in the closed position and automatically open 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.

Exception: Gravity (non-motorized) dampers are permitted to be used in buildings less than three stories in height above grade.

502.4.8 ~~**502.4.6**~~ **Loading dock weatherseals.** *(No change to current text)*

502.4.9 ~~**502.4.7**~~ **Vestibules.** *(No change to current text)*

502.4.10 ~~**502.4.8**~~ **Recessed lighting.** *(No change to current text)*

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. 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.

TABLE 503.2.3(1)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[b]	TEST PROCEDUREa
Air conditioners, Air cooled	< 65,000 Btu/h~~[d]~~	Split system	~~13.0 SEER~~ For zones 1 to 5: 15.0 SEER, 12.5 EER For zones 6 to 8: 14 SEER, 12 EER	AHRI 210/240
		Single package	~~13 SEER~~ 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 ~~< 135,000 Btu/h~~ < 240,000 Btu/h	Split system and single package	~~10.3 EERc~~ ~~(before Jan 1, 2010)~~ ~~11.2 EERc~~ ~~(as of Jan 1, 2010)~~ For zones 1 to 5: 12.0 EER[b], 12.4 IPLV[b] For zones 6 to 8: 11.5 EER[b], 11.9 IPLV[b]	
	~~≥ 135,000 Btu/h and~~ ~~< 240,000 Btu/h~~	~~Split system and single package~~	~~9.7 EER[c]~~ ~~(before Jan 1, 2010)~~ ~~11.0 EER[c]~~ ~~(as of Jan 1, 2010)~~	AHRI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	Split system and single package	~~9.5 EER[c]~~ ~~9.7 IPLV[c]~~ ~~(before Jan 1, 2010)~~ ~~10.0 EER[c] 9.7 IPLV[c]~~ ~~(as of Jan 1, 2010)~~ For zones 1 to 5: 10.8 EER[b], 12.0 IPLV[b] For zones 6 to 8: 10.5 EER[b], 10.9 IPLV[b]	
	≥ 760,000 Btu/h	Split system and single package	~~9.2 EER[c]~~ ~~9.4 IPLV[c]~~ ~~(before Jan 1, 2010)~~ ~~9.7 EER[c]~~ ~~9.4 IPLV[c]~~ ~~(as of Jan 1, 2010)~~ For zones 1 to 5: 10.2 EER[b], 11.0 IPLV[b] For zones 6 to 8: 9.7 EER[b], 11.0 IPLV[b]	
Through-the-wall, Air cooled	< 30,000 Btu/h~~[d]~~	Split system	10.9 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	AHRI 210/240
		Single package	10.6 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	
Air conditioners, Water and evaporatively cooled	~~< 65,000 Btu/h~~	Split system and single package	~~12.1 EER~~ 14.0 EER	AHRI 210/240
	~~≥ 65,000 Btu/h and~~ ~~< 135,000 Btu/h~~	~~Split system and single package~~	~~11.5 EER[c]~~	
	~~≥ 135,000 Btu/h and~~ ~~< 240,000 Btu/h~~	~~Split system and single package~~	~~11.0 EER[c]~~	AHRI 340/360
	~~≥ 240,000 Btu/h~~	~~Split system and single package~~	~~11.5 EER[c]~~	

For SI: 1 British thermal unit per hour = 0.2931 W.

a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

b. IPLVs are only applicable to equipment with capacity modulation.

~~c. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.~~

d. ~~Single-phase air-cooled air conditioners < 65,000 Btu/h are regulated by the National Appliance Energy Conservation Act of 1987 (NAECA); SEER values are those set by NAECA.~~

TABLE 503.2.3(2)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[b]	TEST PROCEDURE[a]
Air cooled (Cooling mode)	< 65,000 Btu/h[d]	Split system	~~13.0 SEER~~ For zones 1 to 5: 15.0 SEER, 12.5 EER For zones 6 to 8: 14.0 SEER, 12.0 EER	AHRI 210/240
		Single package	~~13.0 SEER~~ 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 ~~< 135,000 Btu/h~~ < 240,000 Btu/h	Split system and single package	~~10.1 EER[c]~~ ~~(before Jan 1, 2010)~~ ~~11.0 EER[c]~~ ~~(as of Jan 1, 2010)~~ For zones 1 to 5: 12.0 SEER, 12.4 EER For zones 6 to 8: 11.5 EERb, 11.9 IPLV[b]	
	~~≥135,000 Btu/h and~~ ~~< 240,000 Btu/h~~	~~Split system and single package~~	~~9.3 EER[c]~~ ~~(before Jan 1, 2010)~~ ~~10.6 EER[c]~~ ~~(as of Jan 1, 2010)~~	AHRI 340/360
	≥ 240,000 Btu/h	Split system and single package	~~9.0 EER[c]~~ ~~9.2 IPLV[c]~~ ~~(before Jan 1, 2010)~~ ~~9.5 EER[c]~~ ~~9.2 IPLV[c]~~ ~~(as of Jan 1, 2010)~~ For zones 1 to 5: 12.0 SEER, 12.4 EER For zones 6 to 8: 10.5 EER[b], 10.9 IPLV[b]	
Through-the-Wall (Air cooled, cooling mode)	<30,000 Btu/h[d]	Split system	10.9 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	AHRI 210/240
		Single package	10.6 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	
Water source (Cooling mode)	~~< 17,000 Btu/h~~	~~86°F entering water~~	~~11.2 EER~~	~~AHRI/ASHRAE-13256-1~~
	~~≥ 17,000 Btu/h and~~ < 135,000 Btu/h	~~86°F~~ 85°F entering water	~~12.0~~ 14.0 EER	AHRI/ASHRAE-13256-1
Groundwater source (Cooling mode)	< 135,000 Btu/h	59°F entering water	16.2 EER	AHRI/ASHRAE-13256-1
Ground source (Cooling mode)	< 135,000 Btu/h	77°F entering water	13.4 EER	AHRI/ASHRAE 13256-1
Air cooled (Heating mode)	< 65,000 Btu/h[d] (Cooling capacity)	Split system	~~7.7 HSPF~~ For zones 1 to 5: 9.0 HSPF For zones 6 to 8: 8.5 HSPF	AHRI 210/240
		Single package	~~7.7 HSPF~~ For zones 1 to 5: 8.5 HSPF For zones 6 to 8: 8.0 HSPF	

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[b]	TEST PROCEDURE[a]
	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb outdoor air	~~3.2 COP (before Jan 1, 2010)~~ ~~3.3 COP (as of Jan 1, 2010)~~ 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	~~3.1 COP (before Jan 1, 2010)~~ 3.2 COP ~~(as of Jan 1, 2010)~~	AHRI 340/360
		77°F db/15°F wb outdoor air	2.1 COP	
Through-the-wall (Air cooled, heating mode)	<30,000 Btu/h	Split system	7.1 HSPE (before Jan 23, 2010) 7.4 HSPF (as of Jan 23, 2010)	AHRI 210/240
		Single package	7.0 HSPF (before Jan 23, 2010) 7.4 HSPF (as of Jan 23, 2010)	
Water source (Heating mode)	< 135,000 Btu/h (Cooling capacity)	~~68°F entering water~~ 70°F entering water	~~4.2 COP~~ 4.6 COP	ARI/ASHRAE-13256-1
Groundwater source (Heating mode)	< 135,000 Btu/h (Cooling capacity)	50°F entering water	3.6 COP	ARI/ASHRAE-13256-1
Ground Source (Heating mode)	< 135,000 Btu/h (Cooling capacity)	32°F entering water	3.1 COP	ARI/ASHRAE-13256-1

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. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. IPLVs and Part load rating conditions are only applicable to equipment with capacity modulation.
~~c. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.~~
~~d. Single-phase air-cooled heat pumps < 65,000 Btu/h are regulated by the National Appliance Energy Conservation Act of 1987 (NAECA), SEER and HSPF values are those set by NAECA~~

TABLE 503.2.3(3)
PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINAL HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[b]	TEST PROCEDURE[a]
~~PTAC (Cooling mode) New construction~~	~~All capacities~~	~~95°F db outdoor air~~	~~12.5 - (0.213 · Cap/1000) EER~~	ARI 310/380
~~PTAC (Cooling mode) Replacements[e]~~	~~All capacities~~	~~95°F db outdoor air~~	~~10.9 - (0.213 · Cap/1000) EER~~	
~~PTHP (Cooling mode) New construction~~	~~All capacities~~	~~95°F db outdoor air~~	~~12.3 - (0.213 · Cap/1000) EER~~	
~~PTHP (Cooling mode) Replacements[e]~~	~~All capacities~~	~~95°F db outdoor air~~	~~10.8 - (0.213 · Cap/1000) EER~~	
~~PTHP (Heating mode) New construction~~	~~All capacities~~	—	~~3.2 - (0.026 · Cap/1000) COP~~	
~~PTHP (Heating mode) Replacements[e]~~	~~All capacities~~	—	~~2.9 - (0.026 · Cap/1000) COP~~	
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	

For SI: ºC - [(ºF) - 32]/1.8, 1 British thermal unit per hour - 0.2931 W.

db = dry-bulb temperature, ºF.
wb = wet-bulb temperature, ºF.
a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
b. Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7,000 Btu/h, use 7,000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.
~~c. 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 503.2.3(4)
WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[d, e]	TEST PROCEDURE[a]
Warm air furnaces, gas fired	< 225,000 Btu/h	—	~~78% AFUE~~ ~~or~~ ~~80% *Et* c~~ 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[~~c~~]	~~80% *Et*~~ [~~f~~] 90% E[c] note h	ANSI Z21.47
Warm air furnaces, oil fired	< 225,000 Btu/h	—	~~78% AFUE~~ ~~or~~ ~~80% *Et*~~ 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[~~b~~]	~~81% *Et*[g]~~ 85% Et, [d]	UL 727
Warm air duct furnaces, gas fired	All capacities	Maximum capacity[~~b~~]	~~80% *Ec*~~ *90% Ec*	ANSI Z83.8
Warm air unit heaters, gas fired	All capacities	Maximum capacity[~~b~~]	~~80% *Ec*~~ *90% Ec*	ANSI Z83.8
Warm air unit heaters, oil fired	All capacities	Maximum capacity[~~b~~]	~~80% *Ec*~~ *90% Ec*	UL 731

For SI: 1 British thermal unit per hour = 0.2931 W.
a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
~~b. Minimum and maximum ratings as provided for and allowed by the unit's controls.~~
~~c. Combination units not covered by the National Appliance Energy Conservation Act of 1987 (NAECA) (3-phase power or cooling capacity greater than or equal to 65,000 Btu/h [19 kW]) shall comply with either rating.~~
~~d~~ b. *Et* = Thermal efficiency. See test procedure for detailed discussion.
~~e~~ c. *Ec* = Combustion efficiency (100% less flue losses). See test procedure for detailed discussion.
~~f. *Ec* = Combustion efficiency. Units must also include an IID, have jackets not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.~~
~~g. *Et* = Thermal efficiency. Units must also include an IID, have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.~~
d. 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 503.2.3(5)
BOILERS, GAS- AND OIL-FIRED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPEf	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY~~[c, d, e]~~	TEST PROCEDURE[a]
~~Boilers, Gas fired~~	~~< 300,000 Btu/h~~	~~Hot water~~	~~80% AFUE~~	~~DOE 10 CFR Part 430~~
		~~Steam~~	~~75% AFUE~~	
	~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h~~	~~Minimum capacityb~~	~~75% *Et* and 80% *Ec* (See Note c, d)~~	~~DOE 10 CFR Part 431~~
	~~>2,500,000 Btu/hf~~	~~Hot water~~	~~80% *Ec* (See Note c, d)~~	
		~~Steam~~	~~80% *Ec* (See Note c, d)~~	
~~Boilers, Oil fired~~	~~< 300,000 Btu/h~~	~~—~~	~~80% AFUE~~	~~DOE 10 CFR Part 430~~
	~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h~~	~~Minimum capacityb~~	~~78% *Et* and 83% *Ec* (See Note c, d)~~	~~DOE 10 CFR Part 431~~
	~~> 2,500,000 Btu/hf~~	~~Hot water~~	~~83% *Ec* (See Note c, d)~~	
		~~Steam~~	~~83% *Ec* (See Note c, d)~~	
~~Boilers, Oil fired (Residual)~~	~~≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h~~	~~Minimum capacityb~~	~~78% *Et* and 83% *Ec* (See Note c, d)~~	~~DOE 10 CFR Part 431~~
	~~> 2,500,000 Btu/hf~~	~~Hot water~~	~~83% *Ec* (See Note c, d)~~	
		~~Steam~~	~~83% *Ec* (See Note c, d)~~	
Gas Hot Water	< 300,000 Btu / h		90% Et	DOE 10 CFR Part 430
	> 300,000 Btu / h and > 2.5 mBtu/h		89% Et	DOE 10 CFR Part 431
Gas Steam	< 300,000 Btu / h		89% Et	DOE 10 CFR Part 430
	> 300,000 Btu / h		89% Et	DOE 10 CFR Part 431
Oil	< 300,000 Btu / h		90% Et	DOE 10 CFR Part 430
	> 300,000 Btu / h		89% Et	DOE 10 CFR Part 431
Et = thermal efficiency				

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~

a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

~~b. Minimum ratings as provided for and allowed by the unit's controls.~~

~~c~~ b. *Ec* = Combustion efficiency (100 percent less flue losses). See reference document for detailed information.

~~d~~ c. *Et* = Thermal efficiency. See reference document for detailed information.

~~e. Alternative test procedures used at the manufacturer's option are ASME PTC-4.1 for units greater than 5,000,000 Btu/h input, or ANSI Z21.13 for units greater than or equal to 300,000 Btu/h and less than or equal to 2,500,000 Btu/h input.~~

~~f. These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers, and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.~~

TABLE 503.2.3(6)
CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	MINIMUM EFFICIENCY[b]	TEST PROCEDURE[a]
Condensing units, air cooled	≥ 135,000 Btu/h	10.1 EER 11.2 IPLV	ARI 365
Condensing units, water or evaporatively cooled	≥ 135,000 Btu/h	13.1 EER 13.1 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	

For SI: 1 British thermal unit per hour = 0.2931 W.

a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

b. IPLVs are only applicable to equipment with capacity modulation.

TABLE 503.2.3(7)
WATER CHILLING PACKAGES, EFFICIENCY REQUIREMENTS[a]

EQUIPMENT TYPE	SIZE CATEGORY	~~UNITS~~	~~BEFORE 1/1/2010~~		~~AS OF 1/1/2010C~~				TEST PROCEDURE[b]
			REQUIRED EFFICIENCY- CHILLERS		~~PATH A~~ OPTIONAL COMPLIANCE PATH - REQUIRED EFFICIENCY - CHILLERS WITH VSD		~~PATH B~~		
			FULL LOAD (KW /TON)	IPLV (KW /TON)	FULL LOAD (KW /TON)	IPLV (KW /TON)	~~FULL LOAD~~	~~IPLV~~	
Air-Cooled ~~Chillers~~ w/ Condenser	~~<150 tons~~ All	~~EER~~	~~≥9.562~~ 1.2	~~≥10.416~~ 1.0	~~≥9.562~~ N/A	~~≥12.500~~ N/A	~~NA[d]~~	~~NA[d]~~	AHRI 550/590
	~~≥150 tons~~	~~EER~~			~~≥9.562~~ N/A	~~≥12.750~~ N/A	~~NA[d]~~	~~NA[d]~~	
Air-Cooled without Condenser~~,~~ ~~Electrical Operated~~	All ~~Capacities~~	~~EER~~	~~≥10.586~~ 1.08	~~≥11.782~~ 1.08	~~Air-cooled chillers without condensers must be rated with matching condensers and comply with the air-cooled chiller efficiency requirements~~				
					N/A	N/A			
Water cooled, ~~Electrically Operated,~~ Reciprocating	All ~~Capacities~~	~~kW/ton~~	~~≤0.837~~ 0.840	~~≤0.696~~ 0.630	~~Reciprocating units must comply with water cooled positive displacement efficiency requirements~~				
					N/A	N/A			
Water Cooled, ~~Electrically Operated, Positive Displacement~~ Rotary Screw and Scroll	<~~75~~ 90 tons	~~kW/ton~~	~~≤0.790~~ 0.780	~~≤0.676~~ 0.600	~~≤0.780~~ N/A	~~≤0.630~~ N/A	~~≤0.800~~	~~≤0.600~~	
	≥~~75~~ 90 tons and < 150 tons	~~kW/ton~~	0.730	0.550	~~≤0.775~~ N/A	~~≤0.615~~ N/A	~~≤0.790~~	~~≤0.586~~	
	≥ 150 tons and < 300 tons	~~kW/ton~~	~~≤0.717~~ 0.610	~~≤0.627~~ 0.510	~~≤0.680~~ N/A	~~≤0.580~~ N/A	~~≤0.718~~	~~≤0.540~~	
	≥300 tons	~~kW/ton~~	~~≤0.639~~ 0.600	~~≤0.571~~ 0.490	~~≤0.620~~ N/A	~~≤0.540~~ N/A	~~≤0.639~~	~~≤0.490~~	

EQUIPMENT TYPE	SIZE CATEGORY	~~UNITS~~	~~BEFORE 1/1/2010~~		~~AS OF 1/1/2010C~~				TEST PROCEDURE[b]
			REQUIRED EFFICIENCY-CHILLERS		~~PATH A~~ OPTIONAL COMPLIANCE PATH - REQUIRED EFFICIENCY - CHILLERS WITH VSD		~~PATH B~~		
			FULL LOAD (KW /TON)	IPLV (KW /TON)	FULL LOAD (KW /TON)	IPLV (KW /TON)	~~FULL LOAD~~	~~IPLV~~	
Water Cooled, ~~Electrically Operated,~~ Centrifugal	<150 tons	~~kW/ton~~	~~≤0.703~~ 0.610	~~≤0.669~~ 0.620	~~≤0.634~~ 0.630	~~≤0.596~~ 0.400	~~≤0.639~~	~~≤0.450~~	
	≥150 tons and < 300 tons	~~kW/ton~~	~~≤0.634~~ 0.590	~~≤0.596~~ 0.560	0.600	0.400			
	≥300 tons and < 600 tons	~~kW/ton~~	~~≤0.576~~ 0.570	~~≤0.549~~ 0.510	~~≤0.576~~ 0.580	~~≤0.549~~ 0.400	~~≤0.600~~	~~≤0.400~~	
	≥600 tons	~~kW/ton~~	~~≤0.576~~ 0.550	~~≤0.549~~ 0.510	~~≤0.570~~ 0.550	~~≤0.539~~ 0.400	~~ARI 560~~	~~≤0.400~~	
~~Air Cooled Absorption Single Effect~~	~~All Capacities~~	~~COP~~	~~≥0.600~~	~~NR[e]~~	~~≥0.600~~	~~NR[e]~~	~~NA[d]~~	~~NA[d]~~	~~AHRI 560~~
~~Water-Cooled Absorption Single Effect~~	~~All Capacities~~	~~COP~~	~~≥0.700~~	~~NR[e]~~	~~≥0.700~~	~~NR[e]~~	~~NA[d]~~	~~NA[d]~~	
~~Absorption Double Effect Indirect-Fired~~	~~All Capacities~~	~~COP~~	~~≥1.000~~	~~≥1.050~~	~~≥1.000~~	~~≥1.050~~	~~NA[d]~~	~~NA[d]~~	
~~Absorption Double Effect Direct Fired~~	~~All Capacities~~	~~COP~~	~~≥1.000~~	~~≥1.000~~	~~≥1.000~~	~~≥1.000~~	~~NA[d]~~	~~NA[d]~~	

For SI: 1 ton = 907 kg, 1 British thermal unit per hour = 0.2931 W.

a. The chiller equipment requirements do not apply for chillers used in low-temperature applications where the design leaving fluid temperature is<40ºF.

b. Section 12 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 B. However, both the full load and IPLV must be met to fulfill the requirements of Path A or B.~~

d. NA means that this requirement is not applicable and cannot be used for compliance.

~~e. NR means that there are no minimum requirements for this category.~~

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

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.

~~**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 percent 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; and
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 occupation 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 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.

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 following systems:

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 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. 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 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

~~**503.4.1 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 provided for each cooling system 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 percent of the design supply air quantity as *outdoor air* for cooling.

503.1.1.2 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.

~~**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 provided for each cooling system 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 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 ~~10~~ 7.5 horsepower (~~7.5~~ 5.6 kW) or greater shall be:

1. Driven by a mechanical or electrical variable speed drive; or
2. 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.

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.

4. Revise as follows

SECTION 505
ELECTRICAL POWER AND LIGHTING SYSTEMS
(Mandatory)

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/m2).
6. Daylight spaces complying with Section 505.2.2.2.3 Automatic Daylighting Controls

505.2.2.2 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 505.2.2.2.1 Occupancy Sensors
2. Section 505.2.2.2.2 Time Clock Controls

Exception:

1. Spaces complying with Section 505.2.2.3 Daylight Zone Control.

505.2.2.2.1 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.

505.2.2.2.2 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 4 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.

~~**505.2.2.3.1. Daylight Controls**~~ Daylight zones ~~as defined by this code,~~ shall be provided with automatic daylight controls ~~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 from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration. The daylight controls shall meet the requirements of Section 505.2.2.3.1. and 505.2.2.3.2.

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.

505.2.2.3.1 Automatic daylight 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 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 by 30 percent to 50 percent of rated power and another control step that reduces lighting power by 65 percent to 100 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 are not required to have a separate switch for general area lighting.

505.2.2.3.2 Daylight controls functional performance testing. Automatic daylighting control systems shall be tested to document that control devices are calibrated and adjusted to operate in accordance with approved plans and specifications. A letter of certification of lighting calibration shall be submitted to the code official prior to issuance of the final certificate of occupancy.

~~**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.~~

505.2.2.4 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.

Exception: Items 1, 2, and 4 Where LED lighting is used no additional control is required.

505.5.2 Interior lighting power. The total interior lighting power (watts) is the sum of all interior lighting powers for all areas in the building covered in this permit. The interior lighting power is the floor area for each building area type listed in Table 505.5.2 times the value from Table 505.5.2 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. 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.

~~TABLE 505.5.2~~
~~INTERIOR LIGHTING POWER ALLOWANCES~~

~~LIGHTING POWER DENSITY~~	
~~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~~
~~Multi-Family~~	~~0.7~~
~~Museum~~	~~1.1~~
~~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~~

~~For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m2.~~

TABLE 505.5.2
INTERIOR LIGHTING POWER ALLOWANCES
LIGHTING POWER DENSITY

BUILDING AREA TYPE[a]	**(Watts/Ft²)**
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
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.

~~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~~ 4~~W/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.~~

Add new standards to Chapter 6 as follows:

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

Reason: The proponents 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 New Buildings Institute'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.

This proposal contains measures that may be dependent on the passage of federal legislation pending as of the date of submittal.

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, and introduces some new elements such as commissioning of critical systems and automatic control of daylighting. 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, includes efficiency improvements in mechanical equipment with some climate-specific flexibility, 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 daylight sources combined with automatic daylight controls, and comprehensive control strategy for all daylit zones.

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

Analysis: A review of the standard(s) proposed for inclusion in the code, ASTM E779-03, E1677-95 (00), E2178-03, and E2357-05, 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:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: Makela-Baker-Conner-EC-1-202-Ch 5-Ch 6FF

EC147–09/10
202, 101.2, Chapter 5

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 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}·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/ft2) (5.5 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.~~

~~**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 m3/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/m2).
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~~

~~Building Area Typea~~	~~(W/ft2)~~
~~Multifamily~~	~~0.7~~
~~Museum~~	~~1.1~~
~~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

Building Area Type[a]	Whole Building	Space by Space
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
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	

Building Area Type[a]	Whole Building	Space by Space
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
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 < 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 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
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.

<u>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.</u>

28. Add new standards to Chapter 6 as follows:

ASTM

<u>E779-03</u>	<u>Standard Test Method for Determining Air Leakage Rate by Fan Pressurization</u>
<u>E1677-95 (2000)</u>	<u>Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls</u>
<u>E2178-03</u>	<u>Standard Test Method for Air Permeance of Building Materials</u>
<u>E2357-05</u>	<u>Standard Test Method for Determining Air Leakage of Air Barrier Assemblies</u>
<u>C1371-04</u>	<u>Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers</u>
<u>C1549</u>	<u>Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer</u>
<u>E408-71 (02)</u>	<u>Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques</u>
<u>E1918-97</u>	<u>Standard Test Method for Measuring Solar Reflectance of Horizontal or Low-Sloped Surfaces in the Field</u>

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.

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

ICCFILENAME: HEWLETT-LOYER-MAJETTE-EC1-202-501.2

EC148–09/10
501.1, 501.2, 502.1.1

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.

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

ICCFILENAME: Nowak-EC-1-501.1-501.2-502.1.1

EC149–09/10
501.1, 501.2, Chapter 6

Proponent: Ken Sagan, National Association of Home Builders (NAHB)

1. 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 requirements in Sections 502 (Building envelope), 503 (Building mechanical systems), 504 (Service water heating) and 505 (Lighting) shall each be satisfied on an individual basis. ~~Where one or more of these sections is not satisfied, compliance for that section(s) shall be demonstrated in accordance with the applicable provisions of ASHRAE/IESNA 90.1.~~
Exception: Buildings conforming to Section 506, provided Sections 502.4, 502.5, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied.

2. Delete standards from Chapter 6 as follows:

ASHRAE

~~90.1-2004~~	~~Energy Standard for Buildings Except Low-rise Residential Buildings (ANSI/ASHRAE/IESAN 90.1-2004~~)

IESNA

~~90.1-2001~~	~~Energy Standard for Buildings Except Low-rise Residential Buildings~~

Reason: The IECC is a stand-alone energy code complete with prescriptive and performance compliance paths. IECC has up-dated the code on a three-year cycle to keep current with the developments made in the energy efficiency industry and using the consensus process has optimized the provisions to require energy savings. On the other hand, ASHRAE has not kept up with the requirements on energy efficiency. ASHRAE /IESNA Standard 90.1 -2001 Section 6, is no longer current or up-to-date. The reference of outdated sections of ASHRAE 90.1 Standard is not consistent with the requirements of stringency of the IECC. The wholesale reference to ASHRAE 90.1 does not add value to the IECC. ASHRAE has been trying to impose its overly complex standard directly into the body of the commercial portion of the IECC to eliminate any reference to the IECC. Individuals electing to build to the ASHRAE Standard find difficulty in understanding and complying with the Standard.

If a state or local jurisdiction desires to have ASHRAE 90.1 as their alternative code, they are free to do this.

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

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

ICCFILENAME: Sagan-EC-12-501.1-501.2

EC150–09/10
501.1, 501.2

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. **Circumvents IECC Requirements.** 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. **ASHRAE 90.1 Unenforceable.** 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. **Not Coordinated.** 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. **Not Unified.** 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. **Copies unavailable.** 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. **Use of ASHRAE 90.1 Not Precluded.** 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.

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

ICCFILENAME: Spielvogel-EC-1-501.1

EC151–09/10
501.2

Proponent: Steve Ferguson, representing The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

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) 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.

Exceptions:

1. 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.
2. The use of the Space-by-Space method, ASHRAE/IES 90.1 Section 9.6, shall be permitted to determine the Interior Power Allowance in either method of compliance.

Reason: The current IECC 2009 language does not allow the use of just the 90.1 Lighting section for compliance if the IECC is used. This restricts flexibility in lighting design and compliance in many cases because lighting envelope and mechanical disciplines do not always coordinate on methods of compliance.

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

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

ICCFILENAME: Ferguson-EC-1-501.2

EC152–09/10
501.2, 506

Proponent: Ronald Majette, representing US Department of Energy

1. 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) 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.~~

Delete Section 506 without substitution:

~~**SECTION 506**~~
~~**TOTAL BUILDING PERFORMANCE**~~

Reason: ASHRAE Standard 90.1 has a well defined and regularly updated approach for assessing a building design on the basis of performance equivalency. The continued maintenance of Section 506 in Chapter 5 takes time and more importantly creates the opportunity for the IECC and Standard 90.1 to grow apart. The intent of Chapter 5 is to provide a simplified approach for commercial buildings that minimizes the need to consult the referenced Standard 90.1. If one cannot meet the provisions of Chapter 5 then it seems logical to refer them to Standard 90.1 to address compliance.

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

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

ICCFILENAME: Majette-EC-41-501.2

EC153–09/10
501.2, 507 (New), 507.1 (New), 507.1.1 (New)

Proponent: Krista Braaksma, representing Washington State Building Code Council

Revise as follows:

501.2 Application. The *commercial building* project shall comply with the requirements in Sections 502 (Buildings envelope requirements), 503 (Building mechanical systems), 504 (Service water heating), ~~and~~ 505 (Electrical power and lighting systems), and 507 (Energy consuming mechanisms) in its entirety.

SECTION 507
ENERGY CONSUMING MECHANISMS (Mandatory)

507.1 General (Mandatory). This section establishes criteria for the control of energy consuming mechanisms other than those covered under Section 505 that serve commercial buildings.

507.1.1 Pedestrian escalators and moving pedestrian walkways. Each pedestrian escalator or moving pedestrian walkway shall be equipped with an automatic control device to prevent operation of escalators and moving walkways when the mechanisms are unoccupied.

Reason: The proposal would add a requirement for controls on escalators and moving walkways to prevent continuous operation when they are not in use. This would provide significant energy savings and would also prolong the lifetime of the equipment. These systems automatically detect approaching passengers and the equipment runs only when needed. This technology is becoming more and more common and provides a method to reduce both energy use and greenhouse gas emissions.

According to Xcel Energy, a system installed in the Denver International Airport is estimated to save 30-40% of the electrical use on escalators and moving walkways, representing a reduction of over 2.0 million kilowatt-hours (kWh) per year and will reduce carbon dioxide emissions by four million pounds per year with a 3 year payback. (http://www.powerefficiencycorp.com/article/article_25mar08.php)

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

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

ICCFILENAME: BRAAKSMA-EC-6-501.2-507

EC154–09/10
202

Proponent: Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association (AAMA)

Revise definition as follows:

STOREFRONT. A non-residential ~~system of doors and windows mulled as a~~ composite fenestration structure that has been designed to resist heavy use. Storefront systems include, but are not limited to, exterior fenestration systems that span from the floor level or above to the ceiling of the same story on commercial buildings, with or without mulled windows and doors.

Reason: The purpose of this proposal is to clarify that a storefront system can consist of just windows, just doors, or a combination of the two. Some parties have interpreted the first sentence of the current definition as indicating that both doors and windows must be present in a composite fenestration structure in order for it to be considered storefront, which is not the intent of 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

FILENAME: RUTH-EC-1-202

EC155–09/10
502.1.1

Proponent: James Bowman, American Forest and Paper Association

Revise 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/IESNA90.1. Where required, insulation board shall be installed in compliance with its listing and not alter the approved application of wood structural panels or the lateral force resisting system of the assembly.

Reason: With the increased specification of insulation-board only options, it may make the use of WSP more problematic in high-wind and seismic zones, where compliant structural components and connections are crucial. Each of these components must be attached per their listings, engineered designs and comply with structural code provisions of the IBC. This proposal simply reinforces and provides a reference to the need to adhere to pertinent attachment requirements and not use one set of fasteners for multiple panels or otherwise use inadequate attachments.

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

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

ICCFILENAME: BOWMAN-EC-1-502.1.1.DOC

EC156 –09/10
Tables 502.1.2, 502.2(1), 502.2(2)

Proponent: Casey Harkins, representing Thermal Design, Inc.

Revise 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-0.063	U-0.048	U-0.048	U-0.048	U-0.048	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-0.039	U-0.039	U-0.039
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-0.035	~~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-0.027	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-0.027	U-0.027	U-0.027	U-0.027	U-0.027
									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-0.080	U-0.071	U-0.071	U-0.071	U-0.071	U-0.052
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

(Remainder of table and footnotes unchanged)

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-15ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci
Metal buildings (with R-~~5~~3 thermal blocks[a,b])	~~R-19~~ R-19 + R-11 LS	~~R-19~~ R-19 + R-11 LS	~~R-13 + R-13~~ R-19 + R-11 LS	~~R-13 + R-13~~ R-19 + R-11 LS	~~R-13 + R-13~~ R-19 + R-11 LS	~~R-19~~ R-19 + R-11 LS	~~R-13 + R-13~~ R-19 + R-11 LS	~~R-19~~ R-25 + R-11 LS	~~R-13 + R-13~~ R-25 + R-11 LS	~~R-19~~ R-25 + R-11 LS	~~R-13 + R-19~~ R-30 + R-11 LS	~~R-19~~ R-30 + R-11 LS	~~R-13 + R-19~~ R-30 + R-11 LS	~~R-19 + R-10~~ R-30 + R-11 LS	~~R-11 + R-19~~ R-25 + R-11 + R-11 LS	~~R-19 + R-10~~ R-25 + R-11 + R-11 LS
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-38	R-38	R-49	R-49
Walls, Above Grade																
Mass	NR	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci [c]	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-19	~~R-16~~ R-19.5ci	~~R-16~~ R-13 + R-6.5ci	~~R-16~~ R-19.5ci	~~R-19~~ R-13ci	~~R-19~~ R-19.5ci	~~R-19~~ R-19.5ci	~~R-19~~ R-19.5ci	~~R-13 + R-5.6ci~~ R-19.5ci	~~R-13 + R-5.6ci~~ R-13 + R-19.5ci	~~R-13 + R-5.6ci~~ R-19.5ci	~~R-13 + R-5.6ci~~ R-13 + R-19.5ci	~~R-19 + R-5.6ci~~ R-13 + R-19.5ci	~~R-19 + R-5.6ci~~ R-13 + R-19.5ci	~~R-19 + R-5.6ci~~ R-13 + R-19.5ci	~~R-19 + R-5.6ci~~ R-13 + R-19.5ci

(Remainder of table and footnotes unchanged)

2. Delete and substitute as follows:

~~TABLE 502.2(2)~~
~~BUILDING ENVELOPE REQUIREMENTS - OPAQUE ASSEMBLIES~~

TABLE 502.2(2)
METAL BUILDING ASSEMBLY DESCRIPTIONS

ROOFS	**DESCRIPTION**
R-19+R-11 LS R-25+R-11 LS R-30+R-11 LS R-25+R-11+R-11 LS	Fiberglass liner system with thermal spacer block. A continuous membrane is installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced fiberglass insulation rests on top of the membrane between the purlins. For multilayer installations, the last R-Value of insulation is for unfaced insulation draped over purlins and then compressed when the metal roof panels are attached. A minimum R-3 thermal spacer block between the purlins and the metal roof panels is required.
WALLS	
R-19	Single layer faced fiberglass insulation. The layer of R-19 faced fiberglass insulation is installed continuously perpendicular to the girts and is compressed when the metal skin is attached to the girts.
R-13ci R-19.5ci	Continuous insulation. The continuous insulation is installed on the interior plane of the girts and uninterrupted by the framing members.
R-13 + R-6.5ci R-13 + R-19.5ci	Single layer faced fiberglass insulation with continuous insulation. The first *R*-Value is for faced fiberglass insulation installed continuously perpendicular to the girts and is compressed when the metal skin is attached to the girts. The second *R*-Value is for continuous insulation installed on the interior plane of the girts and uninterrupted by the framing members.

Reason: The purpose of this proposal is to correct erroneous metal building U-Factors specified in the Code, correct an inappropriate redefinition of a metal building assembly description added in the last code cycle and to improve metal building roof and wall requirements for all climate zones, based on revised U-Factor and cost data developed by the Metal Building Task Group of the ASHRAE SSPC 90.1 Envelope Subcommittee.

Previous versions of the IECC, in addition to the DOE's COMcheck software and numerous State Codes, have relied upon the metal building assembly descriptions and U-Factors defined in Appendix A of the ASHRAE 90.1 Standard (90.1-1999 through 90.1-2007). Even before U-Factors themselves were added to the IECC in the 2009 version, the intended performance of the prescriptive R-Value requirements were based on the assumption that the prescribed R-Values achieved the level of performance claimed in the 90.1 Standard. Unfortunately, these performance claims for most of the metal building insulation assemblies were based on invalid assumptions, most significantly the geometry of the insulation as it is typically installed in a metal building roof or wall. After a tremendous amount of discussion and debate since December 2006, primarily in the ASHRAE SSPC 90.1 Envelope Subcommittee, a Metal Building Task Group was formed which reviewed available information, gathered additional data as needed, and developed more accurate U-Factors for these metal building insulation assemblies. This task group presented their findings and recommendations to the SSPC 90.1 Envelope Subcommittee in October 2008, which unanimously accepted the revised U-Factors. These revisions appear in the proposed 90.1-2007 Addendum bb. The revised U-Factors show that the previous U-Factors for metal building insulation assemblies relied on by ASHRAE, IECC and others were overstated by nearly 40%. This has resulted in flawed economic analysis leading in most cases to less than economic criteria for metal building roofs and walls being published. Architects, engineers, contractors, owners and code compliance officials that have relied on these performance claims have unintentionally allowed buildings to be built and approved that fall far below the intended stringency of these Standards and Codes. The owners are stuck with higher energy costs for the life of their buildings as a result. This proposal addresses these issues by incorporating the opaque metal building roof and wall prescriptive criteria, the more accurate U-Factors for metal building insulation assemblies, and associated assembly descriptions proposed in ASHRAE 90.1-2007 Addendum bb.

There are numerous methods of installing insulation in metal building roofs and walls. The most commonly used is conventionally referred to as "Over-the-Purlin" or "Over-the-Girt". The double layer variation is conventionally referred to as "Sag-and-Bag". These assemblies are referred to as "Single Layer" and "Double Layer" in ASHRAE 90.1-1999 through ASHRAE 90.1-2007 and account for all but one of the metal building assemblies listed in Appendix A of the 90.1 Standards (90.1-1999 through 90.1-2007). I will refer to all of these single and double layer roof and wall assemblies collectively as "Over-the-Purlin" assemblies. This type of installation starts with a layer of faced metal building insulation which is installed perpendicular to the secondary structural members (purlins for roofs, girts for walls), pulled tight and then compressed when the metal roof or wall panels are attached. The double layer "Sag-and-Bag" variation, only used in roofs, adds an additional layer of unfaced insulation positioned above the first layer, parallel to and centered between the purlins. The compression of the insulation in both the single layer and double layer variations occurs across the entire assembly, not just at the junction between the roof or wall panels and each underlying structural member.

The problem with and subsequent discussion about the previous performance claims of these Over-the-Purlin metal building roof and wall assemblies arise from the assumptions used in the thermal modeling of the assemblies. Unfortunately, most of the technical data from the modeling was apparently destroyed in some sort of house fire. What remains is a single summary report which lacks specifics on the geometry of modeled assemblies (installed insulation thickness across each assembly). While some other problematic assumptions are listed in the modeling summary report (e.g. thermal spacer block thicknesses and insulation thickness combinations which exceed metal building manufacturers recommendations), the most significant problem appears to be the undisclosed assumed geometry. The report does contain some images of thermal models which suggest that the insulation was assumed to recover to its full nominal insulation thickness within 8 to 12 inches of the purlin and continue to span the space between the purlins maintaining this same full nominal thickness to within 8 to 12 inches of the adjacent purlin.

In the past couple years, two groups studying metal building assemblies independently arrived at the same conclusion: Over-the-Purlin metal building insulation assemblies form a parabolic thickness profile between adjacent purlins when installed. Dr. Merle McBride and others at the Owens-Corning Technical Center arrived at this conclusion when developing new thermal modeling of metal building assemblies. They noted this observation in a presentation to the ASHRAE SSPC 90.1 Envelope Subcommittee in April 2008. Dr. Les Christianson, Professor Emeritus at the University of Illinois Urbana-Champaign, also observed this in his research which looked specifically at the typical installed thicknesses of metal building assemblies. The recognition of the parabolic thicknesses profile contradicts what appears to be the assumption used in previous thermal modeling where the insulation maintains a uniform thickness across the majority of the space between adjacent purlins.

In response to concerns repeatedly raised by Thermal Design, a Metal Building Task Group was created by the ASHRAE SSPC 90.1 Envelope Subcommittee in April 2008 to review the available data from all parties and give guidance to the Envelope Subcommittee on revisions to the 90.1 Standard to address any problems identified. The task group included Dr. McBride, Dr. Christianson as well as a representative from the Metal Building Manufacturers Association (MBMA), the president-elect of the Metal Building Contractors and Erectors Association (MBCEA), a representative from our company and was chaired by an independent party from outside the metal building industry. This task group reviewed and expanded upon the previous research by Thermal Design, Dr. Christianson and Dr. McBride to produce more accurate U-Factors for the metal building assemblies listed in Appendix A of the 90.1 Standard which are intended to reflect the thermal performance of these assemblies as typically installed in the field. As indicated previously, these revised U-Factors were presented to the ASHRAE SSPC 90.1 Envelope Subcommittee at their interim meeting in October 2008 and were unanimously accepted. The work of this task group will be the subject of the "ASHRAE Standard 90.1 Metal Building U-Factors" transaction session at the ASHRAE 2010 Winter Conference in Orlando, FL.

The one other metal building assembly appearing in Appendix A of 90.1-1999 through 90.1-2007 is the "Filled Cavity" roof assembly, conventionally referred to as "long tabs" in the industry. This assembly utilizes extra long side tabs of facing that extend beyond the width of the insulation. The first layer is installed parallel with and between the purlins by attaching the long tabs to the top face of the purlin. Assuming no bracing exists between the purlins, this first layer can expand to the full depth of the insulation between the purlins. The purlins themselves, including the fasteners protruding through the top flange, are exposed to the inside conditioned space. The second layer of insulation is positioned above the first layer, either parallel to and between the purlins, or perpendicular to the purlins. The performance of this assembly also appears to have been overstated in 90.1-1999 through 90.1-2007, but appears to be a result of miscopying from the original source, rather than invalid assumptions in thermal modeling. The ASHRAE 90.1-1999 through 90.1-20007 Standards listed a U-Factor of U-0.041 for this assembly, while the source cited by ASHRAE lists a U-Factor of U-0.057.

A new "Liner System" assembly was added to Appendix A in 90.1-2007 Addendum g. This assembly separates the vapor retarder from the insulation, so that it can be spanned continuously below the structural members, isolating the highly conductive steel purlins and fasteners from the conditioned space. The continuous vapor retarder membrane is held in place by a support structure, typically a grid network of steel strapping. Unfaced insulation is installed parallel to and between the purlins. Because the vapor retarder is separate from the insulation, the insulation can be easily cut to fit around purlin bracing that are common between the purlins. The top layer of unfaced insulation can either be installed parallel to and between the purlins, or installed perpendicular to and over the top of the purlins. This assembly was also added to the IECC in the last code cycle and appears at least as the requirement for "All Other" in climate zone 8. However, the change proposal which added this assembly to the IECC inappropriately renamed it Filled Cavity, though the description in 502.2(2) and the U-Factor in 502.1.2 are for the Liner System assembly from ASHRAE 90.1-2007 Addendum g. The Filled Cavity and Liner System assemblies in ASHRAE 90.1 Addendum g are two entirely different assemblies with different thermal performance. This inappropriate renaming could likely cause confusion in the marketplace, leading to the use of an assembly that performs about 35% below the intended performance of the IECC prescriptive criteria.

The requirements set forth in this proposal are identical to those proposed in the first public review draft of ASHRAE 90.1-2007 Addendum bb and are based on the standard scalar ratio economic optimization procedure used by the ASHRAE SSPC 90.1 Envelope Subcommittee.

Bibliography:

Proposed Addendum bb (First Public Review - March 2009) to Standard 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.

Cost Impact: This proposal will increase the cost of construction. However, it should be noted that in some cases the assemblies prescribed in this proposal may not increase the cost of construction over assemblies which actually meet the intended performance of previous versions of the IECC. For example, to meet the previously prescribed U-Factor performance of U-0.065, the revised U-Factors from the ASHRAE 90.1 Envelope Subcommittee's Metal Building Task Group show you would need an R-19+R-19 double layer (Sag-and-Bag) assembly (U-0.060). The R-19+R-11 Liner System assembly significantly exceeds this performance (U-0.035) and would likely cost less than the R-19+R-19 assembly. This proposal inherently reduces the cost of HVAC equipment and associated infrastructure and in some cases could reduce the net cost of the whole building.

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

ICCFILENAME: Harkin-EC-1-T. 502.1.2-T. 502.2(1)-(2)

EC157–09/10
Table 502.1.2, Table 502.2(1), Table 502.2(2)

Proponent: David C. Hewitt, New Buildings Institute, John Loyer, American Institute of Architects

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-0.0271	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

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-6,5c.i.	R-16 R-13+ R-6,5c.i.	R-16 R-13+ R-6,5c.i.	R-16 R-13+ R-13c.i.	R-19 R-13+ R-6,5c.i	R-16 R-13+ R-13c.i	R-16 R-13+ R-13c.i	R-16 R-13+ R-13c.i	R-13 + R-5.6ci R-13+ R-13c.i	R-13 + R-5.6ci R-13+ R-13c.i	R-13 + R-5.6ci R-13+ R-13c.i	R-13 + R-5.6ci R-13+ R-13c.i	R-19 + R-5.6ci R-13+ R-13c.i	R-19 + R-5.6ci R-13+ R- 19.5c.i	R-19 + R-5.6ci R-13+ R-13c.i	R-19 + R-5.6ci R-13+ R-26c.i
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 + 3.8c.i. or R-20	R-13 + 3.8c.i. or R-20	R-13 + 3.8c.i or R-20	R-13 + 3.8c.i. or R-20	R-13 + 3.8c.i. or R-20	R-13 + 3.8c.i. or R-20	R-13 + 3.8c.i. 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 c.i.	R-13 + R-7.5 c.i.	R-13 + R-7.5 c.i.	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-1.45 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 c.i. R-13+ R-13 c.i. R-13+ R-19.5 c.i R-13+ R-26 c.i	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 and the American Institute of Architects. 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.

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

ICCFILENAME: HEWIIT-LOYER-EC1-T502.1.2

EC158–09/10
Table 502.1.2, Table 502.2(1), Table 502.2(2)

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 I	All othe	Group	All othe	Group	All oth	Group	All oth	Group	All other	Group	All othe	Group	All other	Group
Roofs																
Insulation entirely above deck	~~U-0.063~~ U-0.048	~~U-0.048~~ U-0.039	~~U-0.048~~ U0.039	~~U-0.04~~ U-0.03	~~U-0.048~~ U-0.039	~~U-0.048~~ U-0.039	~~U-0.04~~ U-0.03	~~U-0.048~~ U-0.032	~~U-0.048~~ U-0.032	~~U-0.048~~ U-0.032	~~U-0.04~~ U-0.03	~~U-0.04~~ U-0.03	~~U-0.039~~ U-0.028	~~U-0.039~~ U-0.028	~~U-0.0~~ U-0.0	~~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-0.05~~ U-0.03	~~U-0.055~~ U-0.035	~~U-0.055~~ U-0.035	~~U-0.05~~ U-0.03	~~U-0.055~~ U-0.031	~~U-0.055~~ U-0.031	~~U-0.055~~ U-0.031	~~U-0.04~~ U-0.02	~~U-0.04~~ U-0.02	~~U-0.049~~ U-0.029	~~U-0.049~~ U-0.029	~~U-0.0~~ U-0.0	~~U-0.03~~ U-0.02
Attic and other	~~U-0.034~~ U-0.021	U-0.027 U-0.017	~~U-0.027~~ U-0.021	~~U-0.02~~ U-0.01	~~U-0.027~~ U-0.021	~~U-0.027~~ U-0.017	~~U-0.02~~ U-0.01	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.017	~~U-0.02~~ U-0.0	~~U-0.02~~ U-0.01	~~U-0.027~~ U-0.017	~~U-0.027~~ U-0.017	~~U-0.0~~ U-0.01	~~U-0.027~~ U-0.017
Walls, Above Grade																
Mass	U-0.058	U-0.151	U-0.151	U-0.12	U-0.123	U-0-104	U-0.10	U-0.090	U-0.090	~~U-0.080~~ U-0.047	~~U-0.08~~ U-0.04	~~U-0.07~~ U-0.04	~~U-0.071~~ U-0.047	~~U-0.07~~ U-0.047	~~U-0.0~~ U-0.04	~~U-0.05~~ U-0.047
Metal building	~~U-0.093~~ U-0.147	~~U-0.093~~ U-0.049	~~U-0.093~~ U-0.079	~~U-0.09~~ U-0.04	~~U-0.084~~ U-0.072	~~U-0.084~~ U-0.049	~~U-0.08~~ U-0.04	~~U-0.084~~ U-0.049	~~U-0.069~~ U-0.049	~~U-0.069~~ U-0.039	~~U-0.06~~ U-0.04	~~U-0.06~~ U-0.03	~~U-0.057~~ U-0.039	~~U-0.057~~ U-0.039	~~U-0.05~~ U-0.03	~~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-0.06	~~U-0.084~~ U-0.064	U-0.064	U-0.06	~~U-0.064~~ U-0.037	~~U-0.064~~ U-0.042	~~U-0.064~~ U-0.037	~~U-0.06~~ U-0.03	~~U-0.05~~ U-0.03	~~U-0.064~~ U-0.037	~~U-0.05~~ U-0.037	~~U-0.06~~ U-0.03	U-0.037
Wood framed and other	U-0.089	~~U-0.089~~ U-0.051	~~U-0.089~~ U-0.064	~~U-0.08~~ U-0.05	~~U-0.089~~ U-0.064	~~U-0.089~~ U-0.051	~~U-0.08~~ U-0.05	~~U-0.064~~ U-0.036	~~U-0.064~~ U-0.051	~~U-0.051~~ U-0.036	~~U-0.05~~ U-0.0	~~U-0.05~~ U-0.03	~~U-0.051~~ U-0.03	~~U-0.05~~ U-0.03	~~U-0.0~~ U-0.0	~~U-0.03~~ U-0.03
Walls, Below Grade																
Below-grade wall[a]	C-1.140	C-1.140	C-1.140	C-1.14	C-0.119	C-0.119	~~C-1.14~~ C-0.11	~~C-0.119~~ C-0.092	C-0.119	~~C-0.119~~ C-0.075	~~C-0.11~~ C-0.07	~~C-0.11~~ C-0.05	~~C-0.119~~ C-0.063	~~C-0.09~~ C-0.04	~~C-0.1~~ C-0.0	~~C-0.07~~ C-0.03
Floors																
Mass	U-0.322	U-0.322	~~U-0.107~~ U-0.074	~~U-0.08~~ U-0.06	~~U-0.107~~ U-0.064	~~U-0.087~~ U-0.064	~~U-0.08~~ U-0.05	~~U-0.07~~ U-0.05	~~U-0.07~~ U-0.05	~~U-0.064~~ U-0.05	~~U-0.06~~ U-0.0	~~U-0.05~~ U-0.03	~~U-0.064~~ U-0.042	~~U-0.05~~ U-0.03	~~U-0.0~~ U-0.0	~~U-0.05~~ U-0.03
Joist/Framing - Metal	~~U-0.282~~ U-0.350	~~U-0.282~~ U-0.350	~~U-0.052~~ U-0.038	~~U-0.05~~ U-0.03	~~---~~ U-0.038	~~U-0.03~~ U-0.032	~~U-0.03~~ U-0.03	~~U-0.03~~ U-0.027	~~U-0.03~~ U-0.032	~~U-0.033~~ U-0.024	~~U-0.03~~ U-0.02	~~U-0.03~~ U-0.02	~~U-0.033~~ U-0.024	~~U-0.03~~ U-0.02	~~U-0.0~~ U-0.0	~~U-0.03~~ U-0.02
Joist/Framing - Wood and Other	U-0.282	U-0.282	U-0.033	U-0.03	U-0.033	U-0.033	U-0.02	U-0.022	U-0.022	U-0.018	U-0.02	U-0.01	U-0.018	U-0.018	U-0.01	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-0.51	~~F-0.52~~ F-0.43	~~F-0.52~~ F-0.510	~~F-0.52~~ F-0.434	~~F-0.52~~ F-0.43	~~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-0.84	~~F-0.86~~ F-0.688	~~F-0.86~~ F-0.688	~~F-0.860~~ F-0.688	~~F-0.86~~ F-0.68	~~F-0.68~~ F-0.67	~~F-0.83~~ F-0.671	~~F-0.688~~ F-0.671	~~F-0.68~~ F-0.67	~~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-2~~0~~5ci	R-2~~0~~5ci	R-2~~0~~5ci	R-2~~0~~5ci	R-2~~0~~5ci	R-~~2~~30ci	R-~~2~~30ci	R-~~2~~30ci	R-~~2~~30ci	R-~~2~~30ci	R-~~2~~30ci	R-~~2~~35ci	R-~~2~~35ci	R-~~2~~35ci	R-~~2~~35ci
Metal buildings (with R-5 thermal blocks[a,b])	R-19+ R-11	R-19+ R-11	R-1~~3~~9+ R-1~~3~~1	R-1~~3~~9+ R-1~~3~~1	R-1~~3~~9+ R-1~~3~~1	R-19+ R-11	R-1~~3~~9+ R-1~~3~~1	R-~~19~~25+ R-11	R-~~13~~25+ R-1~~3~~1 ~~Ls~~	R-~~19~~25+ R-11	R-~~13~~30+ R-11~~31 Ls~~	R-~~19~~30+ R_11	R-~~13~~30+ R-11~~31 Ls~~	R-~~19~~30+ R-1~~0~~1	R-~~11~~25+ R-~~19~~11 + R-11	R-~~19~~225+ R-1~~0~~1 + R-11
Attic and Other	R-~~30~~49	R-~~38~~60	R-~~38~~49	R-~~38~~60	R-~~38~~49	R-~~38~~60	R-~~38~~49	R-~~38~~60	R-~~38~~60	R-~~38~~60	R-~~38~~60	R-~~38~~60	R-~~38~~60	R-~~38~~60	R-~~49~~60	R-~~49~~60
Walls, Above Grade																
Mass	NR	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci[e]	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-19.5ci	R-19.5ci
Metal building[b]	R-1~~6~~9	R-~~16~~0+ R-19.5ci	R-1~~6~~3+ R-6.5ci	R-~~16~~0+ R-19.5ci	R-~~19~~0+ R-13ci	R-~~19~~0+ R-19.5ci	R-~~19~~0+ R-19.5ci	R-~~19~~0+ R-19.5ci	R-~~19~~0+ R-19.5ci	R-13+ R-18.8~~5.6~~ci	R-~~3~~0+R-~~5.6~~19.5ci	R-13+ R-~~5.6~~19.5ci	R-~~19~~13+R-~~5.6~~19.5ci	R-~~19~~13+R-~~5.6~~19.5ci	R-~~19~~13+R-~~5.6~~19.5ci	R-~~19~~13+R-~~5.6~~19.5ci
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-~~3.8~~7.5ci	R-13+ R-7.5ci	R-13+ R-7.5ci	R-13+ R-~~7.5~~18.8ci	R-13+ R-~~7.5~~15.6ci	R-13+ R-~~7.5~~18.8ci	R-13+ R-~~7.5~~18.8ci	R-13+ R-~~7.5~~18.8ci	R-13+ R-~~7.5~~18.8ci	R-13+R-~~15.6~~18.8ci	R-13+ R-~~7.5~~18.8ci	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-~~3.8~~15.6ci	R-13+ R-~~3.8~~7.5ci	R-13+ R-~~3.8~~18.8ci	R-13+ R-~~7.5~~18.8ci	R-13+ R-~~7.5~~18.8ci	R-13+ R-~~7.5~~15.6ci	R-13+ R-~~7.5~~18.8ci	R-13+ R-~~15.6~~18.8ci	R-13+ R-~~15.6~~18.8ci
Wall, Below Grade																
Below grade wall[d]	NR	NR	NR	NR	~~NR~~ R-13 + R-3.8ci	NR	~~NR~~ R-7.5ci	R-~~7.5~~10ci	R-7.5ci	R-~~7.5~~ 12.5ci	~~NR~~ R-~~7.5~~12.5ci	R-17.5ci	R-~~7.5~~15ci	R-~~1~~20ci	R-17.5ci	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-3~~0~~8	R-3~~0~~8	R-~~30~~49	R-3~~0~~8	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	~~NR~~R-15 for 24 in. below	R-1~~0~~5 for 24 in. below	~~NR~~R-15 for 24 in. below	R-~~1~~20 for 24 in. below	R-~~1~~20 for 24 in. below	R-~~15~~20 for ~~24~~48 in. below	R-~~15~~20 for 24 in. below	R-~~15~~20 for ~~24~~48 in. below	R-~~15~~20 for ~~24~~48 in. below	R-2~~0~~5 for ~~24~~48 in. below
Heated slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-~~7.5~~10 for ~~12~~24 in. below	R-~~7.5~~15 for ~~12~~24 in. below	R-1~~0~~5 for 24 in. below	R-1~~0~~5 for 24 in. below	R-~~15~~20 for 24 in. below	R-~~15~~20 for ~~24~~48 in. below	R-~~15~~20 for ~~24~~48 in. below	R-~~15~~20 for ~~24~~48 in. below	R-~~15~~20 for ~~24~~48 in. below	R-2~~0~~5 for 48 in. below	R-20 for ~~24~~48 in. below	R-2~~0~~5 for 48 in. below	R-2~~0~~5 for 48 in. below	R-20 ~~for 48 in. below~~ full slab
Opaque doors																
Swinging	U-0.70	U-0.~~7~~50	U-0.70	U-0.~~7~~50	U-0.70	U-0.~~7~~50	U-0.~~7~~50	U-0.~~7~~50	U-0.~~7~~50	U-0.~~7~~50	U-0.~~7~~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. 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.

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.

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

ICCFILENAME: Majette-EC-55-T. 502.1.2-

EC159–09/10
502.2

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.

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

ICCFILENAME: Majette-EC-2-502.2

EC160–09/10
Table 502.2(1)

Proponent: James Bowman, American Forest and Paper Association

Revise table as follows:

Expand the insulation options in Climate Zones 4 through 8 by adding R-value choices that don't force the use of insulation board to the exclusion of other equally efficient products.

Table 502.2(1) (Limited to Changes)
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
Walls, Above Grade																
Wood Framed and Other	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-21	R-13 + R-7.5ci or R-21	R-13 + R-7.5ci or R-21	R-13 + R-7.5ci or R-21	R-13 + ~~R-15.6ci~~ R-7.5ci or R-21	R-13 + R-15.6ci or R-25

(Portions of table and footnotes not shown unchanged)

Reason: Specifying insulation board-only prescriptive options restricts flexibility, eliminates blown-in foam options in Zones 4-6 and removes the option to choose equally efficient insulation products. Limiting compliance to insulation-board only options also may make the use of WSP more problematic in high-wind and seismic zones, where structural components and connections are crucial. Each of these components must be attached per their listings, engineered designs and comply with structural code provisions.

The insulation values for walls in Zone 8, "All Other", should never be in excess of those for steel and are erroneous. Contrary to other requirements in this table, steel wall insulation values in this Zone 8 category are now less at R13+ 7.5 than those for wood at R-13+15.6. There is no plausible justification for flipping these values.

In the interest of maintaining realistic building practices and the marginal efficiency impact in Zone 8 of added wall insulation, which is primarily in Northern Alaska, an R-25 option is proposed for residential, which still exceeds the efficiency of an equivalent steel wall.

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

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

ICCFILENAME: BOWMAN-EC-2-T. 502.2(1).DOC

EC161–09/10
Table 502.2(1)

Proponent: Mark Nowak, representing Steel Framing Alliance

Revise table as follows:

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
Walls, Above Grade																
Metal Framed	R-13	R-13	R-13	R-13~~+R-7.5 ci~~	R-13~~+R-3.8 ci~~	R-13~~+R-7.5 ci~~	R-13+R-7.5 ci	R-13+R-7.5 ci	R-13+R-7.5 ci	R-13+R-7.5 ci	R-13+R-7.5 ci	R-13+R-7.5 ci	R-13+R-7.5 ci	R-13+R-15.6 ci	R-13+R-7.5 ci	R-13+R18.8 ci

(No change to remainder of table or footnotes)

Reason: In climate zone 2 Group R and climate zone 3, a change was made to Table 502.2(1) to return the R-value requirements for metal framed walls to that used in the 2006 IECC. The increased stringencies for climate zones 2 and 3 that were passed in the 2009 IECC are changes that result in significant construction costs but scant energy savings. Energy conservation could be better accomplished in other areas of the building envelope where more energy could be conserved for each dollar invested. Following is an analysis of Group R construction that was conducted in two cities in climate zone 2 and three cities in climate zone 3 that shows the costs and benefits associated with specifying a metal framed wall with the 2006 IECC requirements versus the 2009 requirements. The selected cities are the representative cities developed by PNNL for these respective climate zones. Based on this analysis, which shows simple paybacks from 25 to 65 years, the Steel Framing Alliance believes that there is not sufficient justification to retain the insulation requirements at the 2009 level.

	Climate Zone 2				Climate Zone 3					
	Houston		Phoenix		Memphis		El Paso		San Francisco	
Benefits of Continuous Insulation*	R-13	R-13+7.5	R-13	R-13+7.5	R-13	R-13+7.5	R-13	R-13+7.5	R-13	R-13+7.5
Annual Compressor Electricity Use per Dwelling, heating and cooling (kWh)	3,438	3,327	3,289	3,165	3,376	3,176	2,545	2,402	1,333	1,289
Annual Compressor Energy Savings Per Dwelling in going from R-13 to R-13+7.5 steel framed walls (kWh)	111		124		200		143		45	
Annual Dollar Savings Per Dwelling in specifying R-13+7.5 versus R-13 steel framed walls	$14		$12		$16		$18		$6	
Cost of Electricity ($/kWh)	$0.12		$0.10		$0.08		$0.12		$0.12	
Cost of Continuous Insulation**										
2" expanded polystyrene, R7.7 installed cost, cost to general contractor ($/sqft)	$0.98		$1.01		$1.04		$0.98		$0.92	
2" expanded polystyrene, installed cost per Dwelling unit, includes 20% markup by GC	$445		$455		$471		$445		$418	
Simple Payback, years***	32		38		30		25		65	
*Energy use was derived through an annual hourly-based simulation using Energy Gauge Summit Premier from Florida Solar Energy Center, which uses DOE 2.1E as the simulation engine. The building modeled was a 32 unit multifamily residential building with individual dwellings of 1,000 sqft. Federal minimum efficiency air source heat pumps were modeled to provide space heating and cooling. In all cases except the R-13 steel framed wall, the building envelope was modeled to meet minimum prescriptive requirements of the 2009 IECC. Cost of electricity was based on U.S. DOE EIA 2007 state residential average retail price. The analysis was conducted by Newport Ventures, which maintains certified HERS raters and professional engineers on staff to conduct energy analyses of residential buildings.										
**Costs of continuous insulation were estimated based on RS Means; costs do not include extra charges for jamb extensions.										
***Time required to recoup costs to building owner based on energy savings expected										

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

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

ICCFILENAME: Nowak-EC-3-T. 502.2(1)

EC162–09/10
Table 502.3

Proponent: Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association (AAMA)

Revise as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Climate Zone	1	2	3	4 except Marine	5 & Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
U-Factor								
~~**All Others[a]**~~								
~~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	1.0	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
<u>All Others[a]</u>								
<u>Metal framing with or without thermal break</u>								
~~All Other~~ *U*-Factor	1.20	0.75	0.65	0.55	~~0.55~~<u>0.50</u>	~~0.55~~<u>0.50</u>	0.45	0.45
<u>Framing materials other than metal, with or without metal reinforcement or cladding.</u>								
<u>U-factor</u>	<u>1.20</u>	<u>0.65</u>	<u>0.50</u>	<u>0.35</u>	<u>0.35</u>	<u>0.35</u>	<u>0.35</u>	<u>0.35</u>
Remainder of table unchanged.								

NR = No requirement.
PF = Projection factor (see Section 502.3.2).
a. All others includes operable windows, fixed windows and ~~non-entrance~~ doors <u>other than entrance doors</u>.

Reason: This proposal seeks to address an ongoing concern of the fenestration industry that Table 502.3 of the IECC is not material neutral, by removing separation by framing material for certain end product categories. The end products addressed by this proposal, specifically curtainwall, storefront and entrance doors, are often required by other provisions of the International Codes to meet higher levels of performance than other fenestration products in commercial buildings with regards to characteristics such as structural design load, durability, compliance with ADA, fire resistance rating and noncombustibility, etc.

To allow the designer of these products, and the architect, contractor and others associated with the design and construction of a commercial building, more options to meet these other requirements in a cost effective manner, Table 502.3 allows them more lenient U-factors in some climate zones. This should be permitted regardless of the framing material used. Removing the distinction for curtainwall, storefront and entrance doors recognizes this, and would allow future focus on the more troublesome “All Others” category.

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

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

ICCFILENAME: Ruth-EC-2-T. 502.3

EC163–09/10
Table 502.3

Proponent: Thomas D. Culp, Ph.D., Birch Point Consulting LLC, representing Aluminum Extruders Council

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% maximum of above-grade wall)								
***U*-factor**								
~~**Framing materials other than metal with or without metal reinforcement of 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~~ 0.57[c]	~~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]								
Performance class LC, CW, AW	~~1.20~~ 0.65[c]	~~0.75~~ 0.65	~~0.65~~ 0.60	~~0.55~~ 0.50	~~0.55~~ 0.50	~~0.55~~ 0.50	0.45	0.45
Performance class R	0.57[c]	0.57	0.40	0.35	0.35	0.35	0.35	0.35

(Portions of table not shown remain unchanged)

a. All others includes operable windows, fixed windows, and ~~nonentrance~~ doors other than entrance doors.
b. Performance class determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
c. 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 1.20.

Reason: In past cycles, certain groups have voiced concerns about having separate metal vs. nonmetal fenestration frame categories in Table 502.3 on the basis that they are not "material neutral". We do not agree with those statements, in that there are specific technical reasons for having separate frame categories, and there is nothing inherently wrong with having separate requirements based on material. Material-based requirements are common throughout the I-codes (e.g. wood, metal, and mass wall requirements). In previous cycles, the committee has agreed and repeatedly rejected proposals to remove the metal vs. nonmetal framing categories.

Nonetheless, in a positive effort to address these concerns, we offer this proposal which would be "material neutral", yet also preserve the original reason for having separate metal vs. nonmetal categories – structural performance. This proposal would reformat the table, putting the window requirements in terms of the AAMA/WDMA/CSA 101/I.S.2/A440 performance classes (R vs. LC, CW, AW) instead of by material type. 101/I.S.2/A440 testing is already required by the IBC, and for air leakage in the IECC. (This is just for windows and non-entrance doors. Curtain wall, storefront, and entrance doors do not require 101/I.S.2/A440 testing, and their criteria remain separate in this table.)

At the same time, we have taken the opportunity to also increase stringency, based on requirements being proposed by the New Buildings Institute.

Cost Impact: The code change proposal will increase the cost of construction. There are increased costs associated with the increased stringency in U-factor, most notably with the requirement for double glazing in zone 1 and the increased use of thermally broken frames across several zones. However, these changes are felt to be justified at the levels proposed including the allowance for single glazing for hurricane products in zone 1.

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

ICCFILENAME: CULP-EC-1-T. 502.3.DOC

EC164–09/10
Table 502.3

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.

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

ICCFILENAME: Lowinski-EC-1-T. 502.3

EC165–09/10
Table 502.3

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.

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

ICCFILENAME: HEWITT-LOYER-EC1-T502.3

EC166–09/10
202 (New), Table 502.3, Table 502.3(1) (New), 502.3.2, Table 502.3(2) (New)

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.

$$PF = A/B \qquad \textbf{(Equation 5-1)}$$

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:

502.3.2Maximum*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 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.

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

ICCFILENAME: Majette-EC-52-202-T. 502.3-

EC167–09/10
Table 502.3

Proponent: Ronald Majette, representing US Department of Energy

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	1.0	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-factora	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~~ 5% 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: For consistency with ASHRAE Standard 90.1-07. Since 90.1-07 provides prescriptive provisions for skylights up to 5% of the roof area then for consistency the IECC should allow Table 502.3 to be used up to that percentage as well.

Cost Impact: The code change proposal will increase the cost of construction to the degree that more efficient products will be required.

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

ICCFILENAME: Majette-EC-53-T. 502.3

EC168–09/10
Table 502.3

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.

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

ICCFILENAME: Stone-EC-1-T. 592.3

EC169–09/10
Table 502.3

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~~ <u>0.25</u>	~~0.40~~ <u>0.25</u>	~~0.40~~ <u>0.25</u>	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	~~NR~~ <u>0.33</u>	~~NR~~ <u>0.33</u>	~~NR~~ <u>0.33</u>	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	~~NR~~ <u>0.40</u>	~~NR~~ <u>0.40</u>	~~NR~~ <u>0.40</u>	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.

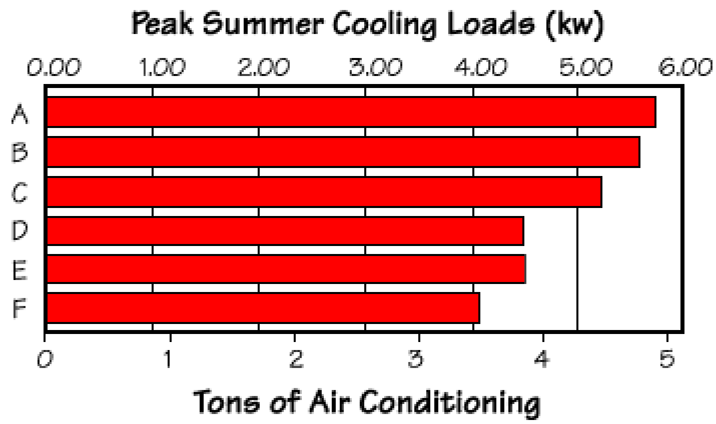
Reason: This proposal will save energy, reduce energy costs and reduce peak electricity demand with virtually no negative construction cost impact by establishing SHGC requirements for climate zones 4-6 consistent with the existing requirements for climate zones 1-3. This proposal will reduce the solar 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*.

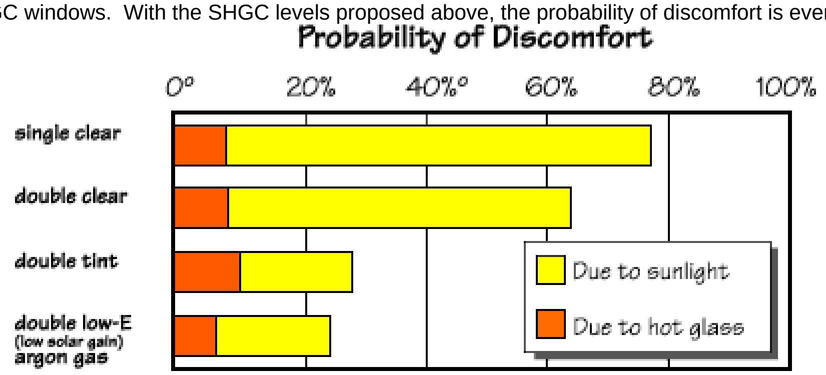
The types of buildings regulated under chapter 5 are typically internal-heat load dominated, and usually reach their maximum energy intensity during summer peak electricity times of the day and year. Despite a more northerly location, the electric utility systems of states throughout these climates zones 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.

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

ICCFILENAME: Stone-EC-4-T. 502.3

EC170–09/10
Table 502.3, 502.3.2

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.

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

ICCFILENAME: Stone-EC-6-T. 502.3-502.3.2

EC171–09/10
502.3.1 (New), Chapter 6 (New)

Proponent: Craig Conner, Building Quality, representing self

1. Add new text as follows:

502.3.1 Storefront and curtain wall in commercial buildings: U-factors and SHGC for storefront and curtain wall in commercial buildings is 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.

(Renumber subsequent sections)

2. Add new standard to Chapter 6 as follows:

AAMA
507-07 Standard Practice for Determining the Thermal Performance Characteristics of Fenestration Systems Installed in Commercial Buildings

Reason: The IECC requires windows to be rated for energy efficiency. However, the rating procedure specified is too slow for the construction process for certain types of commercial windows. An optional alternative procedure is needed for "site built" store front and curtain wall windows. The process needs to produce a rating in time to respond to the normal commercial bid process. The time between bid and construction can be days or weeks. The NFRC web site stated, "it will take on average approximately 100 days to obtain a Label Certificate." The AAMA 507 procedure can be used to rate a window within a few days or less and produces the same rating.

Commercial window makers bid windows for a specific commercial building. Unlike residential windows, combination of glazing and frame are often produced in response to a specific commercial building design. The combinations of available glass and window frames are too numerous to rate all combinations in advance. However, the characteristics of each separate frame and glass option are known in advance. Using the AAMA 507 standard, commercial window makers can quickly and inexpensively use the frame and glass characteristics to produce a timely rating for windows tailored to the specifications for a particular building. Therefore, the AAMA 507 produces a practical window rating that can be used in the commercial site-built bid process and will further encourage energy-efficient commercial windows.

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.

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

ICCFILENAME: CONNER-EC-5-502.3.1-CH 6.DOC

EC172–09/10
502.3.1 (New), Chapter 6

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.

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

ICCFILENAME: Ruth-EC-5-502.3.1-Ch 6

EC173–09/10
502.3.2 (New), Chapter 6 (New)

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.

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

ICCFILENAME: Majette-EC-3-502.3.2-

EC174–09/10
502.3.2, Table 502.3

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.

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

ICCFILENAME: Stone-EC-2-502.3.2-T. 502.3

EC175–09/10

502.3.2, Table 502.3

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. <u>The applicable maximum U-factor for all vertical fenestration other than curtainwall, storefront and entrance doors shall be determined by the total vertical fenestration area as a percentage of above grade wall area as specified in Table 502.3. An area-weighted average of vertical fenestration products shall be permitted to satisfy the U-factor requirements for each category of products.</u> For skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3.

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.

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 Vertical Fenestration U-factor								
Total Fenestration Area > 25% and ≤ 40%of Above Grade Wall [a]	0.65	0.50	0.40	0.35	0.35	0.32	0.32	0.32
~~All other *U*-factor~~[a] Total Fenestration Area ≤ 25% of Above Grade Wall [a]	~~1.20~~ 0.95	~~0.75~~ 0.71	~~0.65~~ 0.57	~~0.55~~ 0.50	~~0.55~~ 0.50	~~0.55~~ 0.47	~~0.45~~ 0.47	~~0.45~~ 0.47

NR = No requirement
PF = Projection factor (see Section 502.3.2).
a. Total Fenestration Area includes the area of all vertical fenestration, including curtainwall, storefront, entrance doors, etc. ~~All others includes operable windows, fixed windows and nonentrance doors.~~

Reason: This proposal is a stepped approach (based on fenestration area) to fenestration U-factor requirements that increases energy efficiency by rewarding energy efficient design choices, while reasonably increasing flexibility. The proposal eliminates the current *IECC* practice of distinguishing between fenestration requirements based on frame material type (e.g., metal v. non-metal). It is unreasonable and anti-competitive that a building's energy efficiency requirements depend on the material selected for window frames. The current practice actually creates an incentive to select much less efficient fenestration, simply on the basis of frame selection. This proposal removes this incentive while leaving options for construction with all frame types.

To fix this problem, the above proposal establishes:

(1) two levels of vertical fenestration area (40% and 25% of above-grade wall);
(2) a U-factor requirement that all of the vertical fenestration (other than curtainwall, storefront and entrance doors) must meet on a for each level of fenestration area; and
(3) an area-weighted average option for U-factor compliance.

Although the proposed U-factor requirements are more stringent on average, the combination of a weighted-average U-factor and fenestration-area-dependent requirement ensures flexibility and a wide range of choices for designers and builders.

The proposal begins with the requirements in the 2009 IECC for non-metal-framed fenestration as the baseline for 40% fenestration area. The U-factors at these levels are improved where reasonably feasible based on proposals from the 07/08 ICC cycle for residential fenestration. Using these values as a baseline, the proposal then develops an alternative set of requirements for 25% window area by using a simple, straightforward UA calculation to determine comparable values at this level. For purposes of the UA calculation, the proposal assumes the opaque wall U-factor to be equal to the highest wall U-factor from Table 502.1.2 for each climate zone.

The result is a flexible U-factor requirement that rewards designers and builders who incorporate more energy efficiency into buildings, rather than arbitrarily rewarding builders who select certain types of fenestration or framing materials (which are not always the most efficient option). The proposal will also save energy since the baseline requirements are more stringent than current code and the requirements for 25% glazing are generally comparable to current requirements for metal-framed windows.

Complaints at previous code hearings that metal-framed products cannot reach increasing energy efficient values have often stymied significant improvements in glazing requirements for commercial and high-rise residential buildings. This proposal addresses this problem squarely by offering a compliance path at 25% glazing geared to values that these products can meet. 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. This proposal resolves these issues fairly and reasonably.

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

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

ICCFILENAME: Stone-EC-5-502.3.2-T. 502.3

EC176–09/10
502.3.3 (New)

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.

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

ICCFILENAME: CULP-EC-3-502.3.3.DOC

EC177–09/10
202 (New), 502.3.3 (New)

Proponent: Ronald Majette, representing US Department of Energy

1. Add new definition 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).

2. Add new text as follows:

502.3.3. Fenestration Orientation. The *vertical fenestration area* shall meet the following requirement:

$A_S \geq A_W$, and $A_S \geq A_E$.

where:

A_s = south oriented *vertical fenestration area* (oriented less than 45 degrees of true south)
A_n = north oriented *vertical fenestration area* (oriented less than 45 degrees of true north)
A_w = west oriented *vertical fenestration area* (oriented less than or equal to 45 degrees of true west)
A_e = east oriented *vertical fenestration area* (oriented less than or equal to 45 degrees of true east)

Exceptions:

1. *Vertical fenestration* that is shaded by *opaque permanent projections.*
2. Buildings that have an existing building or existing permanent infrastructure within 20 ft (6 m) to the south which is at least half as tall as the proposed building.
3. Buildings with shade on 75 percent of the west and east façade from existing buildings, existing permanent infrastructure, or topography at 9 AM and 3 pm on the summer solstice.
4. *Alterations* and *additions* with no increase in *vertical fenestration area*.

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.

This proposed change is intended to limit poorly oriented fenestration. Compliance can be shown by having more south facing fenestration than west facing fenestration. For those buildings affected by this requirement, this reduces envelope loads, energy usage and thereby costs. This approach gives flexibility to building design teams to work with building sitting and fenestration orientation as well as fenestration area to comply with the requirement. This change provides exceptions for retail glass and buildings potentially shaded from the south or west. Also, an exception is provided for certain additions and alterations.

Cost Impact: The code change proposal could increase or decrease the cost of construction based on the difference in orientation and fenestration location that occurs compared to what would have occurred without this requirement. It is likely this requirement will cause some additional thinking about orientation and shape of the building that will reduce the cost of construction.

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

ICCFILENAME: Majette-EC-4-502.3.3

EC178–09/10
502.3.3 (New)

Proponent: Ronald Majette, representing US Department of Energy

Add new text as follows:

502.3.3 Fenestration orientation. Fenestration on walls facing directly west shall be limited to 10 percent of the total fenestration area of the building. As a wall facing within 45 degrees of west is oriented from true west toward the north the percentage shall be permitted to be increased by 1 percent for each 2.5 degrees of orientation of the wall toward the north. As a wall facing within 45 degrees of west is oriented from true west toward the south the percentage shall be permitted to be increased by 1 percent for each 5 degrees of orientation of the wall toward the south.

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 could increase or decrease the cost of construction based on the difference in orientation and fenestration location that occurs compared to what would have occurred without this requirement. It is likely this requirement will cause some additional thinking about orientation and shape of the building that will reduce the cost of construction.

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

ICCFILENAME: Majette-EC-5-502.3.3

EC179–09/10
202 (New), 502.3.3 (New), 505.2.5 (New), Chapter 6

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.

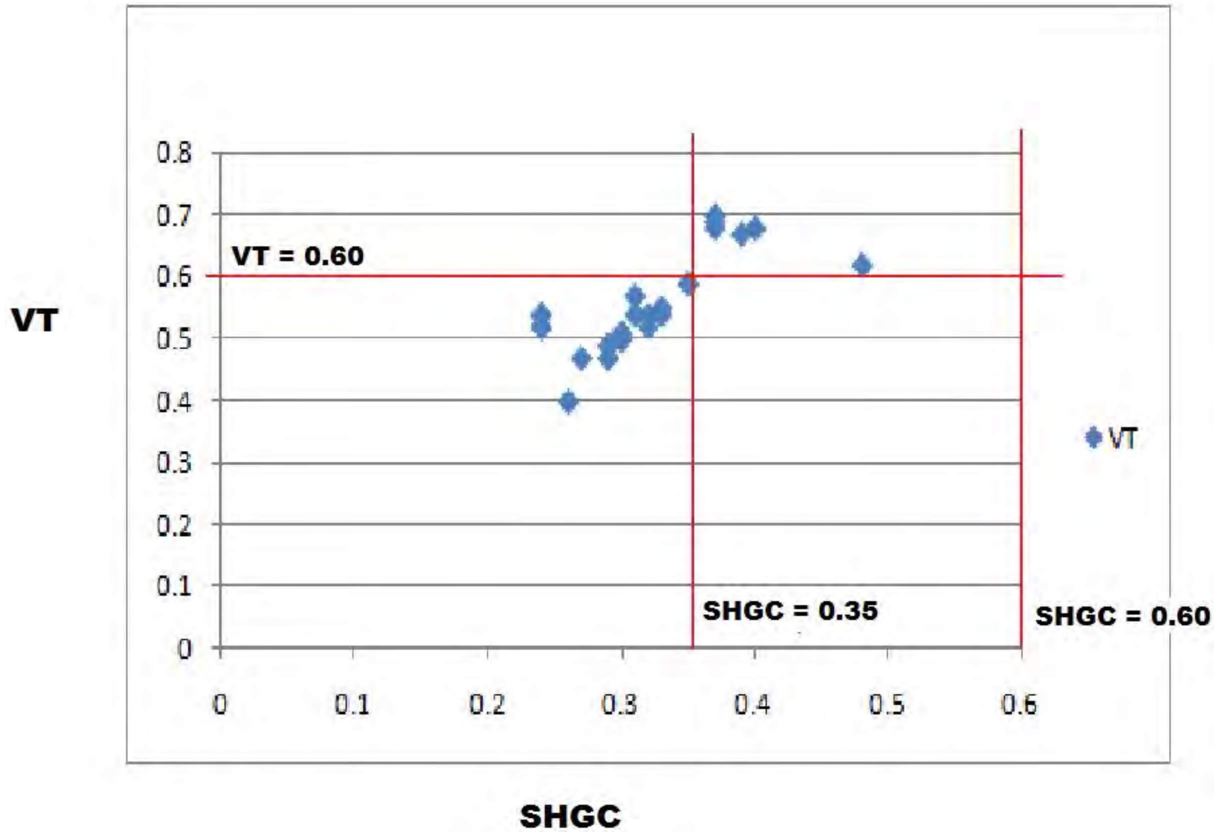


Figure 1 Comparison of VT to SHGC for domed skylights listed in NFRC Database

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:	Committee:	AS	AM	D
	Assembly:	ASF	AMF	DF

ICCFILENAME: Ruth-EC-3-202-502.3.3-505.2.6-Ch 6

EC180–09/10
502.3.3 (New)

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.

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

ICCFILENAME: Stone-EC-7-502.3.3

EC181–09/10
502.4.1, 502.4.2, 502.4.3, 502.4.4, 502.4.5

Proponent: Mr. Laverne Dalgleish, Building Professionals, representing Air Barrier Association of America, Inc.

Revise as follows:

502.4 Air leakage (Mandatory).

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 percent 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.
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.
4. The air barrier material of an envelope assembly shall be joined and sealed in a flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies 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. Joints, seams, and penetrations of vapor retarders.
7. All other openings in the *building envelope.*

502.4.2 Air barrier penetrations. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made air tight.

~~502.4.1~~ 502.4.3 **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.

Exceptions:

1. Site-constructed windows and doors that are weatherstripped or sealed in accordance with Section 502.4.3.
2. Field-fabricated fenestration and doors that are weather stripped.
3. For garage *doors*, air leakage determined by test at standard test conditions in accordance with ANSI/ DASMA 105 shall be an acceptable alternate for compliance with air leakage requirements.

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 Section 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.

~~**502.4.3 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.~~

502.4.5 Outdoor air intakes and exhaust openings. Stair and elevator shaft vents and other outdoor air intakes and exhaust openings ~~integral to the building envelope~~ that penetrate the air barrier shall be equipped with not less than a Class I motorized, leakage-rated damper with a maximum leakage rate of 4 cfm per square foot (6.8 L/s · C m_2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.

Such dampers shall be set in the closed position and automatically open 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.

Exception: Gravity (nonmotorized) dampers are permitted to be used in buildings less than three stories in height above grade.

Reason: Airtight buildings significantly contribute to the reduction of energy use of a building. By installing an air barrier in a building, the heating and cooling load of a building is reduced as air that infiltrates into a building to replace the air that has exfiltrated needs to be conditioned. Reduction in infiltrated air means a reduction in the energy used to condition it. As many existing building materials meet the requirement for air permeance, they only need to be sealed. Sealing of the building envelope was an existing requirement so no additional costs are incurred. The modifications make it easier for the authority having jurisdiction to determine compliance with this part of the IECC.

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

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

ICCFILENAME: DALGLEISH-EC-1-502.4.DOC

EC182–09/10

202 (New), 502.4, 502.8 (New)

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.

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

ICCFILENAME: Majette-EC-32-502.4-

EC183–09/10
502.4.1, 502.4.2

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 weatherstripped 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.

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

ICCFILENAME: CULP-EC-2-502.4.1-502.4.2.DOC

EC184–09/10

502.4.1 (New), 502.4.3

Proponent: Theresa Weston, PhD., representing DuPont Building Innovations

1. Add new text as follows:

<u>**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.</u>

<u>The air barrier shall have the following characteristics:</u>

1. <u>It shall be continuous, with all joints made airtight per Section 502.4.4</u>
2. <u>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.</u>
3. <u>Air barrier materials shall be maintainable, or, if inaccessible, shall meet the durability requirements for the service life of the envelope assembly.</u>

2. Revise as follows:

~~502.4.3~~ <u>502.4.4</u> Sealing of the <u>opaque</u> 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<u> due to thermal and moisture variations and creep.</u> <u>Connections shall be made between:</u>

1. <u>Joints around *fenestration* and *door* frames</u>
2. <u>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</u>
3. <u>Openings at penetrations of utility services through *roofs*, *walls*, and *floors*</u>
4. <u>Site-built *fenestration* and *doors*</u>
5. <u>Building assemblies used as ducts or plenums</u>

6. <u>All other openings in the *building envelope*</u>

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.

<u>References:</u>

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.

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

ICCFILENAME: Weston-EC-3-502.4.1

EC185–09/10
202 (New), 502.4.7

Proponent: Ronald Majette, representing US Department of Energy

1. Add new definition as follows:

<u>**BUILDING ENTRANCE.** Any door, set of doors, doorway, or other form of portal that is used to gain access to the building from the outside by the public.</u>

2. Revise as follows:

502.4.7 Vestibules. <u>All *building entrances*</u> ~~A door that separates *conditioned space* from the exterior~~ shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. <u>The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided for any doors adjacent to revolving doors.</u>

Exceptions:

1. Buildings in climate Zones 1 and 2 as indicated in Figure 301.1 and Table 301.1.
2. Doors not intended to be used ~~as a building *entrance door*~~ by the public, such as doors to mechanical or electrical equipment rooms or intended solely for employee use.
3. Doors opening directly from a *sleeping unit* or dwelling unit.
4. Doors that open directly from a space less than 3,000 square feet (298 m2) in area.
5. ~~Revolving doors.~~

~~6~~ 5. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

Reason: Currently it is unclear in the application of the IECC what door situations require vestibules. One reason for that is the term building entrance is not defined. It is defined in ASHRAE 90.1-07 and for consistency Chapter 5 should lead users to the same end point as Standard 90.1-07. Currently it does not and as a result doors that should have vestibules do not. An example are doors in large retail buildings that have adjacent but exterior sales areas that are separated by the building thermal envelope from the interior of the building and are constantly being used by customers. Application with respect to revolving doors is clarified in that the code can be interpreted that if a revolving door is in the entrance that no vestibule is needed at all.

Cost Impact: The code change will increase the cost of construction to the degree that some doors that would not otherwise have vestibules under the current IECC will now be required to provide them.

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

ICCFILENAME: Majette-EC-44-202-502.4.7

EC186–09/10
502.9 (New)

Proponent: Ronald Majette, representing US Department of Energy

Add new text as follows:

502.9 Insulation of radiant heating systems. Radiant panels, and associated U-bends and headers, designed for sensible heating of an indoor space through heat transfer from the thermally effective panel surfaces to the occupants and/or indoor space by thermal radiation and natural convection and the bottom surfaces of floor structures incorporating radiant heating shall be insulated with a minimum of R-3.5 (0.62 m2/K*W).

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.

Radiant heating and radiant cooling panels transfer heat to and from occupied spaces primarily via radiation. In some applications (e.g. radiant panels in lay-in ceilings), the back sides of the panels are exposed to unconditioned, indirectly conditioned, or semiheated spaces. In these applications heat transfer from the backs of radiant panels are of less value (and in some conditions negative value). This proposal recommends adding a requirement for insulating the surfaces of radiant panels that do not face conditioned spaces because it will save energy.

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

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

ICCFILENAME: Majette-EC-6-502.9

EC187–09/10
202 (New)

Proponent: Ronald Majette, representing US Department of Energy

Add new definitions as follows:

COEFFICENT OF PERFORMANCE (COP)—COOLING. The ratio of the rate of heat removal to the rate of energy input, in consistent units, for a complete refrigerating system or some specific portion of that system under designated operating conditions.

COEFFICIENT OF PERFORMANCE (COP)—HEATING. The ratio of the rate of heat removal to the rate of heat delivered to the rate of energy input, in consistent units, for a complete heat pump system, including the compressor and, if applicable, auxiliary heat, under designated operating conditions.

INTEGRATED PART LOAD VALUE (IPLV). A single-number figure of merit based on part-load EER, COP, or kW/ton expressing part-load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for equipment.

NONSTANDARD PART LOAD VALUE (NPLV). A single-number part-load efficiency figure of merit calculated and referenced to conditions other than IPLV conditions, for units that are not designed to operate at ARI standard rating conditions.

Reason: These terms are used in Section 503.2.3. The proposed definitions are from ASHRAE Standard 90.1.

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

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

ICCFILENAME: MAJETTE-EC-31-202

EC188–09/10
503

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. 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.

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.

~~**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.

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

ICCFILENAME: COHAN-EC-2-503.DOC

EC189–09/10
503.2.1

Proponent: Ronald Majette, representing US Department of Energy

Revise and relocate as follows:

~~302.1~~ 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. 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.The~~ <u>an</u> interior design temperature~~s used for heating and cooling load calculations shall be~~ ~~a maximum of~~ <u>no more than</u> 72ºF (22ºC) for heating and ~~minimum of~~ <u>no less than</u> 75ºF (24ºC) for cooling.

Reason: The current title of Chapter 3 is not consistent with the content of the Chapter. The content of Section 302 is more relevant to Section 503.2.1 and is proposed to be located therein with the issue of load calculations and equipment sizing. The deletion of design conditions from Chapter 3 on climate zones eliminates the need to reference those design loads as an alternative in Section 503.2.1. The content in Section 303 is more appropriate in Chapters 4 and 5 at locations where it is relevant and is not related to climate zones.

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

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

ICCFILENAME: Majette-EC-60-503.2.1

EC190–09/10
503.2.10.3 (New)

Proponent: Krista Braaksma, representing Washington State Building Code Council

Add new text as follows:

<u>**503.2.10.3 Motor efficiency.** Single-speed, polyphase, 500 horsepower or less, 2, 4, and 6 pole, squirrel cage induction motors, not addressed elsewhere in this Code, shall meet or exceed the nominal energy efficiency levels of NEMA Design A or B, Premium Efficiency Motors. Evidence of compliance shall be by a visible label stating that the motor is a "NEMA Premium" product.</u>

Reason: Electric motors have a significant impact on the total energy operating cost for industrial, institutional and commercial buildings.

Electric motors vary in terms of energy efficiency. The NEMA Premium program assists purchasers to identify higher efficient motors.

Based on U.S. Department of Energy data, it is estimated that the NEMA Premium motor program would save 5,800 gigawatts of electricity and prevent the release of nearly 80 million metric tons of carbon into the atmosphere over the next ten years. This is equivalent to keeping 16 million cars off the road.

The Federal Government has recently incentivized the purchase of NEMA Premium motors by creating a federal rebate program. The IECC should recognize the significant savings to be gained through the use of the most energy efficient technology and construction currently available for motors.

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

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

ICCFILENAME: BRAAKSMA-EC-3-503.2.10.3

EC191–09/10
503.2.3, Table 503.2.3(8) (New), Table 503.2.3(9) (New), Chapter 6

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)<u>, and 503.2.3(8)</u> when tested and rated in accordance with the applicable test procedure. <u>Requirements for plate type liquid to liquid heat exchangers can be found in Table 503.2.3(9).</u> 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:

$K_{adj} = 6.174722 - 0.303668(X) + 0.00629466(X)^2 - 0.000045780(X)^3$

$X = DT_{std} + \text{LIFT}$

$DT_{std} = \{24+[\text{full load kW/ton from Table 503.2.3(7)}] \times 6.83\}/\text{Flow}$

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[~~c~~ 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 with Addendum 2	Liquid to Liquid Heat Exchangers

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.

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

ICCFILENAME: Ferguson-EC-5-503.2.3-T. 503.2.3(8)-Ch 6

EC192–09/10

503.2.3, 503.2.3.1 (New), 503.2.3.2 (New), Table 503.2(7)

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 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 ~~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:

$$K\text{adj} = 6.174722 - 0.303668(X) + 0.00629466(X)^2 - 0.000045780(X)^3$$

$$X = DT\text{std} + \text{LIFT}$$

$$DTstd = \{24+[\text{full load kW/ton from Table 503.2.3(7)}] \times 6.83\}/\text{Flow}$$

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.

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

ICCFILENAME: Majette-EC-20-503.2.3

EC193–09/10

Tables 503.2.3(1) and 503.2.3(2) (New)

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	
	≥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^{o}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^{o}F were derived based on the expected performance of commercial unitary products meeting the new full load EER and COP at 47^{o}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.

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

ICCFILENAME: Ferguson-EC-2-T. 503.2.3(1)-(2)

EC194–09/10
Table 503.2.3(2), Chapter 6

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 R-22 test fluid 190°F entering gas temperature 15°F subcooling 95°F entering db	≥176,000 Btu/h·hp	ARI 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.

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

ICCFILENAME: Majette-EC-28-T. 503.2.3(2)

EC195–09/10
Table 503.2.3(2), Chapter 6

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.

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

ICCFILENAME: Majette-EC-59-T. 503.2.3(2)

EC196–09/10

Table 503.2.3(5)

Proponent: Ronald Majette, representing US Department of Energy

Delete Table 503.2.3(5) and replace as follows:

TABLE 503.2.3(5)
BOILERS, GAS- AND OIL-FIRED, MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type[a]	Subcategory or Rating Condition	Size Category (Input)	Minimum Efficiency[b,c]	Test Procedure
Boilers, hot water	Gas-fired	<300,000 Btu/h	80% AFUE	10 CFR Part 430
		≥300,000 Btu/h and ≤2,500,000 Btu/h[d]	80% E_t	10 CFR Part 431
		>2,500,000 Btu/h[a]	82% E_c	
	Oil-fired[e]	<300,000 Btu/h	80% AFUE	10 CFR Part 430
		≥300,000 Btu/h and ≤2,500,000 Btu/h[d]	82% E_t	10 CFR Part 431
		>2,500,000 Btu/h[a]	84% E_c	
Boilers, steam	Gas-fired	<300,000 Btu/h	75% AFUE	10 CFR Part 430
	Gas-fired—all, except natural draft	≥300,000 Btu/h and ≤2,500,000 Btu/h[d]	79% E_t	10 CFR Part 431
		>2,500,000 Btu/h[a]	79% E_t	
	Gas-fired—natural draft	≥300,000 Btu/h and ≤2,500,000 Btu/h[d]	77% E_t	
		>2,500,000 Btu/h[a]	77% E_t	
	Oil-fired[e]	<300,000 Btu/h	80% AFUE	10 CFR Part 430
		≥300,000 Btu/h and ≤2,500,000 Btu/h[d]	81% E_t	10 CFR Part 431
		>2,500,000 Btu/h[a]	81% E_t	

a. These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers and to all packaged boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.
b. E_c = combustion efficiency (100% less flue losses). See reference document for detailed information.
c. E_t = thermal efficiency. See reference document for detailed information.
d. Maximum capacity – minimum and maximum ratings as provided for and allowed by the unit's controls.
e. Includes oil-fired (residual).

Reason: For consistency with Standard 90.1.

Cost Impact: The proposal will not increase the cost of construction as the proposed requirements are consistent with minimum federal law regulating boiler efficiency.

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

ICCFILENAME: Majette-EC-25-T. 503.2.3(5)

EC197–09/10
503.2.4.4

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing self

Revise as follows:

503.2.4.4 Shutoff damper controls. Both outdoor air supply and exhaust ducts 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 in buildings less than three stories in height.
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 m^3/s) or less.
4. No motorized dampers shall be installed in exhaust hoods that vent commercial cooking appliances which use fuel gas.

Reason: The 2006 IFGC, Section 505.1.1, requires that no dampers be installed in an exhaust system used to vent commercial cooking fuel gas appliances. As currently written, under IECC Section 503.2.4.4, there is no exception to the requirement of installing a motorized damper as it has to do with the limitations of IFGC Section 505.1.1.

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

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

ICCFILENAME: DAHMEN-EC3-503.2.4.4.DOC

EC198–09/10
503.2.7 (New), Table 503.2.7 (New)

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.

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

ICCFILENAME: Majette-EC-10-503.2.7-

EC199–09/10
503.2.7

Proponent: Guy McMann, Jefferson County, CO, representing the Colorado Association of Plumbing and Mechanical Officials (CAPMO)

Revise as follows:

503.2.7 Duct and plenum insulation and sealing. All supply and return air ducts and plenums shall be insulated with a minimum of ~~R-5~~ R-6 insulation when located in unconditioned spaces and with a minimum of R-8 insulation when located outside the building. When located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation.

Exceptions:

1. When located within equipment.

2. When the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8°C).

Reason: This R-value is inconsistent with Section 403.2.1 which calls for R-6. R-5 isn't being manufactured in flexible duct or insulating sleeving material. R-4.6 is the lowest Flex available.

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

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

ICCFILENAME: McMann-EC-1-503.2.7

EC200–09/10
503.2.7

Proponent: Michael Resetar, Armacell LLC; Roger Schmidt, K-Flex USA; Shawn Dunahue, Nomaco Insulation

Revise as follows:

503.2.7 Duct and plenum insulation and sealing. All supply and return air ducts and plenums shall be insulated with a minimum of ~~R-5~~ R-6 insulation when located in unconditioned spaces and with a minimum of R-8 insulation when located outside the building. When located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation.

Exceptions:

1. When located within equipment.
2. When the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8°C).

All ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the *International Mechanical Code*.

Reason: Changes in the associated R value for supply and duct and plenums for conditioned spaces should be changed from an R-5 to R-6 based to maintain consistency between IECC Section 403.2.1 and this change would also provide a 20% gain in energy efficiency.

	Summer Performance		**Winter Performance**	
Conditional Information	**R-5**	**R-6**	**R-5**	**R-6**
Line temperature °F	55	55	90	90
Ambient temperature °F	100	100	30	30
Thermal conductivity (Btu•in/h•ft^2•°F)	0.265	0.265	0.265	0.265
Surface Coeff. Internal (Btu/(ft^2-h)	5.3	5.3	1.60	1.60
Surface Coeff. External (Btu/(ft^2-h)	1.6	1.6	1.6	1.6
Required thickness of insulation (inches)	1.25	1.5	1.25	1.5
Heat Flow of Flat Surface (Btu/(ft^2-h)	8.1	6.9	10.7	9.2
Btu savings	1.2		1.5	
Saving in %	14.9%		14.1%	

Cost Impact: The material cost implications would be minimal and would be recovered (paid back) after a period of months due to system efficiency gains. Labor associated with the installation would remain constant to that of the current requirements.

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

ICCFILENAME: Resetar-Schmidt-Dunahue-EC-3-503.2.7

EC201–09/10
503.2.7

Proponent: Michael Resetar, Armacell LLC; Roger Schmidt, K-Flex USA; Shawn Dunahue, Nomaco Insulation

Revise as follows:

503.2.7 Duct and plenum insulation and sealing. All supply and return air ducts and plenums shall be insulated with a minimum of R-5 insulation when located in unconditioned spaces and with a minimum of R-8 insulation when located outside the building. When located within a building envelope assembly, the duct or plenum shall be separated from the building exterior ~~or unconditioned or exempt spaces~~ by a minimum of R-8 insulation.

Exceptions:

1. When located within equipment.
2. When the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8°C).

All ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the *International Mechanical Code*.

Reason: The current language is confusing. We feel the intent of the code is more clearly stated as written above with the removal of "or unconditioned or exempt spaces"

Cost Impact: The material cost implications would be minimal and would be recovered (paid back) after a period of months due to system efficiency gains. Labor associated with the installation would remain constant to that of the current requirements.

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

ICCFILENAME: Resetar-Schmidt-Dunahue-EC-5-503.2.7

EC202–09/10
503.2.7.1.3

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing self

Revise as follows:

503.2.7.1.3 High-pressure duct systems. Ducts designed to operate at static pressures in excess of 3 inches w.g. (746 Pa) shall be insulated and sealed in accordance with Section 503.2.7. In addition, ducts and plenums shall be leak-tested in accordance with the SMACNA *HVAC Air Duct Leakage Test Manual* with the rate of air leakage (*CL*) less than or equal to 6.0 as determined in accordance with Equation 5-2.

$\cancel{CL} = \cancel{Fx\ P^{0.65}}$ $\underline{CL = F/P^{0.65}}$ **(Equation 5-2)**

where:

F = The measured leakage rate in cfm per 100 square feet of duct surface.
P = The static pressure of the test.

Documentation shall be furnished by the designer demonstrating that representative sections totaling at least 25 percent of the duct area have been tested and that all tested sections meet the requirements of this section.

Reason: The 2006 IECC Chapter Referenced Standards adopts SMACNA HVAC Air Duct Leakage Test Manual-1985 under Chapter 6. Equation 5-2 of the IECC is in conflict with Equation 1 of the SMACNA HVAC Air Duct Leakage Manual. This code change proposal corrects this discrepancy.

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

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

ICCFILENAME: DAHMEN-EC2-503.2.7.1.3.DOC

EC203–09/10
503.2.8 (New)

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.

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

ICCFILENAME: Majette-EC-11-503.2.8

EC204–09/10
503.2.8, Table 503.2.8

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~~	~~1½~~	~~3~~
~~Hot water~~	~~1½~~	~~2~~
~~Chilled water, brine or refrigerant~~	~~1½~~	~~1½~~

~~For SI: 1 inch = 25.4 mm.~~

~~a. Based on insulation having a conductivity (*k*) not exceeding 0.27 Btu per inch/h · ft² · °F.~~

~~b. For insulation with a thermal conductivity not equal to 0.27Btu · inch/h · ft² · °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 · ft² · °F).~~
~~k = 0.27 Btu · in/hr · ft² · °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·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**					
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.

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

ICCFILENAME: Majette-EC-12-503.2.8

EC205–09/10
503.2.8

Proponent: James R. Paschal, Paschal Engineering, representing Aquatherm, Inc.

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.

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°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.
6. For piping smaller than 1-1/2 inch nominal size and located within interior partitions, the thicknesses in Table 503.2.8 may be reduced by 1 inch (before any thickness adjustment made per footnote a.), but not to thicknesses below 1 inch.
7. For direct-buried cooling system piping insulation is not required..
8. For direct-buried heating and hot water system piping, these thicknesses may be reduced by 1.5 inches (before any thickness adjustment made per footnote a.) but not to thicknesses below 1 inch.

Reason: For these applications, the cost of insulation and energy required to produce the insulation is much higher than any energy savings over the expected life of the project. This proposal is also consistent with the proposed revisions to ASHRAE 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*. The current IECC only recognizes the use of and reference to ASHRAE 90.1 if used in its entirety, and otherwise requires compliance with Chapter 5 for commercial buildings. While there are other areas where it may make sense to not be consistent between the two, the pipe insulation requirements should be equivalent from an energy conservation perspective.

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

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

ICCFILENAME: Paschal-EC-1-503.2.8

EC206–09/10
Table 503.2.8

Proponent: Michael Resetar, Armacell LLC; Roger Schmidt, K-Flex USA; Shawn Dunahue, Nomaco Insulation

Revise as follows:

TABLE 503.2.8
MINIMUM PIPE INSULATION[a]
~~(thickness in inches)~~

FLUID	NOMINAL PIPE DIAMETER	
	≤ 1.5"	**> 1.5"**
Steam or fluid temperatures > 200°F	~~1-1/2"~~ R-6	~~3"~~ R-12
Hot water: 105°F to 200°F	~~1-1/2"~~ R-6	~~2"~~ R-8
Chilled water, brine or refrigerant: ≤ 55°F	~~1-1/2"~~ R-6	~~1-1/2"~~ R-6

(No change to footnotes)

Reason: Converting wall thickness requirement to an "R" value to be consistent with other insulation requirements within ICC codes and the addition operational temperature ranges help define the three categories.

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

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

ICCFILENAME: Resetar-Schmidt-Dunahue-EC-4-T 503.2.8

EC207–09/10
503.2.8.1 (New)

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.

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

ICCFILENAME: Ahern-EC-2-503.2.8.1

EC208–09/10
Table 503.2.8

Proponent: James R. Paschal, Paschal Engineering, representing Aquatherm, Inc.

Revise as follows:

TABLE 503.2.8
MINIMUM PIPE INSULATION
(thickness in inches)
(No change to table contents)

a. and b. (No change)

c. The table is based on metal pipe. Non-metallic pipes schedule 80 thickness or less shall use the table values. For other non-metallic pipes having thermal resistance greater than that of steel or copper pipe, reduced insulation thicknesses are permitted if documentation is provided showing that the pipe with the proposed insulation has no more heat gain or loss per foot than steel or copper pipe of the same nominal size with the insulation thickness shown in the table.

Reason: Plastic pipe with a heavier wall thickness can provide a significant insulating effect, thereby reducing the amount of external insulation necessary to achieve the same thermal performance. The requirements and values in the table assume that the pipe itself does not contribute to the overall thermal performance of the pipe/insulation combination. The addition of this footnote will explicitly allow recognition of this enhanced performance, while meeting the intent of the table by requiring the same or better performance from the pipe/insulation combination. This proposal is also consistent with the recently revised ASHRAE 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, which recognizes that piping materials with low thermal conductivity and sufficient wall thickness can provide an insulating effect and thereby reduce the overall insulation required to achieve equivalent performance.

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

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

ICCFILENAME: Paschal-EC-2-T. 503.2.8

EC209–09/10
Table 503.2.8

Proponent: Michael Resetar, Armacell LLC; Roger Schmidt, K-Flex USA; Shawn Dunahue, Nomaco Insulation

Revise as follows:

TABLE 503.2.8
MINIMUM PIPE INSULATION[a]
~~(thickness in inches)~~

FLUID	NOMINAL PIPE DIAMETER	
	~~≤ 1.5"~~	~~> 1.5"~~
Steam or fluid temperatures > 200°F	~~1-1/2"~~ R6	~~3"~~ R12
Hot water: 105°F to 200°F	~~1-1/2"~~ R4	~~2"~~ R6
Chilled water, brine or refrigerant: ≤ 55°F	~~1-1/2"~~ R6	~~1-1/2"~~ R6

(No change to footnotes)

Reason: Converting wall thickness requirement to an "R" value to be consistent with other insulation requirements within ICC codes and the addition operational temperature ranges help define the three categories while helping to equalize BTU loss requirement between three categories. The change in hot water reflects compatibility with current requirements within IECC and ASHRAE 90.1.

PAST HISTORY

IECC 2000:
Had Table 803.3.7

FLUID	NOMINAL PIPE DIAMETER	
	≤ 1.5"	> 1.5"
Steam	1.5	3.0
Hot water	1.0	2.0
Chilled water, brine, or refrigerant	1.0	1.5

For **SI**: 1 inch = 25.4 mm, Btu per inch/h × ft^2 × °F = W per 25 mm/K× m^2.
a. Based on insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft^2 × °F.

Steam:
1.5” wall on Flat Surface calculation is equal a “R” value of 6
1.5” wall on Radial Surface calculation is equal a “R” value of 6.4 to 11.4 *(I.D. Dependent)*
3.0” wall on Flat Surface calculation is equal a “R” value of 12
Hot and Chilled Water, brine or refrigerant:
1.0” wall on Flat Surface calculation is equal a “R” value of 4.2
1.0” wall on Radial Surface calculation is equal a “R” value of 5.5 to 7.4 *(I.D. Dependent)*
1.5” wall on Flat Surface calculation is equal a “R” value of 6
1.5” wall on Radial Surface calculation is equal a “R” value of 6.4 to 11.4 *(I.D. Dependent)*
2.0” wall on Flat Surface calculation is equal a “R” value of 8

IECC 2003:
Had Table 803.3.7

FLUID	NOMINAL PIPE DIAMETER	
	≤ 1.5"	> 1.5"
Steam	1½	3
Hot water	1	2
Chilled water, brine or refrigerant	1	1½

For SI: 1 inch = 25.4 mm, British thermal unit per inch/h · ft^2 ·°F = W per 25 mm/K · m^2 .
a. Based on insulation having a conductivity (k) not exceeding 0.27 Btu per inch/h · ft^2 ·°F.

Same Equivalent R Values as IECC 2000

IECC 2006:
Table 803.3.7 converted to Table 503.2.8

FLUID	NOMINAL PIPE DIAMETER	
	≤ 1.5"	> 1.5"
Steam	1½	3
Hot water	1	2
Chilled water, brine or refrigerant	1	1½

For SI: 1 inch = 25.4 mm, British thermal unit per inch/h ft^2 °F = W per 25 mm/K · m^2
a. Based on insulation having a conductivity (k) not exceeding 0.27 Btu per inch/h ft^2 · °F.

Same Equivalent R Values as IECC 2000

IECC 2007/2008:
Had Table 503.2.8

FLUID	NOMINAL PIPE DIAMETER	
	≤ 1.5”	<1.5”
Steam	11/2	3
Hot water	11/2	2
Chilled water, brine or refrigerant	11/2	11/2

For SI: 1 inch = 25.4 mm.
a. Based on insulation having a conductivity (*k*) not exceeding 0.27 Btu per inch/h · ft2 · °F.

b. For insulation with a thermal conductivity not equal to 0.27Btu · inch/h · ft2 · °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 · ft2 · °F).
k = 0.27 Btu · in/hr · ft2 · °F.

Steam:
1.5” wall on Flat Surface calculation is equal a “R” value of 6
1.5” wall on Radial Surface calculation is equal a “R” value of 6.4 to 11.4 *(I.D. Dependent)*
3.0” wall on Flat Surface calculation is equal a “R” value of 12
Hot and Chilled Water, brine or refrigerant:
1.0” wall on Flat Surface calculation is equal a “R” value of 4.2
1.0” wall on Radial Surface calculation is equal a “R” value of 5.5 to 7.4 *(I.D. Dependent)*
1.5” wall on Flat Surface calculation is equal a “R” value of 6
1.5” wall on Radial Surface calculation is equal a “R” value of 6.4 to 11.4 *(I.D. Dependent)*
2.0” wall on Flat Surface calculation is equal a “R” value of 8

IEEC 2009/2010: (Proposal)
Convert Insulation to “R” value by category

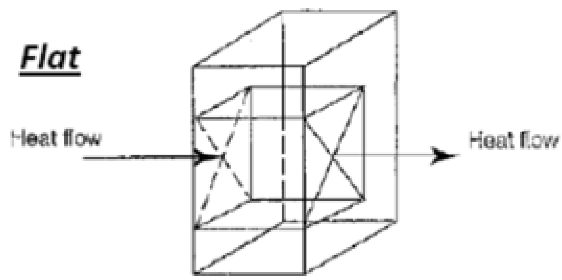
Steam:
R -12 with Flat Surface calculation is equal to a thickness of 3”
R -12 with Radial Surface calculation is equal to a thickness of 2” *(I.D. Dependent)*
Hot and Chilled Water, brine or refrigerant:
R- 6 with Flat Surface calculation is equal to a thickness of 1-1/2”
R -6 with Radial Surface calculation is equal to a thickness of 1” *(I.D. Dependent)*

BTU Loss Example based on 2009/2010 proposal:

	1" Pipe			4" Pipe		
	Temp °F	Insulation R Value	BTU Loss	Temp °F	Insulation R Value	BTU Loss
Steam or fluid temperatures > 200°F	300	R-6	-31	300	R-12	-39
Hot water: 105°F to 200°F	180	R-4	-17	180	R-6	-35
Chilled water, brine or refrigerant: ≤ 55°F	40	R-6	-4	40	R-6	-11
Ambient Temp	75			75		

(*) Chilled water is also addressing condensation concerns with the R-6 requirement

Don’t compare typical flat sheet insulation “R” values with cylindrical pipe insulation “R” values.

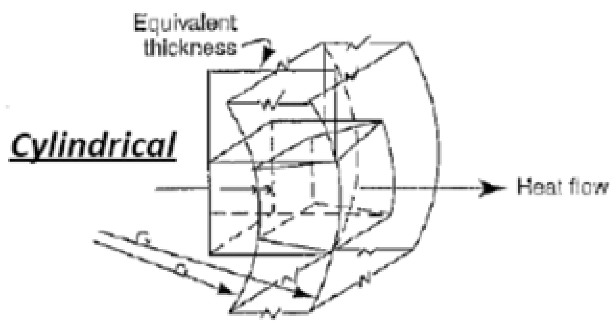


Cylindrical Pipe Insulation "R" value Calculation:

$$R = \frac{r2 \ln\left(\frac{r2}{r1}\right)}{k}$$

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:

$$R = \frac{\textit{Thickness of Material}}{\textit{Material Thermal Conductivity}}$$

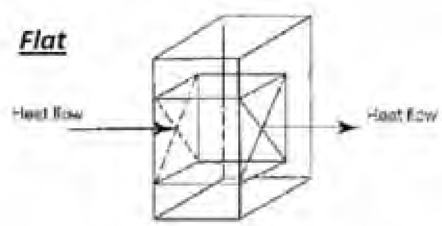
Sheet Insulation Thickness: 2"
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting "R" Value : R-8.0 *(R-8 equals 8 resistance units)*

(*) 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.

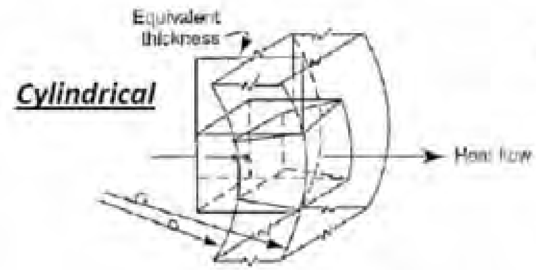


$$R = \frac{\textit{Thickness of Flat Sheet Material}}{\textit{Material Thermal Conductivity}}$$

Wall Thickness (inches)

	3/8	1/2	3/4	1	1-1/2	2
R-Value	1.5	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:

$$R = \frac{r2\ln\left(\frac{r2}{r1}\right)}{k}$$

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	5.5	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/hr•ft^2•°F

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

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

ICCFILENAME: Resetar-Schmidt-Dunahue-EC-6-T. 503.2.8

EC210–09/10
503.2.9

Proponent: Krista Braaksma, representing Washington State Building Code Council

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 25hp (18.6kW) 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 set points 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.

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. Drawing notes shall require commissioning and completion requirements in accordance with this section. Drawing notes may refer to specifications for further requirements. Copies of all documentation shall be given to the owner.

503.2.9.1.1 Commissioning Plan. A commissioning plan shall include as a minimum the following items:

1. A detailed explanation of the original owner's project requirements,
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),
5. Conditions under which the test shall be performed (for example winter and summer design conditions, full outside air), 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 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 Functional performance testing.

1. **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:
   1.1. All modes as described in the Sequence of Operation,
   1.2. Redundant or automatic back-up mode,
   1.3. Performance of alarms, and
   1.4. 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.

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 building 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: The purpose of this code change proposal is to provide expanded direction on commissioning requirements.
Building commissioning requirements have been in place in Washington since 2000. Also, Title 24 (California's energy code) requires commissioning functional and performance testing. Commissioning is an important means of ensuring systems are installed and function as designed. Far too many buildings contain substantive defects and programming errors that impact the performance and functionality of the building. Commissioning is a means of discovering and correcting these defects. Commissioning also provides documentation of system design intent and operating sequences, and documents that building staff receive accurate operation manuals and drawings.

The cost of commissioning is a small part of the overall project (1-2% of total costs), yet can provide substantial payback in the form of reduce energy usage, better building performance, improved air quality, and higher productivity. A 2004 study by Lawrence Berkeley National Laboratory concluded that commissioning is cost-effective for both new and existing buildings of a variety of uses and sizes, not only in energy savings but also in extended equipment lifetimes and lower maintenance costs. Investigators found that the median payback of building commissioning was 4.8 years, and when non-energy impacts were factored in, the payback was considerably reduced. The average energy cost savings per year was 18 percent.

Bibliography:
Lawrence Berkeley National Laboratory Report Number 56637, The Cost-Effectiveness of Commercial-Buildings Commissioning: A Meta-Analysis of Energy and Non-Energy Impacts in Existing Building and New Construction in the United States, December 2004, http://eetd.lbl.gov/Emills/PUBS/Cx-Costs-Benefits.html

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

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

ICCFILENAME: BRAAKSMA-EC-1-503.2.9

EC211–09/10
503.3.1, Table 503.3.1 (New)

Proponent: Ronald Majette, representing US Department of Energy

1. Revise as follows:

503.3.1 Economizers. Supply air economizers shall be provided on each cooling system in buildings located in climate zones 2B, 3B, 4C, 5A, 5C, 6A, 6B, and 8 having a cooling capacity of at least 54,000 Btu/h ~~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. The aggregate cooling capacity of cooling systems without economizers shall not exceed 480,000 Btu/h or 20 percent of it air economizer capacity, whichever is greater.

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 condensors 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*.

2. Add new table as follows:

TABLE 503.3.1
ALTERNATE COMPLIANCE PATH TO AIRSIDE ECONOMIZERS FOR UNITARY EQUIPMENT

Unitary Equipment with Electric Resistance or no heat covered by table						
Size Category (Btu/h)	Climate Zones					
	1A, 1B, 2A, 3A, 4A	2B, 3B	6A, 6B, 8	4C, 5A, 5C	3C, 4B, 5B	7
≥65,000 and <135,000	Economizer not required	11.2 EER 12.7 IEER	11.2 EER 13.8 IEER	11.2 EER 14.9 IEER	Economizer required	Economizer not required
≥135,000 and <240,000		11.0 EER 12.4 IEER	11.0 EER 13.6 IEER	11.0 EER 14.7 IEER		Economizer required
≥240,000 and <760,000		11.0 EER 11.2 IEER	11.0 EER 12.2 IEER	11.0 EER 13.2 IEER		
≥760,000		9.7 EER 10.9 IEER	9.7 EER 11.9 IEER	9.7 EER 12.8 IEER		
Unitary Equipment with other heat covered by table						
Size Category (Btu/h)	Climate Zones					
	1A, 1B, 2A, 3A, 4A	2B, 3B	6A, 6B, 8	4C, 5A, 5C	3C, 4B, 5B	7
≥65,000 and <135,000	Economizer not required	11.0 EER 12.4 IEER	11.0 EER 13.6 IEER	11.0 EER 14.7 IEER	Economizer required	Economizer not required
≥135,000 and <240,000		10.8 EER 12.2 IEER	10.8 EER 13.3 IEER	10.8 EER 14.4 IEER		Economizer required
≥240,000 and <760,000		9.8 EER 11.0 IEER	9.8 EER 12.0 IEER	9.8 EER 13.0 IEER		
≥760,000		9.5 EER 10.7 IEER	9.5 EER 11.6 IEER	9.5 EER 12.6 IEER		
Unitary and Applied Heat Pumps with electric resistance heat or no heat covered by table						
Size Category (Btu/h)	Climate Zones					
	1A, 1B, 2A, 3A, 4A	2B, 3B	6A, 6B, 8	4C, 5A, 5C	3C, 4B, 5B	7
≥65,000 and <135,000	Economizer not required	11.0 EER 12.4 IEER	11.0 EER 13.6 IEER	11.0 EER 14.7 IEER	Economizer required	Economizer not required
≥135,000 and <240,000		10.6 EER 11.9 IEER	10.6 EER 12.9 IEER	10.6 EER 14.0 IEER		Economizer required
≥240,000		9.5 EER 10.7 IEER	9.5 EER 11.6 IEER	9.5 EER 12.6 IEER		
Unitary and Applied Heat Pumps other heat covered by table						
Size Category (Btu/h)	Climate Zones					
	1A, 1B, 2A, 3A, 4A	2B, 3B	6A, 6B, 8	4C, 5A, 5C	3C, 4B, 5B	7
≥65,000 and <135,000	Economizer not required	10.8 EER 12.2 IEER	10.8 EER 13.3 IEER	10.8 EER 14.4 IEER	Economizer required	Economizer not required
≥135,000 and <240,000		10.4 EER 11.7 IEER	10.4 EER 12.7 IEER	10.4 EER 13.8 IEER		Economizer required
≥240,000		9.3 EER 10.4 IEER	9.3 EER 11.4 IEER	9.3 EER 12.3 IEER		

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.

Table 503.3.1(2) is an option in the current IECC that allows for the elimination of the air economizer requirement for air cooled packaged units covered by ARI 340/360 when incremental higher full load efficiencies are used as defined in Table 503.3.1(2). With the new full load and part load efficiencies that will go into effect in 2010 as approved by addendum g to the 2004 ASHRAE 90.1 and addendum s to the 2007 ASHRAE 90.1 and proposed in other changes to the IECC for the 2012 cycle this table needs to be updated as well.

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

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

ICCFILENAME: Majette-EC-13-503.3.1

EC212–09/10
504.5

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 ' °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 ' °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.

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

Filename: Addario-EC-3-504.5

EC213–09/10

504.5

Proponent: James R. Paschal, Paschal Engineering, representing Aquatherm, Inc.

Revise as follows:

504.5 Pipe insulation. For automatic-circulating hot water 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 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). <u>For non-metallic pipes of at least schedule 80 thickness and having thermal resistance greater than that of steel or copper pipe, reduced insulation thicknesses are permitted if documentation is provided showing that the pipe with the proposed insulation has no more heat gain or loss per foot than steel or copper pipe of the same nominal size with the insulation thickness specified here.</u>

Reason: Plastic pipe with a heavier wall thickness can provide a significant insulating effect, thereby reducing the amount of external insulation necessary to achieve the same thermal performance. The requirements and values in the table assume that the pipe itself does not contribute to the overall thermal performance of the pipe/insulation combination. The addition of this footnote will explicitly allow recognition of this enhanced performance, while meeting the intent of the table by requiring the same or better performance from the pipe/insulation combination. This proposal is also consistent with the recently revised ASHRAE 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*, which recognizes that piping materials with low thermal conductivity and sufficient wall thickness can provide an insulating effect and thereby reduce the overall insulation required to achieve equivalent performance.

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

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

ICCFILENAME: Paschal-EC-3-504.5

EC214–09/10

504.5

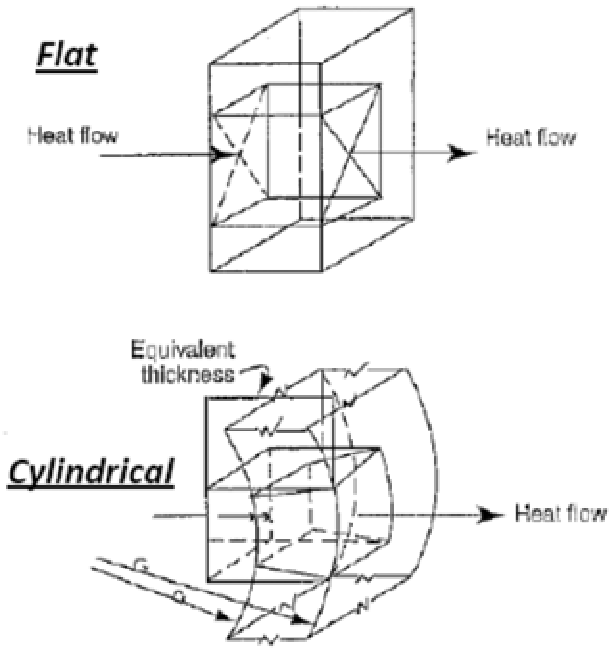
Proponent: Michael Resetar, Armacell LLC; Roger Schmidt, K-Flex USA; Shawn Dunahue, Nomaco Insulation

Revise as follows:

504.5 Pipe insulation. For ~~automatic-circulating~~ hot water <u>delivery</u> systems, piping shall be insulated with ~~1 inch (25 mm)~~ <u>R-6</u> ~~of~~ insulation having a conductivity not exceeding 0.27 Btu per inch/h× ft2 × °F (1.53 W per 25 mm/m2 × K). ~~The first 8 feet (2438mm) of piping in noncirculating systems served by equipment without integral heat traps shall be insulated with 0.5 inch (12.7mm) of material having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K).~~

Reason: Converting wall thickness requirement to an "R" value to be consistent with other insulation requirements within ICC codes and implementing pipe insulation on all hot water lines is a cost effective way to reduce energy consumption and increase water conservation within the structure by maintaining fluid temperature above 105°F longer between uses.

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:

$$R = \frac{\textit{Thickness of Material}}{\textit{Material Thermal Conductivity}}$$

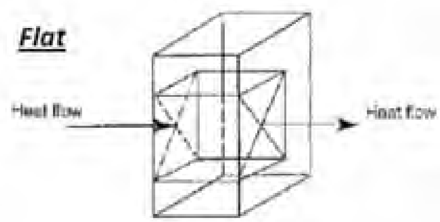
Sheet Insulation Thickness: 2”
Insulation Thermal Conductivity: 0.25 Btu•in/h•ft^2•°F
Resulting “R” Value : R-8.0 *(R-8 equals 8 resistance units)*

(*) 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.

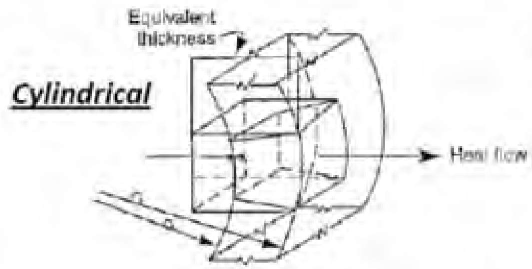


$$R = \frac{\textit{Thickness of Flat Sheet Material}}{\textit{Material Thermal Conductivity}}$$

Wall Thickness (inches)

	3/8	1/2	3/4	1	1-1/2	2
R-Value	1.5	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: The material cost implications would be minimal and would be recovered (paid back) after a period of months due to system efficiency gains. Labor associated with the installation would remain constant to that of the current requirements.

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

ICCFILENAME: Resetar-Schmidt-Dunahue-EC-7-504.5

EC215–09/10
504.5

Proponent: Michael Resetar, Armacell LLC; Roger Schmidt, K-Flex USA; Shawn Dunahue, Nomaco Insulation

Revise as follows:

504.5 Pipe insulation. For automatic-circulating hot water systems, piping shall be insulated with ~~1 inch (25 mm)~~ R-6 ~~of~~ insulation having a conductivity not exceeding 0.27 Btu per inch/h× ft2 × °F (1.53 W per 25 mm/m2 × K). For noncirculating systems**,** the first 8 feet (2438mm) of piping ~~in noncirculating systems~~ served by equipment without integral heat traps shall be insulated with ~~0.5 inch~~ ~~(12.7mm)~~ R-4 ~~of material~~ insulation having a conductivity not exceeding 0.27 Btu per inch/h × ft2 × °F (1.53 W per 25 mm/m2 × K).

Reason: Converting wall thickness requirement to an "R" value to be consistent with other insulation requirements within ICC codes.

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

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

ICCFILENAME: Resetar-Schmidt-Dunahue-EC-8-504.5

EC216–09/10
504.7, 504.7.1, 504.7.2, 504.7.3

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.

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

ICCFILENAME: Majette-EC-16-504.7

EC217–09/10
202 (New), 505.1, 505.2 (New), Tables 505.2(1)-(2) (New), Chapter 6 (New)

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
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

Minimum Nominal Full Load Efficiency (%)								
	Open Drip-Proof Motors				Totally Enclosed Fan Cooled Motors			
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
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

Minimum Nominal Full Load Efficiency (%)								
	Open Drip-Proof Motors				Totally Enclosed Fan Cooled Motors			
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.

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

ICCFILENAME: Majette-EC-22-505-

EC218–09/10
505.1, 505.5.3 (New)

Proponent: Joseph Hill, RA, representing the New York State Department of State

1. Revise as follows:

505.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications, electrical energy consumption, 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.~~

Exception: Dwelling units are not required to comply with Sections 505.2 through 505.5.2

2. Add new text as follows:

505.5.3 Lighting within dwelling units. (Mandatory). Lighting within dwelling units shall have a minimum of 50 percent of the permanently installed interior light fixtures fitted with *high-efficacy lamps*.

Reason: This dwelling unit exception as existing in the Code is somewhat confusing. For dwelling units, the section essentially mixes design and installation requirements for lighting fixtures. The requirements either;
Drives the owner to *install* 50 percent or more of the interior light fixtures with high-efficacy lamps.
Or Conversely;
Requires the designer to comply with all electrical power and lighting requirements of Section 505.

It would be clearer to the code user to list a requirement for a minimum of 50 percent of the permanently installed interior light fixtures to be fitted *high-efficacy lamps*. This **requirement** is part of Chapter 4 of the Energy Code, and would create consistency with the Residential provisions (Chapter 4) of the Energy Code for dwelling units.

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

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

ICCFILENAME: Hill-EC-4-505.1

EC219–09/10
101.4.3, 505.1

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~~ 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.

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.

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.

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

ICCFILENAME: Majette-EC-18-505.1

EC220–09/10
202, 505.2.2.1

Proponent: Rick Sugar, Douglas County, CO, representing Colorado Chapter of the International Code Council

1. Revise as follows:

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, equipment rooms, 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/m2).

2. Add new definition as follows:

EQUIPMENT ROOM. A space that contains either electrical equipment, mechanical equipment, machinery, water pumps or hydraulic pumps that are a function of the buildings services.

Reason: All equipment will need to be serviced periodically. Reducing the lighting in these areas is a life safety hazard when working on or around any equipment. Set parameters on what an equipment room is, so the exception is easier to understand and enforce

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

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

ICCFILENAME: Sugar-EC-1-202 - 505.2.2.1

EC221–09/10
504.6

Proponent: Guy Tomberlin, Fairfax County, Virginia, representing himself

Revise as follows:

504.6 Hot water system controls. ~~Automatic~~ Circulating hot water system pumps or heat trace shall be arranged to be ~~conveniently~~ turned off, <u>either</u> automatically or manually, when the<u>re is limited</u> hot water <u>demand.</u> ~~system is not in operation.~~ <u>Ready access shall be provided to the operating controls</u>**.**

Reason: This proposal cleans up flawed language and does not change the intent of the section. Circulating systems are not automatic but the controls that operate recirculating systems can be automatic or manual. The term "conveniently" is not defined in the family of I-codes. The intent is better stated by requiring ready access for the controls. "Ready access" is used throughout the family of I codes with a clear definition that means access which first does not require the removal of a door panel or similar obstruction. The intent of this section is for the controls to be in a location that building maintenance people can easily get to in order to change time clock settings (automatic systems) or simply flip a switch (manual systems). The phrase "when the hot water system is not in operation" is vague and confusing. Is the intention for the circulation pumps or heat trace to operate 24 hours a day unless the water heating system is not making hot water? In other words, when the water heater is turned off? No. The intent is to stop wasting energy consumed by pumps or heat trace when the demand for hot water is limited or non-existent such as occurs during weekends and nights in most buildings.

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-EC-504.6

EC222–09/10
505.2.2.2

Proponent: Krista Braaksma, representing Washington State Building Code Council

Revise as follows:

505.2.2.2 Automatic lighting shutoff. Buildings larger than 5,000 square feet (465m^2) shall be equipped with an automatic control device to shut off lighting in normally occupied, non egress related, areas. This automatic control device in these areas 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 (2323m^2) 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 occupied~~.~~<u>; or</u>
4. <u>Automatic time switches having a minimum 7 day clock and capable of being set for 7 different day types per week and which incorporate an automatic holiday "shut-off" feature, to turn off all loads for at least 24 hours and then resume normally scheduled operations. Automatic time switches shall also have program back-up capabilities, which prevent the loss of program and time settings for at least 10 hours, if power is interrupted.</u>

<u>Automatic time switches shall incorporate an over-ride switching device which:</u>

1. <u>Is readily accessible;</u>
2. <u>Is located so that a person using the device can see the lights or the areas controlled by the switch, or so that the area being illuminated is annunciated;</u>
3. <u>Is manually operated;</u>
4. <u>Allows the lighting to remain on for no more than 2 hours when an over-ride is initiated; and</u>
5. <u>Controls an area not exceeding 5,000 square feet or 5 percent of the building footprint for footprints over 100,000 square feet, whichever is greater.</u>

Reason: The proposal provides a cost effective method of providing lighting control overrides for after-hours work.

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

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

ICCFILENAME: BRAAKSMA-EC-4-505.2.2.2

EC223–09/10
505.2.2.2

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing self

Revise as follows:

505.2.2.2 Automatic lighting shutoff. Buildings larger than 5,000 square feet ($465 m^2$) 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 ($2323\ m^2$) 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.
4. Lighting intended for continuous operation.

Reason: With rising costs, it is financially inappropriate to require automatic shutoff controls in areas which are used for 24 hour/365 day a year operations. Those spaces which have continuous use have no energy savings or operation savings advantage for installing such controls. Additionally, ASHRAE 90.1 recognizes a similar exception.

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

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

ICCFILENAME: DAHMEN-EC1-505.2.2.2.DOC

EC224–09/10
505.2.2.3

Proponent: Krista Braaksma, Washington representing Washington State Building Code Council

Revise as follows:

505.2.2.3 Daylight zone control. Daylight zones, as defined by this code, shall be provided with individual controls that control the ~~lights~~ luminaires 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.

In all areas with skylights, monitors or other fenestration at or above ceiling level and in all areas with windows, all permanent luminaries in the daylighted zone shall be controlled by automatic daylight sensing controls.

Automatic daylight sensing controls shall:

1. Be capable of reducing the light output of the controlled luminaires while maintaining a uniform level of illuminance by one of the following methods:
   - 1.1. Continuous dimming down to at least 10% of the maximum light output; or
   - 1.2. Step switching of each lamp in individual luminaires (non-continuous dimming devices shall have adjustable separation [deadband] of on and off points to prevent short cycling) and provide an automatic OFF control. Switching alternate luminaires is not permitted except with single lamp luminaires; or
   - 1.3. Step dimming by reducing the output of all of the lamps in individual luminaires by at least 50 percent and providing an automatic OFF control.

2. Control only luminaires within the daylit area(s).
3. Incorporate time-delay circuits to prevent cycling of light level changes of less than three minutes.

Any switching devices installed to override the automatic daylighting control shall comply with the criteria in Section 505.2.2.2.

Exception: ~~Daylight spaces enclosed by walls or ceiling height partitions and containing 2 or fewer light fixtures are not required to have a separate switch for general area lighting.~~ The following are exempt from the requirements for automatic daylighting controls in Section 505.2.2.3:

1. Retail spaces adjacent to vertical glazing (retail spaces under overhead glazing are not exempt).
2. Lighting exempted by Section 505.2.2.1, 505.2.2.2, 505.2.2.2.1, or 505.2.2.2.2.
3. Display, exhibition and specialty lighting controlled independently from general area lighting.
4. Small spaces in the daylight zone that are normally unoccupied (such as a storage room with a window, or restrooms) that are controlled by an occupant sensing device:
5. Rooms less than 300 square feet.
6. Conference rooms 300 square feet and larger that have a lighting control system with at least four scene options and an occupancy sensor control.
7. HID lamps with automatic controls that are capable of reducing the power consumption by at least 50%.
8. HID lamps 100 watts or less.

Reason: This proposal provides greater consistency with ASHRAE Standard 90.1 requirements for daylight zone control. It requires automatic controls to reduce energy consumption in daylighted spaces, both under skylights and next to windows.

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

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

ICCFILENAME: BRAAKSMA-EC-5-505.2.2.3

EC225–09/10
Tables 505.6.2(1) and 505.2(2)

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
	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.

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

ICCFILENAME: Heinisch-EC-1-T. 505.6.2(1)-(2)

EC226–09/10
Table 505.6.2(1), 505.6.2(2)

Proponent: Ronald Majette, representing US Department of Energy

Revise 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 authority having jurisdiction
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 jurisdiction

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 nontradable surfaces.)		No Base Site in Zone 0	500 W	600 W	750 W	1300 W
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.)		**Uncovered Parking Areas**				
	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				
	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	No Tradable Surface Allowances in Zone 0	$0.14 W/ft^2$	$0.14 W/ft^2$	$0.16 W/ft^2$	$0.2 W/ft^2$
	Stairways		$0.75 W/ft^2$	$1.0 W/ft^2$	$1.0 W/ft^2$	$1.0 W/ft^2$
	Pedestrian tunnels		$0.15 W/ft^2$	$0.15 W/ft^2$	$0.2 W/ft^2$	$0.3 W/ft^2$
		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
	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)		$0.25 W/ft^2$	$0.25 W/ft^2$	$0.5 W/ft^2$	$0.7 W/ft^2$

<table>
<tr><th></th><th></th><th>Zone 0</th><th>Zone 1</th><th>Zone 2</th><th>Zone 3</th><th>Zone 4</th></tr>
<tr><td></td><td>Street frontage for vehicle sales lots in addition to “open area” allowance</td><td></td><td>No allowance</td><td>10 W/linear foot</td><td>10 W/linear foot</td><td>30 W/linear foot</td></tr>
<tr><td rowspan="7">Nontradable Surfaces (Lighting power density calculations for the following applications can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowance otherwise permitted in the “Tradable Surfaces” section of this table.)</td><td>Building facades</td><td></td><td>No allowance</td><td>0.1 W/ft2 for each illuminated wall or surface or 2.5 W/linear foot for each illuminated wall or surface length</td><td>0.15 W/ft2 for each illuminated wall or surface or 3.75 W/linear foot for each illuminated wall or surface length</td><td>0.2 W/ft2 for each illuminated wall or surface or 5.0 W/linear foot for each illuminated wall or surface length</td></tr>
<tr><td>Automated teller machines and night depositories</td><td rowspan="2">A single luminaire of 60 watts or less may be installed for each roadway/parking entry, trail head, and toilet facility, or other locations approved by the authority having jurisdiction</td><td>270 W per location plus 90 W per additional ATM per location</td><td>270 W per location plus 90 W per additional ATM per location</td><td>270 W per location plus 90 W per additional ATM per location</td><td>270 W per location plus 90 W per additional ATM per location</td></tr>
<tr><td>Entrances and gatehouse inspection stations at guarded facilities</td><td>0.75 W/ft^2 of covered and uncovered area</td><td>0.75 W/ft^2 of covered and uncovered area</td><td>0.75 W/ft^2 of covered and uncovered area</td><td>0.75 W/ft^2 of covered and uncovered area</td></tr>
<tr><td>Loading areas for law enforcement, fire, ambulance and other emergency service vehicles</td><td></td><td>0.5 W/ft^2 of covered and uncovered area</td><td>0.5 W/ft^2 of covered and uncovered area</td><td>0.5 W/ft^2 of covered and uncovered area</td><td>0.5 W/ft^2 of covered and uncovered area</td></tr>
<tr><td>Drive-up windows/doors</td><td></td><td>400 W per drive-through</td><td>400 W per drive-through</td><td>400 W per drive-through</td><td>400 W per drive-through</td></tr>
<tr><td>Parking near 24-hour retail entrances</td><td></td><td>800 W per main entry</td><td>800 W per main entry</td><td>800 W per main entry</td><td>800 W per main entry</td></tr>
</table>

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m^2.

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.

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.

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

ICCFILENAME: Majette-EC-23-T. 505.6.2(1)-(2)-REDONE

EC227–09/10

505.5.3 (New), 505.5.3.1 (New), 505.5.3.2 (New), Table 505.5.3 (New)

Proponent: Steve Ferguson, representing The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

Add new text and table as follows:

505.5.3 Alternative Compliance Path: Space-by-Space Method. The Space-by-Space Method as detailed in Section 505.5.3.1 and 505.5.3.2 shall be permitted for calculating lighting power allowance.

505.5.3.1 Space-by-Space Method of Calculating Interior Lighting Power Allowance. Use the following steps to determine the interior lighting power allowance by the Space-by-Space Method:

1. Determine the appropriate building type from Table 505.5.3. For building types not listed, selection of a reasonably equivalent type shall be permitted.
2. For each space enclosed by partitions 80% or greater than ceiling height, determine the gross interior floor area by measuring to the center of the partition wall. Include the floor area of balconies or other projections. Retail spaces do not have to comply with the 80% partition height requirements.
3. Determine the interior lighting power allowance by using the columns designated Space-by-Space Method in Table 505.5.3. Multiply the floor area(s) of the space(s) times the allowed LPD for the space type that most closely represents the proposed use of the space(s). The product is the lighting power allowance for the space(s). For space types not listed, selection of a reasonable equivalent category shall be permitted.
4. The interior lighting power allowance is the sum of lighting power allowances of all spaces. Trade-offs among spaces are permitted provided that the total installed interior lighting power does not exceed the interior lighting power allowance.

505.5.3.2 Additional Interior Lighting Power. When using the Space-by-Space Method, an increase in the *interior lighting power allowance* is allowed for specific lighting functions. Additional power shall be allowed only if the specified lighting is installed and automatically controlled, separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified *luminaires* and shall not be used for any other purpose.

An increase in the *interior lighting power allowance* is permitted in the following cases:

1. For spaces in which lighting is specified to be installed in addition to the general lighting for the purpose of decorative appearance, such as chandelier-type luminaries or sconces or for highlighting art or exhibits, provided that the additional lighting power shall not exceed 1.0 W/ft^2 of such spaces.
2. For lighting equipment installed in sales areas and specifically designed and directed to highlight merchandise, calculate the additional lighting power in accordance with Section 505.5.2:

TABLE 505.5.3
LIGHTING POWER DENSITIES USING THE SPACE-BY-SPACE METHOD

Common Space Types[a]	***LPD*, W/ft^2**	**Building-Specific Space Types**	***LPD*, W/ft^2**
Office—Enclosed	1.1	Gymnasium/Exercise Center	
Office—Open Plan	1.1	Playing Area	1.4
Conference/Meeting/Multipurpose	1.3	Exercise Area	0.9
Classroom/Lecture/Training	1.4	Courthouse/Police Station/Penitentiary	
For Penitentiary	1.3	Courtroom	1.9
Lobby	1.3	Confinement Cells	0.9
For Hotel	1.1	Judges' Chambers	1.3
For Performing Arts Theater	3.3	Fire Stations	
For Motion Picture Theater	1.1	Engine Room	0.8
Audience/Seating Area	0.9	Sleeping Quarters	0.3
For Gymnasium	0.4	Post Office—Sorting Area	1.2
For Exercise Center	0.3	Convention Center—Exhibit Space	1.3

Common Space Types[a]	*LPD*, W/ft^2	Building-Specific Space Types	*LPD*, W/ft^2
For Convention Center	0.7	Library	
For Penitentiary	0.7	Card File and Cataloging	1.1
For Religious Buildings	1.7	Stacks	1.7
For Sports Arena	0.4	Reading Area	1.2
For Performing Arts Theater	2.6	Hospital	
For Motion Picture Theater	1.2	Emergency	2.7
For Transportation	0.5	Recovery	0.8
Atrium—First Three Floors	0.6	Nurses' Station	1.0
Atrium—Each Additional Floor	0.2	Exam/Treatment	1.5
Lounge/Recreation	1.2	Pharmacy	1.2
For Hospital	0.8	Patient Room	0.7
Dining Area	0.9	Operating Room	2.2
For Penitentiary	1.3	Nursery	0.6
For Hotel	1.3	Medical Supply	1.4
For Motel	1.2	Physical Therapy	0.9
For Bar Lounge/Leisure Dining	1.4	Radiology	0.4
For Family Dining	2.1	Laundry—Washing	0.6
Food Preparation	1.2	Automotive—Service/Repair	0.7
Laboratory	1.4	Manufacturing	
Restrooms	0.9	Low Bay (<25 ft Floor to Ceiling Height)	1.2
Dressing/Locker/Fitting Room	0.6	High Bay (25 ft Floor to Ceiling Height)	1.7
Corridor/Transition	0.5	Detailed Manufacturing	2.1
For Hospital	1.0	Equipment Room	1.2
For Manufacturing Facility	0.5	Control Room	0.5
Stairs—Active	0.6	Hotel/Motel Guest Rooms	1.1
Active Storage	0.8	Dormitory—Living Quarters	1.1
For Hospital	0.9	Museum	
Inactive Storage	0.3	General Exhibition	1.0
For Museum	0.8	Restoration	1.7

Common Space Types[a]	LPD, W/ft^2	Building-Specific Space Types	LPD, W/ft^2
Electrical/Mechanical	1.5	Bank/Office—Banking Activity Area	1.5

Common Space Types[a]	LPD, W/ft^2	Building-Specific Space Types	LPD, W/ft^2
Workshop	1.9	Religious Buildings	
Sales Area [for accent lighting, see Section 9.6.2(b)]	1.7	Worship Pulpit, Choir	2.4
		Fellowship Hall	0.9
		Retail	
		Sales Area [for accent lighting, see Section 9.6.3(c)]	1.7
		Mall Concourse	1.7
		Sports Arena	
		Ring Sports Area	2.7
		Court Sports Area	2.3
		Indoor Playing Field Area	1.4
		Warehouse	
		Fine Material Storage	1.4
		Medium/Bulky Material Storage	0.9
		Parking Garage—Garage Area	0.2
		Transportation	
		Airport—Concourse	0.6
		Air/Train/Bus—Baggage Area	1.0
		Terminal—Ticket Counter	1.5

a. In cases where both a common space type and a building-specific type are listed, the building specific space type shall apply.

Reason: The Space by Space method for lighting design in ASHRAE/IES Standard 90.1-2007 provide lighting designers more flexibility in designing the lighting systems for a building. It does allow for more innovative design that can save more energy than the current requirements in the IECC. With the approval of EC105 -07/08, lighting designers can no longer use the lighting design criteria of 90.1 if the building project is being designed in accordance with the IECC 2009.This code proposal will provide lighting designers the ability to use the Space by Space method that is currently published in 90.1-2007 when a project is being designed in accordance with the IECC.

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

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

ICCFILENAME: Ferguson-EC-3-505.6.3

EC228–09/10
505.7

Proponent: Ronald Majette, representing US Department of Energy

Revise as follows:

505.7 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. <u>In buildings having a floor area over 10,000 square feet, energy usage shall be monitored and reported separately for the lighting, HVAC, and Plug loads. The energy usage shall be capable of being reported in real time, 15 minute peak demand, hourly, daily, monthly and annual energy consumption and readily accessible to the building occupants.</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.

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

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

ICCFILENAME: Majette-EC-24-505.7

EC229–09/10
505.8 (New)

Proponent: Richard Heinisch, representing Acuity Brands Lighting, Inc.

Add new text as follows:

<u>**505.8 Submittals.** When required by the code official, the following compliance documentation and supplemental information shall be submitted:</u>

<u>1. Specifications for the functionality testing of all lighting products to be included in the construction documents. This may include, as a minimum, a statement of the owner's requirements and a statement documenting how the lighting design satisfies those requirements.</u>
<u>2. Record drawings of the actual installation be provided to the building owner or the designated representative of the building owner. Such record drawings will include, as a minimum, the location and performance data on each piece of lighting equipment.</u>
<u>3. Operating manuals and a maintenance manual are to be provided to the building owner or the designated representative of the building owner. These manuals will include, at a minimum, the following:</u>
- <u>3.1. Submittal data stating all selected options for each piece of lighting equipment requiring maintenance.</u>
- <u>3.2. Operation manuals and maintenance manuals for each piece of lighting equipment requiring maintenance. Required routine maintenance actions shall be clearly identified including, as a minimum, a recommended relamping program.</u>
- <u>3.3. A complete narrative of how each lighting control system is intended to operate including suggested settings.</u>

Reason: To clearly establish the goals and requirements of the lighting system including controls and to ensure that the owner is provided all the information necessary to best use and maintain the lighting systems.

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

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

ICCFILENAME: Heinisch-EC-2-505.8

EC230–09/10
506 (New)

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.

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

ICCFILENAME: Ferguson-EC-6-506

EC231-09/10
202 (New)

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.

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

FILENAME: ADDARIO-EC-2-202

EC232–09/10
Appendix A (New)

Proponent: R. Christopher Mathis and Jonah Butcher, representing MC2 Mathis Consulting Company

Add new Appendix as follows:

APPENDIX A
ALTERNATIVE PRESCRIPTIVE MEASURES FOR ACHIEVING INCREASED LEVELS ENERGY EFFICIENCY BEYOND IECC CODE MINIMUMS

Introduction.

The purpose of Appendix A (“Appendix”) to the International Energy Conservation Code (IECC) is to provide jurisdictions with additional prescriptive energy efficiency measures that can be adopted on a voluntary basis in cases where the jurisdiction has an interest in increasing its energy conservation objectives beyond what the IECC provides as minimum code. The Appendix can also serve as a publicly available repository of building energy code “best practices” that provides innovative ways of increasing energy efficiency that have been successfully implemented in other jurisdictions. States and jurisdictions seeking additional energy efficiency options can review these alternative measures and adopt them as desired for their jurisdictions.

The measures in this Appendix provide an incremental, prescriptive improvement in residential and commercial new construction energy efficiency beyond those levels defined in the main body of the IECC.

How to use this Appendix.

The measures in this Appendix modify existing sections of the 2009 IECC or add new sections. The measures are numbered according to section numbering of the 2009 IECC.

Jurisdictions wishing to adopt some or all of these measures can replace selected sections in the 2009 IECC with the corresponding section in this Appendix through their state or local adoption or amendment processes. Instructions are provided to “revise text as follows” or to add new text or tables to incorporate the desired changes.

The alternative prescriptive measures in this Appendix include alternatives to the following sections:

Chapter 1 – ADMINISTRATION
Section 103 Construction Documents. New requirement for design intent documentation.

Chapter 2 – DEFINITIONS
Section 202 General Definitions. New Definitions needed to implement certain new measures.

Chapter 4 – RESIDENTIAL ENERGY EFFICIENCY
Section 402 Building Thermal Envelope. Improved fenestration and insulation requirements.
Section 402.4.1 Building thermal envelope. Including improved air infiltration sealing.
Section 403.6 Equipment sizing. Including certain limits on equipment over sizing.
Section 404.1 Lighting Equipment. Increased levels of high efficiency lighting.

Chapter 5 – COMMERCIAL ENERGY EFFICIENCY
Section 501.1 Scope. Revised Scope.
Section 501.2 Application. Revised Application.
Section 502.1.1 Insulation and fenestration criteria. Removed exception.
Section 502 Building Thermal Envelope. Improved fenestration and insulation requirements.
Section 502.4 Air leakage (Mandatory). Replace air leakage section.
Section 503.2.9 HVAC system completion. Replace with full commissioning requirement.
Section 505.2 Lighting controls (Mandatory). Revise with additional controls requirement.
Section 505.5.2 Interior Lighting Power. Lowered LPD allowances.

New Section 507 - ALTERNATIVE PRESCRIPTIVE COMPLIANCE PACKAGES
New Section APPENDIX X – Design Intent Form.
New Section APPENDIXY – Compliance Certification Form.

Advanced Energy Efficiency Measures Provided for Voluntary Adoption

{Topic: Certifying Design Intent and Compliance with Design Intent}

A103.2 Design Intent Certification. For all projects covered under this code, the registered design professional of record on the project shall provide a certification that key energy performance design intentions were addressed and met. Such design intent certification shall be recorded on Form (X) as shown in Appendix (X) and shall become a component of the construction documents filed with the authority having jurisdiction.

Key elements delivering design intent shall be recorded on Form (Y) as shown in Appendix (Y) and be inspected and verified as built to design by the registered design professional of record, building owner, and code official before certificate of occupancy is granted. Change orders affecting any energy related building components should be attached to this document with an explanation of impacts on energy usage.

A103.2.1 Energy Performance Certifications. The design professional of record shall certify compliance with all of the provisions of this code, including: Compliance with the building envelope, HVAC, lighting, service water heating and whole building performance requirements defined by this code. Such Energy Performance Certifications shall be recorded on Form (Y) as shown in Appendix (Y) and shall be a component of the construction documents filed with the authority having jurisdiction.

{Topic: New Definitions}

Add new text to section 202 GENERAL DEFINITIONS as follows:

FURNACE ELECTRICITY RATIO. The ratio of furnace electricity use to total furnace energy computed as ratio = (3.412*EAE)/(1000*EF + 3.412*EAE), where EAE (average annual auxiliary electrical consumption) and EF (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 EF is expressed in millions of Btus per year.

ON-SITE RENEWABLE ENERGY. Includes solar photovoltaic; active solar thermal that employs collection panels, heat transfer mechanical components and a defined heat storage system; wind; small hydro; tidal; wave energy; geothermal (core earth); biomass energy systems; landfill gas and bio-fuel based electrical production, Onsite energy shall be generated on or adjacent to the project site and shall not be delivered to the project through the utility service.

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.

{Topic: Improved Prescriptive Residential Energy Efficiency Requirements}

Revise and replace Section 401.2 in its entirety with new section A401.2 as follows:

A401.2 Compliance. Projects shall comply with Sections 401, 402.4, 402.5, 402.5, 402.6, 402.7, and (referred to as the mandatory provisions) and Sections 402.1 through 402.3, 403.2.1 and 404.1 (prescriptive);

Replace Table 402.1.1 in its entirety with the following Table A402.1.1:

TABLE A402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTORb	SKYLIGHTb U-FACTOR	GLAZED FENESTRATION SHGCb, e	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUEh	FLOOR R-VALUE	BASEMENTc WALL R-VALUE	SLABd R-VALUE & DEPTH	CRAWL SPACEc WALL R-VALUE
1	0.65	0.75	0.25	30	16	3/4	13	0	0	0
2	0.50	0.75	0.25	38	16	4/6	13	10/13	0	0
3	0.35	0.65	0.25	38	19	5/8	19	10/13f	10, 2 ft	5/13
4 except Marine	0.32	0.60	0.35	49	19	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.32	0.60	NR	49	22	13/17	30g	10/13	10, 2 ft	10/13
6	0.30	0.60	NR	60	22	15/19	30g	15/19	10, 4 ft	10/13
7 and 8	0.30	0.60	NR	60	25	19/21	38g	15/19	10, 4 ft	10/13

a. *R*-values are minimums. *U*-factors and SHGCs are maximums. R-19 batts compressed into a nominal 2 × 6 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 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.
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 feet, 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. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

Replace Table 402.1.3 in its entirety with the following Table A402.1.3:

TABLE A402.1.3
EQUIVALENT U-FACTORS a

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTORb	FLOOR U-FACTOR	BASEMENT WALL U-FACTORd	CRAWL SPACE WALL U-FACTORc
1	0.65	0.75	0.035	0.069	0.197	0.060	0.360	0.477
2	0.50	0.75	0.029	0.056	0.165	0.060	0.059	0.477
3	0.35	0.65	0.029	0.056	0.141	0.046	0.059	0.136
4 except Marine	0.32	0.60	0.024	0.051	0.141	0.046	0.059	0.065
5 and Marine 4	0.32	0.60	0.024	0.051	0.082	0.033	0.059	0.065
6	0.30	0.60	0.020	0.051	0.060	0.033	0.050	0.065
7 and 8	0.30	0.60	0.020	0.047	0.057	0.027	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, 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 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) of Section 405 (Simulated Performance Alternative) shall be modified to include soil conductivity and exterior air films.

Replace Section 402.4.1 in its entirety with new section A402.4.1 as follows:

A402.4.1 Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration and prevent thermal bypasses. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The thermal envelope, including insulation and air barriers, shall be inspected in accordance with Sections 402.4.1.1 through 402.4.1.6.

A402.4.1.1 Walls adjoining exterior walls or unconditioned spaces. Fully insulated wall in substantial contact with air barrier at both interior and exterior, or for Climate Zones 1 thru 3, sealed exterior air barrier aligned with fully supported insulation. The following areas shall meet these requirements: wall behind shower/tub, wall behind fireplace, insulated attic slopes for un-vented attic spaces, attic knee walls, skylight shaft walls, wall adjoining porch roof, staircase walls, double walls.

A402.4.1.2 Floors between conditioned and exterior spaces. An air barrier shall be installed at any exposed insulation edges. Insulation shall be installed to maintain substantial contact w/ sub-floor above and air barrier below. The following areas shall meet these requirements: Insulated floor above un-conditioned and semi-conditioned space.

A402.4.1.3 Shafts. Openings and gaps to unconditioned space shall be fully sealed with an air barrier. The following areas shall meet these requirements: duct, piping and flue shafts and associated penetrations.

A402.4.1.4 Attic and ceiling interface. Attic penetrations and dropped ceilings shall include a full interior air barrier aligned with insulation with any gaps fully sealed. Insulation shall fit snugly in opening and the opening air barrier shall be fully gasketed. The following areas shall meet these requirements: attic access panel, attic drop-down stair, dropped ceiling/soffit, recessed lighting fixtures, whole-house fan.

A402.4.1.5 Common walls between dwelling units. Gap between drywall shaft wall (common wall) and structural framing between units shall be sealed at all exterior boundary conditions.

A402.4.1.6 Gaps and penetrations. Gaps and penetrations in the thermal envelope of the home shall be sealed and insulated. The following areas shall meet these requirements: the perimeters of windows, doors, skylights, and utility penetrations, hose bibs, exterior electrical outlets and light fixtures.

Revise Section 402.4.2 and replace with section A402.4.2 as follows:

A402.4.2 Air sealing and insulation. Building envelope air tightness and insulation installation shall be demonstrated to comply with the requirements of Section 402.4.2.1 and 402.4.2.2.

A402.4.2.1 Air Sealing Testing ~~option~~. Building envelope tightness ~~and insulation installation~~ shall be considered acceptable when tested air leakage is less than five 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.

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, backdraft and flue dampers;
   Interior doors shall be open;
3. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
4. Heating and cooling system(s) shall be turned off;
5. HVAC ducts shall not be sealed; and
6. Supply and return registers shall not be sealed.

A402.4.2.2 Insulation inspection. Building envelope insulation installation shall be considered acceptable when the insulation installation 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 insulation and its installation.

{Topic: IMPROVED EQUIPMENT SIZING REQUIREMENTS}

Revise Section 403.6 and replace with section A403.6 as follows:

A403.6 Equipment sizing. Heating and cooling equipment shall be sized in accordance with Section M1401.3 of the International Residential Code. The maximum oversizing limit for air conditioners and air-source and ground-source heat pumps is 15% with the following two exceptions: single-speed air-source and ground-source heat pumps in buildings with heating loads that exceed cooling loads have a limit of 25%, and multi-stage heat pumps do not have a strict limit, but shall be sized to allow adequate humidity control in the cooling mode. The maximum oversizing limit for gas, oil or propane heating equipment is 40%.

The following operating conditions shall be used in the sizing calculations and verified where reviewed by the code official:

1. Outdoor temperatures shall be the 99.0% and 1.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the home's location or most representative city for which design temperature data are available;
2. Indoor temperatures shall be 75 F for cooling and 70 F for heating;
3. Infiltration rate shall be selected as "tight", or the equivalent term. In specifying equipment, the next available manufactured size may be used. In addition, indoor and outdoor coils shall be matched in accordance with ARI Standard 210/240.

{Topic: RESIDENTIAL LIGHTING EQUIPMENT EFFICIENCY}

Revise Section 404.1 and replace with section A404.1 as follows:

SECTION 404
ELECTRICAL POWER AND LIGHTING SYSTEMS

A404.1 Lighting equipment (Prescriptive). A minimum of 80 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps.

{Topic: COMMERCIAL ENERGY EFFICIENCY}

Revise Section 501.1 and replace with section A501.1 as follows:

A501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings

Revise Section 501.2 and replace with section A501.2 as follows:

A501.2 Application. The commercial building project shall comply with the requirements in Sections 502 (Building envelope), 503 (Building mechanical systems), 504 (Service water heating), 505 (Lighting), and A507 (Advanced Prescriptive Options) in its entirety.

Compliance with section A507 requires complying with any ONE of the following prescriptive options:

A507.2.1 Efficient Mechanical Equipment
A507.2.2 Reduced Lighting Power Density
A507.2.3 On-Site Supply of Renewable Energy

At the time of plan submittal, the building jurisdiction shall be provided, by the submittal authority, documentation designating the intent to comply with Section A507.2.1, A507.2.2, or A507.2.3 in their entirety.

{Topic: IMPROVED COMMERCIAL BUILDING ENVELOPE MEASURES}

Revise Section 502.1.1 and replace with section A502.1.1 as follows:

A502.1.1 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).

Delete Table 502.1.2 in its entirety and replace with the following table A502.1.2 and footnotes:

TABLE A502.1.2
BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMENT, MAXIMUM U-FACTORS

Climate Zone	1		2		3		4		5		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 (with R-5 thermal blocks)	U - 0.049	U - 0.049	U - 0.049	U - 0.049	U - 0.049	U - 0.049	U - 0.049	U - 0.049	U - 0.049	U - 0.049	U - 0.039	U - 0.039	U - 0.034	U - 0.034	U - 0.034	U - 0.034
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 - 0.027	U - 0.021	U - 0.021	U - 0.021	U - 0.021	U - 0.021	U - 0.021
Walls, Above Grade																
Mass	U-0.151	U-0.123	U-0.123	U-0.123	U-0.123	U - 0.104	U - 0.104	U - 0.104	U - 0.090	U - 0.062	U - 0.080	U - 0.062	U - 0.071	U - 0.062	U - 0.052	U - 0.052
Metal buildingc	U-0.093	U-0.093	U-0.093	U - 0.084	U - 0.084	U - 0.084	U - 0.061	U - 0.061	U - 0.061	U - 0.057	U - 0.061	U - 0.057	U - 0.048	U - 0.048	U - 0.048	U - 0.048
Metal framed	U - 0.084	U - 0.084	U - 0.084	U - 0.064	U - 0.064	U - 0.051	U - 0.064	U - 0.051	U - 0.064	U - 0.051	U - 0.064	U - 0.051	U - 0.064	U - 0.051	U - 0.051	U - 0.037
Wood framed and other	U-0.066	U-0.066	U-0.066	U - 0.064	U - 0.064	U - 0.051	U - 0.064	U - 0.051	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 Graded																
Below-grade wall	NR	NR	NR	NR	C - 0.119	C - 0.119	C - 0.119	C - 0.092	C - 0.119	C - 0.092	C - 0.119	C - 0.092	C - 0.092	C - 0.063	C - 0.092	C - 0.063
Floors																
Mass	NR	U-0.123	U-0.123	U-0.123	U - 0.076	U - 0.069	U - 0.076	U - 0.069	U - 0.076	U - 0.069	U - 0.064	U - 0.055	U - 0.055	U - 0.055	U - 0.055	U - 0.055
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	NR	NR	NR	NR	F - 0.54	F - 0.54	F - 0.54	F - 0.54	F - 0.54	F - 0.54	F - 0.54	F - 0.54	F - 0.40	F – 0.40	F - 0.40	F - 0.40
Heated slabs	F - 0.65	F - 0.65	F - 0.65	F - 0.65	F - 0.65	F - 0.65	F - 0.65	F - 0.58	F - 0.58	F - 0.55	F - 0.58	F - 0.55	F - 0.58	F – 0.55	F - 0.58	F - 0.55

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.

Delete Table 502.2(1) in its entirety and replace with the following table A502.2(1) and footnotes:

TABLE A502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

Climate Zone	1		2		3		4		5		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-20 ci	R - 20ci	R-20 ci	R - 20ci	R-20 ci	R - 25ci	R-25 ci	R - 25ci	R-25 ci	R - 30ci	R-30 ci	R - 35ci	R-35 ci	R - 35ci	R-35 ci
Metal buildings (with R-5 thermal blocksa)b	R-13 + R-19	R-13 + R-19	R-13 + R-19	R-13 + R-19	R-13 + R-19	R-13 + R-19	R-13 + R-19	R-13 + R-19	R-13 + R-19	R-13 + R-19	R-10 + R-19 + R-6 ci	R-10 + R-19 + R-6 ci	R-10 + R-19 + R-10 ci	R-10 + R-19 + R-10 ci	R-10 + R-19 + R-10	R-10 + R-19 + R-10
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-5.7 ci	R-7.6 ci	R-7.6 ci	R-7.6 ci	R-7.6 ci	R-9,5 ci	R-9,5 ci	R-9.5ci	R-11.5 ci	R-19.5ci	R--13.3 ci	R-19.5ci	R-15.0 ci	R-19.5ci	R-25 ci	R-25 ci
Metal buildingc	R-16	R-16	R-16	R-19	R-19	R-19	R-10 + R-13	R-10 + R-13	R-10 + R-13	R-13 + R-13	R-10 + R-13	R-13 + R-13	R-19 + R-13	R-19 + R-13	R-19 + R-13	R-19 + R-13
Metal framed	R-13 + 3.8 ci	R-13 + 3.8 ci	R-13 + 3.8 ci	R-13 + 7.5 ci	R-13 + 7.5 ci	R- 13 + R-11.4 ci	R-13 + 7.5 ci	R- 13 + R-11.4 ci	R-13 + R-7.5 ci	R- 13 + R-11.4 ci	R-13 + R-7.5 ci	R- 13 + R-11.4 ci	R-13 + R-7.5 ci	R- 13 + R-11.4 ci	R- 13 + R-11.4 ci	R- 13 + R-18.8 ci
Wood framed and other	R-13	R-13	R-13	R-13 + R-3.8ci	R-13 + R-3.8ci	R-13 + R-7.5 ci	R-13 + R-3.8ci	R-13 + R-7.5 ci	R-13 + R-3.8ci	R-13 + R-7.5 ci	R-13 + R 7.5ci	R-13 + R-7.5 ci	R-13 + R-7.5 ci	R-13 + R-7.5 ci	R-13 + R-15.6ci	R-13 + R-15.6ci
Walls, Below Graded																
Below-grade wall	NR	NR	NR	NR	R-7.5 ci	R-7.5 ci	R-7.5 ci	R-10 ci	R-7.5 ci	R-10 ci	R-7.5 ci	R-10 ci	R-10.0 ci	R-15 ci	R-10.0 ci	R-15 ci
Floors																
Mass	NR	R-5ci	R-5ci	R-5ci	R-10 ci	R-11.4 ci	R-10 ci	R-11.4 ci	R-10 ci	R-11.4 ci	12.5 ci	R-15 ci	R-15 ci	R-15.0 ci	R-15 ci	R-15.0 ci
Joist / Framing	R-13	R-13	R-30e	R-30e	R-30e	R-30e	R-30	R-30	R-30	R-30	R-30e	R-30e	R-30e	R-30e	R-30e	R-30e
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	R-10 for 24 in.	R-10 for 24 in.	R-10 for 24 in.	R-10 for 24 in.	R-10 for 24 in.	R-10 for 24 in.	R-10 for 24 in.	R-10 for 24 in.	R-15 for 24 in. + R-5ci below	R-15 for ~~48~~ 24 in. + R-5ci below	R-15 for 24 in. + R-5ci below	R-15 for ~~48~~ 24 in. + R-5ci below
Heated slabs	R-10 for 24 in. + R-5ci below	R-10 for 24 in. + R-5ci below	R-10 for 24 in. + R-5ci below	R-10 for 24 in. + R-5ci below	R-10 for 24 in. + R-5ci below	R-10 for 24 in. + R-5ci below	R-10 for 24 in. + R-5ci below	R-15 for 36 in. + R-5ci below	R-15 for 36 in. + R-5ci below	R-20 for 36 in. + R-5ci below	R-15 for 36 in. + R-5ci below	R-20 for 36 in. + R-5ci below	R-20 for 36 in. + R-5ci below	R-20 for 36 in. + R-5ci below	R-20 for 36 in. + R-5ci below	R-20 for 36 in. + R-5ci 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	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53	U - 0.53

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.

Delete Table 502.2(2) in its entirety and replace with the following table A502.2(2):

TABLE A502.2(2)
BUILDING ENVELOPE REQUIREMENTS–OPAQUE ASSEMBLIES

ROOFS	DESCRIPTION	REFERENCE
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 + R-6ci R-11 + R-19 + R-10ci	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. The third 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 A2.3 including Addendum “G”
Walls		
R-16 R-19	Single Layer of Mineral Fiber	ASHRAE/IESNA 90.1 Table A2.3 including Addendum “G”
R-10 + R-13 R-19 + R-13	The first rated R-Value of insulation is for insulation compressed between metal wall panels and the steel structure, the second rated R-value of insulation is for insulation installed from the inside, covering the girts.	ASHRAE/IESNA 90.1 Table A2.3 including Addendum “G”

Delete Table 502.3 in its entirety and replace with the following table A502.3 and footnotes:

TABLE A502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

Climate Zone	1	2	3	4	5	6	7	8
U-Factor								
Vertical Fenestration[a]	0.65	0.65	0.40	0.40	0.40	0.40	0.35	0.35
Entrance Door	0.83	0.83	0.77	0.77	0.77	0.77	0.77	0.77
Skylights [b]	0.75	0.75	0.75	0.60	0.60	0.60	0.60	0.60
SHGC								
Vertical Fenestration[a]	0.25	0.25	0.25	0.30	0.30	0.40	0.40	0.40
Skylights [b]	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

a. 40% maximum of above-grade wall.
b. 3% Maximum, 5% maximum with automatic day lighting controls which must meet the requirements of Section A502.2.2.4.

Revise Section 502.4 and replace with section A502.4 as follows:

A502.4 Air leakage (Mandatory).

A502.4.1 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 space designed to maintain temperature or humidity levels which differ from those in the conditioned space by more than 50% of the difference between the conditioned space and design ambient conditions.

The air barrier shall have the following characteristics:

1. It must be continuous, with all joints made airtight.

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. It shall be capable of withstanding positive and negative combined design wind, fan and stack pressures on the envelope without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
4. Air barrier materials shall be maintainable, or, if inaccessible, shall meet the durability requirements for the service life of the envelope assembly.
5. The air barrier material of an envelope assembly shall be joined and sealed in a flexible manner to the air barrier material of adjacent assemblies, allowing for the relative movement of assemblies due to thermal and moisture variations and creep. Connections shall be made between:
    a. Joints around *fenestration* and *door* frames
    b. 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
    c. Openings at penetrations of utility services through *roofs*, *walls*, and *floors*
    d. Site-built *fenestration* and *doors*
    e. Building assemblies used as ducts or plenums
    f. Joints, seams, and penetrations of vapor retarders
    g. All other openings in the *building envelope*

A502.4.2 Air Barrier Penetrations. All penetrations of the air barrier and paths of air infiltration/exfiltration shall be made air tight. 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.

A502.4.3 Fenestration and Doors. Air leakage for *fenestration* and *doors* shall be determined in accordance with NFRC 400 or ASTM E 283 @ 1.57 psf (75 Pa.). Air leakage shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council, and shall be *labeled* and certified by the *manufacturer*. Air leakage shall not exceed 0.3 cfm/ft2 for glazed swinging entrance doors and for revolving doors and 0.2 cfm/ft2 for all other products under a pressure differential of 0.3 inches of water(1.57 psf).

Exceptions:

a. For garage *doors*, air leakage determined by test at standard test conditions in accordance with ANSI/ DASMA 105 shall be an acceptable alternate for compliance with air leakage requirements.

A502.4.4 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.

A502.4.5 Loading Dock Weatherseals*.* Cargo *doors* and loading dock *doors* shall be equipped with weatherseals to restrict *infiltration* when vehicles are parked in the doorway.

A502.4.6 Vestibules. Building entrances that separate *conditioned space* from the exterior shall be protected with an enclosed vestibule, with all *doors* opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior *doors* to open at the same time. Interior and exterior *doors* shall have a minimum distance between them of not less than 7 ft when in the closed position. The exterior envelope of conditioned vestibules shall comply with the requirements for a conditioned space. The interior and exterior envelope of unconditioned vestibules shall comply with the requirements for a semi heated space.

Exceptions:

1. *Building entrances* with revolving *doors*.
2. *Doors* not intended to be used as a *building entrance.*
3. *Doors* opening directly from a *dwelling unit*.

4. *Doors* that open directly from a *space* that is less than 3000 ft2 in area and is separate from the *building entrance*.
5. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

A502.4.7 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 0.2 cubic foot per minute per square foot (cfm/ft^2) (3.7 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.

A502.4.8 Hot gas bypass limitation. Cooling systems shall not use hot gas bypass or other evaporator pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation. The capacity of the hot gas bypass shall be limited as indicated in Table 502.4.4.

Exception: Unitary packaged systems with cooling capacities not greater than 90,000 Btu/h (26 379 W).

TABLE A502.4.4
MAXIMUM HOT GAS BYPASS CAPACITY

RATED CAPACITY	MAXIMUM HOT GAS BYPASS CAPACITY (% of total capacity)
≤240,000 Btu/h	50%
240,000 Btu/h	25%

For SI: 1 Btu/h = 0.29 watts.

A502.4.9 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, 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. These air tight, operable dampers shall be installed when the air barrier is penetrated by:

1. Fixed open louvers such as in elevator shafts and machine rooms.
2. Mechanical system components which allow infiltration or exfiltration of air when the systems are inactive, such as atrium smoke exhaust systems, elevator shaft smoke relief openings, and other similar elements.

Such dampers shall be set in the closed position and automatically open 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.

Exception: Gravity (nonmotorized) dampers are permitted to be used in buildings less than three stories in height above grade.

A502.4.10 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 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 interior wall or ceiling covering.

{Topic: BUILDING COMMISSIONING REQUIREMENTS}

Revise Section 503.2.9 and replace with section A503.2.9 as follows:

A503.2.9 Mechanical systems commissioning and completion requirements.

A503.2.9.1 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. Drawing notes shall require commissioning and completion requirements in accordance with this section. Drawing notes may refer to specifications for further requirements. Copies of all documentation shall be given to the owner.

A503.2.9.1.1 Commissioning plan. A commissioning plan shall include as a minimum the following items:

1. A detailed explanation of the original owner's project requirements,
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.

A503.2.9.1.2 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.

A503.2.9.1.3 Functional performance testing.

A503.2.9.1.3.1 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.

A503.2.9.1.3.2 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.

A503.2.9.1.3.3 . Testing for Common Rooftop Equipment Problems. Rooftop HVAC equipment will be evaluated to avoid the following common problems:

1. Insufficient duct insulation, or outside conditioned space.
2. Wrong refrigerant charge.
3. Economizer missing or inoperative where required.

A503.2.9.1.4 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.
4. Planned date of complete compliance.

A503.2.9.2 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. The letter will include certification by the owner of the planned date for bringing all noted deficiencies into compliance (See Section 503.2.9.3.4)

A503.2.9.3 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.

A503.2.9.3.1 Drawings. Construction documents shall include as a minimum the location and performance data on each piece of equipment.

A503.2.9.3.2 Required 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 set points.
6. Names and addresses of designer of record, HVAC designer, contractor, and builder.

A503.2.9.3.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section 503.2.9.1.2

A503.2.9.3.4 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.

{Topic: LIGHTING CONTROL REQUIREMENTS}

Revise Section 505.2 and replace with section A505.2 as follows:

A505.2 Lighting controls (Mandatory). Lighting systems shall be provided with controls as required in Sections 505.2.1, 505.2.2, 505.2.3, 505.2.4, and 505.2.5..

A505.2.1 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.

A505.2.2 Additional controls. Each area that is required to have a manual control shall have additional controls that meet the requirements of Sections A505.2.2.1 and A505.2.2.2.

A505.2.2.1 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/m2).

A505.2.2.1.1 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.

A505.2.2.2 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 505.2.2.2.1 Occupancy Sensors
2. Section 505.2.2.2.2 Time Clock Controls
3. Section 505.2.2.2.3 Automatic Daylighting Controls

Where an automatic time switch control device is installed to comply with Section 505.2.2.2, 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).

A505.2.2.2.1 Occupancy sensors Occupancy sensors must 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. Areas where automatic daylight controls are installed are not required to have occupancy sensors in addition to the daylight controls, although integrated or dual controls may be implemented for additional energy savings.

A505.2.2.2.2 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 4 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).

A505.2.2.2.3 Automatic daylighting controls. Automatic controls installed in daylit zones must 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 at least 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 appropriate in continuously occupied areas with ceiling heights of 14 feet or lower

A505.2.5 Additional Control.

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 undershelf or undercabinet 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. Nonvisual Lighting—lighting for nonvisual 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.

Exception:

1. a., b. and d. Where LED lighting is used no additional control is required.

{Topic: LIGHTING POWER DENSITY REQUIREMENTS}

Delete Table 505.5.2 in its entirety and replace with the following table A505.5.2 and footnotes:

TABLE A505.5.2
INTERIOR LIGHTING POWER ALLOWANCES
(Underlining omitted for clarity)

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
Dining: Cafeteria/Fast Food		
Court House	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	1.0	
Living Quarters		1.1
Bedroom		0.5
Study Hall		1.4
Exercise Center	1.0	
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	1.0	
Corridors w/ patient waiting, exam		1.0
Exam / Treatment		1.0
Emergency		2.7
Public & Staff Lounge		0.9
Hospital / Medical Supplies		1.4

LIGHTING POWER DENSITY		
Hospital – Nursery		0.6
Nurse Station		1.0
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	1.0	
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	1.0	
Dining Area		1.2
Guest quarters		1.1
Reception / Waiting		2.1
Motion Picture Theater	1.2	
Audience / Seating Area		1.2
Lobby		1.0
Multi-Family	0.7	
Museum	1.1	
Active Storage		0.8
General Exhibition		1.0
Restoration		1.7
Office	0.9	
Enclosed		1.0
Open Plan		1.0
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 Station	1.0	
Fire Station	0.8	
Fire Station Engine Room		0.8
Sleeping Quarters		0.3
Audience / Seating Area		0.8
Police Station Laboratory		1.4
Post Office / SF	1.1	
Sorting Area		1.2
Lobby		1.0
Religious Buildings	1.3	
Lobby		0.6
Worship / Pulpit / Choir		2.4
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		
Storage		0.5
Laboratory		1.1
Retail: Specialty	1.6	
Town Hall	1.1	
Transportation	1.0	
Dining Area		2.1
Baggage Area		1.0
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. The lighting power densities contained in this table include allowances for video-display terminals, decorative lighting and display lighting Additional lighting power is not allowed for these uses. Task lighting is not included in these connected LPD limits.

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 = (Retail Area 1 X 0.4W/ft2) + (Retail Area 2 X 0.6 W/ft2) + (Retail Area 3 X 0.9 W/ft2) + (Retail Area 4 X 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.

{Topic: ADDITIONAL REQUIREMENTS}

Add New Section A507 as follows:

SECTION A507
ALTERNATIVE PRESCRIPTIVE COMPLIANCE PACKAGES

A507.1 Requirements. Commercial buildings are required to comply with one of the following sections:

1. A507.2.1 Efficient Mechanical Equipment
2. A507.2.2 Reduced Lighting Power Density
3. A507.2.3 On-Site Supply of Renewable Energy

At the time of plan submittal, the building jurisdiction shall be provided, by the submittal authority, documentation designating the intent to comply with Section A507.2.1, A507.2.2, or A507.2.3 in their entirety.

A507.2.1 Efficient Mechanical Equipment

This mechanical alternative compliance option is intended to allow the builder to meet the requirements of section 507 by choosing to install efficient mechanical equipment. This section in no way replaces requirements in section 503, but is one of several optional compliance packages.

Mechanical equipment choices that fulfill requirements for section A507.2.1 shall comply with the following in addition to the requirements in section 503:

1. Package unitary equipment shall meet the minimum efficiency requirements in Tables A507.2.1(1) and A507.2.1(2)
2. Package Terminal Air Conditioners and Heat Pumps shall meet the minimum efficiency requirements in Table A507.2.1(3)
3. Warm air furnaces and combination warm air furnaces / air conditioning units shall meet the minimum efficiency requirements in Table A507.2.1(4)
4. Boilers shall meet the minimum efficiency requirements in Table A507.2.1(5)
5. Electric chillers shall meet the energy efficiency requirements in Table A507.2.1(6)
6. Absorption chillers shall meet the minimum efficiency requirements in Table A507.2.1(7)

TABLE A507.2.1(1)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	REQUIRED EFFICIENCY[a]
Air conditioners, Air cooled	< 65,000 Btu/hd	Split system	15.0 SEER 12.5 EER
		Single package	15.0 SEER 12.0 EER
	≥ 65,000 Btuh/h and < 135,000 Btu/h	Split system and single package	12.0 EERb 12.4 IPLVb
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split system and single package	12.0 EERb 12.4 IPLVb
	≥ 240,000 Btu/h and < 760,000 Btu/h	Split system and single package	10.8 EERb 11.0 IPLVb
	≥ 760,000 Btu/h		10.2 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 A507.2.1(2)
UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	REQUIRED EFFICIENCY[a]
Air cooled (Cooling mode)	< 65,000 Btu/hd	Split system	15.0 SEER 12.5 EER
		Single package	15.0 SEER 12.0 EER
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	12.4 EER[b] 11.9 IPLV[b]
	≥135,000 Btu/h and < 240,000 Btu/h	Split system and single package	12.4 EER[b] 11.9 IPLV[b]
	≥ 240,000 Btu/h	Split system and single package	12.4 EER[b] 10.9 IPLV[b]
Water source (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	9.0 HSPF
		Single package	8.5 HSPF
	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling capacity)	47°F db/43°F w[b] outdoor air	3.4 COP
		77°F db/15°F w[b] outdoor air	2.4 COP
	≥ 135,000 Btu/h (Cooling capacity)	47°F db/43°F w[b] outdoor air	3.2 COP
		77°F db/15°F w[b] outdoor air	2.1 COP
Water source (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 A507.2.1(3)
PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINALHEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY	REQUIRED EFFICIENCY[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 A506.2.1(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
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
	≥ 225,000 Btu/h	Maximum capacity	90% Ec note 1
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
	≥ 225,000 Btu/h	Maximum capacity	85% Et, Note 1
Warm air duct furnaces, gas fired	All capacities	Maximum capacity	*90% Ec*
Warm air unit heaters, gas fired	All capacities	Maximum capacity	*90% Ec*
Warm air unit heaters, oil fired	All capacities	Maximum capacity	*90% Ec*

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 A507.2.1(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

* Systems must be designed with lower operating hot water temperatures (<150◦F) and use hot water reset to take advantage of the much higher efficiencies of condensing boilers.

TABLE A507.2.1(5)
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 < 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 here for chiller efficiency.

TABLE A507.2.1(6)
ABSORPTION CHILLERS - EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	REQUIRED EFFICIENCY FULL LOAD COP (IPLV)
Air Cooled, Single Effect	0.60, but only allowed in heat recovery applications
Water Cooled, Single Effect	0.70, But only allowed in heat recovery applications
Double Effect - Direct Fired	1.0 (1.05)
Double Effect - Indirect Fired	1.20

A507.2.2 Reduced Lighting Power Density - Whole Building Lighting Power Density (watts/SF) must comply with table 507.2.2.

TABLE A507.2.2
REDUCED WHOLE-BUILDING
INTERIOR LIGHTING POWER ALLOWANCES

LIGHTING POWER DENSITY	
Building Type	**Whole Building (W/ft2)**
Automotive Facility	0.8
Convention Center	1.1
Court House	1.1
Dining: Bar / Lounge / Leisure	1.2
Dining: Cafeteria / Fast Food	1.3
Dining: Family	1.4
Dormitory	0.9
Exercise Center	0.9
Retail: Supermarket	1.2
Gymnasium	1.0
Healthcare Clinic	0.9
Hotel	0.9
Library	1.2
Manufacturing Facility	1.2
Motel	0.9
Motion Picture Theater	1.1
Multi-Family	0.6
Museum	1.0
Office	0.8
Parking Garage	0.2
Penitentiary	0.9

LIGHTING POWER DENSITY	
Performing Arts Theater	1.4
Police Station	0.9
Fire Station	0.7
Post Office / SF	1.0
Religious Buildings	1.2
Religious Buildings	1.2
Retail	1.2
School / University	1.1
Retail: Specialty	1.4
Town Hall	1.0
Transportation	0.9
Sports Arena	1.0
Warehouse	0.5
Workshop	1.3

A507.2.3 On-site Supply of Renewable Energy

The building or surrounding property shall incorporate an on-site renewable energy system that supplies 3% or more of total building energy loads. On-site power generation using nonrenewable sources does not meet this requirement.

The jurisdiction shall be provided with an energy analysis as described in Section 506 that documents the renewable energy contribution to the building or a calculation demonstrating that the on-site supply of renewable energy

1. Is capable of providing at least 3% of the total energy load of the building, or
2. Provides on-site renewable energy generation with a nominal (peak) rating of 175 BTU's or 0.50 watts per square foot of building.

{Topic: DESIGN INTENT FORMS}

Add new section, Appendix X as follows:

Appendix X. Design Intent Certification Form: Building Energy
Form X:

The {insert Jurisdiction Name here}'s Energy Conservation Code recognizes the essential importance of key building design considerations in meeting the energy performance requirements of this code. In accordance with the provisions of Sections A103.2, signing this form certifies compliance with the design intent objectives of the code.

I, ________________________________, hereby certify that the following are the energy related design intentions for this project:

1. Building Life Expectancy and Planning Cycle
   1. What is the expected lifetime (design goal) of the building? ________ years
   2. What is the life expectancy of the installed components of this building?
      - 2.1. Building envelope (insulation, fenestration, air sealing) ________ years
      - 2.2. HVAC Equipment (furnaces, boilers, air conditioners) ________ years
      - 2.3. . HVAC delivery systems (ducting, piping) ________ years
      - 2.4. Lighting systems ________ years
      - 2.5. Service water heating ________ years ________

2. Energy Performance Objectives
   1. Using prescribed minimum energy standards for each element of this project ______ (Y/N)
   2. If using higher-than-code levels of energy efficiency for specific elements of this project, identify the specific areas of better-than-code performance used for this project:
      - 2.1. . Building envelope (insulation, fenestration, air sealing) ________ (Y/N)
      - 2.2. . HVAC Equipment (furnaces, boilers, air conditioners) ________ (Y/N)
      - 2.3. . HVAC delivery systems (ducting, piping) ________ (Y/N)
      - 2.4. Lighting systems ________ (Y/N)
      - 2.5. Service water heating ________ (Y/N)

3. Briefly describe those areas of the project where beyond minimum code energy performance is specified. (Attach additional sheets if necessary.)

3. Building Configuration and Design Objectives
   3.1. Provide a short narrative explaining how building orientation will affect the energy use in the building and what design features have been tailored to respond to these conditions. (Attach additional sheets if necessary)
   3.2. Provide short narrative describing the building HVAC elements to be employed for the building specifically related to energy code compliance or beyond code levels of energy efficiency. (Attach additional sheets if necessary)
   3.3. Briefly describe how the following design decisions impacted HVAC Load Sizing:
      1. Building Orientation
      2. Window Area / Window Performance
      3. Opaque Building Envelope Decisions
4. Briefly describe any other building design elements planned for this project intended to meet or exceed the minimum energy efficiency requirements of the code. Attach additional sheets if necessary.)

Designer of Record: ______________________________ Date ____________

Project: ______________________________ ______

Owner ______________________________ Date ____________

Code Official ______________________________ Date ____________

Add new section, Appendix Y as follows:

Appendix Y. Certification of Energy Code Compliance
Form Y: Summary

The {insert Jurisdiction's Name here}'s Energy Conservation Code recognizes that the building energy performance objectives of a project must be delivered upon completion of the project. In accordance with the provisions of Sections A103.3, signing this form certifies compliance with meeting the energy performance objectives of this project and full compliance with the provisions of the energy efficiency code.

I, __________________, hereby certify that this building meets the performance requirements defined by this code:

Certification Checklist:
note: attach additional pages for complex buildings

Envelope Provisions:

	Design Intent		Initial Built as Designed		
Building Component	System	R-Value	Builder / Designer	Owner	Code Official
Roof					
Walls					
Below Grade Walls					
Floors					
Slab on Grade Floors					
Opaque Doors					

Fenestration:

	Design Intent			Initial Built as Designed		
Building Component	System Descriptions	U-value	SHGC	Builder / Designer	Owner	Code Official
Windows						
Skylights						
Doors						

HVAC:

	Design Intent			Initial Built as Designed		
Building Zone Description	System Descriptions	Unit Size	Btu / sqft	Builder / Designer	Owner	Code Official

Service Water Heating:

Design Intent			Initial Built as Designed		
System Descriptions	Unit Size	Btu / sqft	Builder / Designer	Owner	Code Official

Lighting:

	Design Intent			Initial Built as Designed		
Building Zone Description	System Descriptions	Unit Size	Lighting Power/ sqft	Builder / Designer	Owner	Code Official

Designer of Record: ____________________ Date ________

Project: ____________________ ______

Owner ____________________ Date ______

Code Official ____________________ Date ________

Reason: The purpose of the new Appendix A ("Appendix") to the International Energy Conservation Code (IECC) is to expand the code's utility to those jurisdictions seeking improved levels of energy efficiency beyond the performance defined by the minimum code.

This proposal provides such jurisdictions with an easy-to-use set of improved, prescriptive energy efficiency measures for residential and commercial buildings to directly substitute for the referenced section of the code.

The Appendix provides innovative ways of increasing energy efficiency that have been successfully demonstrated elsewhere.

The use of Appendices in other ICC codes has set a precedent for this proposal.

While the IECC addresses regional energy efficiency needs using climate zones, the energy landscape has become far more complicated. The new Appendix provides jurisdictions with more choice and flexibility in addressing local energy efficiency needs. This Appendix allows local jurisdictions to set a higher bar for building energy efficiency in response to their local or regionally-specific needs.

Concerns such as local fuel pricing, inflation, utility reliability and local peak power issues may require jurisdictions to seek building energy efficiency levels beyond those defined by the minimum code.

Generic model codes do not necessarily account for the increasingly complex and regionally specific power needs or challenges to local utility reliability. Efficiency gains for new construction can help delay the need for new peaking plant capacity, keeping the price of energy low in addition to delivering simple conservation savings.

The Appendix provides a basic set of improved prescriptive energy performance increases along with three key elements that are essential to ensuring delivered building energy performance:

1. Residential Air Leakage Testing
2. Residential Duct Leakage Testing

3. Commercial Building Commissioning Requirements

The Appendix also provides for improved efficiency options in:

1. Efficient Mechanical Equipment
2. Reduced Lighting Power Densities
3. On-Site Supply of Renewable Energy

These new sections give jurisdictions options to require better equipment, better lighting and on-site generation to meet their efficiency objectives.

Finally, two additional forms are provided as new appendices intended to help jurisdictions ensure compliance with the code provisions adopted. The first certifies that essential elements of energy efficiency and code compliance have been considered up front. This “Design Intent” certification addresses key issues of building life expectancy, energy code objectives, site considerations and other basic energy code compliance topics. The form tells the building official what elements of energy performance were considered during the planning phase. The second form provides the code official with certification that the objectives of the code and the original design intent have been met.

Credible climate change science gives us only about a decade to be well on our way to Greenhouse Gas Reductions. The Architecture 2030 goals call for drastic incremental increases towards carbon neutral buildings in 2030. Targets such as these are being taken seriously by planners, usually on a regional or municipal level. This Appendix enables the IECC to take a similar approach by providing jurisdictions the choice to take advanced steps towards higher efficiency.

The proponent recognizes the difficulty of performing an honest cost benefit analysis for any proposal at this juncture. In fact, we question any cost benefit analysis offered as justification to an IECC proposal. The number of variables and the rate of change in the energy and power landscape make such as task essentially a real-time impossibility. New power generation capacity is being priced at levels that far out-strip historical costs, so prediction based on historical trends is specious at best. Carbon emissions have yet to be given a price tag. Durability and life cycle cost are becoming more important considerations – from building planning to municipal and state energy policy planning. The time-dependent value (TDV) of electricity is becoming a critical component of efficiency policy and planning. While TDV is a common consideration in utility planning, it is (until now) generally ignored in IECC discussions and economic impact statements.

In light of this challenging and rapidly changing utility and power landscape it seems prudent to allow jurisdictions to be able to use the IECC to accomplish their locally-specific objectives for building energy efficiency. This Appendix provides a means to support these objectives within the IECC context (without creating a competing “code” in the public marketplace.)

Cost Impact: The code change proposal will increase the cost of construction locally if adopted by jurisdictions.

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

ICCFILENAME: Mathis-EC-1-Appendix A