INTERNATIONAL ENERGY CONSERVATION CODE

EC4-07/08

102.1.3, 102.1.3.1 (New), 202, Chapter 6 (New)

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself; Julie Ruth, JRuth Code Consulting, representing the American Architectural Manufacturers Association; Rand Baldwin, Aluminum Extruders Council (AEC); Margaret Webb, Insulating Glass Manufacturers Association (IGMA); Greg Carney, Glass Association of North America (GANA)

1. Revise as follows:

102.1.3 Fenestration product rating. U-factors and solar heat gain coefficients (SHGC) of fenestration products ~~(windows, doors and skylights)~~ shall be determined in accordance with Section 102.1.3.1, 102.1.3.2, or 101.3.3 .~~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 102.1.3(1) or 102.1.3(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 102.1.3(3).~~

2. Add new text as follows:

102.1.3.1 Fenestration rating by NFRC 100 and NFRC 200. Determination of U-Factors for fenestration products shall be in accordance with NFRC 100 by an accredited, independent laboratory, and the products shall be labeled and certified by the manufacturer. Determination of the solar heat gain coefficient (SHGC) of glazed fenestration products shall be in accordance with NFRC 200 by an accredited, independent laboratory, and the products shall be labeled and certified by the manufacturer.

102.1.3.2 Commercial fenestration alternative rating by AAMA 507. U-factors and SHGC for fenestration used in commercial buildings shall be determined in accordance with AAMA 507. 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 the glazing contractor or 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.

102.1.3.3 Default values for fenestration rating. Products lacking a U-factor determined in accordance with Section 102.1.3.1 or 102.1.3.2 shall be assigned a default U-factor from Table 102.1.3(1) or 102.1.3(2). Products lacking an SHGC determined in accordance with Section 102.1.3.1 or 102.1.3.2 shall be assigned a default SHGC from Table 102.1.3(3).

3. Revise definition as follows:

SECTION 202
GENERAL DEFINITIONS

FENESTRATION. Skylights, roof windows, vertical windows (fixed or moveable), curtain wall, storefront glazing, opaque doors, glazed doors, glazed block, and combination opaque/glazed doors. Fenestration includes products with glass and non-glass glazing materials.

4. Add 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: (Conner) The reason for this change is simple. Commercial windows should be rated for energy efficiency. The industry needs a rating method that works with their bid and construction process. The time between bid and construction can be days or weeks. The NFRC web site states, "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 windows are often built "on site". Commercial window makers bid windows for a specific commercial building. 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 window rating that can be used in the commercial site-built bid process.

The NFRC standards should not be granted a monopoly in the code when those standards do not work for most of the commercial site-built industry. AAMA 507 is a good alternative to the NFRC procedures for commercial site-built windows.

Reason: (Ruth) This proposal would permit the use of AAMA 507 to determine the U-factor and SHGC of glazed assemblies in commercial buildings. By following the procedure established in AAMA 507 and working with approved, accredited testing and simulation laboratories, a framing manufacturer can create a design tool that provides the U-factor or SHGC for a glazed assembly quickly and easily, based upon the center of glass properties for the glass package and the framing system used. The values used in the design tool are determined and verified using NFRC procedures, including determination of U-factors in accordance with NFRC 100 and determination of SHGC in accordance with NFRC 200. The validity of the installation is provided by a certificate of compliance, which is completed by the glazing contractor or a registered design professional.

A similar proposal was presented to the IECC committee for consideration during the 2006/2007 ICC Code Change Cycle, but it referenced an earlier edition of AAMA 507. That earlier edition did not require the use of the certificate of compliance described in the standard. The committee had some concern that the certificate was not mandatory, and the proposal was disapproved.

AAMA has revised AAMA 507 in such a manner that the certificate of compliance is now mandatory. This new proposal also specifies that the testing to be done to establish the values included on the certificate of compliance be done in accordance with NFRC 100 and NFRC 200. A study by Architectural Testing Incorporated demonstrated that both the NFRC standards and AAMA 507 give the same results well within 1 percent.

Although NFRC has attempted to provide programs for the verification of the site built glazing systems that occur in commercial buildings, the use of such programs has encountered numerous difficulties. One of the most prominent of these is the long lag time needed to receive NFRC certification of a site built system once the components of the system have been finalized. As a result NFRC certification of site built glazing systems has not become wide spread, with less than 1% of the projects in the U.S. making use of such certification in 2006. The state of California attempted to use the NFRC site built program, but was not able to make it workable. Although NFRC is currently attempting to put a component modeling based program in place, California has opted to add default tables for curtainwall and spandrel panels to the 2007 edition of the California Energy Code, as a safe guard in case the new NFRC program is not available in time.

The values given in AAMA 507 are significantly more accurate than anything that can be contained in default tables. And the procedure is already available, is working and has been working for a few years now. This proposal simply provides an method of receiving NFRC values for a system that is an alternative to the use of a label. It is not a replacement for NFRC ratings for fenestration in commercial buildings. The values obtained using either method are extremely close, so there should be no confusion in the marketplace, while providing multiple options for code officials and manufacturers to help increase code enforcement. Competition is a good thing, and will push both organizations to improve their standards and programs, which then benefits both the public and industry. As long as energy efficient products are being used in accordance with the code, it should not matter whether they use labeling or a certificate of compliance to determine the energy rating of the product.

We urge the committee to recognize this method in the IECC to provide architects and contractors an accurate way to determine the U-factors and SHGC of a proposed glazing system that fits within the fast track time frame of commercial construction.

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

Analysis: Review of proposed new standard AAMA 507-07 indicated that, in the opinion of ICC Staff, the standard did comply with ICC standards review.

Committee Action: Disapproved

Committee Reason: The proposed new standard does not have third-party oversight requirements for the manufacturers doing the determination of the fenestration ratings; therefore, the committee was uncomfortable with allowing the use of this fenestration rating system with less oversight. In addition, the standard is unclear regarding who should be qualified to do the fenestration rating calculations.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Julie Ruth, JRuth Code Consulting, representing the American Architectural Manufacturers Association; Greg Carney, Glass Association of North America, representing same; Margaret Webb, Insulating Glass Manufacturers Association, representing same; Rand Baldwin, Aluminum Extruders Council, representing same; David Walker, National Glass Association, representing same; Bill Koffel, Glazing Industry Code Committee, representing same, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

102.1.3 Fenestration product rating. U-factors and solar heat gain coefficients (SHGC) of fenestration products shall be determined in accordance with Section 102.1.3.1, 102.1.3.2, or 102.1.3.3.

102.1.3.2 Commercial fenestration alternative rating by AAMA 507. U-factors and SHGC for ~~fenestration~~ <u>curtainwall and storefront</u> used in commercial buildings shall be <u>permitted to be</u> determined in accordance with AAMA 507. 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 ~~the glazing contractor or~~ <u>a</u> 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.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: (Conner) This change responds to committee comments by limiting this commercial fenestration rating alternative to curtainwall and storefront glazing, and clarifying that a registered design professional must sign the certificate.

Energy code enforcement that achieves energy savings requires a process that works in the real world of the commercial glass fabricator. AAMA 507 can be used to document glazing ratings within the short time frames glass fabricators have to respond to the requests for the "made to order" glazing. With AAMA 507 the industry can move from a seldom-used commercial window rating to a practical alternative.

Commenter's Reason: (Ruth, et al) Enforcement of the energy code is key to achieving significant energy savings in the real world. At the present time, NFRC procedures are widely used in the residential market for demonstrating compliance with the IRC or IECC. Such a situation, however, does not exist in the commercial market. Due to the custom nature of the commercial market, testing and labeling of standard size "stock" products does not adequately address the degree of variability from project to project that occurs in commercial buildings, and as a result, NFRC procedures are used in less than 1% of commercial projects. Therefore, to provide a tool for code officials to enforce the code and achieve real energy savings, an alternative approach is needed.

AAMA 507 provides such an alternative more suited to the custom nature of commercial fenestration. By relying upon the legal contractual relationship between the general contractor, the registered design professional and the glazing contractor, the provisions of AAMA 507 provide a code official with a quick and accurate way to determine compliance of glazed fenestration in a commercial building.

The key to this verification is the certificate of compliance. The basis of the certificate of compliance is a grid that has been developed by an approved, accredited, independent laboratory using NFRC procedures, which gives the U-factor or SHGC of the whole system based upon the center of glass U-factor or SHGC. Armed with this grid, a registered design professional can determine the resultant U-factor or SHGC of that commercial glazed fenestration system, simply by knowing the center of glass U-factor or SHGC of the glass package used. Since these values are determined using NFRC procedures and NFRC prescribed sizes, they are accurate to within less than 0.1% of the NFRC labeled values for the same system. Thus, AAMA 507 provides a quick and accurate way for the code official, glazing contractor, general contractor and registered design professional to verify the U-factor or SHGC of a glazed fenestration system.

This proposal was disapproved during the code development hearings in Palm Springs due to concerns raised about allowing the glazing contractor to submit the certificate of compliance, and the fact that the scope of the proposal, as originally submitted, would have allowed it to be applied to windows as well as curtainwall and storefront. This public comment addresses those two concerns by removing the provisions that permits the glazing contractor to sign the certificate of compliance and limiting the scope of the proposal to curtainwall and storefront.

We feel these revisions appropriately address the concerns raised by the IECC committee, while providing code officials an important tool for enforcement. We urge you to approve EC4 with these modifications.

Final Action: AS AM AMPC____ D

EC6-07/08
103.1.1

Proposed Change as Submitted:

Proponent: Ronald Majette, U.S. Department of Energy

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. <u>The requirements identified as "mandatory" in Chapters 4 and 5 of this code, as applicable, shall be met.</u>

Reason: The purpose of this proposal is to ensure that the "mandatory" requirements of the IECC such as sealing the building envelope (Section 402.4) and sealing ducts (Section 403.2.2) be complied with for all buildings. Since the ICC has deemed that the mandatory requirements should apply to all buildings, it is reasonable that "above code programs" not be allowed to bypass these requirements.

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

Committee Action: **Approved as Submitted**

Committee Reason: The proposal would add a reasonable stipulation that above code programs meet the mandatory requirements of this code which are minimum requirements for certain elements that the committee believes are necessary for provisions for any energy code.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself, requests Disapproval.

Commenter's Reason: The International Codes (I-codes)need to be internally consistent. The I-codes provide the foundation for the building codes adopted by most U.S. cities, and states, as well as some countries. Although adopting entities can, and do, amend the I-codes, the adopting jurisdictions expect a set of model codes that are internally consistent. Prior to the current code development cycle, the residential IECC and IRC energy requirements were identical in most areas. However, this development cycle introduced many potential inconsistencies. These inconsistencies are substantial enough to affect code usability. To be effective and enforceable, the IECC and IRC need to be consistent.

The table below shows the public comments designed to realign the IECC and IRC residential energy requirements to ensure internal consistency. The code development process deals with each code change separately, so realignment requires multiple comments.

The method suggested for aligning the IECC and IRC falls into one these categories:

- A code change was submitted to the IECC without a parallel comment on the same text in the IRC. At this stage, the code development process does not allow a change unless there was an initial public comment, so realigning the codes means rejecting any comment that would create an inconsistency. The IECC committee already rejected most proposed changes that lacked an IRC version. About six more such rejections are needed to align the two codes. Of course the proponent can come back in the next code development cycle and propose the same comment for both the IECC and IRC.

- The code change was approved in one code and disapproved in the other. The best option is usually to disapprove the change in both codes or approve the same version in both codes.

- Different versions of a requirement were approved in the two codes. Different versions were approved in only two cases. A "compromise" is suggested in both cases.

- The code change was submitted for only one code, but corrects an existing difference between the IECC and IRC. Approving these changes aligns the two codes.

- The code changes were treated the same way in both codes—either approved or disapproved. In this case there is consistency, and no change is needed to align the IECC and IRC. Those code changes are not listed in the table

Inconsistencies in the IRC & IECC Requirements

Key: AS=Approved as Submitted
AM=Approved as Modified
AMPC=Approved as Modified by Public Comment
D=Disapproved

#	Topic	IECC change	IRC change
EC6	Specific items made mandatory, rather than subject performance, even for "above code programs"	IECC AS. Request D in IECC.	No aligning IRC change possible, must change IECC
EC14 & EC154	Extensive package of changes	IECC D	No aligning IRC change possible, must keep IECC D
EC15	Mark R19 bats for actual performance in wall cavity	IECC AM	Request AMPC to align with IECC
EC16 & EC18	Lower maximum fenestration U-factors in southern Zones	IECC EC16 AS. Request EC18 AMPC to put compromise values in IECC.	No IRC version of EC16. Request EC18 AMPC to put compromise values in IRC
EC22 & EC26	Lower maximum SHGC in Zones 1 to 3	IECC EC26 AM. Request EC22 AMPC to put compromise values in IECC.	No IRC version of EC26. Request EC22 AMPC to put compromise values in IRC.
EC33	Increase basement insulation in Zones 6 to 8	IECC AS. Request D.	No aligning IRC change possible, must change IECC
EC35	Increase floor insulation in Zone 7 and 8	IECC AS. Request D.	No aligning IRC change possible, must change IECC
EC36	Add basement insulation in portion of Zone 3	IECC AS	Request AS in IRC also
EC37	Set insulation depth for heated slabs in Zones 1 to 3	IECC AM	Request AMPC to align with IECC
EC42	Removes ground conductance from basement wall U-factor calculations	IECC AM	Request AMPC to align with IECC
EC46	Limit ceiling areas eligible for reduced R-value due to framing restriction	IECC AS. Request D.	No aligning IRC change possible, must change IECC
EC48	Require vertical attic access meet exterior door requirement	IECC D	IRC AM. Request D.
EC50	Modifies the requirement for continuous insulation over steel framing in Zones 1 & 2	IECC AM	Request AMPC to align with IECC
EC51	Add steel framing insulation option equivalent to R-13 walls	IECC D. Committee suggested "fix". Request AMPC with fix.	IRC AS. Request AMPC to align with IECC and "fix".

#	Topic	IECC change	IRC change
EC58	Limit door area exempt from the code to 25 ft^2	IECC AM. Request D also in IECC.	IRC D
EC60	Add "rim joists" to list of areas to be air sealed	IECC AM	Request AMPC to align with IECC
EC64	Add requirements for air sealing & insulation quality installation. Require blower door OR visual inspection. Require fireplace doors & external combustion air.	IECC AM	Request AMPC to align with IECC
EC68	Require programmable thermostat	IECC AM	Request AMPC to align with IECC
EC69	Require a high efficiency furnace blower	IECC AM	Request AMPC to align with IECC
EC70	Add optional metric for manufacturer to show air handler is sealed	IECC AS	Request AS in IRC also
EC71	Require ducts tested OR indoors	IECC AS	Request AS in IRC also
EC74	Increase mechanical pipe insulation from R-2 to R-3	IECC AS	Request AS in IRC also
EC79	Require electronic ignition for gas water heaters	IECC AS	Request AS in IRC also
EC81 & EC82	Require pool heater controls & pool covers. Prohibit continuous pilot light.	IECC EC82 AS	Request AMPC with EC81 to align with existing IECC
RE5 & RE6	Realign IRC mass wall insulation requirements with IECC	No IECC change needed	Request AMPC with RE6 to align with existing IECC
RE8	Require IC (insulation contact) and "air tight" recessed lighting	No IECC change needed	Request AS to align with existing IECC

Energy efficiency is becoming markedly more important. Fortunately, the code changes that saved the most energy were usually written for both codes, allowing a substantial overall increase in energy efficiency for both the 2009 IECC and IRC. With these changes, the two codes will be much more consistent, easier to implement and more energy efficient.

EC6 alignment: EC6 was submitted to the IECC, without a parallel comment to the IRC. To realign the two codes, EC6 should be Disapproved.

EC6 content: Buildings that meet approved "above code programs" should be allowed to exceed code based on overall performance. EC6 requires that "above code programs" explicitly meet items in sections with the "mandatory" heading, even if the overall building exceeds the energy savings required by code. However, EC6 but does not require explicitly meeting the more important items labeled "prescriptive," like insulation levels and window characteristics.

EC6 applies to both the commercial and residential chapters. The commercial chapter allows ASHRAE 90.1 as an alternative for commercial buildings to meet the energy code, but EC6 specifically references the "mandatory" headings on sections in Chapter 5 of the IECC. Therefore EC6 appears to make the "mandatory" items in Chapter 5 effectively overriding the requirements and exceptions in ASHRAE 90.1 or any ASHRAE standard used by an "above code program" even if the result of the "above code program" is significant energy savings.

Calling parts of the code "mandatory," leads to confusion--are the other parts of the code labeled "prescriptive" or lacking any label not really mandatory? Are chapters, such as Chapter 1, completely lacking any "mandatory" headings not really mandatory? EC6 should be Disapproved to avoid confusion and make the IECC and IRC consistent.

EC6 content: EC6 requires that "above code programs" explicitly meet items in sections with the "mandatory" heading, even if the overall building exceeds code. However, EC6 but does not require explicitly meeting the more important items labeled "prescriptive," like insulation levels and window characteristics. "Above code programs" should be allowed to exceed code based on overall home performance. EC6 affects Chapter 1 and therefore applies to both commercial and residential. In commercial, the situation is more confusing because ASHRAE 90.1 is allowed as an alternative, but the "mandatory" heading is on sections of the IECC. In addition, calling parts of the code "mandatory," leads to confusion, leaving the question--are the other parts of the code labeled "prescriptive" or lacking either label not really mandatory?

Public Comment 2:

Ken Sagan, National Association of Home Builders, representing same, requests Disapproval.

Commenter's Reason: Above Code Programs are available for adoption by local jurisdictions at their discretion and are by definition "Above Code". Making existing IECC requirements mandatory, limits energy neutral tradeoffs (e.g. R-6 ducts) and places restrictions on energy saving designs (e.g. passive solar using high solar heat gain windows on southern exposures) that can improve energy performance of a building when properly building.

Final Action: AS AM AMPC____ D

EC9-07/08
202

Proposed Change as Submitted:

Proponent: Guy McMann, Jefferson County, CO, representing the Colorado Association of Plumbing and Mechanical Officials (CAPMO)

Delete definition and substitute 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~~

<u>**CONDITIONED SPACE**. For energy purposes, space within a building that is provided with heating and/or cooling equipment or systems capable of maintaining, through design or heat loss/gain, 50°F (10°C) during the heating season 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.</u>

Reason: This definition leaves a lot to be desired. How does one define the word "heated" or the word "cooled"? Jurisdictions electing to enforce the 2006 IECC are at a disadvantage and subject to non-uniform enforcement and non-uniform interpretation It doesn't make any sense to say that an un-insulated duct in a cold space automatically makes the cold space conditioned as a result of the un-insulated duct being located there to begin with. Why then insulate anything? This definition provides much more guidance

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

Committee Action: **Disapproved**

Committee Reason: It is important that the IECC coordinate with ASHRAE. The code already deals with the issue of the relationship between IECC and ASHRAE 90.1.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Guy McMann, Jefferson County, CO, representing the Colorado Association of Plumbing and Mechanical Officials (CAPMO), requests Approval as Submitted.

Commenter's Reason: The committee disapproved this proposal after trying to determine where the 50 degree and 85 degree numbers came from. This definition has been in the IRC for years and is an established benchmark without question. The current definition has little merit. There is no logic in declaring that an un-insulated duct in an unconditioned space magically makes the space conditioned because un-insulated ducts are not allowed in unconditioned spaces in the first place. If it's determined that this definition is not the absolute best, then, it's a marketable improvement over the current definition and should be approved. If there is a better definition in the future so be it, but in the meantime let's take a step in the right direction and at least get rid of a bad definition.

Final Action: AS AM AMPC____ D

EC14-07/08
202 (New), 401.2, Table 402.1.1, Table 402.1.3, 402.1.5 (New), Table 402.1.5 (New), Table 402.1.6 (New), Table 402.1.7 (New), 402.2.1, 402.2.2, 402.4.1, 402.4.1.1 (New), 402.4.1.2 (New), 402.4.1.3 (New), 402.4.1.4 (New), 402.4.1.5 (New), 402.4.1.6 (New), 402.7 (New), Table 402.7 (New), 403.2.4 (New), 403.4, 403.4.1 (New), 403.4.2 (New), 403.4.3 (New), 403.6, 404, 404.1, 404.2, Table 404.5.2(1)

Proposed Change as Submitted:

Proponent: Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI)

1. Add new definitions as follows:

SECTION 202
GENERAL DEFINITIONS

AIR BARRIER. A material intended to prevent the flow of air between a conditioned space and an unconditioned space.

LIGHT FIXTURE. A complete lighting unit consisting of a lamp or lamps, and ballasting (when applicable) together with the parts designed to distribute the light, position and protect the lamps, and connect the lamps to the power supply. For built-in valence lighting, strings of low-voltage halogens, and track lights, each individual bulb shall count as a fixture.

QUALIFYING LIGHT FIXTURE. A hard-wired light fixture comprised of any of the following components: a) high efficacy luminaire; or b) exterior light fixtures controlled by a motion sensor(s) with integral photo-control photo-sensor.

QUALIFYING LIGHT FIXTURE LOCATIONS. Hard-wired light fixtures located in kitchens, dining rooms, living rooms, family rooms/dens, bathrooms, hallways, stairways, entrances, bedrooms, garage, utility rooms, home offices, and all outdoor fixtures mounted on a building or pole. This excludes portable luminaires, closets, unfinished basements, and landscape lighting.

2. Revise as follows:

401.2 Compliance. Projects shall comply with Sections 401, 402.4, 402.5, 402.6, 402.7, and 403 (referred to as the mandatory provisions) and either:

1. Sections 402.1 through 402.3 (prescriptive); or
2. Section 404 (performance).

TABLE 402.1.1 (Supp)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT [a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[h]	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~~ 0.65	0.75	~~0.37~~ 0.25	30	~~13~~ 15	3 / 4	13	0	0	0
2	~~0.75~~ 0.50	0.75	~~0.37~~ 0.25	~~30~~ 38	~~13~~ 15	4 / 6	13	~~0~~ 10/13	0	0
3	~~0.65~~ 0.40	0.65	~~0.40[e]~~ 0.25[e]	~~30~~ 38	~~13~~ 18	5 / 8	19	~~0~~ 10/13	0	5/13
4 except Marine	~~0.40~~ 0.35	0.60	NR	~~38~~ 49	~~13~~ 18	5 / 10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	~~38~~ 49	~~19 or 13+5[g]~~ 21	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	~~49~~ 60	~~19 or 13+5[g]~~ 21	15 / 19	30[f]	~~10~~ 15/19 ~~13~~	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	~~49~~ 60	~~21~~ 24	19 / 21	~~30~~ 38[f]	~~10~~ 15/19 ~~13~~	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 shall be permitted to be compressed into a 2 × 6 cavity.
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. ~~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.
e. There are no SHGC requirements in the Marine zone.
f. Or insulation sufficient to fill the framing cavity, R-19 minimum.
g. ~~"13+5" means R-13 cavity insulation plus R-5 insulated sheathing.~~ Any combination of insulation shall be permitted to meet the requirements by summing the R-value of the cavity insulation and the R-value of the 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

TABLE 402.1.3 (Supp)
EQUIVALENT U-FACTORS [a]

CLIMATE ZONE	FENES-TRATION U-FACTOR	SKY-LIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	~~1.20~~ 0.65	0.75	0.035	~~0.082~~ 0.069	0.197	~~0.064~~ 0.060	0.360	0.477
2	~~0.75~~ 0.50	0.75	~~0.035~~ 0.029	~~0.082~~ 0.069	0.165	~~0.064~~ 0.060	~~0.360~~ 0.059	0.477
3	~~0.65~~ 0.40	0.65	~~0.035~~ 0.029	~~0.082~~ 0.056	0.141	~~0.047~~ 0.046	~~0.220~~ 0.059	0.136
4 except Marine	~~0.40~~ 0.35	0.60	~~0.030~~ 0.024	~~0.082~~ 0.056	0.141	~~0.047~~ 0.046	0.059	0.065
5 and Marine 4	0.35	0.60	~~0.030~~ 0.024	~~0.060~~ 0.051	0.082	~~0.037~~ 0.033	0.059	0.065
6	0.35	0.60	~~0.026~~ 0.020	~~0.060~~ 0.051	0.060	0.033	~~0.059~~ 0.050	0.065
7 and 8	0.35	0.60	~~0.026~~ 0.020	~~0.057~~ 0.047	0.057	~~0.033~~ 0.027	~~0.041~~ 0.050	~~0.057~~ 0.065

(Footnotes remain unchanged)

3. Add new text and tables as follows:

402.1.5 Envelope component default values. When calculating the U-factor of an assembly as part of Section 402.1.3, 402.1.4, or 404.5.2, the values in Table 402.1.5 through 402.1.7 shall be used unless alternate values are documented and approved by the code official. In addition, the U-factor of the assembly shall be calculated using a series-parallel calculation.

TABLE 402.1.5
FRAME WALL COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.68	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 86%	Framing: 14%
Proposed Design Default Insulation / Framing Fraction	Insulation: 77%	Framing: 23%
Sheathing Layer R-Value	0.63	
Siding Layer R-Value	0.44	
Exterior Air Film R-Value	0.45	

TABLE 402.1.6
FLOOR COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.92	
Floor Covering R-Value	1.23	
Floor Subfloor R-Value	0.63	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 92%	Framing: 8%
Proposed Design Default Insulation / Framing Fraction	Insulation: 90%	Framing: 10%
Exterior Air Film R-Value	0.92	

TABLE 402.1.7
CEILING COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.61	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 93%	Framing: 7%
Proposed Design Default Insulation / Framing Fraction	Insulation: 89%	Framing: 11%
Exterior Air Film R-Value	0.61	

4. 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 or higher wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves.

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, which ever is less.

402.4.1 (Supp) 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. ~~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. Other sources of infiltration.~~

5. Add new text and tables as follows:

402.4.1.1 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.

402.4.1.2 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.

402.4.1.3 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.

402.4.1.4 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.

402.4.1.5 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.

402.4.1.6 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.

402.7 Minimum opaque envelope requirements (Mandatory). The thermal requirements for opaque envelope components shall not be less than the requirements in Table 402.7 when determining alternatives to the R-values in Table 402.1.1 under Sections 402.1.3, 402.1.4, or 404.

TABLE 402.7
MINIMUM INSULATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	STEEL FRAME WALL CONTINUOUS R-VALUE [c]	FLOOR R-VALUE	BASEMENT WALL R-VALUE	SLAB R-VALUE & DEPTH	CRAWL SPACE WALL R-VALUE
1	25	11	0	R-11+3	11	0	0	0
2	25	11	3	R-11+3	11	0	0	0
3	25	11	4	R-11+3	13	0	0	0
4 except Marine	30	11	4	R-11+3	13	5/11 [b]	5, 2ft	5/11 [b]
5 and Marine 4	30	13	5	R-13+5, or R-15+4, or R-21+3	19	5/11 [b]	5, 2ft	5/11 [b]
6	38 [a]	13	13	R-13+5, or R-15+4, or R-21+3	19	5/11 [b]	10, 2ft	5/11 [b]
7 and 8	38 [a]	19	15	R-13+9, or R-19+8, or R-25+7	19	5/11 [b]	10, 2ft	5/11 [b]

a. 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 or the design of the roof/ceiling assembly does not allow sufficient space for the required insulation. This reduction of insulation shall be limited to 500 square feet (46 m^2) of ceiling area.
b. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation configuation meets the requirement.
c. Cavity insulation R-value is listed first, followed by continuous insulation R-value.

403.2.4 Distribution System Efficiency. Ducts shall be located completely within the building thermal envelope or achieve an equivalent distribution efficiency of 0.88 or greater.

Exceptions:

1. In climate zones 1-2, duct systems that supply air from cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15%;
2. In climate zone 3, duct systems that supply air from either cooling equipment or heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15%
3. In climate zones 4-8, duct systems that supply air from heating equipment with an efficiency that exceeds prevailing federal minimum standards by 15%.

403.4 Service water heating. Service water heating systems and piping shall be installed in accordance with the applicable requirements of Sections 403.4.1 through 403.4.2

403.4.1 Insulation. All Service Hot Water piping shall be insulated to at least R-2 for the distance between the Service Water Heater to within 5 feet of each fixture connected to the hot water pipe.

Exception: Distribution systems that supply hot water from Service Water Heating systems with an efficiency that exceeds prevailing federal minimum standards by at least 15% for gas service water heating equipment and achieve efficiency of at least 1.0 EF for electric service water heating equipment.

403.4.2 Stub-in for solar water. All Service Water Heating distribution systems shall have a stub-in connection point for future Solar Hot Water Systems in an accessible location within 5 feet of the roof.

Exception: Distribution systems that supply hot water from Service Water Heating systems with an efficiency that exceeds prevailing federal minimum standards by at least 15% for gas service water heating equipment and achieve efficiency of at least 1.0 EF for electric service water heating equipment.

6. Revise as follows:

~~**403.4**~~ **403.4.3 Circulating hot water systems.** 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.

403.5 Mechanical ventilation. (No change to current text)

403.6 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.

SECTION 404 (Supp)
ELECTRICAL POWER AND LIGHTING SYSTEMS

404.1 Dwelling unit interior and exterior lighting power (Prescriptive). 50% of all dwelling unit interior and exterior hard-wired lighting sockets shall be a qualifying light fixture. All exterior lighting equipment shall be a qualifying light fixture or shall comply with the exterior lighting power requirements of Section 505.7

Exceptions:

1. Swimming pool lighting systems
2. Landscape lighting systems

~~404.1~~ 404.2 (Supp) Interior lighting power (Prescriptive). Lighting in spaces other than dwelling units, e.g. common areas, shall be high efficacy luminaires or shall comply with the interior lighting power requirements in Section 505.5.

~~**Exception:** Dwelling units.~~

SECTION 404
SIMULATED PERFORMANCE ALTERNATIVE
(Performance)

404.1 Scope. This section establishes criteria for compliance using simulated energy performance analysis. Such analysis shall include heating, cooling, lighting, and service water heating energy only.

TABLE 404.5.2(1) (Supp)
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 Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a] 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, with insulation layer on interior side of walls	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a]
Above-grade floors	Type: wood frame Gross Area: same as proposed U-Factor: from Table 402.1.3	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a]
Ceilings	Type: wood frame Gross Area: same as proposed U-Factor: from Table 402.1.3	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a]
~~Doors~~	~~Area: 40 ft^2~~ ~~Orientation: North~~ ~~U-Factor: same as fenestration from Table 402.1.3~~	~~As proposed~~ ~~As proposed~~ ~~As proposed~~
~~Glazing~~Fenestration[a-b]	Total area[bc] = (a) The proposed ~~glazing~~fenestration area; where the proposed ~~glazing~~fenestration area is less than ~~18%~~15% of the conditioned floor area (b) ~~18%~~15% of the conditioned floor area; where the proposed ~~glazing~~fenestration area is ~~18%~~15% or more of the conditioned floor area Orientation: equally distributed to four cardinal compass orientations (N, E, S & W) U-Factor: from Table 402.1.1~~2~~ SHGC: For glazing, which shall equal the total area as defined above minus 40 ft^2, from Table 402.1.1	As proposed As proposed As proposed As proposed

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	except that for climates with no requirement (NR) SHGC = 0.40 shall be used; for opaque doors, which shall equal 40 ft^2, SHGC = 0 for all climates, equally distributed to four cardinal compass orientations. 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 External shading: none	Same as standard reference design[~~c~~ d] As proposed
Air Exchange Rate	Specific Leakage Area (SLA)[~~d~~ e] = ~~0.00036 assuming no energy recovery~~ 0.00015 combined with the mechanical ventilation rate, which shall be 0.01 x CFA + 7.5 x (Nbr+1) where: CFA = conditioned floor area Nbr = number of bedrooms and assuming continuous balanced ventilation using a energy/heat recovery ventilator with a recovery efficiency of 76% [g]	For residences that are not tested, ~~the same as the standard reference design~~ 0.00060 SLA assuming no energy recovery For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate[~~e~~f] 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~~f] combined with the mechanical ventilation rate [~~g~~, 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
Internal Gains	IGain = 17,900 + 23.8 x CFA + 4104 x Nbr + $\Delta IG_{lighting}$ (Btu/day per dwelling unit) Where $\Delta IG_{lighting}$ represents the reduced internal gains from efficient lighting as defined by the lighting building component.	~~Same as standard reference design,~~ IGain = 17,900 + 23.8 x CFA + 4104 x Nbr + $\Delta IG_{lighting}$ (Btu/day per dwelling unit) Where $\Delta IG_{lighting}$ represents the reduced internal gains from efficient lighting as defined by the lighting building component.
Heating systems[~~h,~~ i, j]	Fuel type: same as proposed design Efficiencies: Electric: air-source heat pump with ~~prevailing federal minimum~~ efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum. Nonelectric furnaces: natural gas furnace with ~~prevailing federal minimum~~ efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum Nonelectric boilers: natural gas boiler with ~~prevailing federal minimum~~ efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum 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[~~h, j~~ i, k]	Fuel type: Electric Efficiency: as proposed, unless the proposed efficiency is greater than 15% above the ~~in accordance with~~ prevailing federal minimum ~~standards~~ efficiency, in which case it shall be 15% above the federal minimum. Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed As proposed As proposed
Service Water Heating[~~h, k~~ i, l]	Fuel type: same as proposed design Efficiency: as proposed, unless the proposed efficiency is greater than 15% above the ~~in accordance with~~ prevailing federal minimum ~~standards~~ efficiency, in which case it shall be 15% above the federal minimum. Use: ~~gal/day=30 + (10 x N_{br})~~ Same as proposed design	As proposed As proposed ~~Same as standard reference~~ Use: gal/day=30 + (10 x N_{br})

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	A thermal distribution system efficiency (DSE) of ~~0.80~~ 0.88 shall be applied to both the heating and cooling system efficiencies	~~Same as standard reference design,~~ A thermal distribution system efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies, except as specified by Table 404.5.2(2)
Thermostat	Type: Manual, cooling temperature setpoint = ~~78~~ 75°F; Heating temperature set point = ~~68~~ 70 °F	Same as standard reference
Lighting	kWh/yr = (455 + 0.80 * CFA) + □kWh/yr where: □kWh/yr = [29.5 – 0.5189*CFA *50% –295.12*50% + 0.0519*CFA] Internal gains in the Standard Reference Design shall be reduced by 90% of the impact from efficient lighting, calculated in btu/day using the following equation: $\Delta IG_{lighting}$ = - 0.90 * ΔkWh/yr * 10^6 / 293 / 365	kWh/yr = (455 + 0.80 * CFA) + □kWh/yr where: □kWh/yr = [29.5 – 0.5189*CFA*FL% – 295.12*FL% + 0.0519*CFA] FL% = the ratio of Qualifying Light Fixtures to all light fixtures in Qualifying Light Fixture Locations. The Proposed Design shall not have FL% more than 50% from CFL. Internal gains in the Proposed Design shall be reduced by 90% of the impact from efficient lighting, calculated in btu/day using the following equation: $\Delta IG_{lighting}$ = 0.90 * ΔkWh/yr * 10^6 / 293 / 365

a. Insulation installation, including percent of insulation missing and insulation substantially filling cavity and, shall be determined and documented by an independent party approved by the code official.

(Re-letter current notes a. through k. to become notes b. through l.)

404.2 Mandatory requirements. Compliance with this section requires that the criteria of Sections 401, 402.4, 402.5, 402.6, 402.7, and 403 be met.

Reason: The **International Energy Conservation Code** is badly in need of updating, to reflect the new era of higher energy prices and the increased focus on energy efficiency at all levels of government and the private sector. The stringency of the IECC has not increased significantly in many years, yet energy prices have risen sharply and promise to remain high. Our energy systems are strained by rising demand. Global warming creates a new imperative to reduce America's energy use. For these reasons, the time has come for the ICC to do its part to improve the energy efficiency of America's buildings. This proposal comprises a number of changes that, taken together, are intended to achieve at least a 30% efficiency improvement in the IECC's residential provisions.

Members of the **Energy Efficient Codes Coalition** have put forward this proposal as part of our fulfillment of commitments made under the **National Action Plan for Energy Efficiency**. The NAPEE initiative has drawn formal commitments from state and local governments, utilities, utility regulatory bodies and others to engage in a renewed effort to increase energy efficiency in American homes.

This proposal complements the 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** commercial building standard. It also reflects the energy efficiency improvement targets set in federal legislation pending in Congress.

A chorus of leading voices from across the country is calling for this type of energy efficiency upgrade in American homes and buildings. The Secretary of the **U.S. Department of Energy** has launched a new Energy Efficiency Campaign, calling for the evaluation and strengthening of building codes in both the residential and commercial sectors. Colorado Gov. Bill Ritter opened a **Western Governors Association** workshop earlier this year calling for recommendations "to achieve at least a 30% improvement over the current International Energy Efficiency Codes."

On July 18, 2007, the **National Petroleum Council** delivered a report to Secretary of Energy entitled Facing the Hard Truths about Energy: A Comprehensive View to 2030 of Global Oil and Natural Gas. Five strategies for meeting future energy challenges are identified in the report. Listed first is: "Moderate the growing demand for energy by increasing efficiency of transportation, residential, commercial, and industrial uses."

The need for more efficient consumption of energy in buildings has been echoed by the **American Institute of Architects** in its "2030 Challenge" to the global community of architects and builders to make all new buildings carbon-neutral by 2030. Building energy code upgrades also form part of the plan put forward by the **Mayors for Climate Protection**, a new alliance of 400+ US mayors who have committed their cities in 43 states to addressing climate change.

We have also submitted these proposals separately so that each could also be considered on its own merits and so that we could identify the rationale and supporting information for each individual change. As a result, rather than repeat them, we incorporate the supporting information for those changes by reference in this reason statement.

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

Committee Action: **Disapproved**

Committee Reason: The code change proposal requested changes throughout the code that would make aggressive cuts in energy uses. The committee disapproved this change because it recognized that there were other proposals for the same energy reductions in the individual areas (insulation, fenestration, etc.). The committee preferred to discuss and examine each of those individual proposals for individual items rather than approve this proposal with sweeping changes.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI), representing Energy Efficient Codes Coalition (EECC), requests Approval as Modified by this Public Comment.

Modify proposal as follows:

SECTION 202
GENERAL DEFINITIONS

HIGH-EFFICACY LAMPS ~~LUMINAIRE (Supp).~~ ~~A lighting fixture that does not contain a medium screw base socket (E24/E26) and whose lamps have a minimum efficacy of~~ Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps, or lamps with a minimum efficacy of:

1. 60 lumens per watt for lamps over 40 watts,
2. 50 lumens per watt for lamps over 15 watts to 40 watts,
3. 40 lumens per watt for lamps 15 watts or less.

AIR BARRIER. ~~A material intended to prevent the flow of air between a conditioned space and an unconditioned space.~~ 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.

~~**LIGHT FIXTURE.** A complete lighting unit consisting of a lamp or lamps, and ballasting (when applicable) together with the parts designed to distribute the light, position and protect the lamps, and connect the lamps to the power supply. For built-in valence lighting, strings of low-voltage halogens, and track lights, each individual bulb shall count as a fixture.~~

~~**QUALIFYING LIGHT FIXTURE.** A hard-wired light fixture comprised of any of the following components: a) high efficacy luminaire; or b) exterior light fixtures controlled by a motion sensor(s) with integral photo-control photo-sensor.~~

~~**QUALIFYING LIGHT FIXTURE LOCATIONS.** Hard-wired light fixtures located in kitchens, dining rooms, living rooms, family rooms/dens, bathrooms, hallways, stairways, entrances, bedrooms, garage, utility rooms, home offices, and all outdoor fixtures mounted on a building or pole. This excludes portable luminaires, closets, unfinished basements, and landscape lighting.~~

401.2 Compliance. Projects shall comply with Sections 401, 402.4, 402.5, 402.6, 402.7, and 403 (referred to as the mandatory provisions) and either:

1. Sections 402.1 through 402.3 (prescriptive); or
2. Section 404 (performance).

TABLE 402.1.1 (Supp)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT [a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[h]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[G]	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	0.65	0.75	~~0.25~~ 0.30	30	~~15~~ 13	3 / 4	13	0	0	0
2	0.50	0.75	~~0.25~~ 0.30	38	~~15~~ 16	4 / 6	13	~~10/13~~ 0	0	0
3	0.40	0.65	~~0.25[e]~~ 0.30	38	~~18~~ 16	5 / 8	19	5 ~~10~~/13	0	5/13
4 except Marine	0.35	0.60	NR	49	~~18~~ 20	5 / 10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	49	~~21~~ 20	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	60	~~21~~ 20	15 / 19	30[f]	15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	60	24	19 / 21	38[f]	15/19	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 shall be permitted to be compressed into a 2 x 6 cavity.

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

d. R-5 shall be added to the required slab edge *R*-values for heated slabs.

e. There are no SHGC requirements in the Marine zone.
f. Or insulation sufficient to fill the framing cavity, R-19 minimum.
g. Any combination of insulation shall be permitted to meet the requirements through calculating an equivalent UA or by summing the R-value of the cavity insulation and the R-value of the 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, but shall also meet the minimum insulation requirements in Table 402.1.1, but in no case shall insulated sheathing be less than R-2.

TABLE 402.1.3 (Supp)
EQUIVALENT U-FACTORS [a]

CLIMATE ZONE	FENES-TRATION U-FACTOR	SKY-LIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR[c]	CRAWL SPACE WALL U-FACTOR
1	0.65	0.75	0.035	~~0.069~~ 0.082	0.197	~~0.060~~ 0.063	0.360	0.477
2	0.50	0.75	~~0.029~~ 0.027	~~0.069~~ 0.076	0.165	~~0.060~~ 0.063	~~0.059~~ 0.360	0.477
3	0.40	0.65	~~0.029~~ 0.027	~~0.056~~ 0.062	0.141	~~0.046~~ 0.049	~~0.059~~ 0.091	0.136
4 except Marine	0.35	0.60	~~0.024~~ 0.021	~~0.056~~ 0.062	0.141	~~0.046~~ 0.049	0.059	0.065
5 and Marine 4	0.35	0.60	~~0.024~~ 0.021	~~0.051~~ 0.058	0.082	0.033	0.059	0.065
6	0.35	0.60	~~0.020~~ 0.017	~~0.051~~ 0.058	0.060	0.033	0.050	0.065
7 and 8	0.35	0.60	~~0.020~~ 0.017	~~0.047~~ 0.053	0.057	~~0.027~~ 0.028	0.050	0.065

(Footnotes a and b remain unchanged)
c. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure 301.1 and Table 301.2.

402.1.5 Envelope Component Descriptions and Default Values. When calculating the U-factor of an assembly as part of Section 402.1.3, 402.1.4, or 404.5.2, the values in Table 402.1.5.1 through 402.1.5.3~~7~~ shall be used unless alternate values are approved by the code official. In addition, the U-factor of the assembly shall be calculated using a series-parallel calculation with the default framing fractions in Table 402.1.5.1 through 402.1.5.3. Subject to approval by the code official, the calculation of frame fractions for the proposed design by determining the type of construction (Satisfactory, Intermediate or Advanced) as defined in sections 402.1.5.1 through 402.1.5.3 shall be permitted. Subject to approval by the code official, the frame fractions for the proposed design shall be permitted to be determined by the type of construction (Satisfactory, Intermediate or Advanced) as defined in sections 402.1.5.1 through 402.1.5.3.

402.1.5.1 Wood stud frame walls. The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood stud frame walls are defined as follows:

Satisfactory Insulation and Framing Fractions:
Satisfactory wood stud frame walls include studs framed on 16 inch centers with double top plate and single bottom plate. Corners use three studs and each opening is framed using two studs.

Studs and plates: 21%
Insulated cavity: 75%
Headers: 4%

Intermediate Insulation and Framing Fractions:
Intermediate wood stud frame walls include studs framed on 16 inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and each opening is framed by two studs.

Studs and plates: 18%
Insulated cavity: 78%
Headers: 4%

Advanced Insulation and Framing Fractions:
Advanced wood stud frame walls include studs framed on 24 inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and one stud is used to support each header.

Studs and plates: 13%
Insulated cavity: 83%
Headers: 4%

TABLE ~~402.1.5~~ 402.1.5.1
FRAME WALL COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.68	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: ~~77~~ 78%	Framing: ~~23~~ 22%
Proposed Design Default Insulation / Framing Fraction	Insulation: ~~77~~ 78%	Framing: ~~23~~ 22%
Insulating Sheathing Layer R-Value	0 or as installed	
Structural Sheathing Layer R-Value	0.62 ~~63~~	
Siding Layer R-Value	0.61 ~~44~~	
Exterior Air Film R-Value	0.25 ~~45~~	

402.1.5.2 Wood frame floors. The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood stud frame floors are defined as follows:

Satisfactory Insulation and Framing Fractions:
Satisfactory wood floors include open joist systems framed 12 inch centers or solid joists framed 16 inch centers.
Framing: 12%
Insulated cavity: 88%

Intermediate Insulation and Framing Fractions:
Intermediate wood floors include open joist systems framed 16 inch centers or solid joists framed 20 inch centers.
Framing: 10%
Insulated cavity: 90%

Advanced Insulation and Framing Fractions:
Advanced wood floors include open joist systems framed 20 inch centers or joists framed 24 inch centers.
Framing: 8%
Insulated cavity: 92%

TABLE ~~402.1.6~~ 402.1.5.2
FLOOR COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.92	
Floor Covering R-Value	1.23	
Floor Subfloor R-Value	0.94 ~~63~~	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 90%	Framing: 10%
Proposed Design Default Insulation / Framing Fraction	Insulation: 90%	Framing: 10%
Exterior Air Film R-Value	0.92	

402.1.5.3 Wood frame ceilings. The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood stud frame ceilings are defined as follows:

Satisfactory Insulation and Framing Fractions:
Satisfactory ceiling insulation and framing assumes tapering of insulation depth around the perimeter with resultant decrease in thermal resistance. An increased R-value is assumed in the center of the ceiling due to the effect of piling leftover insulation.

Framing: 11%
Insulated cavity: 89%

Intermediate Insulation and Framing Fractions:
Intermediate ceiling insulation and framing assumes tapering of insulation depth around the perimeter with resultant decrease in thermal resistance. An increased R-value is assumed in the center of the ceiling due to the effect of piling leftover insulation.

Framing: 9%
Insulated cavity: 91%

Advanced Insulation and Framing Fractions:
Advanced ceiling insulation and framing assumes full and even depth of insulation extending to the outside edge of exterior perimeter of the ceiling.

Framing: 7%
Insulated cavity: 93%

TABLE ~~402.1.7~~ 402.1.5.3
CEILING COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.61	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: ~~89~~ 91%	Framing: ~~11~~ 9%
Proposed Design Default Insulation / Framing Fraction	Insulation: ~~89~~ 91%	Framing: ~~11~~ 9%
Exterior Air Film R-Value	0.61	

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 or higher wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves.

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, which ever is less.

402.4.1 (Supp) 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.

~~**402.4.1.1 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.~~

~~**402.4.1.2 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.~~

~~**402.4.1.3 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.~~

~~**402.4.1.4 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.~~

~~**402.4.1.5 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.~~

~~**402.4.1.6 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.~~

402.4.2 Air sealing and insulation. Building envelope air tightness and insulation installation shall be demonstrated to comply with the following requirements established by Section 402.4.2.1 and 402.4.2.2:

402.4.2.1 Performance testing. Building envelope tightness shall be tested to have an air leakage less than 0.00036 SLA when tested with a blower door at a pressure of 50 pascals (0.2 inch w.g.). Testing shall occur any time after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances and sealing thereof. Where required by the code official, an approved party independent from the builder shall conduct the building envelope tightness test. A written test report showing compliance shall be provided to the code official.

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 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 duct systems shall be sealed and supply and return registers shall not be sealed.

402.4.2.2 Visual inspection requirement. Building envelope insulation installation shall be field verified to meet the 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 insulation; in such case, a written inspection report, including a checklist demonstrating compliance shall be provided to the code official before interior finish materials are applied.

TABLE 402.4.2
INSULATION INSPECTION

COMPONENT	**CRITERIA**
Thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier.
Ceiling / attic	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation.
Walls	Corners and headers are insulated.
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.
Crawlspace walls	Insulation is permanently attached to walls.
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.
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.

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

(Renumber subsequent sections)

~~**402.7 Minimum opaque envelope requirements (Mandatory).** The thermal requirements for opaque envelope components shall not be less than the requirements in Table 402.7 when determining alternatives to the R-values in Table 402.1.1 under Sections 402.1.3, 402.1.4, or 404.~~

~~**TABLE 402.7**~~
~~**MINIMUM INSULATION REQUIREMENTS BY COMPONENT**~~

~~CLIMATE ZONE~~	~~CEILING R-VALUE~~	~~WOOD FRAME WALL R-VALUE~~	~~MASS WALL R-VALUE~~	~~STEEL FRAME WALL CONTINUOUS R-VALUE~~ [c]	~~FLOOR R-VALUE~~	~~BASEMENT WALL R-VALUE~~	~~SLAB R-VALUE & DEPTH~~	~~CRAWL SPACE WALL R-VALUE~~
~~1~~	~~25~~	~~11~~	~~0~~	~~R-11+3~~	~~11~~	~~0~~	~~0~~	~~0~~
~~2~~	~~25~~	~~11~~	~~3~~	~~R-11+3~~	~~11~~	~~0~~	~~0~~	~~0~~
~~3~~	~~25~~	~~11~~	~~4~~	~~R-11+3~~	~~13~~	~~0~~	~~0~~	~~0~~
~~4 except Marine~~	~~30~~	~~11~~	~~4~~	~~R-11+3~~	~~13~~	~~5/11~~ [b]	~~5, 2ft~~	~~5/11~~ [b]
~~5 and Marine 4~~	~~30~~	~~13~~	~~5~~	~~R-13+5, or R-15+4, or R-21+3~~	~~19~~	~~5/11~~ [b]	~~5, 2ft~~	~~5/11~~ [b]
~~6~~	~~38~~ [a]	~~13~~	~~13~~	~~R-13+5, or R-15+4, or R-21+3~~	~~19~~	~~5/11~~ [b]	~~10, 2ft~~	~~5/11~~ [b]
~~7 and 8~~	~~38~~ [a]	~~19~~	~~15~~	~~R-13+9, or R-19+8, or R-25+7~~	~~19~~	~~5/11~~ [b]	~~10, 2ft~~	~~5/11~~ [b]

~~a. 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 or the design of the roof/ceiling assembly does not allow sufficient space for the required insulation. This reduction of insulation shall be limited to 500 square feet (46 m^2) of ceiling area.~~

~~b. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation configuation meets the requirement.~~

~~c. Cavity insulation R-value is listed first, followed by continuous insulation R-value.~~

403.2.2 Sealing. All ducts, air handlers, filter boxes, and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3 of the *International Residential Code*. A written test report showing compliance with the duct tightness tests below shall be provided to the code official. The report shall include the test type and tested leakage in CFM per 100 ft^2 of conditioned floor area at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Where required by the code official, an approved party independent from the builder shall conduct the test. 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 per 100 ft^2 of conditioned floor area or a total leakage less than or equal to 12 CFM per 100 ft^2 of conditioned floor area. 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 per 100 ft^2 of conditioned floor area. 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 per 100 ft^2 of conditioned floor area.

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

~~**403.2.4 Distribution System Efficiency.** Ducts shall be located completely within the building thermal envelope or achieve an equivalent distribution efficiency of 0.88 or greater.~~

~~**Exceptions:**~~

1. ~~In climate zones 1-2, duct systems that supply air from cooling equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15%;~~
2. ~~In climate zone 3, duct systems that supply air from either cooling equipment or heating equipment with an efficiency that exceeds prevailing federal minimum standards by at least 15%~~
3. ~~In climate zones 4-8, duct systems that supply air from heating equipment with an efficiency that exceeds prevailing federal minimum standards by 15%.~~

403.4 Service water heating. Service hot water piping shall be installed in accordance with Sections 403.4.1 through 403.4.3.

403.4.1 Insulation. All Service Hot Water piping shall be insulated to at least R-2 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 Heater to within 5 feet of each fixture connected to the hot water pipe.

Exception: Hot water d~~D~~istribution systems not located below ground or located in a mass floor or mass wall in contact with ground that supply hot water from ~~Service Water Heating systems with an efficiency that exceeds prevailing federal minimum standards by at least 15% for~~ condensing gas service water heating equipment, from instantaneous service electric or gas water heating equipment ~~and achieve efficiency of at least 1.0 EF for~~ or from heat pump electric service water heating equipment.

~~**403.4.2 Stub-in for Solar Water.** All Service Water Heating distribution systems shall have a stub-in connection point for future Solar Hot Water Systems in an accessible location within 5 feet of the roof.~~

~~**Exception:** Distribution systems that supply hot water from Service Water Heating systems with an efficiency that exceeds prevailing federal minimum standards by at least 15% for gas service water heating equipment and achieve efficiency of at least 1.0 EF for electric service water heating equipment.~~

403.4.3 Circulating hot water systems. All circulating service hot water piping shall be insulated to R-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.

403.6 Equipment sizing. Heating and cooling equipment shall be sized in accordance with ~~Section M1401.3 of the International Residential Code, and~~ this section and Table 403.6.

~~**403.6.1 Oversizing Limits.** 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%.~~

TABLE 403.6

UNIT	MAXIMUM OVERSIZING PERCENTAGE [1,2]	CLIMATE ZONE	MINIMUM EFFICIENCY & TEST PROCEDURES
Air Conditioners	15%	ALL	Table 503.2.3(1)
Multi-speed[3] Air-Source Heat Pumps and Ground-Source Heat Pumps	15%	ALL	Table 503.2.3(2)
Single -speed Air-Source Heat Pumps and Ground Source Heat Pumps	15% 25%	1-3 ---- 4-8	Table 503.2.3(2) or Table 503.2.3(3)
All fuel-fired heating appliances	40%	ALL	Table 503.2.3(4) or Table 503.2.3(5)

Notes: ~~**403.6.2 Operating conditions.** The following operating conditions shall be used in the sizing calculations and verified by the code official:~~

1. Equipment shall be sized in accordance with ACCA Manual J:
   a. Indoor and outdoor coils shall be matched for size;
   b. 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;
   c. ~~2.~~ Indoor temperatures shall be 75 F for cooling and ~~70~~ 72 F for heating;
   d. ~~3.~~ Infiltration rate shall be ~~selected as "tight", or the equivalent term~~ assumed as 0.00036 Specific Leakage Area (SLA).
2. ~~**403.6.3 Specifying equipment.** Specification of t~~The next larger size of available manufactured ~~size~~ equipment shall be acceptable, regardless of the percentage listed. ~~In addition, indoor and outdoor coils shall be matched in accordance with ARI Standard 210/240.~~
3. Multi-speed units shall be permitted to exceed the listed percentage only to the cooling capacity necessary to control humidity levels.

SECTION 404 (Supp)
ELECTRICAL POWER AND LIGHTING SYSTEMS

404.1 (Supp) ~~**Interior lighting power (Prescriptive).** Lighting in spaces other than dwelling units, e.g. common areas, shall be high efficacy luminaires or shall comply with the interior lighting power requirements in Section 505.5~~

~~**Exception:** Dwelling units.~~

~~**404.1 Dwelling unit interior and exterior lighting power (Prescriptive).** 50% of all dwelling unit interior and exterior hard-wired lighting sockets shall be a qualifying light fixture. All exterior lighting equipment shall be a qualifying light fixture or shall comply with the exterior lighting power requirements of Section 505.7~~

~~**Exceptions:**~~

~~1. Swimming pool lighting systems~~
~~2. Landscape lighting systems~~

404.2 Lighting equipment ~~**(Supp) Interior lighting power (Prescriptive).**~~ A minimum of fifty percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps. ~~Lighting in spaces other than dwelling units, e.g. common areas, shall be high efficacy luminaires or shall comply with the interior lighting power requirements in Section 505.5.~~

SECTION 404
SIMULATED PERFORMANCE ALTERNATIVE
(Performance)

Section 404.1 Scope. This section establishes criteria for compliance using simulated energy performance analysis. Such analysis shall include heating, cooling, lighting, and service water heating energy only.

TABLE 404.5.2(1) (Supp)
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 Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a] 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, with insulation layer on interior side of walls	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a]
Above-grade floors	Type: wood frame Gross Area: same as proposed U-Factor: from Table 402.1.3	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a]
Ceilings	Type: wood frame Gross Area: same as proposed U-Factor: from Table 402.1.3	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a]
Doors	Area: 40 ft^2 Orientation: North *U*-Factor: same as fenestration from Table 402.1.3	As proposed As proposed As proposed
Glazing ~~Fenestration~~[b]	Total area[c] = (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 Orientation: equally distributed to four cardinal compass orientations (N, E, S & W) U-Factor: from Table 402.1.1 SHGC: From Table 402.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used. ~~For glazing, which shall equal the total area as defined above minus 40 ft^2, from Table 402.1.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used; for opaque doors, which shall equal 40 ft^2, SHGC = 0 for all climates, equally distributed to four cardinal compass orientations.~~ Interior shade fraction: Summer (all hours when cooling is required) = 0.85 ~~0.90~~ Winter (all hours when heating is required) = 0.85 ~~0.90~~ External shading: none	As proposed As proposed As proposed As proposed Same as standard reference design[d] As proposed
Air Exchange Rate	Specific Leakage Area (SLA)[e] = 0.00036 assuming no energy recovery. ~~0.00015 combined with the mechanical ventilation rate, which shall be 0.01 x CFA + 7.5 x (Nbr+1)~~ ~~where:~~ ~~CFA = conditioned floor area~~ ~~Nbr = number of bedrooms~~ ~~and assuming continuous balanced ventilation using a energy/heat recovery ventilator with a recovery efficiency of 76%~~ [g]	Specific Leakage Area (SLA)[d] = the tested leakage for the proposed home and ~~For residences that are not tested, 0.00060 SLA assuming no energy recovery~~ testing shall be in accordance with 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 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 (Nbr+1) where: CFA = conditioned floor area Nbr = number of bedrooms

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Internal Gains	IGain = 17,900 + 23.8 x CFA + 4104 x Nbr + $\Delta IG_{lighting}$ (Btu/day per dwelling unit) Where $\Delta IG_{lighting}$ represents the reduced internal gains from efficient lighting as defined by the lighting building component.	IGain = 17,900 + 23.8 x CFA + 4104 x Nbr + $\Delta IG_{lighting}$ (Btu/day per dwelling unit) Where $\Delta IG_{lighting}$ represents the reduced internal gains from efficient lighting as defined by the lighting building component.
Heating systems [i, j]	As proposed ~~Fuel type: same as proposed design~~ ~~Efficiencies:~~ ~~Electric: air source heat pump with efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum.~~ ~~Nonelectric furnaces: natural gas furnace with efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum~~ ~~Nonelectric boilers: natural gas boiler with efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum~~ 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 [i, k]	As proposed ~~Fuel type: Electric~~ ~~Efficiency: as proposed, unless the proposed efficiency is greater than 15% above the prevailing federal minimum efficiency, in which case it shall be 15% above the federal minimum.~~ Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed ~~As proposed~~ ~~As proposed~~
Service Water Heating [i, l]	As proposed ~~Fuel type: same as proposed design~~ ~~Efficiency: as proposed, unless the proposed efficiency is greater than 15% above the prevailing federal minimum efficiency, in which case it shall be 15% above the federal minimum.~~ Use: Same as proposed design	As proposed ~~As proposed~~ Use: 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. For tested duct systems, the leakage rate shall be the applicable maximum rate from Section 403.2.2.	~~A thermal distribution system efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies, except as specified by Table 404.5.2(2)~~ As tested or as specified in Table 404.5.2(2) if not tested.
Thermostat	Type: Manual, cooling temperature setpoint = 75°F; Heating temperature set point = 72 ~~70~~ °F	Same as standard reference
~~Lighting~~	~~kWh/yr = (455 + 0.80 * CFA) + ΔkWh/yr~~ ~~where:~~ ~~ΔkWh/yr = [29.5 – 0.5189*CFA *50% - 295.12*50% + 0.0519*CFA]~~ ~~Internal gains in the Standard Reference Design shall be reduced by 90% of the impact from efficient lighting, calculated in btu/day using the following equation:~~ ~~$\Delta IG_{lighting}$ = - 0.90 * ΔkWh/yr * 10^6 / 293 / 365~~	~~kWh/yr = (455 + 0.80 * CFA) + ΔkWh/yr~~ ~~where:~~ ~~ΔkWh/yr = [29.5 – 0.5189*CFA*FL% – 295.12*FL% + 0.0519*CFA]~~ ~~FL% = the ratio of Qualifying Light Fixtures to all light fixtures in Qualifying Light Fixture Locations.~~ ~~The Proposed Design shall not have FL% more than 50% from CFL.~~ ~~Internal gains in the Proposed Design shall be reduced by 90% of the impact from efficient lighting, calculated in btu/day using the following equation:~~ ~~$\Delta IG_{lighting}$ = 0.90 * ΔkWh/yr * 10^6 / 293 / 365~~

a. Insulation installation, including percent of insulation missing and insulation substantially filling cavity and, shall be determined and documented by an independent party approved by the code official.
b. 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.
c. For residences with conditioned basements, R-2 and R-4 residence and townhouses, the following formula shall be used to determine glazing area:
$AF = A_s \times FA \times F$
Where:
AF = Total glazing area.
A_s = Standard reference design total glazing area.
FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 x 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.
d. 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.
e. 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.
f. 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.
g. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE Handbook of Fundamentals page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE Handbook of Fundamentals, page 26.19 for intermittent mechanical ventilation.
h. 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.
i. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
j. 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.
k. 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.
l. For a proposed design with a nonstorage-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 404.5.2(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	~~0.80~~ --	0.95
Untested ~~D~~distribution systems entirely located in conditioned space [c]	0.88	1.00
~~Proposed "reduced leakage" with entire air distribution system located in the conditioned space [d]~~	~~0.96~~	~~--~~
~~Proposed "reduced leakage" air distribution system with components located in the unconditioned space~~	~~0.88~~	~~--~~
"Ductless" systems [d] ~~[e]~~	1.00	--

a. through c. (No change to current text)
~~d. Proposed "reduced leakage" shall mean leakage to outdoors not greater than 3 cfm per 100 ft2 of conditioned floor area and total leakage not greater than 9 cfm per 100 ft2 of conditioned floor area at a pressure differential of 0.02 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Total leakage of not greater than 3 cfm per 100 ft2 of conditioned floor area at a pressure difference of 0.02 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure, shall be deemed to meet this requirement without measurement of leakage to outdoors. This performance shall be specified as required in the construction documents and confirmed through field-testing of installed systems as documented by an approved independent party.~~
~~e.~~ d. Ductless systems may have forced airflow across a coil but shall not have any ducted airflows external to the manufacturer's air handler enclosure.

Add the following reference to Chapter 6:

ACCA Manual J version 8 2006

(Portions of proposal not shown remain unchanged)

Commenter's Reason: The Energy Efficient Codes Coalition (EECC) is a unique, broad-based alliance of energy efficiency advocates who have adopted the goal of a 30% improvement in residential energy efficiency in the 2009 International Energy Conservation Code (IECC).

The EECC grew out of a growing chorus of calls for better energy codes, from an increasing number of highly respected governmental and other bodies like the EPA/DOE National Action Plan for Energy Efficiency, ASHRAE, Western Governors Association, US Department of Energy, National Petroleum Council, American Institute of Architects, Mayors for Climate Protection and members of Congress. These organizations realize that the efficiency of the new homes we build in the next several years is a major factor in our nation's energy and environmental future. America's homes and buildings use 70% of our electricity and over half of our natural gas. More and more people and their leaders are waking up to the fact that the era of cheap energy is gone forever, and that America's energy policies must adapt. Energy codes are no exception: we must take strong steps now to begin to reduce the energy waste that is damaging family budgets as well as the U.S. economy, and that is worsening the prospects of energy shortages and environmental damage.

EECC's premise is that a 30% improvement in the 2009 residential energy code is achievable and affordable using reasonable building practices and today's "state-of-the-shelf" technologies. EC-14 is "The 30% Solution" in a single package and is the *only* comprehensive proposal designed to achieve the ambitious, yet achievable, goal of boosting residential energy efficiency by 30% in the 2009 IECC. It would achieve greater energy efficiency in virtually every part of the house subject to code requirements – space heating and cooling, thermal envelope, duct sealing, air sealing, hot water heating and lighting.

As a complement to this comprehensive package, EECC has also introduced individual proposals and submitted public comments as necessary to offer virtually all of the same proposals for individual consideration, with the appropriate explanation and justification for each proposal. For the sake of efficiency, we will not repeat all of that explanation and reasoning here. Further, EECC has also offered a public comment on and proposed modification for EC154, which is somewhat more aggressive appendix that EECC proposes that ICC adopt for the consideration of those jurisdictions that want something more than the standard IECC.

Our approach to the modification proposed by this public comment to EC14 is relatively straightforward. Begin with the 30% improvement package originally submitted by the EECC as EC14. Modify the package by: (1) amending the proposals to reflect modifications approved by the Development Committee to the EECC's proposals; (2) sort through the remaining proposals and eliminate any that would be better placed in the appendix for this code cycle; (3) develop appropriate modifications to EECC proposals recommended for disapproval by the Committee to address the Committee's expressed concerns; and (4) replace EECC proposals with comparable or better proposals offered by others and approved by the Committee, modified as necessary.

Specifically, for item (4), this public comment proposes modifying EC-14 to include EC-64 (infiltration and insulation installation), EC-71 (ducts) and EC-84 (lighting), with additional modifications where appropriate as further improvements.

As noted in item (3) above, the modification proposed by this public comment also includes modifications that are introduced by individual comments to address concerns raised by opponents, supporters or the Committee. The proposed modification includes, but is not limited to, the following revisions:

-SHGC in Climate Zones 1, 2 and 3 as approved by the committee
-Wall insulation consistent with approved values in Climate Zones 5 and 6
-Wall insulation product neutral improvements in Climate Zones 2,3,4,7 and 8.
-Basement wall insulation in Climate Zones 2 and 3
-U-factors recalculated for the appropriate R-value and framing fractions
-Framing fractions modified to be consistent with ASHRAE, HERS and other sources
-Definitions of framing fractions
-Modified component R-values including air film, sheathing, etc.
-Removed solar stub-in requirement for hot water systems and made other improvements to hot water distribution proposal
-Equipment sizing requirement language improved to be cleaner and more intuitive
-Door and window requirements consistent with committee approved language
-Proposed home infiltration testing a requirement for the performance path
-Heating, cooling and hot water system efficiency in the performance path changed to be consistent with the language approved by the committee in EC-91

This public comment to EC-14 is a comprehensive solution that is both cost-effective and achieves significant energy savings. This proposal is even more important now than it was when originally submitted. Oil and gas prices have more than doubled since the IECC was first published, and have risen sharply even since the February committee hearings. A significant increase in the IECC's energy efficiency criteria is thus long overdue, necessary to the affordability of American housing, and increasingly economically justified.

Homes built 30% more efficient than the standards of the IECC are built in every state today, through voluntary programs. In 2007, over 23,000 homes were built to perform at least 50% better than the IECC, to qualify for federal tax credits. However, only about 10% of the market chooses to go this way voluntarily. Why should 90% of American homebuyers be denied the chance to live in better-performing homes? High-performance homes are being built and selling well at all ends of the market, from Habitat for Humanity homes to custom upscale models. There is no reason the IECC should not adopt EC-14, as modified in this public comment to address the issues raised in the February hearings.

High-energy-performance homes pay significant dividends to new homebuyers. In fact, in comparing the positive cash flow of energy efficiency investments in Greensburg, Kansas, the National Renewable Energy Laboratory found that the "break-even point" is actually reached when new homes are built to roughly 60% more efficient than today's model energy code. If new homes last an average of 50 years, the 2009 determines the energy performance of homes that will be using energy well past the middle of this century. Each year we wait results in a million or more homes condemned to wasting 30% more energy than necessary, and a million or more families consigned to paying energy bills 30% or more higher than they should have to pay. Even waiting a single ICC code cycle condemns 3 million or more homes to sub-par performance. Now is the time to upgrade the IECC.

Public Comment 2:

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

Replace proposal as follows:

Table 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value & Depth	Crawl Space Wall R-Value
1	~~1.20~~ .65	.75	~~.37~~ .35	30	13	3/4	13	0	0	0
2	~~.75~~ .65	.75	~~.37~~ .35	30	13	4/6	13	0	0	0
3	.65	.65	.40	30	13	5/8	19	0	0	5/13
4 except Marine	.40	.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	.35	.60	NR	38	19 OR 13+5	13/17	30	10/13	10, 2 ft	10/13
6	.35	.60	NR	49	19 OR 13+5	15/19	30	10/13	10, 4 ft	10/13
7 and 8	.35	.60	NR	49	21	19/21	30	10/13	10, 4 ft	10/13

Table 402.1.1
EQUIVALENT U-FACTORS

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Ceiling U-Factor	Wood Frame Wall U-Factor	Mass Wall U-Factor	Floor U-Factor	Basement Wall U-Factor	Crawl Space Wall U-Factor
1	~~1.20~~ .65	.75	.035	.082	.197	.064	.360	.477
2	~~.75~~ .65	.75	.035	.082	.165	.064	.360	.477
3	.65	.65	.035	.,082	.141	.047	.360	.136
4 except Marine	.40	.60	.030	.082	.141	.047	.059	.065
5 and Marine 4	.35	.60	.030	.060	.082	.033	.059	.065
6	.35	.60	.026	.060	.060	.033	.059	.065
7 and 8	.35	.60	.026	.057	.057	.033	.059	.065

Commenter's Reason: To correct the Fenestration U-Factor and SHGC to values based on full building simulations using WUFI Plus a full building simulation tool basing calculations on hourly weather date for temperature, wind, and solar. Approval of this comment will accomplish the same thing as approving NMHC comments EC16 and EC26. The .65 Fenestration U-Factor in Zone 1 is a modification approved by the committee and justified by the WUFU Plus calculations. The modifications to Zones 2 revise the actions of the committee to a U-Factor of .65 whereas the committee had approved .50. The committee changes to Zone 3 and Zone 4 are not included base on the WUFI Plus analysis that did not justify the changes made by the committee.

Specific Changes:

Zone 1. Acceptance of the committee approved change for a U-Factor of .65 in Zone 1 will change the requirement from allowing a single glazed window with aluminum frame and **no thermal break** to at minimum a double glazed aluminum frame window **with thermal break** or any other window frame type with double glazing. The current code window (U-1.2 & SHGC-.37) was changed to (U-.65 & SHGC-.30) at the Code Development Hearings. The change to a U-Factor of .65 was a cost effective change when combined with a SHGC of .35 (Table 1, Line 3). This change would result in about a 7% reduction in building energy usage. The committee approved window with a U -.65 and a SHGC -.30 would have reduced the energy usage of the building by about 10% (Table 1, Line 8) but it was not considered to be cost effective in that the simple payback was about 187 years and the cost to the consumer in rent increase of approximately $54.01 per month was not offset by the reduction in the monthly energy cost of $3.17. The U-Factor of .65 for Zone 1 was the one and only approved window modification that was cost effective in all of the changes approved by the ICC Energy Conservation Code Committee. According to the ASHRAE 90.1 window cost data there is no cost impact for window Item 3 and window Item 4. Item 3 (U -.65 & SHGC -.35) was chosen over Item 4 (U -.65 & SHGC -.37) because it has a larger Monthly Energy Cost Savings (Table 1, Column O) and thus would be a better selection than Item 4.

Zone 2. This comment changes the window requirement for Zone 2 from allowing a double glazed window with aluminum frame and **no thermal break** to at minimum a double glazed aluminum frame window **with thermal break** or any other window frame type with double glazing. This is the same window as proposed for Zone 1. The current code window (U-.75 & SHGC-.37) was changed to (U-.50 & SHGC-.35) by the ICC Energy Conservation Code Committee. Based on the WUFI analysis (Table 1, Line 12) the cost effective change is (U -.65 & SHGC-.35). This code change makes the correction to the U-Value. This change will reduce the energy use by about 2% in Zone 2 (Table 1, Line 12). The window was chosen because it does provide a cost effect change to the consumer.

Zone 3. The current IECC code requirement (U-.65 & SHGC-.40) proved to be the most cost effective solution for Zone 3 (Table 1, Line 21). The ICC Energy Conservation Committee approved (U-.40 & SHGC-.35). This change (Table 1, Line 30) with a payback of about 158 years would cost about $11,099 and save about $66 a year in energy cost. In terms of the consumer the rent would have to go up about $84.08 per month for a savings on the energy bill of $5.51 per month.

Zone 4. The current IECC code requirement (U-.40 & SHGC-NR) proved to be the most cost effective solution for Zone 4 (Table 1, Line 34). The ICC Energy Conservation Committee approved a change to the U-Factor (U.-35) and did not change the SHGC. In this case (Table 1, Line 36), with a payback of 96 years the committee change would cost about $2,127 and save approximately $22 annually on the energy bill. In terms of the consumer the rent would have to go up about $16.11 per month for a savings on the energy bill of about $1.84 per month, all for a savings of about 1% in the energy usage.

WUFI Annual Energy Analysis. The results of the WUFI Plus analysis for different window U-Factors and SHGC in Zones 1, 2, 3, and 4 are shown in Table 1.

TABLE 1
WINDOW EVALUATIONS FOR ZONES 1,2,3 AND 4

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
							Loads								
Item Number	Location	Zone	Wall R	Ceiling R	U	SHGC All	Heat (KWh)	Cool (KWh)	Total (KWh)	% Total Khw Savings	Total Cost Impact	Total Savings H & C 80% Furn 10 SEER	Simple Payback 80% Furn 10 SEER	Monthly Rent Impact	Monthly Energy Cost Savings
1	**Miami 2006 IECC**	1	13	30	1.2	0.37	554	37337	37892	0%	$0	$0	Code		
2	Miami Optimization Zone 1 SR 5	1	13	30	0.67	0.39	461	35942	36403	4%	-$1,762	$17	CEC	-$13.35	$1.39
3	**Miami 2008 AP U .65 SHGC .35**	1	13	30	0.65	0.35	465	34792	35257	7%	$0	$27	CEC	$0.00	$2.21
4	**Miami 2006 IECC U .65**	1	13	30	0.65	0.37	461	35312	35772	6%	$0	$22	CEC	$0.00	$1.85
5	Miami 2006 IECC U .55	1	13	30	0.55	0.37	447	34982	35429	6%	$2,674	$26	104	$20.25	$2.15
6	Miami Optimization Zone 1 SR 10	1	13	30	0.47	0.32	443	33372	33815	11%	$4,456	$40	112	$33.76	$3.33
7	Miami 2006 IECC U.65 SHGC .25	1	13	30	0.65	0.25	480	32102	32583	14%	$7,109	$49	145	$53.86	$4.09
8	Miami 2008 AS Modified	1	13	30	0.65	0.3	468	33450	33918	10%	$7,129	$38	187	$54.01	$3.17
9	Miami 2006 IECC SHGC .25	1	13	30	1.2	0.25	567	34068	34635	9%	$7,129	$28	257	$54.01	$2.31
10	**Phoenix 2006 IECC**	2	13	30	0.75	0.37	5661	77669	83331	0%	$0	$0	Code		
11	Phoenix 2006 IECC SHGC .30	2	13	30	1.27	0.3	6689	79851	86541	-4%	$7,109	-$70	IEU	$53.86	-$5.82
12	**Phoenix 2008 AM U .65 SHGC .35**	2	13	30	0.65	0.35	5507	76530	82037	2%	-$20	$18	CEC	-$0.15	$1.46
13	**Phoenix 2006 IECC U .65**	2	13	30	0.65	0.37	5492	76973	82465	1%	-$20	$14	CEC	-$0.15	$1.20
14	Phoenix 2006 IECC U .5	2	13	30	0.5	0.37	5235	75908	81144	3%	$2,957	$36	81	$22.40	$3.03
15	Phoenix 2006 IECC U.55	2	13	30	0.55	0.37	5321	76262	81583	2%	$2,653	$29	91	$20.10	$2.42
16	Phoenix 2008 AP U.5 SHGC .35	2	13	30	0.5	0.35	5259	75489	80748	3%	$4,436	$39	114	$33.60	$3.24
17	Phoenix 2006 IECC U .5 SHGC .25	2	13	30	0.5	0.25	5331	73374	78705	6%	$11,565	$54	216	$87.61	$4.47
18	Phoenix 2008 AS Modified	2	13	30	0.5	0.3	5292	74440	79732	4%	$11,099	$46	240	$84.08	$3.86
19	Phoenix 2008 AM U ..65 SHGC .3	2	13	30	0.65	0.3	5569	75493	81062	3%	$7,109	$23	303	$53.86	$1.96
20	Phoenix 2006 IECC SHGC .25	2	13	30	0.75	0.25	5775	75114	80889	3%	$7,109	$17	430	$53.86	$1.38
21	**Memphis 2006 IECC**	3	13	30	0.65	0.4	29065	23309	52375	0%	$0	$0	Code		
22	Memphis 2006 IECC U.65 SHGC .35	3	13	30	0.65	0.35	29274	22565	51838	1%	$1,762	-$4	IEU	$13.35	-$0.32
23	Memphis 2006 IECC SHGC .3	3	13	30	0.65	0.3	29469	21831	51301	2%	$8,892	-$7	IEU	$67.36	-$0.60
24	Memphis 2006 IECC SHGC .25	3	13	30	0.65	0.25	29682	21138	50820	3%	$8,871	-$12	IEU	$67.21	-$0.98
25	Memphis 2006 IECC U.55 SHGC .30	3	13	30	0.55	0.3	28932	21605	50537	4%	$12,882	$21	603	$97.59	$1.78
26	Memphis Optimization Zone 3 SR 5	3	13	30	0.47	0.36	28226	22281	50507	4%	$4,436	$50	88	$33.60	$4.21
27	Memphis Optimization Zone 3 SR 10	3	13	30	0.47	0.31	28443	21564	50007	5%	$6,218	$46	135	$47.11	$3.83
28	Memphis 2006 IECC U .4	3	13	30	0.4	0.4	27693	22731	50424	4%	$11,099	$73	152	$84.08	$6.08
29	Memphis 2006 IECC SHGC .55	3	13	30	0.55	0.4	28526	23072	51598	1%	$4,436	$29	154	$33.60	$2.40
30	Mempnis 2008 AP U .4 SHGC .35	3	13	30	0.4	0.35	27879	21975	49854	5%	$11,099	$70	158	$84.08	$5.86
31	Memphis 2008 IECC AM	3	13	30	0.4	0.3	28086	21273	49359	6%	$11,099	$66	168	$84.08	$5.51
32	Memphis 2006 IECC U.55 SHGC .35	3	13	30	0.55	0.35	28742	22310	51052	3%	$6,218	$25	252	$47.11	$2.06
33	Memphis 2006 IECC U .4 SHGC .25	3	13	30	0.4	0.25	28274	20559	48833	7%	$19,991	$63	317	$151.44	$5.26
34	**Baltimore 2006 IECC**	4	13	38	0.4	NR	46476	16558	63034	0%	$0	$0	Code		
35	Baltimore 2004 90.1	4	13	38	0.67	0.39	51905	10204	62109	1%	-$9,783	-$214	IEU	-$74.11	-$17.80
36	Baltimore 2006 IECC U .35	4	13	38	0.35	NR	46038	16510	62548	1%	$2,127	$22	96	$16.11	$1.84
	Cost Effective Change	CEC													
	Increased Energy Usage	IEU													

Building Solar Analysis. NMHC comments to EC16 and EC26 are based on full building simulations using WUFI Plus for a 4-story 32 unit apartment building with 20% window area. The apartment building was rectangular in shape with an east west orientation. Windows were located on the north and south facing walls. The shape and orientation and window location were selected because they represented the better performing building when compared to a square building with equal window on all orientations and a rectangular building with north south orientation. The WUFI Plus simulation is based on hourly weather data for a complete year which includes temperature, wind and solar action on the building.

U-Factor and SHGC Selection. The U-Factors and SHGC values proposed by the proponents and selected by the ICC Energy Conservation Committee were not based on any analysis of the energy savings or the cost impact to the typical apartment owner or tenant. They were simply negotiated numbers that lowered the values based on the assumption that lower values would reduce the energy use of the building. In some cases the numbers were selected to allow manufactures of current product to meet the requirements and thus not eliminate product from the market.

Window Cost. Window cost data used in the analysis is based on the numbers used by the ASHRAE 90.1 Envelope Subcommittee corrected for inflation at an annual rate of 3%.

Fuel Cost. Fuel costs are also the same as those being used by the ASHRAE 90.1 Envelope Subcommittee ($1.16/Therm for gas, $0.0868/KWh for electric). Just for comparison it should be noted that a doubling of the fuel cost would not have any impact on the window criteria selected. A doubling of the fuel cost would in effect reduce the simple payback by 50%. The simple payback for windows that were not cost effective (Table 1, Column N) ranged from a low of 81 years to a high of 603 years. Doubling the fuel cost would have made the simple payback range from a low of 40.5 years to a high of 301.5 years.

Multifamily Financial Implications. NMHC window selection is based on the impact to the consumer. For multifamily properties there is a consistent relationship between the price of a property and the rents that are necessary to cover the costs. If these relationships are not maintained the property is not built because the banks and financial organizations that fund the properties will not provide the funding. The ratio for multifamily properties is 11% to 12% of the property value (i.e. the cost of the proposed change). The values for Monthly Rent Impact (Table 1, Column N) are based on a ratio of 11% (1/9) which is equivalent to a simple payback of 9 years concurrent with the financing requirements for multifamily properties. In other words the cost of any improvement to the property must be offset by an increase in rent. Energy calculations are somewhat different in that cost increase can be offset by reductions in energy usage (Table 1, Column O). Windows that meet the criteria and that would be cost effective are identified in Column M as CEC (Cost Effective Change). Columns N (Monthly Rent Impact) and O (Monthly Energy Cost Savings) show the relationship between Monthly Rent Impact, the impact on rent to cover the increased construction costs, and the savings in Monthly Energy Cost that will occur as a result of the change in window type due to the reduction in energy usage.

Revised Table 402.1.1. The following reproduction is how Table 402.1.1 would appear if NMHC comments to EC16 and EC26 are approved.

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	Floor R-Value	Basement Wall R-Value	Slab R-Value & Depth	Crawl Space Wall R-Value
1	.65	.75	.35	30	13	¾	13	0	0	0
2	.65	.75	.35	30	13	4/6	13	0	0	0
3	.65	.65	.40	30	13	5/8	19	0	0	5/13
4 except Marine	.40	.60	NR	38	13	5/10	30	10/13	10, 2ft	10/13
5 and Marine 4	.35	.60	NR	38	19 or 13+5	13/17	30	10/13	10, 2ft	10/13
6	.35	.60	NR	49	19 or 13+5	15/19	30	10/13	10, 4ft	10/13
7 and 8	.35	.60	NR	49	21	19/21	30	10/13	10, 4ft	10/13

WUFI Validation. Reference Table 1 Column M Simple Payback. In evaluating the window criteria and other proposed changes it became quite clear that some of the paybacks were rather large and thus questionable. The developer of the WUFI Plus program has evaluated the program against other energy models and thus there is a level of confidence. To further check the results I also ran the WUFI Plus program in Zones 1, 3, 5, and 6 using current code requirements based on a building without any energy improvements. The results are found in Table 2. The simple paybacks in ranged from 7-14 years.

WUFI Validation:

Table 2
WUFI Plus Validation

Location	Zone	Wall R	Ceiling R	Window U	Window SHGC All	Loads Heat (KWh)	Loads Cool (KWh)	Loads Total (KWh)	% Khw Savings	Total Cost Impact	Total Savings H & C 80% Furn 10 SEER	Simple Payback 80% Furn 10 SEER	Monthly Rent Impact	Monthly Energy Cost Savings	Monthly Cost Impact
Miami WR-0 CR-0 U-1.20 SHGC-.4	1	0	0	1.2	0.4	5286	127835	133121	0%	$0	$0	CEC	$0	$0	$0
Miami WR-0 CR-30 U-1.2 SHGC-.4	1	0	30	1.2	0.4	1256	70063	71318	46%	$4,838	$701	7	$37	$58	$22
Miami WR-13 CR-30 U-1.2 SHGC-.4	1	13	30	1.2	0.4	549	38152	38701	71%	$9,456	$1,013	9	$72	$84	$13
Miami WR-13 CR-0 U-1.20 SHGC-.4	1	13	0	1.2	0.4	4571	94972	99543	25%	$4,618	$321	14	$35	$27	($8)
Memphis WR-0 CR-0 U-1.20 SHGC-.4	3M	0	0	1.2	0.4	162083	81899	243982	0%	$0	$0	CEC	$0	$0	$0
Memphis WR-13 CR-30 U-1.2 SHGC-.4	3M	13	30	1.2	0.4	32233	24647	56879	77%	$9,456	$6,927	1	$72	$577	$506
Memphis WR-0 CR-30 U-1.2 SHGC-.4	3M	0	30	1.2	0.4	58177	43803	101980	1%	$4,838	$5,476	1	$37	$456	$420
Memphis WR-13 CR-0 U-1.20 SHGC-.4	3M	13	0	1.2	0.4	132032	62497	194529	20%	$4,618	$1,656	3	$35	$138	$103
Chicago WR-0 CR-0 U-1.20 SHGC-.4	5	0	0	1.2	0.4	338036	19843	357878	0%	$0	$0	CEC	$0	$0	$0
Chicago WR-0 CR-38 U-1.2 SHGC-.4	5	0	38	1.2	0.4	128635	11584	140219	61%	$6,048	$10,441	1	$46	$870	$824
Chicago WR-19 CR-38 U-1.2 SHGC-.4	5	19	38	1.2	0.4	67290	5646	72935	80%	$53,237	$13,530	4	$403	$1,127	$724
Chicago WR-19 CR-0 U-1.20 SHGC-.4	5	19	0	1.2	0.4	267563	13931	281494	21%	$47,189	$3,541	13	$357	$295	($62)
Helena (Billings) WR-0 CR-0 U-1.20 SHGC-.4	6	0	0	1.2	0.4	345779	19889	365668	0%	$0	$0	CEC	$0	$0	$0
Helena (Billings) WR-0 CR-49 U-1.2 SHGC-.4	6	0	49	1.2	0.4	120724	11899	132623	64%	$0	$11,214	CEC	$0	$934	$934
Helena (Billings) WR-19 CR-49 U-1.2 SHGC-.4	6	19	49	1.2	0.4	58106	6861	64967	82%	$52,817	$14,358	4	$400	$1,196	$796
Helena (Billings) WR-19 CR-0 U-1.2 SHGC-.4	6	19	0	1.2	0.4	272863	14796	287659	21%	$43,606	$3,655	12	$330	$305	($25)

CEC – Cost Effective Change – Less than one year payback.

Public Comment 3:

Ted A. Williams, American Gas Association, requests Disapproval.

Commenter's Reason: The Committee correctly disapproved this proposal. In addition to its Committee Reason, the proponents provided no cost effectiveness or benefit-to-cost analysis of this proposal or its components. While it might be agreed that the proposal, in total, would significantly reduce energy consumption, it is clear that elements of the proposal would dramatically increase building costs disproportionately to the resulting energy savings. Such proposals to IECC would serve to make the code less adoptable by state and local jurisdictions, which would not be the interest of ICC.

Public Comment 4:

Thomas S. Zaremba, Roetzel & Andress, representing The Advanced Building Coalition consisting of: The Association of Industrial Metalized Coaters & Laminators – Window Film Committee; The International Window Film Association; The Aluminum Extruders Council; APA; Nu-Wool Co., Inc.; Pilkington North America, Inc.; AGC FlatGlass North America, Inc.; Icynene, Inc.; Craig Conner, Building Quality; and, Birch Point Consulting, requests Disapproval.

Commenter's Reason: As set out more fully below, EC14-07/08 is an effort on the part of its Proponents to actually introduce ***inconsistencies*** into the ICC family of codes. This is a serious, if not fatal, flaw to the adoption of EC14. The Advanced Building Coalition (ABC) urges you to vote to approve the motion to support the IECC Committee recommendation to Disapprove EC14.

ABC is a broad group of building component manufacturers and other interested parties whose objective is to promote a significant, cost effective increase in building energy efficiency and sustainability. In fact, the most significant energy saving proposals approved by the IECC and IRC code committees were authored by ABC members. While we strongly support a cost effective increase in the building energy codes, the proposed "solution" in EC14 is flawed. EC14 contains over a hundred proposed changes to the code, whose components were also submitted as 30 individual proposals. Not only did the IECC Committee recommend that EC14 in its entirety be disapproved, when its component parts were individually considered, the Committee also recommended that 73% of its parts be disapproved.

EC14 is inconsistent with numerous positions taken by the IECC Committee and should not be adopted as a package proposal, even in a modified form. We ask that you vote in favor of the motion to sustain the Committee's decision to disapprove EC14.

EC 14 is an effort to introduce Inconsistencies into the ICC Family of Codes: As part of a strategy to eliminate the energy provisions from the IRC, the proponents of EC14 did not submit a single corresponding change to Chapter 11 of the IRC. Both the IRC and IECC are widely used, and deviations between the two codes will create confusion and enforcement complications. Adoptability and enforceability are key considerations if real energy savings is to be realized. This efforts of proponents to actually introduce inconsistencies into the ICC family of codes is a serious, if not fatal, flaw to the adoption of EC14.

Structural and Life Safety Issues: The energy codes must be viewed in conjunction with the building codes, recognizing the importance of other building constraints such as life safety and structural requirements. However, several components of EC14 fail to account for these issues, specifically, by ignoring the different considerations for hurricane impact windows and wall bracing design.

Product Specificity: ABC believes that proposed code changes must be non-proprietary. However, EC14 would introduce code provisions that would give certain products a competitive advantage in the marketplace. EC14 would reduce, significantly, the flexibility otherwise afforded by the IECC's alternate performance path. This reduction in flexibility would work a significant reduction in competition, in turn, resulting in unnecessary increases in the costs of construction.

Cost Effectiveness: At the Committee hearings, the proponents of EC14 did not provide any detailed analysis of the cost impact of this proposal. Cost effectiveness and affordability are critical to the adoptability of any building code. If a code is not adopted, it will result in no energy savings, no matter how stringent its provisions.

Proponents of EC14 claim that it will reduce utility costs which will especially benefit low income families, but, as seen in the recent residential housing crisis, low income families are the first casualties if they cannot afford to pay the cost of construction through mortgage or rent payments. Utility savings alone cannot justify increased construction costs. Utility costs must be considered in conjunction with all other increases in the cost of construction. Testimony at the Committee hearing demonstrated unacceptably long payback periods for EC14 and its component proposals.

Procedural Flaws: EC14 literally proposes over a hundred additions and deletions to the existing code, too many to be analyzed in detail here. Rule 3.3.4 of CP# 28-05 provides that: "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." The Proponent's statement in support of these numerous code changes utterly fails to provide any of the information required by Rule 3.3.4.

When, as here, a Proponent fails to substantiate a code change as required by the rules governing these proceedings, neither the Committee or the ICC Membership should be put to the burden of analyzing lengthy, complex proposals which contain multiple parts to determine whether each facet of the proposed change is technically justified.

The IECC Committee was correct in recommending that EC14 be disapproved. ABC urges you to vote in favor of the motion to sustain the Committee recommendation disapproving EC14.

Final Action: AS AM AMPC____ D

EC15-07/08 Part I
Table 402.1.1

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART I – IECC

Revise table footnote as follows:

TABLE 402.1.1 (Supp)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. ~~R-19 shall be permitted to be compressed into a 2 × 6 cavity.~~ <u>R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be labeled with the compressed batt R-value in addition to the full thickness R-value.</u>

(Portions of table and footnotes not shown remain unchanged)

Reason: R-19 batts are routinely used in a nominal 2x6 frame wall cavity. The compressed batt R-value is about R-1 or R-2 less than the rated R-value. Batts should be produced to fit the common cavity size, or the compressed batt R-value should be added to the batt label. Batts with other R-values are produced to fit the intended cavity.

The effect of compressing fiberglass batts on batt R-value was quantified in the study entitled, "The Effect of Compression on the Material R-Value of Fiberglass Batt Insulation.[1]

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> *"Installations that result in batt thicknesses less than the label thickness can have substantially lower material R-values. Compression of the insulation specimens to 90% of full thickness reduced the R-values by 5.6 to 9.4%."*

R-19 batts are 6.25 or 6.5 inches thick; however, the 2x6 cavity is only 5.5 inches thick. A 6.25-inch batt compressed into a 5.5-inch cavity is compressed 12%. A 6.5-inch batt compressed into a 5.5-inch cavity is compressed about 15%. Based on the study quoted above, compression reduces the batt R-value by about R-1 or R-2.

NAIMA, the trade association for fiberglass insulation and slag/rock wool insulation, has acknowledged the R-1 reduction in stating that an R-19 batt in a 2x6 cavity is really R-18.[2]

> "*When a standard R-19 batt (6" to 6 ¾" thick) is used to fill the 5 1⁄2" wall cavity, it has to be compressed. Compressing the insulation causes it to lose some of its thermal effectiveness, reducing its R-value to R-18*."

Other batts are correctly sized to fit the cavity they are designed for and marked with the R-value they achieve when placed in that cavity. R-21 batts, a higher R-value than R-19, are correctly sized to fit in a nominal 2x6 cavity. Either the R-19 batt should also be marked with the R-value it achieves in a 2x6 wall application, or R-19 batts should be produced to fit in a 2x6 cavity without compression and without loss of R-value.

Quotes from:

[1] Graves, Ronald S., and David W. Yarbrough. 1992. "The Effect of Compression on the Material R-Value of Fiberglass Batt Insulation." *Journal of Building Physics*, Vol. 15, No. 3, 248-260 (page 258). Building Materials Group Oak Ridge National Laboratory Oak Ridge, TN 37831 http://jen.sagepub.com/cgi/content/abstract/15/3/248

[2] NAIMA (North American Insulation Manufacturers Association). *Insulation Facts #32, A Guide To Selecting Fiber Glass Insulation Products for New Home Construction and Remodeling*.

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

PART I – IECC
Committee Action: **Approved as Modified**

Modify proposal as follows:

TABLE 402.1.1 (Supp)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]
(No change to 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 ~~labeled~~ <u>marked</u> with the compressed batt *R*-value in addition to the full thickness R-value.

Committee Reason: The proposal recognizes that the common practice of compressing insulation into a stud cavity could cause erroneous application of insulation values to a stud wall. Therefore, it is reasonable to ask for an R-Value to be marked on the insulation that tells what that value is when compressed into the cavity, as is commonly done. The modification was made, given that the definition of "labeled" just approved in an earlier code change proposal requires a third party agency, which was not the intent for this proposal.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Shaunna Mozingo, City of West Minister, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of Part I, to be consistent with Part II which was disapproved by the IRC B/E committee.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 2:

Ken Sagan, National Association of Home Builders, requests Disapproval.

Commenter's Reason: This is a problem where only the batt edges along the studs are compressed more than 1-inch. The heat loss is through the entire framed wall, not just the insulation. The proponent provided no data to show the increase in cost provides a cost-benefit. This proposal adds to the ineffective enforcement and inspection of an existing industry practice. By adopting this proposal, it effectively prohibits the use of unfaced batts that are currently permitted by the ICC.

Final Action: AS AM AMPC____ D

EC15-07/08 Part II
IRC Table N1102.1

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART II – IRC

Revise table footnote as follows:

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

a. R-values are minimums. U-factors and SHGC are maximums. ~~R-19 insulation shall be permitted to be compressed into a 2x6 cavity.~~ R-19 batts compressed into a nominal 2x6 framing cavity such that the R-value is reduced by R-1 or more shall be labeled with the compressed batt R-value in addition to the full thickness R-value.

(Portions of table and footnotes not shown remain unchanged)

Reason: R-19 batts are routinely used in a nominal 2x6 frame wall cavity. The compressed batt R-value is about R-1 or R-2 less than the rated R-value. Batts should be produced to fit the common cavity size, or the compressed batt R-value should be added to the batt label. Batts with other R-values are produced to fit the intended cavity.

The effect of compressing fiberglass batts on batt R-value was quantified in the study entitled, "The Effect of Compression on the Material R-Value of Fiberglass Batt Insulation.[1]

"Installations that result in batt thicknesses less than the label thickness can have substantially lower material R-values. Compression of the insulation specimens to 90% of full thickness reduced the R-values by 5.6 to 9.4%."

R-19 batts are 6.25 or 6.5 inches thick; however, the 2x6 cavity is only 5.5 inches thick. A 6.25-inch batt compressed into a 5.5-inch cavity is compressed 12%. A 6.5-inch batt compressed into a 5.5-inch cavity is compressed about 15%. Based on the study quoted above, compression reduces the batt R-value by about R-1 or R-2.

NAIMA, the trade association for fiberglass insulation and slag/rock wool insulation, has acknowledged the R-1 reduction in stating that an R-19 batt in a 2x6 cavity is really R-18.[2]

"*When a standard R-19 batt (6" to 6 ¾" thick) is used to fill the 5 1⁄2" wall cavity, it has to be compressed. Compressing the insulation causes it to lose some of its thermal effectiveness, reducing its R-value to R-18.*"

Other batts are correctly sized to fit the cavity they are designed for and marked with the R-value they achieve when placed in that cavity. R-21 batts, a higher R-value than R-19, are correctly sized to fit in a nominal 2x6 cavity. Either the R-19 batt should also be marked with the R-value it achieves in a 2x6 wall application, or R-19 batts should be produced to fit in a 2x6 cavity without compression and without loss of R-value.

Quotes from:

[1] Graves, Ronald S., and David W. Yarbrough. 1992. "The Effect of Compression on the Material R-Value of Fiberglass Batt Insulation." *Journal of Building Physics*, Vol. 15, No. 3, 248-260 (page 258). Building Materials Group Oak Ridge National Laboratory Oak Ridge, TN 37831 http://jen.sagepub.com/cgi/content/abstract/15/3/248

[2] NAIMA (North American Insulation Manufacturers Association). *Insulation Facts #32, A Guide To Selecting Fiber Glass Insulation Products for New Home Construction and Remodeling*.

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

PART II – IRC
Committee Action: Disapproved

Committee Reason: There is a problem with compressing insulation batts but this change does not do enough. Perhaps a table for the compressed values would help. The proponent should bring this back.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE N1102.1.1 (Supp)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT
(No change to 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 ~~labeled~~ marked with the compressed batt R-value in addition to the full thickness R-value.

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6*

EC15 alignment: EC15 was Approved as Modified by the IECC committee. Approving the same modification for the IRC would align the IECC and IRC.

EC15 content: R-19 batts are routinely used in 2x6 wall cavities. R-19 batts are 6.25 or 6.5 inches thick, but the nominal 2x6 wall cavity is only 5.5 inches. When compressed into a nominal 2x6 wall cavity, the R-19 batts achieve only R-17 or R-18. EC15 requires the correct (lower) R-value to be marked on R-19 batts compressed into a nominal 2x6 cavity.

Final Action: AS AM AMPC____ D

EC16-07/08

Table 402.1.1, Table 402.1.3

Proposed Change as Submitted:

Proponent: Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI)

Revise tables as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	~~1.20~~ 0.65	0.75	0.37	30	13	3 / 4	13	0	0	0
2	~~0.75~~ 0.50	0.75	0.37	30	13	4 / 6	13	0	0	0
3	~~0.65~~ 0.40	0.65	0.40[e]	30	13	5 / 8	19	0	0	5/13
4 except Marine	~~0.40~~ 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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE 402.1.3 (Supp)
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	~~0.75~~ 0.50	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.65~~ 0.40	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	~~0.40~~ 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 increases energy efficiency in climate zones 1-4 by specifying more realistic fenestration U-factors that more closely resemble actual windows and, as a result, will close a significant gap in trade-off compliance paths and compliance software. This is a more robust and more stringent alternative proposal to set realistic window U-factors for the IECC's prescriptive path. A second, less stringent proposal has also been submitted as another option for consideration.

The present window U-factor requirements in the three southernmost climate zones are unreasonably high, given the SHGC requirements of 0.37 and 0.40. To meet the SHGC requirement in these three zones, builders typically use low solar gain, low-e glass, which, with a reasonable frame, has a much lower U-factor value 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 more aggressive levels than the alternative proposal we have submitted, but is still designed to match windows available in all markets. According to the ASHRAE Handbook (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	0.67	0.48	0.63	0.44
Aluminum Thermal Break	0.47	0.41	0.44	0.37
Wood/Vinyl	0.39	0.35	0.36	0.31

Based on this data, this proposal should generally continue to allow, under the prescriptive compliance path, metal frames in zone 1, and metal frames with thermal break in zone 2. For prescriptive compliance, a vinyl, wood or composite frame would likely be necessary for zone 3 (although some thermally broken metal frames may also qualify). Of course, any frame type could also be continued to be used in zone 3 under either the Total UA alternative or the Simulated Performance Alternative. As for zone 4, the increase from 0.40 to 0.35 would not involve any change in frame, but only require that a more efficient vinyl, wood or composite window be used, possibly with a gas fill (like climate zones 5-8 and marine climate zone 4).

In our experience, these values are already achieved by many, if not most, of the windows sold in these climate zones. Indeed, from a cost-effectiveness standpoint, it could be easily contended that the U-factor for zones 1 and 2 also be set at 0.40, since there does not appear to be an additional cost to achieve this level, given competitive pricing between vinyl and aluminum window frames. For example, the state of California is presently using the 0.40 level as the baseline for the pending upgrades to their standard for all three climate zones.

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

Committee Action: Approved as Submitted

Committee Reason: The fenestration U-factors proposed are the same as those proposed in EC14-07/08 and represent the most aggressive increase in stringency for this group of values. The committee approved this code change proposal recognizing the need for aggressive reductions in energy consumption and recognizing that a sufficient amount of products are readily available to fill this need.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

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

Modify proposal as follows:

Table 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement Wall R-Value	Slab R-Value & Depth	Crawl Space Wall R-Value
1	.65	.75	.37	30	13	3/4	13	0	0	0
2	~~.50~~ **.65**	.75	.37	30	13	4/6	13	0	0	0
3	~~.40~~ **.65**	.65	.40	30	13	5/8	19	0	0	5/13
4 except Marine	~~.35~~ **.40**	.60	NR	38	13	5/10	19	10/13	10, 2 ft	10/13
5 and Marine 4	.35	.60	NR	38	19 OR 13+5	13/17	30	10/13	10, 2 ft	10/13
6	.35	.60	NR	49	19 OR 13+5	15/19	30	10/13	10, 4 ft	10/13
7 and 8	.35	.60	NR	49	21	19/21	30	10/13	10, 4 ft	10/13

Table 402.1.3
EQUIVALENT U-FACTORS

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Ceiling U-Factor	Wood Frame Wall U-Factor	Mass Wall U-Factor	Floor U-Factor	Basement Wall U-Factor	Crawl Space Wall U-Factor
1	.65	.75	.035	.082	.197	.064	.360	.477
2	~~.50~~ **.65**	.75	.035	.082	.165	.064	.360	.477
3	~~.40~~ **.65**	.65	.035	.,082	.141	.047	.360	.136
4 except Marine	~~.35~~ **.40**	.60	.030	.082	.141	.047	.059	.065
5 and Marine 4	.35	.60	.030	.060	.082	.033	.059	.065
6	.35	.60	.026	.060	.060	.033	.059	.065
7 and 8	.35	.60	.026	.057	.057	.033	.059	.065

Commenter's Reason. To correct the Fenestration U-Factor to factors based on full building simulations using WUFI Plus a full building simulation tool basing calculations on hourly weather date for temperature, wind, and solar. Approval of this comment and NMHC comment to EC26-07/08 will make modifications to window requirements in Zones 1 and 2 and return the code to the current values in Zones 3 and 4. This comment and NMHC comment to EC26-07/08 should be considered together as they address proposed changes to the window requirements for U-Factor and SHGC in Zones 1, 2, 3 and 4.

Specific Changes:

Zone 1. Acceptance of the committee approved change for a U-Factor of .65 in Zone 1 from the current code requirement U-Factor of 1.20 will change the requirement from allowing a single glazed window with aluminum frame and **no thermal break** to at minimum a double glazed aluminum frame window **with thermal break** or any other window frame type with double glazing. The current code window (U-1.2 & SHGC-.37) was changed to (U-.65 & SHGC-.30) at the Code Development Hearings. The change to a U-Factor of .65 was a cost effective change when combined with a SHGC of .35 (Table 1, Line 3). This change would result in about a 7% reduction in building energy usage. The committee approved window with a U -.65 and a SHGC -.30 would have reduced the energy usage of the building by about 10% (Table 1, Line 8) but it was not considered to be cost effective in that the simple payback was about 187 years and the cost to the consumer in rent increase of approximately $54.01 per month was not offset by the reduction in the monthly energy cost of $3.17. The U-Factor of .65 for Zone 1 was the one and only approved window modification that was cost effective in all of the changes approved by the ICC Energy Conservation Code Committee. According to the ASHRAE 90.1 window cost data there is no cost impact for window Item 3 and window Item 4. Item 3 (U -.65 & SHGC -.35) was chosen over Item 4 (U -.65 & SHGC -.37) because it has a larger Monthly Energy Cost Savings (Table 1, Column O) and thus would be a better selection than Item 4.

Zone 2. This comment changes the window requirement in the current code for Zone 2 from allowing a double glazed window with aluminum frame and **no thermal break** to at minimum a double glazed aluminum frame window **with thermal break** or any other window frame type with double glazing. This is the same window as proposed for Zone 1. The current code window (U-.75 & SHGC-.37) was changed to (U-.50 & SHGC-.35) by the ICC Energy Conservation Code Committee. Based on the WUFI analysis (Table 1, Line 12) the cost effective change is (U -.65 & SHGC-.35). This code change makes the correction to the U-Value for the IECC. NMHC comment to EC26 makes the correction to the SHGC. This change will reduce the energy use by about 2% in Zone 2 (Table 1, Line 12). The window was chosen because it does provide a cost effect change to the consumer.

Zone 3. The current IECC code requirement (U-.65 & SHGC-.40) proved to be the most cost effective solution for Zone 3 (Table 1, Line 21). The ICC Energy Conservation Committee approved (U-.40 & SHGC-.35). This change (Table 1, Line 30) with a payback of about 158 years, would cost about $11,099 and save about $66 a year in energy cost. In terms of the consumer the rent would have to go up about $84.08 per month for a savings on the energy bill of $5.51 per month. This comment corrects the U-value. Comment to EC26 corrects the SHGC value.

Zone 4. The current IECC code requirement (U-.40 & SHGC-NR) proved to be the most cost effective solution for Zone 4 (Table 1, Line 34). The ICC Energy Conservation Committee approved a change to the U-Factor (U.-35) and did not change the SHGC. In this case (Table 1, Line 36), with a payback of 96 years the committee change would cost about $2,127 and save approximately $22 annually on the energy bill. In terms of the consumer the rent would have to go up about $16.11 per month for a savings on the energy bill of about $1.84 per month, all for a savings of about 1% in the energy usage.

WUFI Annual Energy Analysis. The results of the WUFI Plus analysis for different window U-Factors and SHGC in Zones 1, 2, 3, and 4 are shown in Table 1.

TABLE 1
WINDOW EVALUATIONS FOR ZONES 1,2,3 AND 4

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
							Loads			% Total Khw Savings	Total Cost Impact	Total Savings H & C	Simple Payback	Monthly Rent Impact	Monthly Energy Cost Savings
Item Number	Location	Zone	Wall R	Ceiling R	U	SHGC All	Heat (KWh)	Cool (KWh)	Total (KWh)			80% Furn 10 SEER	80% Furn 10 SEER		
1	**Miami 2006 IECC**	**1**	**13**	**30**	**1.2**	**0.37**	**554**	**37337**	**37892**	**0%**	**$0**	**$0**	**Code**		
2	Miami Optimization Zone 1 SR 5	1	13	30	0.67	0.39	461	35942	36403	4%	-$1,762	$17	CEC	-$13.35	$1.39
3	**Miami 2008 AP U .65 SHGC .35**	**1**	**13**	**30**	**0.65**	**0.35**	**465**	**34792**	**35257**	**7%**	**$0**	**$27**	**CEC**	**$0.00**	**$2.21**
4	**Miami 2006 IECC U .65**	**1**	**13**	**30**	**0.65**	**0.37**	**461**	**35312**	**35772**	**6%**	**$0**	**$22**	**CEC**	**$0.00**	**$1.85**
5	Miami 2006 IECC U .55	1	13	30	0.55	0.37	447	34982	35429	6%	$2,674	$26	104	$20.25	$2.15
6	Miami Optimization Zone 1 SR 10	1	13	30	0.47	0.32	443	33372	33815	11%	$4,456	$40	112	$33.76	$3.33
7	Miami 2006 IECC U.65 SHGC .25	1	13	30	0.65	0.25	480	32102	32583	14%	$7,109	$49	145	$53.86	$4.09
8	Miami 2008 AS Modified	1	13	30	0.65	0.3	468	33450	33918	10%	$7,129	$38	187	$54.01	$3.17
9	Miami 2006 IECC SHGC .25	1	13	30	1.2	0.25	567	34068	34635	9%	$7,129	$28	257	$54.01	$2.31
10	**Phoenix 2006 IECC**	**2**	**13**	**30**	**0.75**	**0.37**	**5661**	**77669**	**83331**	**0%**	**$0**	**$0**	**Code**		
11	Phoenix 2006 IECC SHGC .30	2	13	30	1.27	0.3	6689	79851	86541	-4%	$7,109	-$70	IEU	$53.86	-$5.82
12	**Phoenix 2008 AM U .65 SHGC .35**	**2**	**13**	**30**	**0.65**	**0.35**	**5507**	**76530**	**82037**	**2%**	**-$20**	**$18**	**CEC**	**-$0.15**	**$1.46**
13	**Phoenix 2006 IECC U .65**	**2**	**13**	**30**	**0.65**	**0.37**	**5492**	**76973**	**82465**	**1%**	**-$20**	**$14**	**CEC**	**-$0.15**	**$1.20**
14	Phoenix 2006 IECC U .5	2	13	30	0.5	0.37	5235	75908	81144	3%	$2,957	$36	81	$22.40	$3.03
15	Phoenix 2006 IECC U.55	2	13	30	0.55	0.37	5321	76262	81583	2%	$2,653	$29	91	$20.10	$2.42
16	Phoenix 2008 AP U.5 SHGC .35	2	13	30	0.5	0.35	5259	75489	80748	3%	$4,436	$39	114	$33.60	$3.24
17	Phoenix 2006 IECC U .5 SHGC .25	2	13	30	0.5	0.25	5331	73374	78705	6%	$11,565	$54	216	$87.61	$4.47
18	Phoenix 2008 AS Modified	2	13	30	0.5	0.3	5292	74440	79732	4%	$11,099	$46	240	$84.08	$3.86
19	Phoenix 2008 AM U ..65 SHGC .3	2	13	30	0.65	0.3	5569	75493	81062	3%	$7,109	$23	303	$53.86	$1.96
20	Phoenix 2006 IECC SHGC .25	2	13	30	0.75	0.25	5775	75114	80889	3%	$7,109	$17	430	$53.86	$1.38
21	**Memphis 2006 IECC**	**3**	**13**	**30**	**0.65**	**0.4**	**29065**	**23309**	**52375**	**0%**	**$0**	**$0**	**Code**		
22	Memphis 2006 IECC U.65 SHGC .35	3	13	30	0.65	0.35	29274	22565	51838	1%	$1,762	-$4	IEU	$13.35	-$0.32
23	Memphis 2006 IECC SHGC .3	3	13	30	0.65	0.3	29469	21831	51301	2%	$8,892	-$7	IEU	$67.36	-$0.60
24	Memphis 2006 IECC SHGC .25	3	13	30	0.65	0.25	29682	21138	50820	3%	$8,871	-$12	IEU	$67.21	-$0.98
25	Memphis 2006 IECC U.55 SHGC .30	3	13	30	0.55	0.3	28932	21605	50537	4%	$12,882	$21	603	$97.59	$1.78
26	Memphis Optimization Zone 3 SR 5	3	13	30	0.47	0.36	28226	22281	50507	4%	$4,436	$50	88	$33.60	$4.21
27	Memphis Optimization Zone 3 SR 10	3	13	30	0.47	0.31	28443	21564	50007	5%	$6,218	$46	135	$47.11	$3.83
28	Memphis 2006 IECC U .4	3	13	30	0.4	0.4	27693	22731	50424	4%	$11,099	$73	152	$84.08	$6.08
29	Memphis 2006 IECC SHGC .55	3	13	30	0.55	0.4	28526	23072	51598	1%	$4,436	$29	154	$33.60	$2.40
30	Mempnis 2008 AP U .4 SHGC .35	3	13	30	0.4	0.35	27879	21975	49854	5%	$11,099	$70	158	$84.08	$5.86
31	Memphis 2008 IECC AM	3	13	30	0.4	0.3	28086	21273	49359	6%	$11,099	$66	168	$84.08	$5.51
32	Memphis 2006 IECC U.55 SHGC .35	3	13	30	0.55	0.35	28742	22310	51052	3%	$6,218	$25	252	$47.11	$2.06
33	Memphis 2006 IECC U .4 SHGC .25	3	13	30	0.4	0.25	28274	20559	48833	7%	$19,991	$63	317	$151.44	$5.26
34	**Baltimore 2006 IECC**	**4**	**13**	**38**	**0.4**	**NR**	**46476**	**16558**	**63034**	**0%**	**$0**	**$0**	**Code**		
35	Baltimore 2004 90.1	4	13	38	0.67	0.39	51905	10204	62109	1%	-$9,783	-$214	IEU	-$74.11	-$17.80
36	Baltimore 2006 IECC U .35	4	13	38	0.35	NR	46038	16510	62548	1%	$2,127	$22	96	$16.11	$1.84
	Cost Effective Change	**CEC**													
	Increased Energy Usage	**IEU**													

Building Solar Analysis. NMHC comments to EC16 and EC26 are based on full building simulations using WUFI Plus for a 4-story 32 unit apartment building with 20% window area. The apartment building was rectangular in shape with an east west orientation. Windows were located on the north and south facing walls. The shape and orientation and window location were selected because they represented the better performing building when compared to a square building with equal window on all orientations and a rectangular building with north south orientation. The WUFI Plus simulation is based on hourly weather data for a complete year which includes temperature, wind and solar action on the building.

U-Factor and SHGC Selection. The U-Factors and SHGC values proposed by the proponents and selected by the ICC Energy Conservation Committee were not based on any analysis of the energy savings or the cost impact to the typical apartment owner or tenant. They were simply negotiated numbers that lowered the values based on the assumption that lower values would reduce the energy use of the building. In some cases the numbers were selected to allow manufactures of current product to meet the requirements and thus not eliminate product from the market.

Window Cost. Window cost data used in the analysis is based on the numbers used by the ASHRAE 90.1 Envelope Subcommittee corrected for inflation at an annual rate of 3%.

Fuel Cost. Fuel costs are also the same as those being used by the ASHRAE 90.1 Envelope Subcommittee ($1.16/Therm for gas, $0.0868/KWh for electric). Just for comparison it should be noted that a doubling of the fuel cost would not have any impact on the window criteria selected. A doubling of the fuel cost would in effect reduce the simple payback by 50%. The simple payback for windows that were not cost effective (Table 1, Column N) ranged from a low of 81 years to a high of 603 years. Doubling the fuel cost would have made the simple payback range from a low of 40.5 years to a high of 301.5 years.

Multifamily Financial Implications. NMHC window selection is based on the impact to the consumer. For multifamily properties there is a consistent relationship between the price of a property and the rents that are necessary to cover the costs. If these relationships are not maintained the property is not built because the banks and financial organizations that fund the properties will not provide the funding. The ratio for multifamily properties is 11% to 12% of the property value. The values for Monthly Rent Impact (Table 1, Column N) are based on a ratio of 11% (1/9) which is equivalent to a simple payback of 9 years concurrent with the financing requirements for multifamily properties. In other words the cost of any improvement to the property must be offset by an increase in rent. Energy calculations are somewhat different in that cost increase can be offset by reductions in energy usage (Table 1, Column O). Windows that meet the criteria and that would be cost effective are identified in Column M as CEC (Cost Effective Change). Columns N (Monthly Rent Impact) and O (Monthly Energy Cost Savings) show the relationship between Monthly Rent Impact, the impact on rent to cover the increased construction costs, and the savings in Monthly Energy Cost that will occur as a result of the change in window type due to the reduction in energy usage.

Revised Table 402.1.1. The following reproduction is how Table 402.1.1 would appear if NMHC comments to EC16 and EC26 are approved.

TABLE 402.1.1 (WITH NMHC PROPOSED CHANGES)
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	.65	.75	.35	30	13	¾	13	0	0	0
2	.65	.75	.35	30	13	4/6	13	0	0	0
3	.65	.65	.40	30	13	5/8	19	0	0	5/13
4 except Marine	.40	.60	NR	38	13	5/10	30	10/13	10, 2ft	10/13
5 and Marine 4	.35	.60	NR	38	19 or 13+5	13/17	30	10/13	10, 2ft	10/13
6	.35	.60	NR	49	19 or 13+5	15/19	30	10/13	10, 4ft	10/13
7 and 8	.35	.60	NR	49	21	19/21	30	10/13	10, 4ft	10/13

WUFI Validation. Reference Table 1 Column M Simple Payback. In evaluating the window criteria and other proposed changes it became quite clear that some of the paybacks were rather large and thus questionable. The developer of the WUFI Plus program has evaluated the program against other energy models and thus there is a level of confidence. To further check the results I also ran the WUFI Plus program in Zones 1, 3, 5, and 6 using current code requirements based on a building without any energy improvements. The results are found in Table 2. The simple paybacks in ranged from 1-14 years.

WUFI Validation:

TABLE 2
WUFI PLUS VALIDATION

Location	Zone	Wall R	Ceiling R	Window U	Window SHGC All	Loads Heat (KWh)	Loads Cool (KWh)	Loads Total (KWh)	% Khw Savings	Total Cost Impact	Total Savings H & C 80% Furn 10 SEER	Simple Payback 80% Furn 10 SEER	Monthly Rent Impact	Monthly Energy Cost Savings	Monthly Cost Impact
Miami WR-0 CR-0 U-1.20 SHGC-.4	1	0	0	1.2	0.4	5286	127835	133121	0%	$0	$0	CEC	$0	$0	$0
Miami WR-0 CR-30 U-1.2 SHGC-.4	1	0	30	1.2	0.4	1256	70063	71318	46%	$4,838	$701	7	$37	$58	$22
Miami WR-13 CR-30 U-1.2 SHGC-.4	1	13	30	1.2	0.4	549	38152	38701	71%	$9,456	$1,013	9	$72	$84	$13
Miami WR-13 CR-0 U-1.20 SHGC-.4	1	13	0	1.2	0.4	4571	94972	99543	25%	$4,618	$321	14	$35	$27	($8)
Memphis WR-0 CR-0 U-1.20 SHGC-.4	3M	0	0	1.2	0.4	162083	81899	243982	0%	$0	$0	CEC	$0	$0	$0
Memphis WR-13 CR-30 U-1.2 SHGC-.4	3M	13	30	1.2	0.4	32233	24647	56879	77%	$9,456	$6,927	1	$72	$577	$506
Memphis WR-0 CR-30 U-1.2 SHGC-.4	3M	0	30	1.2	0.4	58177	43803	101980	1%	$4,838	$5,476	1	$37	$456	$420
Memphis WR-13 CR-0 U-1.20 SHGC-.4	3M	13	0	1.2	0.4	132032	62497	194529	20%	$4,618	$1,656	3	$35	$138	$103
Chicago WR-0 CR-0 U-1.20 SHGC-.4	5	0	0	1.2	0.4	338036	19843	357878	0%	$0	$0	CEC	$0	$0	$0
Chicago WR-0 CR-38 U-1.2 SHGC-.4	5	0	38	1.2	0.4	128635	11584	140219	61%	$6,048	$10,441	1	$46	$870	$824
Chicago WR-19 CR-38 U-1.2 SHGC-.4	5	19	38	1.2	0.4	67290	5646	72935	80%	$53,237	$13,530	4	$403	$1,127	$724
Chicago WR-19 CR-0 U-1.20 SHGC-.4	5	19	0	1.2	0.4	267563	13931	281494	21%	$47,189	$3,541	13	$357	$295	($62)
Helena (Billings) WR-0 CR-0 U-1.20 SHGC-.4	6	0	0	1.2	0.4	345779	19889	365668	0%	$0	$0	CEC	$0	$0	$0
Helena (Billings) WR-0 CR-49 U-1.2 SHGC-.4	6	0	49	1.2	0.4	120724	11899	132623	64%	$0	$11,214	CEC	$0	$934	$934
Helena (Billings) WR-19 CR-49 U-1.2 SHGC-.4	6	19	49	1.2	0.4	58106	6861	64967	82%	$52,817	$14,358	4	$400	$1,196	$796
Helena (Billings) WR-19 CR-0 U-1.2 SHGC-.4	6	19	0	1.2	0.4	272863	14796	287659	21%	$43,606	$3,655	12	$330	$305	($25)

CEC – Cost Effective Change – Less than one year payback.

Public Comment 2:

Ron Burton, BOMA, International, requests Disapproval.

Commenter's Reason: As stated in the Committee reason for its action to Approve this proposal to change fenestration Tables 402.1.1 and 402.1.3 As Submitted, "the fenestration U-factors are the same as those proposed in EC14-07/08 and represent the **most aggressive increase in stringency** (emphasis added by commenter) for this group of values". As the proponent stated in its reason, "this code change proposal will increase the cost of construction", and estimates have confirmed that there will be a significant increase in the cost of construction. The proponent also stated that while "the initial cost of this "improvement" may be higher, …the "long-term savings outweigh these costs". However, neither the proponent nor any other person presenting testimony during the Public Hearings in Palm Springs, CA provided the Committee with ANY actual cost data, even though this information was requested during the Public Hearing debate on this proposed code change. Further, NO cost impact analysis was provided - either the proponent or any other person - of the potential economic impact of this change on the construction industry, building owners, potential tenants, the local and/or regional economy, the tax base in the jurisdiction having authority, or any other criteria that should be reasonably expected by the Committee, those in attendance during the Public Hearing, or the voting members of ICC. As a result, the Committee took action without a critical piece of essential information to inform its decision and its Approval As Submitted of this code change proposal should therefore be overturned by the voting members of ICC. BOMA International recommends a vote of Disapproval during the Final Action Consideration of the 2007-2008 code change cycle.

Public Comment 3:

Thomas D. Culp, Birch Point Consulting LLC, representing Aluminum Extruders Council, requests Disapproval.

Commenter's Reason: To be credible and achieve a real (not just theoretical) increase in energy savings in the field, any proposed change must be based on good science, promote sustainability, be cost effective, and account for other key building aspects such as life safety and structural requirements. Unfortunately, the U-factors proposed in EC16-07/08 fail these criteria on many accounts. We ask your disapproval, in favor of EC18 as modified by the IRC Committee.

Any energy analysis will show that U-factors are of only secondary importance in these warm southern climates, providing only minor energy savings. For example, the energy savings for a 2000 ft^2 home with 300 ft^3 of glazing averages a mere $23 per year for nine different zone 2 cities. In zone 1, the energy savings are even less, or are actually negative in some cases! On the other hand, the high incremental cost of going to double glazing in zone 1 and adding a thermal break to an aluminum frame (which is the dominant material) in zone 2 results in extremely long payback periods of 40+ years. **Cost effectiveness** and affordability must be considered for any proposal to gain wide acceptance in actual use.

One of the most concerning aspects of this proposal is that the selected U-factor values and cost implications will strongly encourage increased use of plastic window materials in zones 2-3. This is of concern for two important reasons:

First, promoting plastic windows would raise issues with **durability, structural, and life safety requirements**. Building codes in coastal areas all the way from Texas to Massachusetts are being updated at a dramatic rate to greatly increase structural wind load and impact requirements, yet this proposal does not account for the heavier framing materials used in hurricane impact products. In contrast, EC18 does account for both energy efficiency and hurricane impact products.

Second, the **sustainability** and green attributes of PVC vinyl materials have been seriously challenged with concerns about toxicity during manufacture, lack of recycling, and toxic emissions during burning or landfill disposal. Green building programs such as The Living Building Challenge from the Cascadia Region Green Building Council prohibit the use of PVC materials in their program. PVC is on their list of "worst known offending materials" that it believes "should be phased out of production due to health/toxicity concerns." [1]

The Healthy Building Network and Greenpeace strongly advocate transitioning away from PVC building materials, calling PVC "**a major**

environmental health disaster" and "one of the most toxic substances saturating our planet". [2,3] They point out that PVC poses major hazards in its manufacture, product life, and disposal.

The California State Assembly has a bill pending which would ban PVC packaging materials because of these same concerns about PVC's "environmental and human health risk throughout its life cycle".[4] This has also been with the support of Governor Schwarzenegger's Ocean Protection Council and their concerns about PVC packaging materials on the marine environment.

Vinyl also suffers from very poor **recyclability**. The Association of Post Consumer Plastics Recyclers declared efforts to recycle PVC a failure and labeled it a contaminant in 1998. The California State Assembly has stated PVC acts as a "problematic contaminant in the recycling stream of other more abundant, nontoxic plastic resins, preventing municipalities from accepting greater quantities of packaging for recycling, and preventing municipalities from achieving higher landfill diversion rates."[4]

In contrast, this proposal has the disturbing effect of actually promoting plastic PVC windows, creating potential sustainability, durability, and structural problems -- all for a change in U-factor that only has minor importance in these warm southern zones anyway. We ask for your disapproval of EC16 in favor of EC18 as modified by the IRC committee, which provides a much more reasonable increase in energy efficiency while avoiding these unintended consequences.

1. "The Living Building Challenge - In Pursuit of True Sustainability in the Built Environment", Version 1.2, Cascadia Region Green Building Council, April 2007.
2. http://www.healthybuilding.net/pvc/index.html
3. http://www.greenpeace.org/usa/campaigns/toxics/go-pvc-free
4. California Assembly Bill AB2505

Public Comment 4:

William E. Koffel, P.E., Koffel Associates, Inc., representing the Glazing Industry Code Committee requests Disapproval.

Commenter's Reason: The proposed U-factors in EC16 lack technical justification by ignoring cost effective energy analysis, life safety considerations for hurricane products, and consistency and enforceability with the IRC. We ask for your disapproval, and to instead consider EC18 as modified by the IRC committee.

This proposal disregards energy analyses which demonstrate that energy performance in these hot climates is dominated by SHGC and not U-factor, which is of relatively minor importance, especially in zones 1-2. In fact, some energy analyses show that requiring double glazing in Hawaii, Puerto Rico, and Miami will actually *increase* energy consumption and use of air conditioning, because higher U-factors are beneficial in these areas for shedding internal heat gains when temperatures cool off in the evening.

Also, the proposal makes no distinction between normal windows and hurricane impact resistant products. These are different products and warrant separate consideration, just as skylights perform differently from windows. Hurricane products have higher U-factors from using heavier metal and/or reinforced framing to meet strict life safety requirements. To ensure that both the energy and structural safety requirements are satisfied and enforced in these regions, the requirements must account for the important differences of hurricane products.

For structural safety and cost reasons, the hurricane window market is dominated by monolithic laminated glazing and aluminum frames. From a safety standpoint, monolithic laminated glazing is preferred over double glazing to minimize the amount of flying glass debris in a hurricane event. For a 2000 ft2 home with 300 ft2 of windows, this proposal would add approximately $2000 per home to go to double glazing in zone 1, and an additional $900 per home to add a thermally broken frame in zone 2. The corresponding average energy savings is near zero in zone 1, and only $23 per year in zone 2 … giving no payback ever in zone 1, and a simple payback of 40 years in zone 2. In zone 3, no operable windows with aluminum frames -- even with thermal breaks and low-e double glazing -- would be allowed, leaving the question what hurricane products would be used in the high wind speed coastal areas of North and South Carolina. When considering safety, structural, and affordability requirements, this proposal just does not make sense.

Finally, this proposal was not also submitted to the IRC and would create a significant deviation between the IECC and IRC, leading to enforcement issues in the field. We ask for your disapproval of EC16, and instead consider EC18 as modified by the IRC committee. EC18 addresses both the IECC and IRC, and provides an appropriate increase in energy efficiency while also recognizing cost effectiveness and the special requirements for hurricane glazing.

Public Comment 5:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of this item. There was not a part II to this code change and therefore the IRC B/E committee was not able to comment.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 6:

Julie Ruth, JRuth Code Consulting, representing AAMA, requests Disapproval.

Commenter's Reason: Although lowering the maximum SHGC would appear to always be an energy efficient move in cooling dominated climates, in actuality a tradeoff occurs between the energy savings achieved through reduced solar heat gain, and the energy costs due to reduced visible light transmittance through the product. As a general rule, the lower the SHGC of the window, the lower its Visible Light Transmittance. Windows with a SHGC below 0.30 will generally permit about 50% of the available visible light to pass through the product. As the amount of visible light transmitted is reduced, more glazing is needed to provide adequate natural lighting to the building, as perceived by the homeowner or consumer. As designers or home builders begin to respond to this situation, the net result could actually be more glazing in the building envelop, with an even lower average U-factor for the home, a greater lighting load, and a solar heat gain comparable to what would have occurred had the maximum SHGC not been reduced to 0.30. Therefore, AAMA is opposed to reducing the maximum SHGC in cooling dominated climates to 0.30, and we ask for disapproval of this proposal.

Public Comment 7:

Ken Sagan, National Association of Home Builders, requests Disapproval.

Commenter's Reason: This change will require going from a single to a double pane window in climate zone 1. Energy savings for a 2,000 square foot home going to a second pane would be about $8/year according to research conducted by National Assoc of Home Builders Research Center. The cost for changing 320 square feet of glazing to Insulated Glass (IG) glazing will approach $8000 making the payback 100 years. This well beyond anything that can be deemed cost effective.

Final Action: AS AM AMPC____ D

EC18-07/08, Part I

Table 402.1.1, Table 402.1.3

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART I – IECC

Revise tables as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.37	30	13	3 / 4	13	0	0	0
2	~~0.75~~ 0.55[i]	0.75	0.37	30	13	4 / 6	13	0	0	0
3	~~0.65~~ 0.55[i]	0.65	0.40[e]	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a. through h. (No change to current text)
i. For impact rated glazing the maximum U-factor shall be 0.70.

TABLE 402.1.3 (Supp)
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~~ 0.55	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.65~~ 0.55	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	0.060	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: The proposed U-factor, 0.55, better reflects the windows already used to meet zone 2 and 3 requirements. Windows in climate zones 2 and 3 require a low SHGC. Low-E coatings are routinely used to achieve a low SHGC, which leads to a double pane window. In practice a double pane window with low-E will have U-factors below the 0.65 and 0.75 currently required for zones 2 and 3. Since a 0.55 U-factor is more reflective of a typical window it is also more appropriate as a base case for the performance modeling. A lower U-factor will also lower the heating energy used in climate zones 2 and 3, especially in the northern part of zone 3. This value (0.55) could also be applied in zone 1, but due to the overwhelming dominance of cooling loads it is not clear if a performance analysis in zone 1 would show a higher or lower U-factor saves energy.

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

PART I – IECC
Committee Action: Disapproved

Committee Reason: 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.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1
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	Floor R-Value	Basement[(c)] Wall R-Value	Slab[(d)] R-Value & Depth	Crawl Space[(c)] Wall R-Value
1	1.20	0.75	0.40	30	13	3	13	0	0	0
2	~~0.55~~ 0.65[g]	0.75	0.40	30	13	4	13	0	0	0
3	~~0.55~~ 0.50[g]	0.65	0.40	30	13	5	19	0	0	5/13
4 except Marine	~~0.40~~ 0.35	0.60	NR	38	13	5	19	10 / 13	10, 2 ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[(g)]	13	30[(f)]	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	19 or 13+5[(g)]	15	30[(f)]	10 / 13	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	19	30[(f)]	15 / 21	15, 4 ft	10 / 13

g. For impact rated ~~glazing the maximum U-factor shall be 0.70 resistant~~ fenestration complying with Section R301.2.1.2 of the IRC (or Section 1609.1.2 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	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	~~0.55~~ 0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.55~~ 0.50	0.65	0.035	0.082	0.141	0.047	0.220	0.136
4 except Marine	~~0.40~~ 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	0.037	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	0.041	0.057

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC18 alignment: Different U-factors were approved in the IECC (which approved EC16) and IRC (which approved a modified EC18). Because no IRC version of EC16 exists, EC18 is used here to align the two codes. <u>The same values should be approved in both codes.</u>

EC18 content: There has been considerable discussion concerning the appropriate U-factors for fenestration in southern climates. This change represents a compromise between the southern U-factors approved in the IECC (in EC16) and the southern U-factors approved in the IRC. This change preserves the lowest U-factor approved by the IECC in zone 4, where U-factor is most important to energy efficiency due to higher heating loads. It also recognizes that U-factor has little impact in zone 1, where it is not cost-effective to require a low U-factor. Zones 2 and 3 represent a compromise between the values approved in the IECC and IRC.

Public Comment 2:

Thomas D. Culp, Birch Point Consulting LLC, representing Aluminum Extruders Council, requests Approval as Modified by this Public Comment.

William E. Koffel, P.E., Koffel Associates, Inc., representing Glazing Industry Code Committee, requests Approval as Modified by this Public Comment.

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.37	30	13	3 / 4	13	0	0	0
2	0.55[i] <u>0.65[i]</u>	0.75	0.37	30	13	4 / 6	13	0	0	0
3	0.55[i]	0.65	0.40[e]	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a. through h. (No change to current text)

i. For ~~impact rated glazing~~ <u>impact resistant fenestration complying with Section 1609.1.2 of the *International Building Code*,</u> the maximum U-factor shall be <u>1.20 in zone 2 and</u> 0.70 <u>in zone 3</u>.

TABLE 402.1.3 (Supp)
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	0.55 <u>0.65</u>	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.55	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	0.060	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)

Commenter's Reason: (Culp) We ask that you support EC18 part I as modified by this comment to be consistent with the proposal approved by the IRC Building & Energy code committee.

Unlike the highly flawed EC16, this proposal as modified by the IRC committee offers an increase in energy efficiency which also recognizes the unique technical requirements for these southern regions. The southern zones are currently dominated by aluminum framing – and for good reasons. Central and northern markets saw a large switch to plastic windows over the last 15-20 years, but there are reasons the south and southwest stayed aluminum. First, **durability and structural performance** are especially important in these regions. For example, the intense climate in Phoenix can easily lead to frame distortion and degradation, and the **structural and life safety concerns** from tropical storm and hurricane events along the Gulf Coast and Florida are obvious.

Second, any energy analysis will show that U-factors are of only secondary importance in these warm southern climates, providing only minor energy savings. For example, for a 2000 ft^2 home with 300 ft^3 of glazing, the energy savings of decreasing the U-factor by 0.1

averages a mere $10 per year for twelve different zone 2 cities. In zone 1 (including Hawaii, Miami, and Puerto Rico), the energy savings are even less, or are actually negative in some cases! On the other hand, the high incremental cost of going to double glazing in zone 1 and adding a thermal break to an aluminum frame in zone 2 results in extremely long payback periods of 40+ years. The payback for hurricane impact products is even longer if the criteria do not recognize the differences in these heavier products. **Cost effectiveness** and affordability must be considered for any proposal to gain wide acceptance in actual use.

Finally, aluminum is a **sustainable, green material** with proven recyclability. **Recyclability** and more efficient use of materials reduces the ecological impact of a building. This includes reduced landfill waste, as well as reduced energy and emissions associated with manufacturing, transportation, and disposal. In contrast, the sustainability and green attributes of PVC vinyl materials have been seriously challenged with concerns about toxicity during manufacture, lack of recycling, and toxic emissions during burning or landfill disposal.

This proposal provides an increase in energy efficiency, while also properly accounting for the sustainability, durability, structural, and life safety benefits of aluminum windows in these regions.

Commenter's Reason: (Koffel) This comment addresses window U-factors in the southern zones, and would modify Part I of EC18 for the IECC to be consistent with the modification passed by the IRC Building/Energy Code Committee for Part II.

To aid enforcement and use of the energy codes, consistency is desirable between the IECC and IRC, and only EC18 as modified by the IRC B/E committee appropriately addresses both the IECC and IRC. EC18 provides an increase in energy efficiency while also accounting for cost effectiveness, different technologies used in these regional markets, and the special life safety requirements for hurricane glazing.

In particular, this proposal recognizes that hurricane products used to meet impact resistance standards are different than normal windows. Hurricane products commonly have higher U-factors from using heavier metal and/or reinforced framing to meet strict life safety requirements. Monolithic laminated glazing is also common in zones 1-2 for two reasons. First, from a safety standpoint, monolithic laminated glazing is preferred over double glazing to minimize the amount of flying glass debris in a hurricane event. Second, the significantly increased cost of double glazing for impact products, and the minor importance of U-factor in these hot climates, results in extremely long payback periods (40+ years). By setting separate requirements for hurricane impact products which recognize the importance of meeting strict life safety requirements, this proposal would help ensure that neither the energy nor structural requirements are ignored in these regions.

Commenter's Reason: (Mozingo) The Colorado Chapter requests approval of Part I as modified to be consistent with Part II as modified and approved by the IRC B/E committee.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 3:

Julie Ruth, JRuth Code Consulting, representing AAMA, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.37	30	13	3 / 4	13	0	0	0
2	~~0.55[i]~~ 0.65[i]	0.75	0.37	30	13	4 / 6	13	0	0	0
3	~~0.55[i]~~ 0.50[i]	0.65	0.40[e]	30	13	5 / 8	19	0	0	5/13
4 except Marine	~~0.40~~ 0.38	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a. through h. (No change to current text)

i. For impact resistant fenestration complying with Section 1609.1.2 of the *International Building Code*, ~~rated glazing~~ the maximum U-factor shall be ~~0.70~~ 0.75 in Climate Zone 2 and 0.65 in climate Zone 3.

TABLE 402.1.3 (Supp)
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	~~0.55~~ 0.65[i]	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.65~~ 0.50[i]	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	~~0.40~~ 0.38	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

a. (No change)
b. (No change)
c. For impact resistant fenestration complying with Section 1609.1.2 of the *International Building Code*, the maximum U-factor shall be 0.75 in Climate Zone 2 and 0.65 in Climate Zone 3.

Commenter's Reason: During the ICC Code Development Hearings in Palm Springs, different action was taken by the IRC Building and Energy Committee, and the IECC committee, in regards to the maximum U-factor requirements for residential fenestration in climate zones 1 – 4. The potential result is maximum U-factors that vary widely between the two codes. If these values are upheld as approved by the committees during the Code Development Hearings, a jurisdiction that adopts both the 2009 IRC and 2009 IECC will have conflicting provisions in place in regards to fenestration in one and two family dwellings and low rise multifamily buildings.

This Public Comment seeks to find some middle ground between the two sets of values that were approved. In some cases, a compromise value between the more stringent value approved by the IECC committee and the less stringent value approved by the IRC committee is proposed. In other cases the less stringent value approved by the IRC committee is proposed. Similarly, a compromise regarding maximum U-factors for impact resistant fenestration is offered.

Specifically, in climate zone 3 a compromise U-factor of 0.50 is proposed. This is less stringent than the 0.40 approved by the IECC committee, and more stringent than the 0.55 approved by the IRC B&E committee. Similarly, a compromise U-factor of 0.38 is proposed for climate zone 4.

On the other hand, the less stringent U-factor of 1.20 for climate zone 1 and 0.65 for climate zone 2, that were approved by the IRC committee, are proposed. Climate zones 1 and 2 are cooling dominated zones and the current SHGC of 0.40 (and proposed revisions to SHGC) will mandate a fairly energy efficient glass package in these areas, regardless of the maximum U-factor permitted.

With regards to impact resistant fenestration, a revision to footnote h that was approved by the IRC B&E committee is proposed to retain the current maximum U-factors for impact resistant fenestration. This revised footnote is proposed for both the IRC and IECC. The proposed revision to footnote h makes its more stringent than what was approved by the IRC B&E committee. Adding the footnote to the IECC would reduce its stringency.

At the present time some products which meet both the maximum U-factor and SHGC in the IECC, and the impact resistant opening requirements of Section 1609.1.2 of the 2006 International Building Code, do exist. The manufacturers of such products have had to put them through two different programs – one for labeling in accordance with NFRC 100 and 200 for the U-factor and SHGC of the product, and a separate one to demonstrate compliance with the impact resistant fenestration requirements. If the maximum U-factor for these products is changed, the manufacturers will need to design new products, possibly with different glass packages, to meet these requirements, and then have those new products evaluated through these two programs. While it is possible that some manufacturers could have some products available that have met this multi layer set of requirements by the implementation of the 2009 International Codes, it is doubtful any of them will be able to provide a line of products as full as what is currently available within that time frame. This could severely limit the products available to the consumer, designer and homebuilder.

These revisions would provide consistent energy savings in both the IRC and IECC. The proposed U-factor of 0.50 in climate zone 3 and 0.65 in climate zone 2 would result in greater than 10% reduction in maximum U-factor in these cooling dominated climate zones, for those products that are not required to be impact resistant. The reduction of maximum U-factor in climate zone 4 from 0.40 to 0.38 would provide a 5% reduction in maximum U-factor in a climate zone where heating load is a more significant factor. The proposed footnote would permit impact resistant fenestration that complies with the current IECC and IRC limits for U-factor and SHGC to continue to be used. Further, this is a reasonable reduction in U-factor in these climate zones and would appear to be a cost effective way to achieve significant energy savings.

Final Action: AS AM AMPC____ D

EC18-07/08, Part II

IRC Table N1102.1, Table N1102.1.2

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART II – IRC

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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	~~0.75~~ 0.55[h]	0.75	0.40	30	13	4	13	0	0	0
3	~~0.65~~ 0.55[h]	0.65	0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through g. (No change to current text)
h. For impact rated glazing the maximum U-factor shall be 0.70.

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	~~0.75~~ 0.55	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.65~~ 0.55	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	0.060	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: The proposed U-factor, 0.55, better reflects the windows already used to meet zone 2 and 3 requirements. Windows in climate zones 2 and 3 require a low SHGC. Low-E coatings are routinely used to achieve a low SHGC, which leads to a double pane window. In practice a double pane window with low-E will have U-factors below the 0.65 and 0.75 currently required for zones 2 and 3. Since a 0.55 U-factor is more reflective of a typical window it is also more appropriate as a base case for the performance modeling. A lower U-factor will also lower the heating energy used in climate zones 2 and 3, especially in the northern part of zone 3. This value (0.55) could also be applied in zone 1, but due to the overwhelming dominance of cooling loads it is not clear if a performance analysis in zone 1 would show a higher or lower U-factor saves energy.

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

PART II – IRC
Committee Action: Approved as Modified

Modify proposal as follows:

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

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	~~0.55[h]~~ 0.65[h]	0.75	0.40	30	13	4	13	0	0	0
3	0.55[h]	0.65	0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through g. (No change to current text)
h. For ~~impact rated glazing~~ impact resistant fenestration complying with Section R301.2.1.2, the maximum U-factor shall be 1.20 in zone 2 and 0.70 in zone 3.

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	~~0.55~~ 0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.55	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	0.060	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)

Committee Reason: This change lowers the U-factor in zone 2 & 3 but retains a higher U-factor for impact rated glazing. This is a needed change for a location such as Florida where impact glazing is required.

The modification raises the U-factor which makes it less restrictive in Zone 2 & 3 and will accommodate the impact rated glazing and increase the affordability while saving energy.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

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

Climate Zone	Fenestration U-Factor	Skylight[b] U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement[c] Wall R-Value	Slab[d] R-Value & Depth	Crawl Space[c] Wall R-Value
1	1.20	0.75	0.40	30	13	3	13	0	0	0
2	0.65 [h]	0.75	0.40	30	13	4	13	0	0	0
3	~~0.55~~ 0.50 [h]	0.65	0.40	30	13	5	19	0	0	5/13
4 except Marine	~~0.40~~ 0.35	0.60	NR	38	13	5	19	10 / 13	10, 2 ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10 / 13	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	15 / 21	15, 4 ft	10 / 13

a through g (No change)
h. For impact rated ~~resistant~~ fenestration complying with Section R301.2.1.2, the maximum U-factor shall be ~~1.20~~ 0.75 in Zone 2 and ~~0.70~~ 0.65 in Zone 3.

TABLE1102.1.3
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	0.65	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.55~~ 0.50	0.65	0.035	0.082	0.141	0.047	0.220	0.136
4 except Marine	~~0.40~~ 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	0.037	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	0.041	0.057

(Footnotes remain unchanged)

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC18 alignment: Different U-factors were approved in the IECC (which approved EC16) and IRC (which approved a modified EC18). Because no IRC version of EC16 exists, EC18 is used here to align the two codes. The same values should be approved in both codes.

EC18 content: There has been considerable discussion concerning the appropriate U-factors for fenestration in southern climates. This change represents a compromise between the southern U-factors approved in the IECC (in EC16) and the southern U-factors approved in the IRC. This change preserves the lowest U-factor approved by the IECC in zone 4, where U-factor is most important to energy efficiency due to higher heating loads. It also recognizes that U-factor has little impact in zone 1, where it is not cost-effective to require a low U-factor. Zones 2 and 3 represent a compromise between the values approved in the IECC and IRC.

Public Comment 2:

Ronald Majette, U.S. Department of Energy, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

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

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	~~0.65[h]~~ 0.50	0.75	0.40	30	13	4	13	0	0	0
3	~~0.55[h]~~ 0.40	0.65	0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through g. (No change to current text)
~~h. For impact resistant fenestration complying with Section R301.2.1.2, the maximum U-factor shall be 1.20 in zone 2 and 0.70 in zone 3.~~

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~~ 0.50	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.55~~ 0.40	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	0.060	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)

Commenter's Reason: The purpose of this proposal is to improve residential fenestration U-factor requirements in climate zones 2 and 3. This proposal would make the fenestration U-factor in climate zones 2 and 3 in the IRC consistent with the IECC as modified by approved proposal EC16-07/08.

Public Comment 3:

Chuck Murray, Washington State University Energy Program, representing Northwest Energy Code Group, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

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

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	~~1.2~~ 0.65	0.75	0.40	30	13	3	13	0	0	0
2	~~0.65[h]~~ 0.50	0.75	0.40	30	13	4	13	0	0	0
3	~~0.55[h]~~ 0.40	0.65	0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	~~0.40~~ 0.35	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through g. (No change to current text)
~~h. For impact resistant fenestration complying with Section R301.2.1.2, the maximum U-factor shall be 1.20 in zone 2 and 0.70 in zone 3.~~

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~~ 0.65	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	~~0.65~~ 0.50	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.55~~ 0.40	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	~~0.40~~ 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)

Commenter's Reason: The IECC committee modified the u-factors for climate zone 1-4 in EC16. We have copied those values into the modification to EC 18 to provide consistency between the IECC and IRC. EC16 was not submitted with a companion IRC submittal.

The IECC committee reason statement for EC16 includes the following statement. *"The committee approved this code change proposal recognizing the need for aggressive reductions in energy consumption and recognizing that a sufficient amount of products are readily available to fill this need."*

Public Comment 4:

Julie Ruth, JRuth Code Consulting, representing AAMA, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

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

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	0.65[h]	0.75	0.40	30	13	4	13	0	0	0
3	~~0.55[h]~~ 0.50[h]	0.65	0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	~~0.40~~ 0.38	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through g. (No change to current text)

h. For impact resistant fenestration complying with Section R301.2.1.2, the maximum U-factor shall be ~~1.20~~ 0.75 in climate zone 2 and ~~0.70~~ 0.65 in climate zone 3.

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[b]	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	~~0.55~~ 0.50[b]	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	~~0.40~~ 0.38	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

a. (No change)

b. For impact resistant fenestration complying with Section R301.2.1.2 of the *International Residential Code*, the maximum U-factor shall be 0.75 in Climate Zone 2 and 0.65 in Climate Zone 3.

Commenter's Reason: During the ICC Code Development Hearings in Palm Springs, different action was taken by the IRC Building and Energy Committee, and the IECC committee, in regards to the maximum U-factor requirements for residential fenestration in climate zones 1 – 4. The potential result is maximum U-factors that vary widely between the two codes. If these values are upheld as approved by the committees during the Code Development Hearings, a jurisdiction that adopts both the 2009 IRC and 2009 IECC will have conflicting provisions in place in regards to fenestration in one and two family dwellings and low rise multifamily buildings.

This Public Comment seeks to find some middle ground between the two sets of values that were approved. In some cases, a compromise value between the more stringent value approved by the IECC committee and the less stringent value approved by the IRC committee is proposed. In other cases the less stringent value approved by the IRC committee is proposed. Similarly, a compromise regarding maximum U-factors for impact resistant fenestration is offered.

Specifically, in climate zone 3 a compromise U-factor of 0.50 is proposed. This is less stringent than the 0.40 approved by the IECC committee, and more stringent than the 0.55 approved by the IRC B&E committee. Similarly, a compromise U-factor of 0.38 is proposed for climate zone 4.

On the other hand, the less stringent U-factor of 1.20 for climate zone 1 and 0.65 for climate zone 2, that were approved by the IRC committee, are proposed. Climate zones 1 and 2 are cooling dominated zones and the current SHGC of 0.40 (and proposed revisions to SHGC) will mandate a fairly energy efficient glass package in these areas, regardless of the maximum U-factor permitted.

With regards to impact resistant fenestration, a revision to footnote h that was approved by the IRC B&E committee is proposed to retain the current maximum U-factors for impact resistant fenestration. This revised footnote is proposed for both the IRC and IECC. The proposed revision to footnote h makes its more stringent than what was approved by the IRC B&E committee. Adding the footnote to the IECC would reduce its stringency.

At the present time some products which meet both the maximum U-factor and SHGC in the IECC, and the impact resistant opening requirements of Section 1609.1.2 of the 2006 International Building Code, do exist. The manufacturers of such products have had to put them through two different programs – one for labeling in accordance with NFRC 100 and 200 for the U-factor and SHGC of the product, and a separate one to demonstrate compliance with the impact resistant fenestration requirements. If the maximum U-factor for these products is changed, the manufacturers will need to design new products, possibly with different glass packages, to meet these requirements, and then have those new products evaluated through these two programs. While it is possible that some manufacturers could have some products available that have met this multi layer set of requirements by the implementation of the 2009 International Codes, it is doubtful any of them will be able to provide a line of products as full as what is currently available within that time frame. This could severely limit the products available to the consumer, designer and homebuilder.

These revisions would provide consistent energy savings in both the IRC and IECC. The proposed U-factor of 0.50 in climate zone 3 and 0.65 in climate zone 2 would result in greater than 10% reduction in maximum U-factor in these cooling dominated climate zones, for those products that are not required to be impact resistant. The reduction of maximum U-factor in climate zone 4 from 0.40 to 0.38 would provide a 5% reduction in maximum U-factor in a climate zone where heating load is a more significant factor. The proposed footnote would permit impact resistant fenestration that complies with the current IECC and IRC limits for U-factor and SHGC to continue to be used. Further, this is a reasonable reduction in U-factor in these climate zones and would appear to be a cost effective way to achieve significant energy savings.

Public Comment 5:

Michael D. Fischer, The Kellen Company, representing Window and Door Manufacturers Association, request Disapproval.

Commenter's Reason: The IRC B/E Committee approved EC 18, stating that the exemption allowing impact resistant product to have less restrictive U-Factors in Florida is a necessity. The IECC Committee disagreed and found 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 hurricane prone regions as far north as climate zones 4 and 5, and there are products available and sold today to meet the U-factors in those areas of 0.40 and 0.35. An exemption in climate zones 2 and 3 that runs through the coastline of North Carolina is unnecessary, since a wide range of energy efficient and impact resistant products are available nationwide. There is no justification for this reduction in stringency.

Final Action: AS AM AMPC____ D

EC21-07/08, Part I
Table 402.1.1, Table 402.1.3

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART I – IECC

Revise tables as follows:

TABLE 402.1.1 (Supp)
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[h]	Floor R-Value	Basement[c] Wall R-Value	Slab[d] R-Value & Depth	Crawl Space[c] Wall R-Value
1	1.20	0.75	0.37	30	13	3 / 4	13	0	0	0
2	0.75	0.75	0.37	30	13	4 / 6	13	0	0	0
3	0.65	0.65	0.40[e]	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	~~0.35~~ 0.32 or 0.35 if SHGC ≥ 0.45[i]	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	~~0.35~~ 0.32 or 0.35 if SHGC ≥ 0.45[i]	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a. through h. (No change to current text)

i. SHGC shall be NFRC tested value.

TABLE 402.1.3 (Supp)
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	0.060	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 would lower the U-factor for windows in the northern climate zones. Two trends make more energy efficient windows cost effective in northern windows-- the increased range of window energy efficiency options available at a reasonable cost and the increased price of the natural gas used for heating.

The US windows market is moving towards a "northern window" and "southern window", both defined by their U-factor and SHGC. Heating dominates in the north. Cooling dominates in the south. Northern window performance is dominated by the need for a low U-factor. This proposal lowers the northern window U-factor requirement to 0.32, which is readily available in the current market. Southern windows also do better with a low U-factor, but the low of a U-factor is not justified in the southern zones.

The SHGC (solar heat gain coefficient) is a measure of the solar heating transmitted through a window. The impact of window SHGC literally varies with the season. A lower SHGC means lower solar heat gain, consequently lower cooling loads and peak cooling loads-- therefore a low SHGC is beneficial during the cooling season. On the heating side, a higher SHGC means higher solar heat gain, consequently lower heating loads due to the free solar heating-- therefore a higher SHGC is beneficial in heating seasons. Wherever one season dominates in a region, that season determines the preferable SHGC for that region. Therefore the "southern window", where the cooling season dominates, benefits from a low SHGC. Likewise the "northern window", where the heating season dominates, benefits from a high SHGC.

Typically windows with a U-factor of 0.32 or less have an SHGC of 0.35 or less. Some types of low-E windows tend to have higher SHGC, typically with slightly higher U-factors. This proposal recognizes a limited U-factor "tradeoff" to achieve a higher SHGC and greater free solar heating, based on work done at the Lawrence Berkley National Laboratory. The Efficient Windows Collaborative web site also shows the value of higher SHGC in the northern climates.

Window costs are difficult to determine. There are a few "break points" that produce price jumps; for example the transition from double to triple pane, or the transition from clear glass to low-E glass. A reasonable estimate for the cost of decreased window U-factor, provided none of these "break points" is crossed, comes from a study done in the Pacific Northwest. The study estimated a cost of $\$0.08/\text{ft}^2$ per 0.01 U-factor improvement (Quantec 2002). Using this estimate, this proposal would increase costs by $\$0.24/\text{ft}^2$, or about $\$72$ for a residence with 300 ft^2 of window. The same study predicted that the incremental cost would fall with time, so current costs are probably slightly lower.

Another constraint on residential windows, is the need to be relatively clear. Tinted and reflective windows are not suitable for the residential market. Putting all these constraints together, double pane, not tinted, not reflective, U-factor <= 0.32 (or <=0.35 if SHGC >= 0.45) defines a group of windows. An examination of the NFRC data for the "horizontal slider" window type showed over 10,000 entries for windows meeting this criteria. Therefore, these windows are available.

Simple payback times were estimated based on examining the Efficient Windows Collaborative web site's projections of window costs for the cities in the northern climates and comparing window choices with higher and lower U-factors. Simple paybacks for a 0.32 U-factor window were about 3 to 6 years for the cities in zones 6, 7 and 8. Therefore this proposal is cost-effective for the northern zones.

Bibliography:
Dariush Arasteh, Robin Mitchell, and Steve Selkowitz. August 1, 2003. *Performance Based Ratings for the ENERGY STAR® Windows Program: A discussion of issues and future possibilities.* Lawrence Berkeley National Laboratory. Berkeley, California.

Efficient Windows Collaborative. http://www.efficientwindows.org/
Information on individual cities is at http://www.efficientwindows.org/selection.cfm and http://www.efficientwindows.org/factsheets.cfm

Quantec. January 2002. *Market Progress Evaluation Report for the Energy Star Windows Project.* Northwest Energy Efficiency Alliance, Portland, Oregon.

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

PART I – IECC
Committee Action: **Disapproved**

Committee Reason: Given that the advantages for SHGC gains depends upon the direction of the wall in which the windows are installed, the committee believed that this provision was an oversimplification of the value of the trade-off. This would be better dealt with in performance design.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

William E. Koffel, P.E., Koffel Associates, Inc., representing Glazing Industry Code Committee, requests Approval as Submitted.

Commenter's Reason: This proposal is an important component for increasing stringency of the energy codes, and is the *only* proposal that would increase energy efficiency of windows in the north. It is simple, yet also provides flexibility for builders and manufacturers. Products are readily available to meet this requirement with any of the major low-e glass technologies, while still promoting the use of the right glass in the right place. In this case, energy may be saved by either meeting the lower U-factor, or by using the appropriate glazing to capture free solar energy and reduce heating demand in the north. 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 …

Public Comment 2:

Thomas S. Zaremba and Tom Mewbourne, Pilkington North America, Inc., representing AGC Flatglass North America, Inc., requests Approval as Submitted.

Commenter's Reason: EC21-07/08 should be approved for a variety of reasons:

1. EC21-07/08 proposes two, alternate paths of compliance. The first path lowers the U-factor in zones 6 through 8 from 0.35 to 0.32 (First Path) which will save energy.
2. The second path provides a very simple, alternative where a U-factor of 0.35 can be used if the window's SHGC is ≥ 0.45 (Second Path). The Second Path also saves energy by maximizing the benefits of the free solar energy in the winter in these northern climate zones.
3. Alternate paths are important because, as energy stringency increases, alternate paths increase the number of products available to meet the prescriptive provisions of the code. This, in turn, results in greater competition and lowers the price consumers will have to pay for complying products.

4. The IECC Committee's recommendation of disapproval is not well founded.

First, the current code **ALLOWS** the use of **ANY SHGC** glass in zones 4 through 8. Hence, the current code **ALREADY ALLOWS** the use of the glass proposed in the Second Path. Second, the Committee's concern over orientation is, at best, exaggerated. In that regard, assuming a 4-sided house, in the winter, windows facing east, west and south all enjoy the benefits of free, solar heating. As heating costs rise, this means reduced heating loads and lower utility bills in the north. In the summertime, only the west face is susceptible to the potential for overheating from an afternoon sun. However, this concern should not be exaggerated. Overheating will only occur a small fraction of the time and can easily be controlled. First, overheating only occurs if meteorological conditions (ie., clouds) don't block the sun. Likewise, it only happens where west facing windows are not shaded by trees, awnings, screens or any other objects. Even where there are no clouds or shading of any kind, overheating is easily controlled either by opening the west facing windows or simply closing the drapes.

The Second Path provided by EC21 is already permitted by the current code and is the energy equivalent of the First Path. Adopting EC21 will encourage annual energy reductions by promoting the free use of the sun to reduce winter heating loads.

Public Comment 3:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	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	0.75	0.40	30	13	3/4	13	0	0	0
2	0.75	0.75	0.40	30	13	4/6	13	0	0	0
3	0.65	0.65	0.40[(e)]	30	13	5/8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[(g)]	13/17	30[(f)]	10 / 13	10, 2 ft	10 / 13
6	0.32 ~~or 0.35 if SHGC ≥ 0.45~~ [(i)]	0.60	NR	49	19 or 13+5[(g)]	15/19	30[(f)]	10 / 13	10, 4 ft	10 / 13
7 and 8	0.32 ~~or 0.35 if SHGC ≥ 0.45~~ [(i)]	0.60	NR	49	21	19/21	30[(f)]	10 / 13	10, 4 ft	10 / 13

Preceding footnotes unchanged
(i) Where no more than 110 ft^2 of glazed fenestration per dwelling unit is facing within 45 degrees of due west and the SHGC is ≥ 0.45, the maximum U-factor shall be 0.35. The SHGC shall be the NFRC tested value and shall not be a default value from Table N1101.5(3).

(Portions of proposal not shown remains unchanged)

Commenter's Reason: This proposal improves energy efficiency by requiring an improved U-factor for common fenestration products in climate zones 6 through 8. It will also encourage reductions in energy use by encouraging the use of higher SHGC (higher solar gain) fenestration in the heating dominated northern climates. High SHGC glass uses the free energy of the sun to reduce wintertime heating loads in the north.

This modification addresses the IECC committee's principal objection. In disapproving the original proposal, the IECC committee stated, "*given that the advantages for SHGC gains depends upon the direction of the wall in which the windows are installed, the committee believes that this provision was an oversimplification of the value of the trade-off*." The original EC21 proposal is modified here to limit the west-facing glazing to no more than 110 ft^2 for the high solar gain fenestration option;[1] approximately the area of two 7 by 8-ft sliding glass doors. The modification establishes a reasonable limit on west-facing glazing, which can cause an unwanted increase in summertime heating.

This code change encourages a higher SHGC in heating-dominated climates. Energy Star is likely to go further and actually require a higher SHGC.[2]

The IECC committee also stated, "*this would be better dealt with in performance design.*" It is true that the performance path can handle any arbitrary design; however, the prescriptive option exists to provide a simple compliance path for basic designs. One basic element of many energy-efficient designs in heating climates is high solar gain. This change adds a reasonable high solar gain glazing option for heating-dominated climates as part of the prescriptive path. This modification also moves the option into a footnote to make the table clearer.

This change would improve northern window energy efficiency. As noted in the original code change, this increased energy efficiency is cost-effective.

1 The 110 ft^2 limit was based on an analysis presented by Z. Todd Taylor, Pacific Northwest National Laboratory, at the July 2007 "Energy Codes 2007" conference in Pittsburgh, PA.
2 A draft of the new Energy Star requirements are in the 1/18/08 letter at
http://www.energystar.gov/index.cfm?c=archives.windows_criteria_amendment

Public Comment 4:

Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Bill Prindle, representing Energy Efficient Codes Coalition; Jeff Harris, representing the Alliance to Save Energy; Steven Rosenstock, representing Edison Electric Institute; Harry Misuriello, representing the American Council for Energy Efficient Economy, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENES-TRATION U-FACTOR	SKY-LIGHT U-FACTOR	GLAZED FENEST-RATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE[g]	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	0.37	30	13	3/4	13	0	0	0
2	0.75	0.75	0.37	30	13	4/6	13	0	0	0
3	0.65	0.65	0.40	30	13	5/8	19	0	0	5 / 13
4 except Marine	0.40	0.60	NR	38	13	5/10	19	10 / 13	10, 2ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5	13/17	30	10 / 13	10, 2ft	10 / 13
6	0.32 ~~or 0.35 if SHGC ≥ 0.45[i]~~	0.60	NR	49	19 or 13+5	15/19	30	10 / 13	10, 4ft	10 / 13
7 and 8	0.32 ~~or 0.35 if SHGC ≥ 0.45[i]~~	0.60	NR	49	21	19/21	30	10 / 13	10, 4ft	10 / 13

a. through h. (No change to current text)
~~i. SHGC shall be NFRC tested value.~~

(Portions of proposal not shown remain unchanged)

Commenter's Reason: This proposed modification corrects the major flaw in the original proposal while retaining the undisputed benefits of a reduced window U-factor in climate zones 6-8. The original proposal introduced a special limited exception for high solar gain window products in these northern climates; this concept has been consistently rejected in prior proposals for many years. These proposals have typically oversimplified the key differences between heating and cooling energy saved, and the proponents have not demonstrated that this tradeoff would actually save energy in homes with varying operational and design characteristics. Even though appended to a reduction in U-factors for fenestration in these climate zones, neither the *IECC* nor *IRC* Code Development Committees were able to find that the benefits from a lower U-factor outweighed the negative impact of the trade-off. As originally written, the proposal cannot guarantee any energy savings, since it does not recognize the orientation of the fenestration and ignores other important issues like comfort and peak demand.

This modification cures this problem and secures the benefit of lower U-factors across-the-board to save energy all-year-round by simply eliminating the trade-off exception while recognizing the necessary improvement in window performance for climates that range from 7,200 to more than 12,000 Heating Degree Days during the heating season. It also responds the *IECC* Code Development Committee's accurate reasoning that, "Given that the advantages for SHGC gains depends upon the direction of the wall in which the windows are installed, the Committee believes that this provision is an oversimplification of the value of the tradeoff. This would be better dealt with in performance design."

Support for Proposal As Modified.

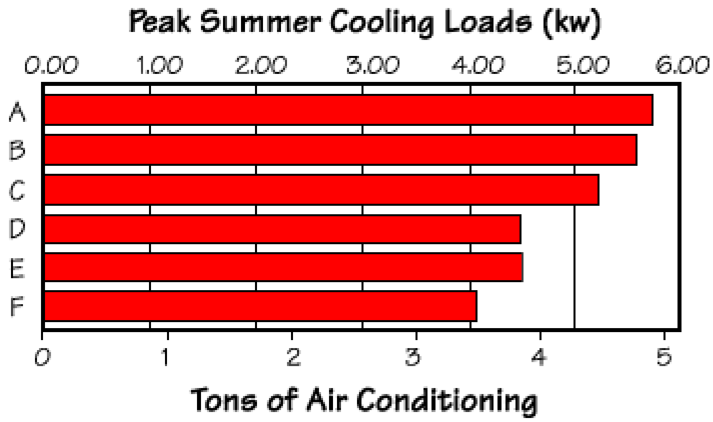
We support lowering the U-factor to 0.32 in zones 6-8 without any exceptions because this would result in a guaranteed increase of almost 10% in window insulating value (almost a 10% reduction in heat loss through these windows) in these cold climates and guaranteed energy savings year-round in every 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. 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 argon-fill, a fairly low cost option. While lowering the U-factor to 0.32 may be aggressive, 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.

Opposition to the Original EC21 with High SHGC Special Product Exception.

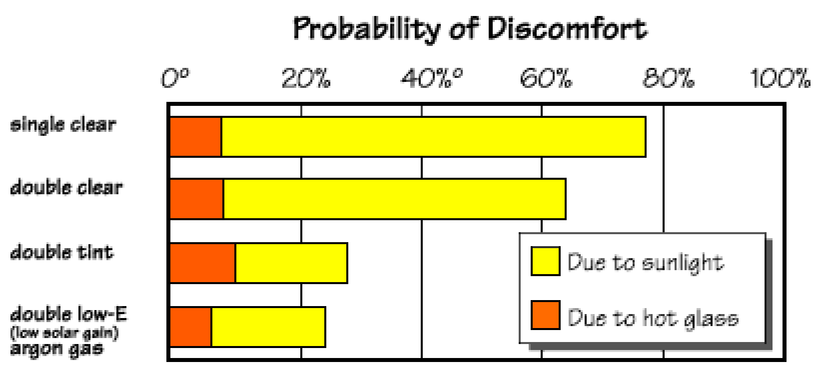
Regardless of the approach to the lower U-factor, we fundamentally disagree with the concept of creating a special exception that allows higher U-factors in windows with higher SHGC values. There is no valid evidence that a window with a minimum SHGC of 0.45 and a maximum U-factor of 0.35 would use equal to or less energy in most, much less all cases, regardless of orientation, in reasonably designed and operated houses, than a window with a 0.32 U-factor. Indeed, the risk is substantial that a higher SHGC would actually create occupant discomfort in the summer and increase summer energy use (where windows face west and south), especially during critical times of peak electric demand. Moreover, higher SHGCs could result in upsizing the air conditioning equipment by as much as an additional half-ton and increasing peak summer electric load per home by as much as half a kilowatt (0.5 kW). The *IECC* and *IRC* should not be weakened to make room for specific product exceptions.

1. **Promotion of Higher SHGCs Would Negatively Impact Electric Peak Demand and HVAC Sizing.** One of the most serious challenges facing the electric system is reliably meeting peak demand. Most utility systems in the US, including those across the northern part of the US, have peak demands that occur in the summer as a result of meeting residential and commercial air conditioning

loads. Peak demand growth requires utilities (and indirectly consumers) to construct and pay for expensive additional generating units to supply power for only a few hours per year. Increasing peak demand and summer HVAC sizing are unintended negative consequences that support rejection of an approach that promotes high solar gain. The following chart provided by Lawrence Berkeley National Laboratory (LBNL), which can be found on the Efficient Window Collaborative (EWC) website – www.efficientwindows.org), illustrates the peak demand and HVAC sizing issue by showing the potential peak demand impact from different window types. Window F is the low SHGC, low U-factor window while window E is a high SHGC, low U-factor window. As is readily apparent, promoting a higher SHGC would have a negative impact on electrical peak demand and equipment sizing.



2. **Promotion of Higher SHGCs Would Negatively Impact Summer Comfort.** As written, EC21 encourages the installation of high solar heat gain glazing, regardless of the orientation, by establishing an exception to the lower U-factor. High solar gain will lead to significant occupant discomfort in the summer, even in colder climates (while possibly impacting winter comfort during the daytime). As explained by the EWC, as more direct sunlight passes through glazing, the probability of occupant discomfort increases enormously. The following chart provided by LBNL on the EWC website shows that use of a double pane clear window (with no low SHGC treatment) makes it almost three times more likely that the occupant will be uncomfortable, as compared to a sensible low SHGC low-e window. When occupants are consistently uncomfortable, they are likely to lower thermostat set-points in the summer and produce energy losses instead of savings (it is also possible in some cases that some may also lower their thermostats during the daytime during the winter).



3. **Special Product Exception is Inconsistent with Proper Passive Solar Design and Improperly Ignores Window Orientation.** There is already room in the *IECC* and *IRC* for a passive-solar designed home. Builders have used the simulated performance alternative for years to take advantage of sophisticated designs that involve the correct windows for each orientation, thermal mass capable of absorbing heat gain, and overhangs to shield solar radiance when it is unneeded. With the performance path, builders can simulate the actual impact of specific window choices for specific orientations on a specific house. However, the oversimplified trade-off proposed by EC21 does not require any of the measures necessary for passive solar design, and as such, is not a reasonable addition to the simple prescriptive path. Recognizing that high SHGC windows are beneficial only for southern orientations with the proper design, the US Department of Energy's own recommendations for passive solar design recommend low SHGC windows (not high SHGC) for east and west oriented windows in northern cold climates. (http://www.eere.energy.gov/consumer). In addition, given the lack of solar gain on northern exposures during the winter in these climate zones, there is no basis for trading off the guaranteed benefits of a lower U-factor for no possible benefits from SHGC for north-facing glazing. As proposed, EC21 does not apply only to passive solar-designed homes, nor does it require proper orientation, but instead could apply to any home with any window orientation built in the northern portion of the country.
4. **Special Product Exception is Confusing and Inconsistent with Simplified Prescriptive Path.** This proposal, if adopted as written, will establish another confusing prescriptive alternative that runs counter to the simplified approach presently embodied in both the *IECC* and *IRC*. The changes adopted in the 2006 cycle as developed by the U.S. Department of Energy established a single, simple prescriptive path to encourage ease of compliance and enforcement, as well as economies of scale and more effective competition, resulting in lower overall building costs. Permitting such a specific prescriptive trade-off for one feature (high window SHGC) will encourage other interests to seek their own prescriptive trade-offs, ultimately resulting in over-complicating the recently simplified 2006 version of the code. This will only make the job of the code official more difficult without any offsetting benefits.
5. **Similar High SHGC Proposals Have Been Consistently Rejected by the ICC.** Similar proposals have been disapproved repeatedly by the *IECC* Committee in past code cycles for the same reasons (these proposals have also been rejected on public comment by the ICC membership for both the *IECC* and *IRC*). The *IECC* Development Committee stated in the last code cycle:

-EC44 and EC45-06/07: “Regarding the new concept of introducing minimum SHGC values in northern climates, there are still too many unknown variables to justify this. For one, the orientation of the building will affect how much savings is realized. For another, the change in temperatures over the past few years in northern climates makes it unclear whether we can move to the concept of using windows to save on heating values.”

-EC54-06/07: “The concept of heat gain windows in heating climates brings concerns as discussed in other code change proposals regarding the dependency on orientation or other factors that could limit solar access to truly gain the advantages from these windows. In addition, many of these climates now have longer cooling seasons due to change in human behavior as well as climate changes.

EC21, as written, suffers from the same fundamental flaws as these earlier proposals, and should be likewise rejected at the Final Action Hearing. EC21, as modified by this public comment, would eliminate these flaws while retaining an improvement in U-factor to save natural gas, heating oil, and electricity. It should be adopted only if it is modified as described above.

Final Action: AS AM AMPC____ D

EC21-07/08, Part II
Table N1102.1, Table N1102.1.2

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART II – IRC

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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	~~0.35~~ 0.32 or 0.35 if SHGC ≥ 0.45[h]	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	~~0.35~~ 0.32 or 0.35 if SHGC ≥ 0.45[h]	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through g. (No change to current text)
h. SHGC shall be NFRC tested value.

**TABLE N1102.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[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	0.060	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 would lower the U-factor for windows in the northern climate zones. Two trends make more energy efficient windows cost effective in northern windows-- the increased range of window energy efficiency options available at a reasonable cost and the increased price of the natural gas used for heating.

The US windows market is moving towards a "northern window" and "southern window", both defined by their U-factor and SHGC. Heating dominates in the north. Cooling dominates in the south. Northern window performance is dominated by the need for a low U-factor. This proposal lowers the northern window U-factor requirement to 0.32, which is readily available in the current market. Southern windows also do better with a low U-factor, but the low of a U-factor is not justified in the southern zones.

The SHGC (solar heat gain coefficient) is a measure of the solar heating transmitted through a window. The impact of window SHGC literally varies with the season. A lower SHGC means lower solar heat gain, consequently lower cooling loads and peak cooling loads-- therefore a low SHGC is beneficial during the cooling season. On the heating side, a higher SHGC means higher solar heat gain, consequently lower heating loads due to the free solar heating-- therefore a higher SHGC is beneficial in heating seasons. Wherever one season dominates in a region, that season determines the preferable SHGC for that region. Therefore the "southern window", where the cooling season dominates, benefits from a low SHGC. Likewise the "northern window", where the heating season dominates, benefits from a high SHGC.

Typically windows with a U-factor of 0.32 or less have an SHGC of 0.35 or less. Some types of low-E windows tend to have higher SHGC, typically with slightly higher U-factors. This proposal recognizes a limited U-factor "tradeoff" to achieve a higher SHGC and greater free solar heating, based on work done at the Lawrence Berkley National Laboratory. The Efficient Windows Collaborative web site also shows the value of higher SHGC in the northern climates.

Window costs are difficult to determine. There are a few "break points" that produce price jumps; for example the transition from double to triple pane, or the transition from clear glass to low-E glass. A reasonable estimate for the cost of decreased window U-factor, provided none of these "break points" is crossed, comes from a study done in the Pacific Northwest. The study estimated a cost of $0.08/ft^2 per 0.01 U-factor improvement (Quantec 2002). Using this estimate, this proposal would increase costs by $0.24/ft^2, or about $72 for a residence with 300 ft^2 of window. The same study predicted that the incremental cost would fall with time, so current costs are probably slightly lower.

Another constraint on residential windows, is the need to be relatively clear. Tinted and reflective windows are not suitable for the residential market. Putting all these constraints together, double pane, not tinted, not reflective, U-factor <= 0.32 (or <=0.35 if SHGC >= 0.45) defines a group of windows. An examination of the NFRC data for the "horizontal slider" window type showed over 10,000 entries for windows meeting this criteria. Therefore, these windows are available.

Simple payback times were estimated based on examining the Efficient Windows Collaborative web site's projections of window costs for the cities in the northern climates and comparing window choices with higher and lower U-factors. Simple paybacks for a 0.32 U-factor window were about 3 to 6 years for the cities in zones 6, 7 and 8. Therefore this proposal is cost-effective for the northern zones.

Bibliography:

Dariush Arasteh, Robin Mitchell, and Steve Selkowitz. August 1, 2003. *Performance Based Ratings for the ENERGY STAR® Windows Program: A discussion of issues and future possibilities.* Lawrence Berkeley National Laboratory. Berkeley, California.

Efficient Windows Collaborative. http://www.efficientwindows.org/
Information on individual cities is at http://www.efficientwindows.org/selection.cfm and http://www.efficientwindows.org/factsheets.cfm

Quantec. January 2002. *Market Progress Evaluation Report for the Energy Star Windows Project*. Northwest Energy Efficiency Alliance, Portland, Oregon.

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

PART II – IRC
Committee Action: Disapproved

Committee Reason: The reason and testimony did not give enough adequate data to justify changing what is currently in the code now.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

William E. Koffel, P.E., Koffel Associates, Inc., representing the Glazing Industry Code Committee, requests Approval as Submitted.

Commenter's Reason: This proposal is an important component for increasing stringency of the energy codes, and is the *only* proposal that would increase energy efficiency of windows in the north. It is simple, yet also provides flexibility for builders and manufacturers. Products are readily available to meet this requirement with any of the major low-e glass technologies, while still promoting the use of the right glass in the right place. In this case, energy may be saved by either meeting the lower U-factor, or by using the appropriate glazing to capture free solar energy and reduce heating demand in the north. 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 …

Public Comment 2:

Thomas S. Zaremba and Tom Mewbourne, Pilkington North America, Inc., representing AGC Flatglass North America, Inc., requests Approval as Submitted.

Commenter's Reason: EC21-07/08 should be approved for a variety of reasons:

1. EC21-07/08 proposes two, alternate paths of compliance. The first path lowers the U-factor in zones 6 through 8 from 0.35 to 0.32 (First Path) which will save energy.
2. The second path provides a very simple, alternative where a U-factor of 0.35 can be used if the window's SHGC is ≥ 0.45 (Second Path). The Second Path also saves energy by maximizing the benefits of the free solar energy in the winter in these northern climate zones.
3. Alternate paths are important because, as energy stringency increases, alternate paths increase the number of products available to meet the prescriptive provisions of the code. This, in turn, results in greater competition and lowers the price consumers will have to pay for complying products.
4. The IECC Committee's recommendation of disapproval is not well founded.

First, the current code **ALLOWS** the use of **ANY SHGC** glass in zones 4 through 8. Hence, the current code **ALREADY ALLOWS** the use of the glass proposed in the Second Path. Second, the Committee's concern over orientation is, at best, exaggerated. In that regard, assuming a 4-sided house, in the winter, windows facing east, west and south all enjoy the benefits of free, solar heating. As heating costs rise, this means reduced heating loads and lower utility bills in the north. In the summertime, only the west face is susceptible to the potential for overheating from an afternoon sun. However, this concern should not be exaggerated. Overheating will only occur a small fraction of the time and can easily be controlled. First, overheating only occurs if meteorological conditions (ie., clouds) don't block the sun. Likewise, it only happens where west facing windows are not shaded by trees, awnings, screens or any other objects. Even where there are no clouds or shading of any kind, overheating is easily controlled either by opening the west facing windows or simply closing the drapes.

The Second Path provided by EC21 is already permitted by the current code and is the energy equivalent of the First Path. Adopting EC21 will encourage annual energy reductions by promoting the free use of the sun to reduce winter heating loads.

Public Comment 3:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

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

Climate Zone	Fenestration U-Factor	Skylight[(b)] U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement[(c)] Wall R-Value	Slab[(d)] R-Value & Depth	Crawl Space[(c)] Wall R-Value
1	1.20	0.75	0.40	30	13	3	13	0	0	0
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3	0.65	0.65	0.40[(e)]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10 / 13	10, 2 ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[(g)]	13	30[(f)]	10 / 13	10, 2 ft	10 / 13
6	0.32 ~~or 0.35 if SHGC ≥ 0.45[(h)]~~	0.60	NR	49	19 or 13+5[(g)]	15	30[(f)]	10 / 13	10, 4 ft	10 / 13
7 and 8	0.32 ~~or 0.35 if SHGC ≥ 0.45[(h)]~~	0.60	NR	49	21	19	30[(f)]	10 / 13	10, 4 ft	10 / 13

Preceding footnotes unchanged
(h) Where no more than 110 ft^2 of glazed fenestration per dwelling unit is facing within 45 degrees of due west and the SHGC is ≥ 0.45, the maximum U-factor shall be 0.35. The SHGC shall be the NFRC tested value and shall not be a default value from Table N1101.5(3).

(Portion of proposal not shown remains unchanged)

Commenter's Reason: This proposal improves energy efficiency by requiring an improved U-factor for common fenestration products in climate zones 6 through 8. It will also encourage reductions in energy use by encouraging the use of higher SHGC (higher solar gain) fenestration in the heating dominated northern climates. High SHGC glass uses the free energy of the sun to reduce wintertime heating loads in the north.

This modification addresses the IECC committee's principal objection. In disapproving the original proposal, the IECC committee stated, "*given that the advantages for SHGC gains depends upon the direction of the wall in which the windows are installed, the committee believes that this provision was an oversimplification of the value of the trade-off*." The original EC21 proposal is modified here to limit the west-facing glazing to no more than 110 ft^2 for the high solar gain fenestration option;[1] approximately the area of two 7 by 8-ft sliding glass doors. The modification establishes a reasonable limit on west-facing glazing, which can cause an unwanted increase in summertime heating.

This code change encourages a higher SHGC in heating-dominated climates. Energy Star is likely to go further and actually require a higher SHGC.[2]

The IECC committee also stated, "*this would be better dealt with in performance design.*" It is true that the performance path can handle any arbitrary design; however, the prescriptive option exists to provide a simple compliance path for basic designs. One basic element of many energy-efficient designs in heating climates is high solar gain. This change adds a reasonable high solar gain glazing option for heating-dominated climates as part of the prescriptive path. This modification also moves the option into a footnote to make the table clearer.

This change would improve northern window energy efficiency. As noted in the original code change, this increased energy efficiency is cost-effective.

1 The 110 ft^2 limit was based on an analysis presented by Z. Todd Taylor, Pacific Northwest National Laboratory, at the July 2007 "Energy Codes 2007" conference in Pittsburgh, PA.
2 A draft of the new Energy Star requirements are in the 1/18/08 letter at
http://www.energystar.gov/index.cfm?c=archives.windows_criteria_amendment

Public Comment 4:

Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Bill Prindle, representing Energy Efficient Codes Coalition; Jeff Harris, representing the Alliance to Save Energy; Steven Rosenstock, representing Edison Electric Institute; Harry Misuriello, representing the American Council for Energy Efficient Economy, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT

CLIMATE ZONE	FENES-TRATION U-FACTOR	SKY-LIGHT U-FACTOR	GLAZED FENEST-RATION 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
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3	0.65	0.65	0.40	30	13	5/8	19	0	0	5 / 13
4 except Marine	0.40	0.60	NR	38	13	5/10	19	10 / 13	10, 2ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5	13/17	30	10 / 13	10, 2ft	10 / 13
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a through g (No change)
~~h. SHGC shall be NFRC tested value.~~

(Portion of proposal not shown remain unchanged)

Commenter's Reason: Commenter's Reason: This proposed modification corrects the major flaw in the original proposal while retaining the undisputed benefits of a reduced window U-factor in climate zones 6-8. The original proposal introduced a special limited exception for high solar gain window products in these northern climates; this concept has been consistently rejected in prior proposals for many years. These proposals have typically oversimplified the key differences between heating and cooling energy saved, and the proponents have not demonstrated that this tradeoff would actually save energy in homes with varying operational and design characteristics. Even though appended to a reduction in U-factors for fenestration in these climate zones, neither the *IECC* nor *IRC* Code Development Committees were able to find that the benefits from a lower U-factor outweighed the negative impact of the trade-off. As originally written, the proposal cannot guarantee any energy savings, since it does not recognize the orientation of the fenestration and ignores other important issues like comfort and peak demand.

This modification cures this problem and secures the benefit of lower U-factors across-the-board to save energy all-year-round by simply eliminating the trade-off exception while recognizing the necessary improvement in window performance for climates that range from 7,200 to more than 12,000 Heating Degree Days during the heating season. It also responds the *IECC* Code Development Committee's accurate reasoning that, "Given that the advantages for SHGC gains depends upon the direction of the wall in which the windows are installed, the Committee believes that this provision is an oversimplification of the value of the tradeoff. This would be better dealt with in performance design."

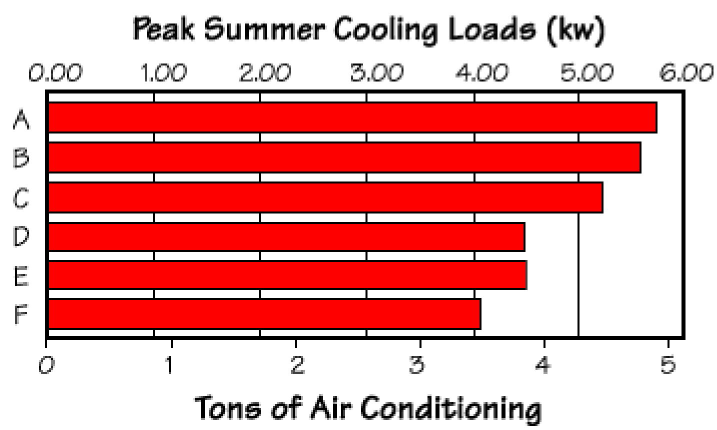
Support for Proposal As Modified.

We support lowering the U-factor to 0.32 in zones 6-8 without any exceptions because this 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 guaranteed 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. 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 argon-fill, a fairly low cost option. While lowering the U-factor to 0.32 may be aggressive, 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.

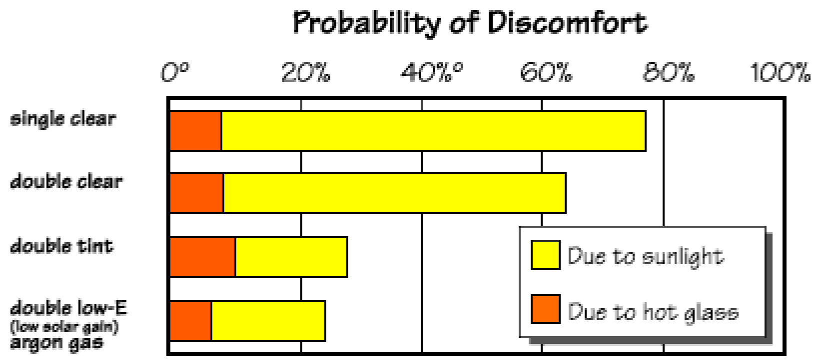
Opposition to the Original EC21 with High SHGC Special Product Exception.

Regardless of the approach to the lower U-factor, we fundamentally disagree with the concept of creating a special exception that allows higher U-factors in windows with higher SHGC values. There is no valid evidence that a window with a minimum SHGC of 0.45 and a maximum U-factor of 0.35 would use equal to or less energy in most, much less all cases, regardless of orientation, in reasonably designed and operated houses, than a window with a 0.32 U-factor. Indeed, the risk is substantial that a higher SHGC would actually create occupant discomfort in the summer and increase summer energy use (where windows face west and south), especially during critical times of peak electric demand. Moreover, higher SHGCs could result in upsizing the air conditioning equipment by as much as an additional half-ton and increasing peak summer electric load per home by as much as half a kilowatt (0.5 kW). The *IECC* and *IRC* should not be weakened to make room for specific product exceptions.

1. **Promotion of Higher SHGCs Would Negatively Impact Electric Peak Demand and HVAC Sizing.** One of the most serious challenges facing the electric system is reliably meeting peak demand. Most utility systems in the US, including those across the northern part of the US, have peak demands that occur in the summer as a result of meeting residential and commercial air conditioning loads. Peak demand growth requires utilities (and indirectly consumers) to construct and pay for expensive additional generating units to supply power for only a few hours per year. Increasing peak demand and summer HVAC sizing are unintended negative consequences that support rejection of an approach that promotes high solar gain. The following chart provided by Lawrence Berkeley National Laboratory (LBNL), which can be found on the Efficient Window Collaborative (EWC) website – www.efficientwindows.org), illustrates the peak demand and HVAC sizing issue by showing the potential peak demand impact from different window types. Window F is the low SHGC, low U-factor window while window E is a high SHGC, low U-factor window. As is readily apparent, promoting a higher SHGC would have a negative impact on electrical peak demand and equipment sizing.



2. **Promotion of Higher SHGCs Would Negatively Impact Summer Comfort.** As written, EC21 encourages the installation of high solar heat gain glazing, regardless of the orientation, by establishing an exception to the lower U-factor. High solar gain will lead to significant occupant discomfort in the summer, even in colder climates (while possibly impacting winter comfort during the daytime). As explained by the EWC, as more direct sunlight passes through glazing, the probability of occupant discomfort increases enormously. The following chart provided by LBNL on the EWC website shows that use of a double pane clear window (with no low SHGC treatment) makes it almost three times more likely that the occupant will be uncomfortable, as compared to a sensible low SHGC low-e window. When occupants are consistently uncomfortable, they are likely to lower thermostat set-points in the summer and produce energy losses instead of savings (it is also possible in some cases that some may also lower their thermostats during the daytime during the winter).



3. **Special Product Exception is Inconsistent with Proper Passive Solar Design and Improperly Ignores Window Orientation.** There is already room in the *IECC* and *IRC* for a passive-solar designed home. Builders have used the simulated performance alternative for years to take advantage of sophisticated designs that involve the correct windows for each orientation, thermal mass capable of absorbing heat gain, and overhangs to shield solar radiance when it is unneeded. With the performance path, builders can simulate the actual impact of specific window choices for specific orientations on a specific house. However, the oversimplified trade-off proposed by EC21 does not require any of the measures necessary for passive solar design, and as such, is not a reasonable addition to the simple prescriptive path. Recognizing that high SHGC windows are beneficial only for southern orientations with the proper design, the US Department of Energy's own recommendations for passive solar design recommend low SHGC windows (not high SHGC) for east and west oriented windows in northern cold climates. (http://www.eere.energy.gov/consumer). In addition, given the lack of solar gain on northern exposures during the winter in these climate zones, there is no basis for trading off the guaranteed benefits of a lower U-factor for no possible benefits from SHGC for north-facing glazing. As proposed, EC21 does not apply only to passive solar-designed homes, nor does it require proper orientation, but instead could apply to any home with any window orientation built in the northern portion of the country.
4. **Special Product Exception is Confusing and Inconsistent with Simplified Prescriptive Path.** This proposal, if adopted as written, will establish another confusing prescriptive alternative that runs counter to the simplified approach presently embodied in both the *IECC* and *IRC*. The changes adopted in the 2006 cycle as developed by the U.S. Department of Energy established a single, simple prescriptive path to encourage ease of compliance and enforcement, as well as economies of scale and more effective competition, resulting in lower overall building costs. Permitting such a specific prescriptive trade-off for one feature (high window SHGC) will encourage other interests to seek their own prescriptive trade-offs, ultimately resulting in over-complicating the recently simplified 2006 version of the code. This will only make the job of the code official more difficult without any offsetting benefits.
5. **Similar High SHGC Proposals Have Been Consistently Rejected by the ICC.** Similar proposals have been disapproved repeatedly by the *IECC* Committee in past code cycles for the same reasons (these proposals have also been rejected on public comment by the ICC membership for both the *IECC* and *IRC*). The *IECC* Development Committee stated in the last code cycle:
   -EC44 and EC45-06/07: "Regarding the new concept of introducing minimum SHGC values in northern climates, there are still too many unknown variables to justify this. For one, the orientation of the building will affect how much savings is realized. For another, the change in temperatures over the past few years in northern climates makes it unclear whether we can move to the concept of using windows to save on heating values."

   -EC54-06/07: "The concept of heat gain windows in heating climates brings concerns as discussed in other code change proposals regarding the dependency on orientation or other factors that could limit solar access to truly gain the advantages from these windows. In addition, many of these climates now have longer cooling seasons due to change in human behavior as well as climate changes.

EC21, as written, suffers from the same fundamental flaws as these earlier proposals, and should be likewise rejected at the Final Action Hearing. EC21, as modified by this public comment, would eliminate these flaws while retaining an improvement in U-factor to save natural gas, heating oil, and electricity. It should be adopted only if it is modified as described above.

Final Action: AS AM AMPC____ D

EC22-07/08, Part I
Table 402.1.1

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART I – IECC

Revise tables as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	~~0.37~~ <u>0.30</u>[i]	30	13	3 / 4	13	0	0	0
2	0.75	0.75	~~0.37~~ <u>0.30</u>[i]	30	13	4 / 6	13	0	0	0
3	0.65	0.65	~~0.40[e]~~ <u>0.30</u>[i]	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a. through h. (No change to current text)
<u>i. For impact rated glazing the maximum SHGC shall be 0.40</u>

Reason: Low SHGC windows reduce cooling energy use and increase heating energy use. Climate zones 1, 2 and 3 are predominately cooling dominated, thus low SHGC windows offer an energy savings. Glass is available with a variety of residential low-E coatings, including several products at or below 0.30 SHGC and some products with an SHGC as low as 0.25.

Most energy-saving options come at an increased cost but manufacturer-applied low-E coatings are different. The inherent cost difference for the various available low-E options is small, provided the glass with that coating is produced in large commercially viable quantities. With this code change, large quantities of low-SHGC windows would be required for climate zones 1, 2 and 3.

Small commercial buildings often use "residential-style" windows, made by the same companies that manufacture residential windows and requiring SHGCs below 0.30. Between the existing commercial requirement and this new residential requirement, a large market will be created for low SHGC windows. Therefore, these windows will be available for essentially no incremental cost. Additionally, because low SHGC reduces peak load sizes, there will be a small reduction in the required cooling capacity, which is also a possible first-cost savings.

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

PART I – IECC
Committee Action: **Disapproved**

Committee Reason: In anticipation of consideration of more aggressive values in EC24-07/08 and EC26-07/08.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.1 (Supp)
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[h]	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[i]~~ 0.35[i]	30	13	3 / 4	13	0	0	0
2	0.75	0.75	~~0.30[i]~~ 0.35[i]	30	13	4 / 6	13	0	0	0
3	0.65	0.65	~~0.30[i]~~ 0.35[i]	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a. through h. (No change to current text)

i. For impact rated ~~glazing~~ fenestration complying with Section R301.2.1.2 or Section 1609.1.2 of the *International Building Code*, the maximum SHGC shall be 0.40.

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC22 / EC26 Alignment: Both changes deal with SHGC (solar heat gain coefficient) in the south. EC26 was Approved as Modified in the IECC. EC22 was Disapproved in both the IRC and IECC. A modified EC22 offers an option to align both codes.

EC22 / EC26 Content: Reduced SHGC is an important way to reduce cooling in the south. The IECC was approved with more aggressive SHGC requirement, but the IRC committee did not approve any changes. This change represents a compromise between the values approved in the IECC and the existing value that the IRC committee desired. An SHGC of 0.35 is considered reasonable by most of the window/glass industry.

Public Comment 2:

Julie Ruth, JRuth Code Consulting, representing AAMA, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.1 (Supp)
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[h]	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[i]~~ 0.35[i]	30	13	3 / 4	13	0	0	0
2	0.75	0.75	~~0.30[i]~~ 0.35[i]	30	13	4 / 6	13	0	0	0
3	0.65	0.65	~~0.30[i]~~ 0.35[i]	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a. through h. (No change to current text)

i. ~~For impact rated glazing the maximum SHGC shall be 0.40.~~ For impact resistant fenestration complying with Section 1609.1.2 of the *International Building Code*, the maximum SHGC shall be 0.40 in climate Zones 1 to 3.

Commenter's Reason: The action taken in Palm Springs by the IECC committee effectively lowered the maximum SHGC for glazed fenestration in residential construction in Climate Zones 1-3 to 0.30. The IRC Building and Energy Committee did not approve any changes to the maximum SHGC for these products and choose instead to leave it at its current value of 0.40.

Although lowering the maximum SHGC would appear to always be an energy efficient move in cooling dominated climates, in actuality a tradeoff occurs between the energy savings achieved through reduced solar heat gain, and the energy costs due to reduced visible light transmittance through the product. As a general rule, the lower the SHGC of the window, the lower its Visible Light Transmittance. Windows with a SHGC below 0.30 will generally permit about 50% of the available visible light to pass through the product. As the amount of visible light transmitted is reduced, more glazing is needed to provide adequate natural lighting to the building, as perceived by the homeowner or consumer. As designers or home builders begin to respond to this situation, the net result could actually be more glazing in the building envelop, with an even lower average U-factor for the home, a greater lighting load, and a solar heat gain comparable or greater then what would have occurred had the maximum SHGC not been reduced to 0.30.

Reducing the maximum SHGC to 0.30 in climate zones 1-3 is unduly harsh, may not be cost effective and could severely limit short term product availability. At the present time products which meet the maximum U-factor and SHGC in the IECC and IRC, and the impact resistant opening requirements of Section 1609.1.2 of the 2006 International Building Code and Section R301.2.1.2 of the 2006 International Residential Code do exist, but the manufacturers of such products have had to put their design through two different programs – one for labeling in accordance with NFRC 100 and 200 for the U-factor and SHGC of the product, and a separate one to demonstrate compliance with the impact resistant fenestration requirements. If the maximum SHGC for these products is changed, the manufacturers will need to design new products, possibly with different glass packages, to meet these requirements, and then have those new products evaluated through these two programs. While it is possible that some manufacturers could have some products available that have met this multi layer set of requirements by the implementation of the 2009 International Codes, it is doubtful any of them will be able to provide a line of products as full as what is currently available within that time frame. This could severely limit the products available to the consumer, designer and homebuilder.

Proposed footnote i would permit impact resistant fenestration that complies with the current IECC limits for SHGC to continue to be used.

Reducing the SHGC from 0.40 to 0.35 in both the IRC and IECC is a reasonable and more cost effective compromise that provides a 12.5% reduction in the maximum SHGC permitted, while permitting some level of visible light transmittance through the glazing.

We urge the ICC membership to approve both Parts I & II of EC22 with the modifications offered.

Final Action: AS AM AMPC____ D

EC22-07/08, Part II

Table N1102.1

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART II – IRC

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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	~~0.40~~ 0.30[h]	30	13	3	13	0	0	0
2	0.75	0.75	~~0.40~~ 0.30[h]	30	13	4	13	0	0	0
3	0.65	0.65	~~0.40[e]~~ 0.30[h]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through g. (No change to current text)

h. For impact rated glazing the maximum SHGC shall be 0.40.

Reason: Low SHGC windows reduce cooling energy use and increase heating energy use. Climate zones 1, 2 and 3 are predominately cooling dominated, thus low SHGC windows offer an energy savings. Glass is available with a variety of residential low-E coatings, including several products at or below 0.30 SHGC and some products with an SHGC as low as 0.25.

Most energy-saving options come at an increased cost but manufacturer-applied low-E coatings are different. The inherent cost difference for the various available low-E options is small, provided the glass with that coating is produced in large commercially viable quantities. With this code change, large quantities of low-SHGC windows would be required for climate zones 1, 2 and 3.

Small commercial buildings often use "residential-style" windows, made by the same companies that manufacture residential windows and requiring SHGCs below 0.30. Between the existing commercial requirement and this new residential requirement, a large market will be created for low SHGC windows. Therefore, these windows will be available for essentially no incremental cost. Additionally, because low SHGC reduces peak load sizes, there will be a small reduction in the required cooling capacity, which is also a possible first-cost savings.

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

PART II – IRC
Committee Action: Disapproved

Committee Reason: There was not enough technical data presented to justify changing the SHGC in zone 1, 2 & 3 to 0.30. Also, this may limit the availability of aluminum and vinyl sashes in these zones.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

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

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[h]	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[h]~~ 0.35[h]	30	13	3	13	0	0	0
2	0.75	0.75	~~0.30[h]~~ 0.35[h]	30	13	4	13	0	0	0
3	0.65	0.65	~~0.30[h]~~ 0.35[h]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through g. (No change to current text)

h. For impact rated ~~glazing~~ fenestration complying with Section R301.2.1.2 or Section 1609.1.2 of the *International Building Code*, the maximum SHGC shall be 0.40.

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC22 / EC26 Alignment: Both changes deal with SHGC (solar heat gain coefficient) in the south. EC26 was Approved as Modified in the IECC. EC22 was Disapproved in both the IRC and IECC. A modified EC22 offers an option to align both codes.

EC22 / EC26 Content: Reduced SHGC is an important way to reduce cooling in the south. The IECC was approved with more aggressive SHGC requirement, but the IRC committee did not approve any changes. This change represents a compromise between the values approved in the IECC and the existing value that the IRC committee desired. An SHGC of 0.35 is considered reasonable by most of the window/glass industry.

Public Comment 2:

Julie Ruth, JRuth Code Consulting, representing AAMA, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

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

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[h]	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[h]~~ 0.35[h]	30	13	3	13	0	0	0
2	0.75	0.75	~~0.30[h]~~ 0.35[h]	30	13	4	13	0	0	0
3	0.65	0.65	~~0.30[h]~~ 0.35[h]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through g. (No change to current text)
h. ~~For impact rated glazing the maximum SHGC shall be 0.40.~~ <u>For impact resistant fenestration complying with Section R301.2.1.2 of the *International Residential Code*, the maximum SHGC shall be 0.40.</u>

Commenter's Reason: The action taken in Palm Springs by the IECC committee effectively lowered the maximum SHGC for glazed fenestration in residential construction in Climate Zones 1-3 to 0.30. The IRC Building and Energy Committee did not approve any changes to the maximum SHGC for these products and choose instead to leave it at its current value of 0.40.

Although lowering the maximum SHGC would appear to always be an energy efficient move in cooling dominated climates, in actuality a tradeoff occurs between the energy savings achieved through reduced solar heat gain, and the energy costs due to reduced visible light transmittance through the product. As a general rule, the lower the SHGC of the window, the lower its Visible Light Transmittance. Windows with a SHGC below 0.30 will generally permit about 50% of the available visible light to pass through the product. As the amount of visible light transmitted is reduced, more glazing is needed to provide adequate natural lighting to the building, as perceived by the homeowner or consumer. As designers or home builders begin to respond to this situation, the net result could actually be more glazing in the building envelop, with an even lower average U-factor for the home, a greater lighting load, and a solar heat gain comparable or greater then what would have occurred had the maximum SHGC not been reduced to 0.30.

Reducing the maximum SHGC to 0.30 in climate zones 1-3 is unduly harsh, may not be cost effective and could severely limit short term product availability. At the present time products which meet the maximum U-factor and SHGC in the IECC and IRC, and the impact resistant opening requirements of Section 1609.1.2 of the 2006 International Building Code and Section R301.2.1.2 of the 2006 International Residential Code do exist, but the manufacturers of such products have had to put their design through two different programs – one for labeling in accordance with NFRC 100 and 200 for the U-factor and SHGC of the product, and a separate one to demonstrate compliance with the impact resistant fenestration requirements. If the maximum SHGC for these products is changed, the manufacturers will need to design new products, possibly with different glass packages, to meet these requirements, and then have those new products evaluated through these two programs. While it is possible that some manufacturers could have some products available that have met this multi layer set of requirements by the implementation of the 2009 International Codes, it is doubtful any of them will be able to provide a line of products as full as what is currently available within that time frame. This could severely limit the products available to the consumer, designer and homebuilder.

Proposed footnote "i" (Part I) would permit impact resistant fenestration that complies with the current IECC limits for SHGC to continue to be used.

Reducing the SHGC from 0.40 to 0.35 in both the IRC and IECC is a reasonable and more cost effective compromise that provides a 12.5% reduction in the maximum SHGC permitted, while permitting some level of visible light transmittance through the glazing.

We urge the ICC membership to approve both Parts I & II of EC22 with the modifications offered.

Public Comment 3:

Ronald Majette, U.S. Department of Energy, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

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

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[h]	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~~[h]~~	30	13	3	13	0	0	0
2	0.75	0.75	0.30~~[h]~~	30	13	4	13	0	0	0
3	0.65	0.65	0.30~~[h]~~	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through g. (No change to current text)
~~h. For impact rated glazing the maximum SHGC shall be 0.40.~~

Commenter's Reason: The purpose of this proposal is to improve residential fenestration solar heat gain coefficient (SHGC) requirements in climate zones 1-3. This proposal would make the IRC consistent with the IECC, as modified by approved proposal EC26-07/08.

Final Action: AS AM AMPC____ D

EC25-07/08, Part II
IRC Table N1102.1

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

Proposed Change as Submitted:

Proponent: Vickie J. Lovell, InterCode Incorporated, representing the Association of Industrial Metallized Coaters and Laminators

PART II – IRC

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[h]	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	1.2	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through g. (No change to current text)

h. Fenestration with a projection factor of ≥ 0.50 shall comply with the following SHGC requirements: Climate Zone 1- NR; Climate Zone 2- NR; Climate Zone 3 - NR. Projection factor shall be determined using Figure 1102.1.

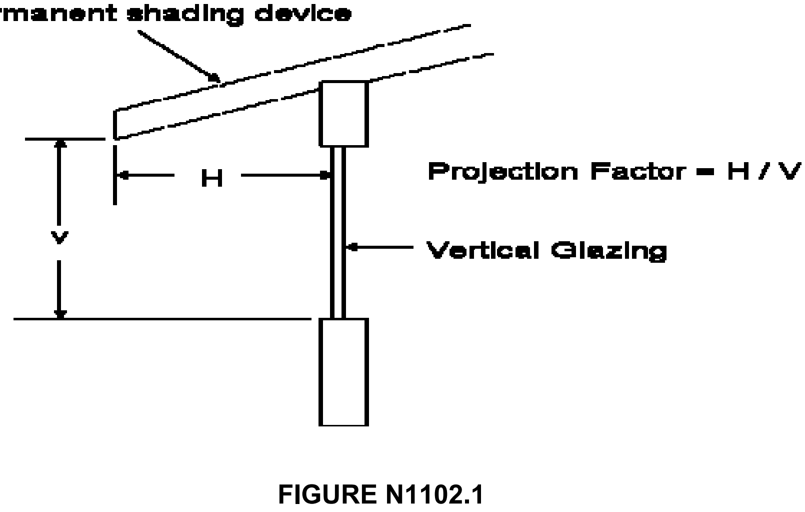


FIGURE N1102.1
PROJECTION FACTOR

Reason: This proposed code change allows for the use of overhangs to meet the solar heat gain coefficient requirements within the IRC. Overhangs are considered permanent exterior shading devices and are allowed to be used in IECC Chapter 5 as a prescriptive trade-off to meeting the SHGC requirements within the code. The calculation for determining the projection factor for overhangs has been in the 2000, 2003 and 2006 IECC for commercial buildings and has been proven to be very simple to calculate, fitting well into a prescriptive approach. The overhang credit is orientation independent to match the simplicity of the SHGC requirement in Table 402.1.1.

The projection factor of 0.5 will require at least a 3 ½ foot overhang on a 5 ft tall window and 4 foot overhang on a 6'8" patio door to allow a trade-off. The SHGC adjustment is based on Table 5.5.4.4.1 SHGC Multipliers for Permanent Projections of ASHRAE 90.1-2004, which is currently allowed by code. The SHGC adjustment was based on a weighted average SHGC Multiplier accounting for overhangs on the East, West and South orientation (75% of the weighting) and overhangs on the North orientation (25% of the weighting). Weighting the value accounts for a portion of the windows on the North orientation and therefore reduces the credit for an overhang.

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. The use of these shading devices were previously allowed under the 2003 IECC and is currently allowed as a trade-off under the commercial provisions of the IECC. Currently the only method available for accounting for the benefits for overhangs is by using a Section 404 Simulated Performance Alternative approach allowed under the IECC but not Chapter 11 of the IRC.

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

PART II – IRC
Committee Action: Approved as Modified

Modify proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]
(No change to proposed table)

a. through g. (No change to current text)

h. Fenestration with a projection factor of ≥ 0.50 shall be deemed to comply with the ~~following~~ SHGC requirements in Climate Zones 1 through 3. ~~: Climate Zone 1- NR; Climate Zone 2- NR; Climate Zone 3 - NR.~~ Projection factor shall be determined using Figure N1102.1.

(Portions of proposal not shown remain unchanged)

Committee Reason: This change will allow the user of the code another design option. This will permit modification and configuration of the structure to achieve a lower SHGC. The modification makes an editorial change. The proponent is urged to address the width of the overhang and additional clarification and bring back.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Vickie Lovell, InterCode Incorporated, representing AIMCAL, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]
(No change to proposed table)

a. through g. (No change to current text)

h. Fenestration with a projection factor of ≥ 0.50 shall be deemed to comply with the SHGC requirements in Climate Zones 1 through 3. Projection factor shall be determined using Figure N1102.1. The minimum horizontal distance of an overhang on each side of a window should be greater than or equal to the depth of the overhang (the distance from the surface of the window to the farthest most point of the projection.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: During testimony on this proposal, an opponent raised an issue of an appropriate width for an overhang over a window. The Committee recommended this proposal for approval, but also noted in the report of the Public Hearings that the proposal should address the width of the overhang and other questions raised during testimony.

Based on an internet search there is very little, if any, guidance on how far overhangs should extend horizontally on each side of the window. Several sources were reviewed including the California Energy Commission's Standard and Residential Design Manual. One resource provided the following guidance (which we have borrowed):

> "The horizontal distance of the overhang on each side of the window should be greater than or equal to the depth of the overhang (the distance from the surface of the window to the farthest most point of the overhang)".

So, a 3 ft. overhang should extend at least 3 feet horizontally on each side of the window. This would provide the same projection factor on the sides of the window as directly perpendicular to the window. Extending the overhang should provide similar shading on the window as the sun moves across the horizon.

In addition to the width of the overhang, it was also suggested during testimony that this shading option should be limited to only south facing fenestration. However, a simple method would need to be developed to make it easy to determine the SHGC when the exterior shading device is installed on a window. Orientation would also need to be addressed for defining South (e.g. +/- 45 degrees from true South).

Another option for further modifying EC25 would have been to only allow overhangs on the south facing glass AND create new code language that allows the use of external shading devices on the east and west glazing. External shading devices, e.g. shade screens, have proven to be very effective at shading east and west facing glazing. This proposal does not cover the use of side fins placed perpendicular to the window that are also effective at shading east and west facing glazing. These issues can still be considered by the designer.

All of these changes should be addressed in another cycle because they were beyond the scope of this original proposal.

As was stated during the public hearing, the intent of this proposal is not to require overhangs or any other specific method of providing shading. However, when the design incorporates architectural features or products that provide shading, it is only common sense that such benefits should be able to be taken into account in the energy calculations. This proposal addresses one of those shading options.

Public Comment 2:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of Part II. EC25 07/08 Part I was withdrawn by proponent

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 3:

Garrett A. Stone, Brickfield, Burchette, Ritts & Stone, P.C., representing Cardinal Glass Industries, requests Disapproval.

Commenter's Reason: EC25 should be disapproved. By establishing a complete exception to southern SHGC requirements for windows with shading devices that have projection factors of 0.50 or greater, this proposal adds substantial uncertainty and complexity to the *IRC* simplified prescriptive path. It will also make compliance and enforcement more difficult, and will discourage builders from using low SHGC windows -- a consistent, well-tested and much lower-cost means of reducing unwanted solar gain. Increased design flexibility should not come at the expense of energy efficiency. EC25 does not offer any energy savings and, in many cases, would lead to uncomfortable and inefficient homes with increased energy usage.

While EC25 was not reviewed by the *IECC* Development Committee, the Committee did reject two other proposals that would have created similar projection factor trade-offs (EC54 and EC55). Apparently recognizing that the *IECC* Committee would not recommend approval of the proposal, the proponent chose to withdraw EC25 from consideration for the *IECC*. It should also be noted that even the *IRC* Committee had concerns with whether the proposal was complete, stating: “The proponent is urged to address the width of the overhang and additional clarification and bring back.” EC 25 would create several problems if adopted into the *IRC*.

Adds Complexity. The proposal adds unnecessary complexity to the simplified *IRC* prescriptive compliance path by requiring calculation of a “projection factor” for every overhang for every window in the home in order to determine the applicable SHGC requirement. In order to calculate “projection factor,” individual measurements would be necessary for the length and width of each overhang, the width of the window (to ensure the overhang extended the full width of the window) and the distance from the overhang to the bottom of the window. After these calculations are made, only in cases where the projection factor was equal to or exceeded 0.50 would the window be exempt from the SHGC requirement. As a result, some windows might be exempt while others would not, leading to a significant risk that non-compliant windows would be used in some applications (since builders tend to order the same glass for every window or otherwise risk glass that looks different from window to window). In short, EC25 proposes to replace a simple compliance measure – a specific labeled NFRC value for SHGC (0.40) – with a complex measurement and calculation process and, at best, no benefit.

For a number of years the homebuilders argued that window area restrictions were too complex for and created compliance problems in a prescriptive path. After the 2000 *IECC*, the US Department of Energy joined in this refrain, arguing that such restrictions led to compliance and enforcement problems. Ultimately, DOE developed and proposed a revised *IECC* with no window area limits in either the prescriptive or UA compliance paths. The ICC adopted this approach; as a result, since the publication of the 2004 *IECC*, there has been no such requirement in the prescriptive path. Unfortunately, EC25 resurrects the problem of window area calculations, but in a far more complicated and problematic form.

Creates an Enforcement Nightmare. In addition to builder compliance problems, this proposal also creates enforcement challenges. The proposal does not specify the required width or shape of the overhang (referred to in the proposal as a “permanent shading device”). This failure is a crucial flaw (even the *IRC* Committee recognized this flaw, but nonetheless decided to recommend approval on the hope that the proponent would fix the problem in the future). Moreover, there is no guidance as to whether the overhang should be measured at its longest point or the average. What is a “permanent shading device?” Could a creative builder simply extend a 2 X 4 or a decorative trellis above a window and thus simply exempt the window from SHGC requirements (or something even more temporary)? Like the builder, the code official would be required to inspect and measure the different aspects of each shading device and window and calculate a projection factor to determine compliance; as noted above, the value would vary by the height of the window, the extension of the overhang and the width of the overhang. This would certainly cost substantial increased enforcement resources with zero benefit.

Builders and code officials can easily determine SHGC values with no measurements or calculations -- simply by looking at the NFRC label. There is no justification for adding a complex set of calculations to the prescriptive path to offer an option that is unlikely to be widely used and where there will be no efficiency benefits. According to the proponent, this proposal would require a 3½ foot overhang for a 5 foot tall window – this seems to be the wrong approach to promote, particularly in southern cooling climates subject to high wind issues. In the event that the builder wants credit for an overhang, the builder need only turn to the performance path to calculate the exact effect of each overhang depending on orientation and other factors. A projection factor exception is the wrong answer for the simplified prescriptive path in the *IRC*.

Provides No Energy Savings and Will Often Result In Greater Energy Use. The inherent assumption in the proposal is that the projection factor will provide the same energy savings as a low SHGC window. This is a flawed and incorrect assumption. At the outset, even the proponent does not claim any energy savings from the proposal. What the proponent ignores, however, is that it is very unlikely in most cases that a 0.50 projection factor will yield even the same benefits as a low-SHGC window. First, projection factor varies with orientation, season and time of day. Windows on the southern side of the home will have different shading values than windows on the northern side, yet the proposal assumes the same value for both sides. Second, this proposal will often lead to higher energy use because it will eliminate a reliable labeled SHGC value (a more sure thing) in favor of a projection factor that may be calculated incorrectly. Third, under the existing prescriptive path, if an overhang is installed, the homeowner receives the benefits of both the window SHGC and the overhang; however, this proposal would eliminate the additional SHGC benefit. Finally and most importantly, the typical window that meets the 0.40 SHGC prescriptive requirement has an SHGC and a U-factor considerably lower than the prescriptive requirement – these extra benefits would also be lost through the proposed exception. Nothing in the current *IECC* prohibits or discourages the use of overhangs, so there is no need to reduce efficiency to make a special exception for them.

Similar Proposals Have Been Consistently Rejected by the ICC. Similar proposals for both the *IECC* and *IRC* have been rejected for years by the ICC membership. In the case of EC25, the proponent withdrew the proposal from the *IECC* Committee consideration before it could be voted down. Similar proposals were, however, recommended for disapproval by the *IECC* Committee in Palm Springs (EC54 and EC55). The Committee stated on EC55: "The concept of shading as a trade-off for SHGC values needs to be dealt with on a case-by-case basis in the performance provisions. The variables that were not included were related to direction that the walls face. The concerns were that this proposal would allow a trade-off where the energy use was not actually equivalent."

Final Action: AS AM AMPC____ D

NOTE: PART I REPRODUCED FOR INFORMATIONAL PURPOSES ONLY – SEE ABOVE

EC25-07/08, PART I – IECC

Revise tables as follows:

TABLE 402.1.1 (Supp)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[i]	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	0.75	0.37	30	13	3 / 4	13	0	0	0
2	0.75	0.75	0.37	30	13	4 / 6	13	0	0	0
3	0.65	0.65	0.40[e]	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a. through h. (No change to current text)

i. Fenestration with a projection factor of ≥ 0.50 shall comply with the following SHGC requirements: Climate Zone 1- No Requirement; Climate Zone 2- No Requirement; Climate Zone 3 – No Requirement. Projection factor shall be calculated using Equation 5-1.

Reason (Part I): This proposed code change allows for the use of overhangs to meet the solar heat gain coefficient requirements within the IECC. Overhangs are considered permanent exterior shading devices and are allowed to be used in IECC Chapter 5 as a prescriptive trade-off to meeting the SHGC requirements within the code. The calculation for determining the projection factor for overhangs has been in the 2000, 2003 and 2006 IECC for commercial buildings and has been proven to be very simple to calculate, fitting well into a prescriptive approach. The overhang credit is orientation independent to match the simplicity of the SHGC requirement in Table 402.1.1.

The projection factor of 0.5 will require at least a 3 ½ foot overhang on a 5 ft tall window and 4 foot overhang on a 6'8" patio door to allow a trade-off. The SHGC adjustment is based on Table 5.5.4.4.1 SHGC Multipliers for Permanent Projections of ASHRAE 90.1-2004, which is currently allowed by code. The SHGC adjustment was based on a weighted average SHGC Multiplier accounting for overhangs on the East, West and South orientation (75% of the weighting) and overhangs on the North orientation (25% of the weighting). Weighting the value accounts for a portion of the windows on the North orientation and therefore reduces the credit for an overhang.

Allowing flexibility in meeting the solar heat gain coefficient through the use of proven shading alternatives will increase the usability of the prescriptive code for the building and design community while ensuring that the new fenestration is energy efficient. The IECC Code development committee disapproved a similar proposed code change for the 207 IECC Supplement stating that this trade-off is allowed under the performance approach. Unfortunately, very few areas in states that use the IECC, have the infrastructure in place, to support performance based modeling needed to perform a Section 404 performance based computer run. Owner builders and other building contractors that only have access to US DOEs' REScheck software, are limited in their ability to trade off the SHGC requirement and would be required to either purchase performance based software for approximately $277 (REM Design Software) or higher a consultant for an equivalent price to trade-off the SHGC requirement. Note that the use of these shading devices were previously allowed under the 2003 IECC and is currently allowed as a trade-off under the commercial provisions of the IECC.

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

PART I – IECC **Withdrawn by Proponent**

EC26-07/08

Table 402.1.1

Proposed Change as Submitted:

Proponent: Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI)

Revise table as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	~~0.37~~ 0.35	30	13	3 / 4	13	0	0	0
2	0.75	0.75	~~0.37~~ 0.35	30	13	4 / 6	13	0	0	0
3	0.65	0.65	~~0.40~~ 0.35[e]	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	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 0.35. A second, alternative proposal, with a more aggressive and stringent, but still cost-effective and realistic SHGC of 0.25, is also being submitted for consideration. Controlling window solar heat gain is enormously important to control home cooling loads.

The 2006 IECC prescriptive window SHGC requirements in climate zones 1-3 for residential are set at 0.40, which were originally established in the 1998 IECC. However, technology has continued to improve in this area. The need for and viability of lower SHGCs are already recognized in the 2006 IECC for commercial buildings, where the prescriptive values range from 0.25 to 0.40 depending on projection factor (0.25 with no overhang).

In the last code cycle, the values for climate zones 1–2 for residential windows were debated and the IECC adopted a slight reduction to 0.37. This proposal suggests a further improvement to 0.35 and extends that requirement to all three zones that presently have SHGC requirements. It is not expected that this requirement will have a significant impact on those complying under the prescriptive path (most windows that meet 0.37 also meet 0.35), but will strengthen performance trade-offs (through a 5% reduction in solar gain in zones 1-2 and a 10% reduction in zone 3) and, by maintaining the same requirements for all three zones, will promote economies of scale and lower costs of construction.

This proposal represents a small, but 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 not increase the cost of construction.

Committee Action: **Approved as Modified**

Modify the proposal as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	~~0.35~~ 0.30	30	13	3 / 4	13	0	0	0
2	0.75	0.75	~~0.35~~ 0.30	30	13	4 / 6	13	0	0	0
3	0.65	0.65	~~0.35[e]~~ 0.30	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

(Portions of proposal not shown remain unchanged)

Committee Reason: The committee believed that 0.30 maximum SHGC rating for fenestration in these zones to be reasonable, with ample products available that will achieve this value. The modification from 0.35 to 0.30 was suggested by the proponent as a more aggressive value that would be consistent with the level of stringency that the present concerns with energy conservation demands. The committee heard debate from industry representatives stating that .35 was more reasonable from a product availability point of view. Ultimately, the committee decided upon the more aggressive value of 0.30 with the statement that there is sufficient product availability to make this value reasonable.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Julie Ruth, JRuth Code Consulting, representing AAMA, requests Approval as Submitted.

Commenter's Reason: As originally submitted, EC26 established a maximum SHGC of 0.35 in Climate Zones 1, 2 and 3 for residential glazed fenestration in the IECC. This would have been a 12.5% reduction in the SHGC. This provided for some reduction in solar heat gain, and hence anticipated cooling load, in the building, while still allowing a certain amount of daylighting through the fenestration products.

As a general rule, the lower the SHGC of the glazed product, the lower its Visible Light Transmittance. Windows with a SHGC below 0.30 will generally permit about 50% of the available visible light to pass through the product.

The action taken in Palm Springs by the IECC committee effectively lowered the maximum SHGC for glazed fenestration in residential construction in Climate Zones 1-3 to 0.30. The IRC Building and Energy Committee did not approve any changes to the maximum SHGC for these products and choose instead to leave it at its current value of 0.40.

Lowering the SHGC from 0.40 to 0.35 in the IECC is a reasonable compromise that should result in some net energy savings. A public comment for EC22 that would revise the SHGC in the IRC to 0.35 was also submitted. We urge the ICC membership to approve EC26 as submitted so that the two International Codes (IRC and IECC) can have the same requirement for the same product going into the same building.

Public Comment 2:

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

Further modify proposal as follows:

TABLE 402.1.1 (Supp)
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[h]	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~~ .35	30	13	3 / 4	13	0	0	0
2	0.75	0.75	~~0.30~~ .35	30	13	4 / 6	13	0	0	0
3	0.65	0.65	~~0.30~~ 40	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

Commenter's Reason: To correct the Fenestration SHGC to ones based on full building simulations using WUFI Plus a full building simulation tool basing calculations on hourly weather date for temperature, wind, and solar. Approval of this comment and NMHC comment to EC16-07/08 will make modifications to window requirements in Zones 1 and 2 and return the code to the current values in Zones 3 and 4. This comment and NMHC comment to EC16-07/08 should be considered together as they address proposed changes to the window requirements for U-Factor and SHGC in Zones 1, 2, 3 and 4.

Specific Changes:

Zone 1. The current code window (U-1.2 & SHGC-.37) was changed to (U-.65 & SHGC-.30) at the Code Development Hearings. The change to a U-Factor of .65 was a cost effective change when combined with a SHGC of .35 (Table 1, Line 3). This change would result in about a 7% reduction in building energy usage. The committee approved window with a U -.65 and a SHGC -.30 would have reduced the energy usage of the building by about 10% (Table1, Line 8) but it was not considered to be cost effective in that the simple payback was about 187 years and the cost to the consumer in rent increase of approximately $54.01 per month was not offset by the reduction in the monthly energy cost of $3.17. According to the ASHRAE 90.1 window cost data there is no cost impact for window Item 3 and window Item 4. Item 3 (U -.65 & SHGC -.35) was chosen over Item 4 (U -.65 & SHGC -.37) because it has a larger Monthly Energy Cost Savings (Table 1, Column O) and thus would be a better selection than Item 4.

Zone 2. This comment proposes the same window for Zone 2 as is proposed for Zone 1. The current code window (U-.75 & SHGC-.37) was changed to (U-.50 & SHGC-.35) by the ICC Energy Conservation Code Committee. Based on the WUFI analysis (Table 1, Line 12) the cost effective change is (U -.65 & SHGC-.35). This code change makes the correction to the SHGC for the IECC. NMHC comment EC16 makes the correction to the U-Factor. This change will reduce the energy use by about 2% in Zone 2 (Table 1, Line 12). The window was chosen because it does provide a cost effect change to the consumer.

Zone 3. The current IECC code requirement (U-.65 & SHGC-.40) proved to be the most cost effective solution for Zone 3 (Table 1, Line 21). The ICC Energy Conservation Committee approved (U-.40 & SHGC-.35). This change (Table 1, Line 30) with a payback of about 158 years would cost about $11,099 and save about $66 a year in energy cost. In terms of the consumer the rent would have to go up about $84.08 per month for a savings on the energy bill of $5.51 per month. This comment corrects the SHGC. Comment to EC16 corrects the U-Factor.

Zone 4. The current IECC code requirement (U-.40 & SHGC-NR) proved to be the most cost effective solution for Zone 4 (Table 1, Line 34). The ICC Energy Conservation Committee approved a change to the U-Factor (U.-35) and did not change the SHGC. In this case (Table 1, Line 36), with a payback of 96 years the committee change would cost about $2,127 and save approximately $22 annually on the energy bill. In terms of the consumer the rent would have to go up about $16.11 per month for a savings on the energy bill of about $1.84 per month, all for a savings of about 1% in the energy usage.

WUFI Annual Energy Analysis. The results of the WUFI Plus analysis for different window U-Factors and SHGC in Zones 1, 2, 3, and 4 are shown in Table 1.

TABLE 1
WINDOW EVALUATIONS FOR ZONES 1,2,3 AND 4

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
							Loads			% Total Khw Savings	Total Cost Impact	Total Savings H & C	Simple Payback	Monthly Rent Impact	Monthly Energy Cost Savings
Item Number	Location	Zone	Wall R	Ceiling R	U	SHGC All	Heat (KWh)	Cool (KWh)	Total (KWh)			80% Furn 10 SEER	80% Furn 10 SEER		
1	**Miami 2006 IECC**	**1**	**13**	**30**	**1.2**	**0.37**	**554**	**37337**	**37892**	**0%**	**$0**	**$0**	**Code**		
2	Miami Optimization Zone 1 SR 5	1	13	30	0.67	0.39	461	35942	36403	4%	-$1,762	$17	CEC	-$13.35	$1.39
3	**Miami 2008 AP U .65 SHGC .35**	**1**	**13**	**30**	**0.65**	**0.35**	**465**	**34792**	**35257**	**7%**	**$0**	**$27**	**CEC**	**$0.00**	**$2.21**
4	**Miami 2006 IECC U .65**	**1**	**13**	**30**	**0.65**	**0.37**	**461**	**35312**	**35772**	**6%**	**$0**	**$22**	**CEC**	**$0.00**	**$1.85**
5	Miami 2006 IECC U .55	1	13	30	0.55	0.37	447	34982	35429	6%	$2,674	$26	104	$20.25	$2.15
6	Miami Optimization Zone 1 SR 10	1	13	30	0.47	0.32	443	33372	33815	11%	$4,456	$40	112	$33.76	$3.33
7	Miami 2006 IECC U.65 SHGC .25	1	13	30	0.65	0.25	480	32102	32583	14%	$7,109	$49	145	$53.86	$4.09
8	Miami 2008 AS Modified	1	13	30	0.65	0.3	468	33450	33918	10%	$7,129	$38	187	$54.01	$3.17
9	Miami 2006 IECC SHGC .25	1	13	30	1.2	0.25	567	34068	34635	9%	$7,129	$28	257	$54.01	$2.31
10	**Phoenix 2006 IECC**	**2**	**13**	**30**	**0.75**	**0.37**	**5661**	**77669**	**83331**	**0%**	**$0**	**$0**	**Code**		
11	Phoenix 2006 IECC SHGC .30	2	13	30	1.27	0.3	6689	79851	86541	-4%	$7,109	-$70	IEU	$53.86	-$5.82
12	**Phoenix 2008 AM U .65 SHGC .35**	**2**	**13**	**30**	**0.65**	**0.35**	**5507**	**76530**	**82037**	**2%**	**-$20**	**$18**	**CEC**	**-$0.15**	**$1.46**
13	**Phoenix 2006 IECC U .65**	**2**	**13**	**30**	**0.65**	**0.37**	**5492**	**76973**	**82465**	**1%**	**-$20**	**$14**	**CEC**	**-$0.15**	**$1.20**
14	Phoenix 2006 IECC U .5	2	13	30	0.5	0.37	5235	75908	81144	3%	$2,957	$36	81	$22.40	$3.03
15	Phoenix 2006 IECC U.55	2	13	30	0.55	0.37	5321	76262	81583	2%	$2,653	$29	91	$20.10	$2.42
16	Phoenix 2008 AP U.5 SHGC .35	2	13	30	0.5	0.35	5259	75489	80748	3%	$4,436	$39	114	$33.60	$3.24
17	Phoenix 2006 IECC U .5 SHGC .25	2	13	30	0.5	0.25	5331	73374	78705	6%	$11,565	$54	216	$87.61	$4.47
18	Phoenix 2008 AS Modified	2	13	30	0.5	0.3	5292	74440	79732	4%	$11,099	$46	240	$84.08	$3.86
19	Phoenix 2008 AM U ..65 SHGC .3	2	13	30	0.65	0.3	5569	75493	81062	3%	$7,109	$23	303	$53.86	$1.96
20	Phoenix 2006 IECC SHGC .25	2	13	30	0.75	0.25	5775	75114	80889	3%	$7,109	$17	430	$53.86	$1.38
21	**Memphis 2006 IECC**	**3**	**13**	**30**	**0.65**	**0.4**	**29065**	**23309**	**52375**	**0%**	**$0**	**$0**	**Code**		
22	Memphis 2006 IECC U.65 SHGC .35	3	13	30	0.65	0.35	29274	22565	51838	1%	$1,762	-$4	IEU	$13.35	-$0.32
23	Memphis 2006 IECC SHGC .3	3	13	30	0.65	0.3	29469	21831	51301	2%	$8,892	-$7	IEU	$67.36	-$0.60
24	Memphis 2006 IECC SHGC .25	3	13	30	0.65	0.25	29682	21138	50820	3%	$8,871	-$12	IEU	$67.21	-$0.98
25	Memphis 2006 IECC U.55 SHGC .30	3	13	30	0.55	0.3	28932	21605	50537	4%	$12,882	$21	603	$97.59	$1.78
26	Memphis Optimization Zone 3 SR 5	3	13	30	0.47	0.36	28226	22281	50507	4%	$4,436	$50	88	$33.60	$4.21
27	Memphis Optimization Zone 3 SR 10	3	13	30	0.47	0.31	28443	21564	50007	5%	$6,218	$46	135	$47.11	$3.83
28	Memphis 2006 IECC U .4	3	13	30	0.4	0.4	27693	22731	50424	4%	$11,099	$73	152	$84.08	$6.08
29	Memphis 2006 IECC SHGC .55	3	13	30	0.55	0.4	28526	23072	51598	1%	$4,436	$29	154	$33.60	$2.40
30	Mempnis 2008 AP U .4 SHGC .35	3	13	30	0.4	0.35	27879	21975	49854	5%	$11,099	$70	158	$84.08	$5.86
31	Memphis 2008 IECC AM	3	13	30	0.4	0.3	28086	21273	49359	6%	$11,099	$66	168	$84.08	$5.51
32	Memphis 2006 IECC U.55 SHGC .35	3	13	30	0.55	0.35	28742	22310	51052	3%	$6,218	$25	252	$47.11	$2.06
33	Memphis 2006 IECC U .4 SHGC .25	3	13	30	0.4	0.25	28274	20559	48833	7%	$19,991	$63	317	$151.44	$5.26
34	**Baltimore 2006 IECC**	**4**	**13**	**38**	**0.4**	**NR**	**46476**	**16558**	**63034**	**0%**	**$0**	**$0**	**Code**		
35	Baltimore 2004 90.1	4	13	38	0.67	0.39	51905	10204	62109	1%	-$9,783	-$214	IEU	-$74.11	-$17.80
36	Baltimore 2006 IECC U .35	4	13	38	0.35	NR	46038	16510	62548	1%	$2,127	$22	96	$16.11	$1.84
	Cost Effective Change	**CEC**													
	Increased Energy Usage	**IEU**													

Building Solar Analysis. NMHC comments to EC16 and EC26 are based on full building simulations using WUFI Plus for a 4-story 32 unit apartment building with 20% window area. The apartment building was rectangular in shape with an east west orientation. Windows were located on the north and south facing walls. The shape and orientation and window location were selected because they represented the better performing building when compared to a square building with equal window on all orientations and a rectangular building with north south orientation. The WUFI Plus simulation is based on hourly weather data for a complete year which includes temperature, wind and solar action on the building.

U-Factor and SHGC Selection. The U-Factors and SHGC values proposed by the proponents and selected by the ICC Energy Conservation Committee were not based on any analysis of the energy savings or the cost impact to the typical apartment owner or tenant. They were simply negotiated numbers that lowered the values based on the assumption that lower values would reduce the energy use of the building. In some cases the numbers were selected to allow manufactures of current product to meet the requirements and thus not eliminate product from the market.

Window Cost. Window cost data used in the analysis is based on the numbers used by the ASHRAE 90.1 Envelope Subcommittee corrected for inflation at an annual rate of 3%.

Fuel Cost. Fuel costs are also the same as those being used by the ASHRAE 90.1 Envelope Subcommittee ($1.16/Therm for gas, $0.0868/KWh for electric). Just for comparison it should be noted that a doubling of the fuel cost would not have any impact on the window criteria selected. A doubling of the fuel cost would in effect reduce the simple payback by 50%. The simple payback for windows that were not cost effective (Table 1, Column N) ranged from a low of 81 years to a high of 603 years. Doubling the fuel cost would have made the simple payback range from a low of 40.5 years to a high of 301.5 years.

Multifamily Financial Implications. NMHC window selection is based on the impact to the consumer. For multifamily properties there is a consistent relationship between the price of a property and the rents that are necessary to cover the costs. If these relationships are not maintained the property is not built because the banks and financial organizations that fund the properties will not provide the funding. The ratio for multifamily properties is 11% to 12% of the property value (i.e. the cost of the proposed change). The values for Monthly Rent Impact (Table 1, Column N) are based on a ratio of 11% (1/9) which is equivalent to a simple payback of 9 years concurrent with the financing requirements for multifamily properties. In other words the cost of any improvement to the property must be offset by an increase in rent. Energy calculations are somewhat different in that cost increase can be offset by reductions in energy usage (Table 1, Column O). Windows that meet the criteria and that would be cost effective are identified in Column M as CEC (Cost Effective Change). Columns N (Monthly Rent Impact) and O (Monthly Energy Cost Savings) show the relationship between Monthly Rent Impact, the impact on rent to cover the increased construction costs, and the savings in Monthly Energy Cost that will occur as a result of the change in window type due to the reduction in energy usage.

Revised Table 402.1.1. The following reproduction is how Table 402.1.1 would appear if NMHC comments to EC16 and EC26 are approved.

TABLE 402.1.1 (WITH NMHC PROPOSED CHANGES)
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	.65	.75	.35	30	13	¾	13	0	0	0
2	.65	.75	.35	30	13	4/6	13	0	0	0
3	.65	.65	.40	30	13	5/8	19	0	0	5/13
4 except Marine	.40	.60	NR	38	13	5/10	30	10/13	10, 2ft	10/13
5 and Marine 4	.35	.60	NR	38	19 or 13+5	13/17	30	10/13	10, 2ft	10/13
6	.35	.60	NR	49	19 or 13+5	15/19	30	10/13	10, 4ft	10/13
7 and 8	.35	.60	NR	49	21	19/21	30	10/13	10, 4ft	10/13

WUFI Validation. Reference Table 1 Column M Simple Payback. In evaluating the window criteria and other proposed changes it became quite clear that some of the paybacks were rather large and thus questionable. The developer of the WUFI Plus program has evaluated the program against other energy models and thus there is a level of confidence. To further check the results I also ran the WUFI Plus program in Zones 1, 3, 5, and 6 using current code requirements based on a building without any energy improvements. The results are found in Table 2. The simple paybacks in ranged from 7-14 years.

WUFI Validation:

TABLE 2
WUFI PLUS VALIDATION

Location	Zone	Wall R	Ceiling R	Window U	Window SHGC All	Loads Heat (KWh)	Loads Cool (KWh)	Loads Total (KWh)	% Khw Savings	Total Cost Impact	Total Savings H & C 80% Furn 10 SEER	Simple Payback 80% Furn 10 SEER	Monthly Rent Impact	Monthly Energy Cost Savings	Monthly Cost Impact
Miami WR-0 CR-0 U-1.20 SHGC-.4	1	0	0	1.2	0.4	5286	127835	133121	0%	$0	$0	CEC	$0	$0	$0
Miami WR-0 CR-30 U-1.2 SHGC-.4	1	0	30	1.2	0.4	1256	70063	71318	46%	$4,838	$701	7	$37	$58	$22
Miami WR-13 CR-30 U-1.2 SHGC-.4	1	13	30	1.2	0.4	549	38152	38701	71%	$9,456	$1,013	9	$72	$84	$13
Miami WR-13 CR-0 U-1.20 SHGC-.4	1	13	0	1.2	0.4	4571	94972	99543	25%	$4,618	$321	14	$35	$27	($8)
Memphis WR-0 CR-0 U-1.20 SHGC-.4	3M	0	0	1.2	0.4	162083	81899	243982	0%	$0	$0	CEC	$0	$0	$0
Memphis WR-13 CR-30 U-1.2 SHGC-.4	3M	13	30	1.2	0.4	32233	24647	56879	77%	$9,456	$6,927	1	$72	$577	$506
Memphis WR-0 CR-30 U-1.2 SHGC-.4	3M	0	30	1.2	0.4	58177	43803	101980	1%	$4,838	$5,476	1	$37	$456	$420
Memphis WR-13 CR-0 U-1.20 SHGC-.4	3M	13	0	1.2	0.4	132032	62497	194529	20%	$4,618	$1,656	3	$35	$138	$103
Chicago WR-0 CR-0 U-1.20 SHGC-.4	5	0	0	1.2	0.4	338036	19843	357878	0%	$0	$0	CEC	$0	$0	$0
Chicago WR-0 CR-38 U-1.2 SHGC-.4	5	0	38	1.2	0.4	128635	11584	140219	61%	$6,048	$10,441	1	$46	$870	$824
Chicago WR-19 CR-38 U-1.2 SHGC-.4	5	19	38	1.2	0.4	67290	5646	72935	80%	$53,237	$13,530	4	$403	$1,127	$724
Chicago WR-19 CR-0 U-1.20 SHGC-.4	5	19	0	1.2	0.4	267563	13931	281494	21%	$47,189	$3,541	13	$357	$295	($62)
Helena (Billings) WR-0 CR-0 U-1.20 SHGC-.4	6	0	0	1.2	0.4	345779	19889	365668	0%	$0	$0	CEC	$0	$0	$0
Helena (Billings) WR-0 CR-49 U-1.2 SHGC-.4	6	0	49	1.2	0.4	120724	11899	132623	64%	$0	$11,214	CEC	$0	$934	$934
Helena (Billings) WR-19 CR-49 U-1.2 SHGC-.4	6	19	49	1.2	0.4	58106	6861	64967	82%	$52,817	$14,358	4	$400	$1,196	$796
Helena (Billings) WR-19 CR-0 U-1.2 SHGC-.4	6	19	0	1.2	0.4	272863	14796	287659	21%	$43,606	$3,655	12	$330	$305	($25)

CEC – Cost Effective Change – Less than one year payback.

Public Comment 3:

Ken Sagan, National Association of Home Builders, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

TABLE 402.1.1 (Supp)
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[h]	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~~ .35	30	13	3 / 4	13	0	0	0
2	0.75	0.75	~~0.30~~ .35	30	13	4 / 6	13	0	0	0
3	0.65	0.65	~~0.30~~ .35	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

Commenter's Reason: Availability of windows with SHGC values at or below 0.30 is limited; it is even more problematic for sliding glass doors. In addition, the visible light transmittance through most low SHGC windows is very low. There are some new solar heat gain limiting window coatings that allow more light to transmit through; however, there is a significant cost premium for them.

This requirement also ties the hands of energy efficient designers. When designing a passive solar house to take advantage of winter solar heat gain on south facing windows in climate zones 2 and 3, a higher solar heat gain glass would be used. In order to meet the proposed 0.30 average SHGC requirement they would have to have glass with a SHGC considerably below 0.30 that is not commercially available.

This proposal restricts energy efficient design options and has limited availability in the marketplace.

Public Comment 4:

Thomas S. Zaremba and Tom Mewbourne, Pilkington North America, Inc., representing AGC Flatglass North America, Inc., requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

TABLE 402.1.1 (Supp)
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[h]	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	0.75	0.75	0.30	30	13	4 / 6	13	0	0	0
3	0.65	0.65	0.30	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a through h (No change)
I. Impact-resistant fenestration complying with 1609.1.2 of the *International Building Code* shall have a maximum SHGC of 0.40.

Commenter's Reason: This proposed modification to the Committee's action is intended to afford greater flexibility in the design and use of hurricane resistant-glass that complies with section 1609.1.2 of the International Building Code.

This modification to the Committee's action is necessary because many window products manufactured to safely withstand impact from flying debris in hurricane force winds are designed using monolithic (single pane) laminated glass anchored in a special aluminum frame. Aluminum is used to provide structural strength and a monolithic glass design is used to minimize the amount of glass that may break and add to the dangers of flying debris in a hurricane. Monolithic, low-e glass can achieve a 0.40 SHGC. Reaching SHGC levels below that requires a far more expensive, dual-pane, (IGU) design.

I urge you to Approve EC26 As Modified by this Public Comment.

Public Comment 5:

Thomas D. Culp, Birch Point Consulting LLC, representing the Aluminum Extruders Council, requests Disapproval.

Commenter's Reason: Although it is clear that lower SHGC and/or shading improves energy efficiency in the southern zones, one concern is how far the SHGC requirement can be lowered without promoting overly dark glass that increases lighting energy use. It is difficult for some products to meet the 0.30 SHGC (particularly patio doors, picture windows, and skylights), but they are available. However, to achieve the lower SHGC, these products generally use either a darker low-e coating or tinted glass, resulting in a visible light transmittance typically ranging from 25-45%. Blocking one-half to three-quarters of the light will obviously lead to increased use of electrical lighting.

New low-e coatings aimed at lower SHGC and higher VT have been introduced in the last year, although only from 2 companies. First, it is inappropriate to establish a requirement based on such as new product with limited competition and availability. Also, the use of these new products is not a simple "drop-in" replacement, as some have claimed. These new products are even more susceptible to damage during handling and manufacturing than traditional "soft coat" low-e products. Many manufacturers will have to make significant capital investments to purchase new glass washing equipment, as well as train personnel to properly handle these new products. These products are also more difficult to use in laminated glass for hurricane impact and security glazing. The proponents wrongly claim that this proposal will not increase the cost of construction, as there are additional costs and time associated with the new products themselves, equipment, training, and yield loss.

This proposal moves too far too fast. If the unintended consequence of promoting dark glass is to be avoided, the industry needs more time to implement the new low-e coating technologies being introduced. This proposal is inappropriate for this code cycle, and we ask your disapproval.

Public Comment 6:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval this item. EC26 07/08 did not have a part II and therefore the IRC B/E committee did not hear this code change proposal.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Final Action: AS AM AMPC____ D

EC27-07/08

Table 402.1.1, Table 402.1.3, 402.2.1

Proposed Change as Submitted:

Proponent: Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI)

Revise tables and section as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.37	30	13	3 / 4	13	0	0	0
2	0.75	0.75	0.37	~~30~~ 38	13	4 / 6	13	0	0	0
3	0.65	0.65	0.40[e]	~~30~~ 38	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	~~49~~ 60	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	~~49~~ 60	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE 402.1.3 (Supp)
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~~ 0.031	0.082	0.165	0.064	0.360	0.477
3	0.65	0.65	~~0.035~~ 0.031	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	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~~ 0.023	0.060	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	~~0.026~~ 0.023	0.057	0.057	0.033	0.059	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 requirement for R-49 <u>or higher</u> wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves.

Reason: This code proposal is intended to improve the thermal envelope efficiency through improved insulation in ceilings. By increasing the ceiling insulation from R-30 to R-38 in climate zones 2 & 3 residential buildings can achieve approximately 1 to 1.5 % heating and cooling energy cost savings. By increasing from R-38 to R-49 in climate zones 4 & 5, residential buildings can achieve approximately 6 to 7 % heating and cooling energy cost savings. By increasing from R-49 to R-60 in climate zones 6, 7 & 8, residential buildings can achieve approximately 4 to 6 % heating and cooling energy cost savings. These savings are significant and when coupled with other proposed code modifications can lead to significant overall energy savings for homes.

As energy prices continue to climb, energy costs are becoming a burden to every person in the country, in addition to increasing energy imports that are becoming a burden on the US economy and energy independence. Residential buildings consume 22% of the United States primary energy and 37% of all electricity consumption (EIA 2005).

The residential building energy efficiency requirements in ICC codes have not had a substantial overall national improvement in many years. During that time, fuel prices have increased dramatically and environmental concerns from energy usage (notably global warming) have come to the forefront. Improving residential new construction energy efficiency is one of the most cost-effective ways to reduce consumption within the country. This proposal represents one reasonable and cost effective improvement that will provide states with an option to easily increase the efficiency of their code.

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

Committee Action: **Disapproved**

Committee Reason: The proponent did not provide an analysis to justify the increase in R-values. The increase in insulation in a roof-ceiling assembly could have structural implications, thus making the affordability of this increase in insulation a bigger concern.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Steven Rosenstock, Edison Electric Institute, Harry Misuriello, American Council for Energy Efficient Economy, requests Approval as Submitted.

Commenter's Reason: An important part of improving energy efficiency for housing in the United States is to improve the thermal envelope, including the insulation level of ceilings. EC-27 proposes to make modest improvements ceiling R-values in the IECC in climate zones 2- 8.

<u>The IECC Development Committee asked for an analysis to justify the increase in R-values for EC-27 specifically. The committee also recognized a possible concern raised by some opponents over the structural implications from the increase in insulation in a roof-ceiling assembly, and associated added costs from structural issues. The information below responds to these concerns and demonstrates that the proposed increases in ceiling R-value are justified and should be approved.</u>

<u>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 EC-27 are consistent with those recommendations.</u>

Energy Savings Analysis:

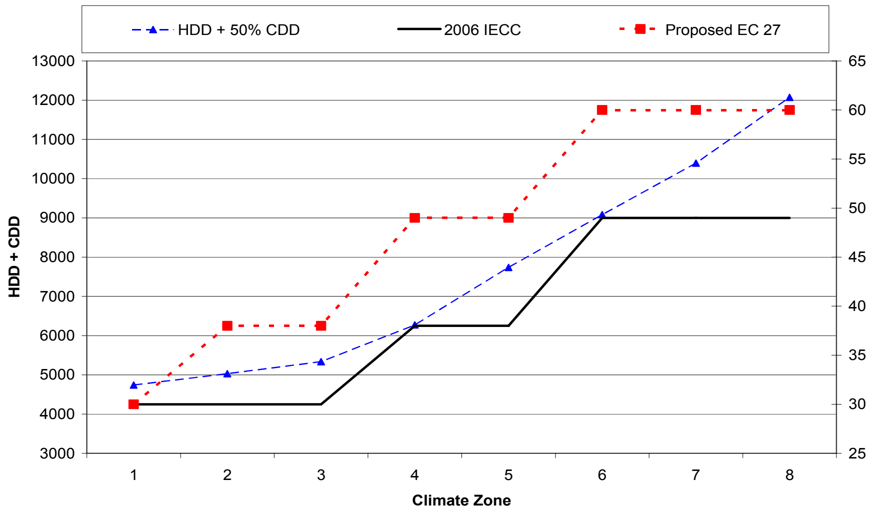
EC-27 is part of the well-rounded selection of upgrades that are needed to improve the codes toward a 30% improvement in energy efficiency. EC-27 has energy savings, depending on the climate zone, that range from 0.7% to 1.0% purchased energy savings (total heating, cooling and hot water). In order to achieve cost effective 30% energy savings, energy improvement need to be made in each of the components, and the ceiling is a critical part of the energy losses of homes. Our estimate of energy cost savings by climate zone is set for the below:

EC-27	Climate Zone 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
Heating, Cooling, Hot Water Savings	N/A	0.7%	0.8%	1.0%	0.8%	0.7%	0.9%	0.8%

This proposal will save energy at a time when the wholesale price of natural gas is around $1.20 per therm ($12/MMBtu) and the wholesale price of heating oil is over $3.60 per gallon (as of June 3, 2008). The following table shows that the proposed ceiling R-values correlated better with increases in HDD and CDD by climate zone than do existing values. In short, climate zones 2-3 should have a higher R-value than Miami, Florida. Similarly, climate zones 4-5 should be higher than zones 2-3 and climate zones 6-8 should exceed 4-5.

Structural Information:

Comparison of HDD/CDD and Insulation Levels by Climate Zone



The issue of structural issues associated with the increase from R-49 ceiling insulation to R-60 ceiling insulation is apparently unfounded. For example, the added dead load is minimal and structural requirements are based on nominal dead loads that can accommodate the minor difference in load created by R-60 vs. R-49 insulation. In regard to roof snow load, added insulation can create a colder roof surface which results in a slight increase in roof snow load. But, this too is already accounted for in building codes and engineering standards. If the unspecified structural concern was related to eave blocking to accommodate thicker insulation, the proposal addresses this by retaining the current code allowances for reduced R-value at the roof perimeter (no impact). In reality, the added insulation will provide structural, safety, and building durability benefits by preventing the formation of roof eave ice dams in cold climates as discussed in an article published in the *Disaster Safety Review*, Volume 3, Number 1, Spring 2004, "TRADITIONAL AND IMPROVED PRACTICES FOR ROOF VENTILATION AND PREVENTION OF ICE DAMS", by Jay H. Crandell, PE, ARES Consulting.

Final Action: AS AM AMPC____ D

EC28-07/08, Part I

Table 402.1.1, Table 402.1.3

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART I – IECC

Revise tables as follows:

TABLE 402.1.1 (Supp)
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[h,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	0.37	30	13	3 / 4	13	0	0	0
2	0.75	0.75	0.37	30	13	4 / 6	13	0	0	0
3	0.65	0.65	0.40[e]	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	~~19~~ 21[i] or 13+~~5~~ 7	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	~~19~~ 21[i] or 13+~~5~~ 7	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a. through h. (No change to current text)

i. R-19 spray foam or blown-in (cellulose, fiberglass) wall insulation shall be deemed to meet this requirement when installed to fill wall cavities, including corners and headers, in a nominal 2X6 wood frame wall.

TABLE 402.1.3 (Supp)
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	~~0.060~~ <u>0.057</u>	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	~~0.060~~ <u>0.057</u>	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 seeks to increase the northern wall insulation R-values from R-19 to R-21, and specifies a complying R-value for cellulose and spray foam provided headers and corners are filled.

Proposals to increase wall insulation to R-15 and R-21 have been heard in the last two code cycles. In the 2005-2006 cycle, a proposal for R-15 walls in southern zones and R-21 walls in northern zones was decisively defeated by a vote of 80% of the code officials. In the following code cycle, the proponent withdrew the proposal.

Several arguments were made against the R-15 and R-21 wall insulation. The strongest arguments were made against requiring R-15 in the south. R-15 batts are seldom used in the south. R-15 batts are expensive, partly because the higher density fiberglass inherently requires more material to get to an R-15. R-15 was seen as a proprietary value selected partly to preserve the dominance of fiberglass batts over two growing insulation upstarts--cellulose and spray foam. Blown cellulose and the spray foam used in residential construction can achieve R-13 in a 2x4 wall cavity but can not achieve R-15 in a 2x4 wall cavity, without additional R-value from elsewhere (e.g.: insulated sheathing).

In contrast to R-15, R-21 is routinely used in some northern areas; for example, R-21 batts are the predominate insulation in the 2x6 walls common in the Pacific Northwest. Where R-21 batts are in common use, the cost premium is much more modest than for the R-15 batts.

R-21 is considered a “proprietary” value in the sense that blown cellulose and the spray foam used in residences can achieve R-19 but do not typically achieve R-21 in a 2x6 wall cavity. Although cellulose and spray foam do not achieve R-21, they do provide a higher level of air sealing. Like any blown product, including blown fiberglass, blown cellulose and spray foam are better suited for small spaces and odd-sized cavities. In addition, cellulose is perhaps the premiere recycling success story for building products, consisting of about 80% recycled newsprint. This proposes cellulose and spray foam be deemed to comply if headers and corners are filled with insulation. Filling headers and corners reduces the overall U-factor and more aggressively seals the thermal envelope than fiberglass batts.

The insulated sheathing R-value is also increased by R-2 to R-7. This tracks the cavity insulation increase by the same amount.

his proposal addresses one additional issue with R-19 batts--the reduced R-value for R-19 batts in a 2x6 wall cavity. R-19 batts are not properly sized for a nominal 2x6 wall cavity and must be compressed to fit. A nominal 2x6 frame wall has a 5.5-inch cavity for insulation. R-19 batts are 6.25 or 6.5 inches thick. The compressed R-19 batt R-value is about R-1 or R-2 less than the rated R-value. In contrast, R-21 batts are produced to fit the 2x6 cavity size without losing R-value from compression.

The effect of compressing fiberglass batts on batt R-value was quantified in the study entitled, “The Effect of Compression on the Material R-Value of Fiberglass Batt Insulation.”[1]

> *“Installations that result in batt thicknesses less than the label thickness can have substantially lower material R-values. Compression of the insulation specimens to 90% of full thickness reduced the R-values by 5.6 to 9.4%.”*

A 6.25-inch batt compressed into a 5.5- inch cavity is compressed 12%. A 6.5-inch batt compressed into a 5.5-inch cavity is compressed 15%. Based on the study quoted above, compression reduces the batt R-value by about R-1 or R-2.

NAIMA, the trade association for fiberglass insulation and rock/slag wool insulation, has acknowledged the R-1 reduction in saying that an R-19 batt in a 2x6 cavity is really R-18.[2]

> “*When a standard R-19 batt (6” to 6 ¾” thick) is used to fill the 5 1⁄2” wall cavity, it has to be compressed. Compressing the insulation causes it to lose some of its thermal effectiveness, reducing its R-value to R-18*.”

In contrast to the reduced R-value of the compressed R-19 batt, the R-21 batt is correctly sized for a 2x6 wall cavity and will not lose R-value by compression. Replacing the R-19 batt requirement with R-21 results in a “double bump”--the compression loss for R-19 batts is eliminated by specifying a batt with the correct size, and the cavity insulation R-value is modestly increased.

Quotes from:

[1] Graves, Ronald S., and David W. Yarbrough. 1992. “The Effect of Compression on the Material R-Value of Fiberglass Batt Insulation.” *Journal of Building Physics*, Vol. 15, No. 3, 248-260 (page 258). Building Materials Group Oak Ridge National Laboratory Oak Ridge, TN 37831 http://jen.sagepub.com/cgi/content/abstract/15/3/248

[2] NAIMA (North American Insulation Manufacturers Association). *Insulation Facts #32, A Guide To Selecting Fiber Glass Insulation Products for New Home Construction and Remodeling*.

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

PART I – IECC
Committee Action: **Approved as Modified**

Modify the proposal as follows:

TABLE 402.1.1 (Supp)
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	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40[c]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	~~21~~[h] 20 or 13+~~7~~ 5-	13	30f	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	~~21~~[h] 20 or 13+~~7~~ 5	15	30 f	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30 f	10/13	10, 4 ft	10/13

a. through h. (No change to current text)

~~i. R-19 spray foam or blown-in (cellulose, fiberglass) wall insulation shall be deemed to meet this requirement when installed to fill wall cavities, including corners and headers, in a nominal 2X6 wood frame wall.~~

(Portions of proposal not shown remain unchanged)

Committee Reason: The proposal represents a reasonable opportunity for raising energy conservation stringency. The modification is simply a compromise value for insulation values. The modification also deletes a footnote because it would be no longer applicable.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Jonathan Humble, AIA, American Iron and Steel Institute, representing American Iron and Steel Institute and the Steel Framing Alliance, requests Disapproval.

Commenter's Reason: We applaud the concept of making residential construction more energy efficient and cost effective, but in this case it is our view that the proposal is not complete and therefore should not be incorporated into the code. This proposal provides a market advantage to other primary building materials, and thus fails to adequately address all primary building materials in a fair and equitable manner.

Our concern is the lack of attention given to IECC Table 402.2.4 and IRC Table N1102.2.4, both entitled “Steel-Frame Ceiling, Wall and Floor Insulation (R-Value)”. These tables are mutually related to the minimum envelope insulation tables in EC28-07/08. In this case, by changing the minimum insulation values in EC28-07/08 it establishes a gap between those tables and the corresponding wood frame R-value equivalent values in IECC Table 402.4.4 and IRC Table N1102.2.4. This gap creates a conflict and places the code official in the unenviable position having to make an interpretation. This gap also has the potential of penalizing cold-formed steel framing through a decision by an official to choose a more stringent requirement in order to side with caution, and/or even requiring testing to demonstrate compliance, all because the coordinating equivalent reference was not addressed in the code change.

In view of the above we request that the membership disapprove this proposal.

Final Action: AS AM AMPC____ D

EC28-07/08, Part II

Table N1102.1, Table N1102.1.3

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART II – IRC

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	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40[c]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	~~19~~ 21[h] or 13+~~5~~ 7	13	30f	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	~~19~~ 21[h] or 13+~~5~~ 7	15	30 f	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30 f	10/13	10, 4 ft	10/13

a. through g. (No change to current text)

h. R-19 spray foam or blown-in (cellulose, fiberglass) wall insulation shall be deemed to meet this requirement when installed to fill wall cavities, including corners and headers, in a nominal 2X6 wood frame wall.

TABLE N1102.1.3
EQUIVALENT U-FACTORS[a]

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor	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	~~0.060~~ 0.057	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	~~0.060~~ 0.057	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

(Footnote remains unchanged)

Reason: This proposal seeks to increase the northern wall insulation R-values from R-19 to R-21, and specifies a complying R-value for cellulose and spray foam provided headers and corners are filled.

Proposals to increase wall insulation to R-15 and R-21 have been heard in the last two code cycles. In the 2005-2006 cycle, a proposal for R-15 walls in southern zones and R-21 walls in northern zones was decisively defeated by a vote of 80% of the code officials. In the following code cycle, the proponent withdrew the proposal.

Several arguments were made against the R-15 and R-21 wall insulation. The strongest arguments were made against requiring R-15 in the south. R-15 batts are seldom used in the south. R-15 batts are expensive, partly because the higher density fiberglass inherently requires more material to get to an R-15. R-15 was seen as a proprietary value selected partly to preserve the dominance of fiberglass batts over two growing insulation upstarts--cellulose and spray foam. Blown cellulose and the spray foam used in residential construction can achieve R-13 in a 2x4 wall cavity but can not achieve R-15 in a 2x4 wall cavity, without additional R-value from elsewhere (e.g.: insulated sheathing).

In contrast to R-15, R-21 is routinely used in some northern areas; for example, R-21 batts are the predominate insulation in the 2x6 walls common in the Pacific Northwest. Where R-21 batts are in common use, the cost premium is much more modest than for the R-15 batts.

R-21 is considered a "proprietary" value in the sense that blown cellulose and the spray foam used in residences can achieve R-19 but do not typically achieve R-21 in a 2x6 wall cavity. Although cellulose and spray foam do not achieve R-21, they do provide a higher level of air sealing. Like any blown product, including blown fiberglass, blown cellulose and spray foam are better suited for small spaces and odd-sized cavities. In addition, cellulose is perhaps the premiere recycling success story for building products, consisting of about 80% recycled newsprint. This proposes cellulose and spray foam be deemed to comply if headers and corners are filled with insulation. Filling headers and corners reduces the overall U-factor and more aggressively seals the thermal envelope than fiberglass batts.

The insulated sheathing R-value is also increased by R-2 to R-7. This tracks the cavity insulation increase by the same amount.

his proposal addresses one additional issue with R-19 batts--the reduced R-value for R-19 batts in a 2x6 wall cavity. R-19 batts are not properly sized for a nominal 2x6 wall cavity and must be compressed to fit. A nominal 2x6 frame wall has a 5.5-inch cavity for insulation. R-19 batts are 6.25 or 6.5 inches thick. The compressed R-19 batt R-value is about R-1 or R-2 less than the rated R-value. In contrast, R-21 batts are produced to fit the 2x6 cavity size without losing R-value from compression.

The effect of compressing fiberglass batts on batt R-value was quantified in the study entitled, "The Effect of Compression on the Material R-Value of Fiberglass Batt Insulation."[1]

"Installations that result in batt thicknesses less than the label thickness can have substantially lower material R-values. Compression of the insulation specimens to 90% of full thickness reduced the R-values by 5.6 to 9.4%."

A 6.25-inch batt compressed into a 5.5- inch cavity is compressed 12%. A 6.5-inch batt compressed into a 5.5-inch cavity is compressed 15%. Based on the study quoted above, compression reduces the batt R-value by about R-1 or R-2.

NAIMA, the trade association for fiberglass insulation and rock/slag wool insulation, has acknowledged the R-1 reduction in saying that an R-19 batt in a 2x6 cavity is really R-18.[2]

"*When a standard R-19 batt (6" to 6 ¾" thick) is used to fill the 5 1⁄2" wall cavity, it has to be compressed. Compressing the insulation causes it to lose some of its thermal effectiveness, reducing its R-value to R-18*."

In contrast to the reduced R-value of the compressed R-19 batt, the R-21 batt is correctly sized for a 2x6 wall cavity and will not lose R-value by compression. Replacing the R-19 batt requirement with R-21 results in a "double bump"--the compression loss for R-19 batts is eliminated by specifying a batt with the correct size, and the cavity insulation R-value is modestly increased.

Quotes from:

[1] Graves, Ronald S., and David W. Yarbrough. 1992. "The Effect of Compression on the Material R-Value of Fiberglass Batt Insulation." *Journal of Building Physics*, Vol. 15, No. 3, 248-260 (page 258). Building Materials Group Oak Ridge National Laboratory Oak Ridge, TN 37831 http://jen.sagepub.com/cgi/content/abstract/15/3/248

[2] NAIMA (North American Insulation Manufacturers Association). *Insulation Facts #32, A Guide To Selecting Fiber Glass Insulation Products for New Home Construction and Remodeling*.

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

PART II – IRC
Committee Action: Approved as Modified

Modify proposal as follows:

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

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40[c]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	~~21[h]~~ 20 or 13+~~7~~ 5	13	30f	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	~~21[h]~~ 20 or 13+~~7~~ 5	15	30 f	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30 f	10/13	10, 4 ft	10/13

a. through g. (No change to current text)

~~h. R-19 spray foam or blown-in (cellulose, fiberglass) wall insulation shall be deemed to meet this requirement when installed to fill wall cavities, including corners and headers, in a nominal 2X6 wood frame wall.~~

(Portions of proposal not shown remain unchanged)

Committee Reason: This change will improve the energy efficiency for wood frame walls and all insulation manufacturers agree that they can meet. The modification eliminates the footnote that would give an advantage to certain insulation products.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Jonathan Humble, AIA, American Iron and Steel Institute, representing American Iron and Steel Institute and the Steel Framing Alliance, requests Disapproval.

Commenter's Reason: We applaud the concept of making residential construction more energy efficient and cost effective, but in this case it is our view that the proposal is not complete and therefore should not be incorporated into the code. This proposal provides a market advantage to other primary building materials, and thus fails to adequately address all primary building materials in a fair and equitable manner.

Our concern is the lack of attention given to IECC Table 402.2.4 and IRC Table N1102.2.4, both entitled "Steel-Frame Ceiling, Wall and Floor Insulation (R-Value)". These tables are mutually related to the minimum envelope insulation tables in EC28-07/08. In this case, by changing the minimum insulation values in EC28-07/08 it establishes a gap between those tables and the corresponding wood frame R-value equivalent values in IECC Table 402.4.4 and IRC Table N1102.2.4. This gap creates a conflict and places the code official in the unenviable position having to make an interpretation. This gap also has the potential of penalizing cold-formed steel framing through a decision by an official to choose a more stringent requirement in order to side with caution, and/or even requiring testing to demonstrate compliance, all because the coordinating equivalent reference was not addressed in the code change.

In view of the above we request that the membership disapprove this proposal.

Final Action: AS AM AMPC____ D

EC29-07/08

Table 402.1.1, Table 402.1.3

Proposed Change as Submitted:

Proponent: Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI)

Revise tables as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.37	30	~~13~~ 15	3 / 4	13	0	0	0
2	0.75	0.75	0.37	30	~~13~~ 15	4 / 6	13	0	0	0
3	0.65	0.65	0.40[e]	30	~~13~~ 18	5 / 8	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	~~13~~ 18	5 / 10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	~~19 or 13+5[g]~~ 21	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	~~19 or 13+5[g]~~ 21	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	~~21~~ 24	19 / 21	30[f]	10/13	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

a. through f. (No change to current text)

g. ~~"13+5" means R-13 cavity insulation plus R-5 insulated sheathing.~~ Any combination of insulation shall be permitted to meet the requirements by summing the R-value of the cavity insulation and the R-value of the insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

h. (No change to current text)

TABLE 402.1.3 (Supp)
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~~ 0.076	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	~~0.082~~ 0.076	0.165	0.064	0.360	0.477
3	0.65	0.65	0.035	~~0.082~~ 0.062	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	~~0.082~~ 0.062	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	~~0.060~~ 0.055	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	~~0.060~~ 0.055	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	~~0.057~~ 0.053	0.057	0.033	0.059	0.065

(Footnotes remain unchanged)

Reason: This proposal sets the wall insulation requirements based on relative need within a given climate zone, instead of being based on specific products. This proposal simplifies the requirements to be an individual requirement instead of having multiple requirements that are not equivalent. The individual numbers can be achieved through a combination of cavity insulation and insulated sheathing types. This approach allows for any combination of products or insulation types to be installed to meet the required value. These insulation requirements can also be consistently modeled for a performance path.

The current code approach includes R-Value combinations that are not equal to their "equivalent" u-factor. This change will allow for a single consistent baseline between the prescriptive and performance paths.

This would entail an increase in insulation to R-15 in climate zones 1 and 2, R-18 in climate zones 3 and 4, R-21 in climate zones Marine 4, 5 and 6, and R-24 in climates 7 and 8. These insulation requirements in increments of 3 can easily be achieved with current products and construction techniques. R-15 can be achieved with R-15 or R-13 plus insulating sheathing of R-2 or greater. R-18 can be achieved with R-19, R-15 + R-3 or R-13 + R-5. R-21 can be achieved with R-21, R-19 + R-2, or R-15 + R-7.5. R-24 can be achieved with R-19 + R-5 or R-21 + R-3.

In addition to the consistency and clarity of the code, this proposal increases the frame wall insulation values to achieve up to 8% heating and cooling energy cost savings. As energy prices continue to climb, energy costs are becoming a burden to every person in the country, in addition to increasing energy imports that are becoming a burden on the US economy and energy independence. Residential buildings consume 22% of the United States primary energy and 37% of all electricity consumption (EIA 2005).

The residential building energy efficiency requirements in ICC codes have not had a substantial overall national improvement in many years. During that time, fuel prices have increased dramatically and environmental concerns from energy usage (notably global warming) have come to the forefront. Improving residential new construction energy efficiency is one of the most cost-effective ways to reduce consumption within the country. This proposal represents one reasonable and cost effective improvement that will provide states with an option to easily increase the efficiency of their code.

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

Committee Action: Disapproved

Committee Reason: The committee considered some extensive modifications and there was concern that the code change proposal was not complete and prepared enough. Further study is necessary.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Steven Rosenstock, Edison Electric Institute, Harry Misuriello, American Council for Energy Efficient Economy, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.37	30	13 ~~15~~	3 / 4	13	0	0	0
2	0.75	0.75	0.37	30	16 ~~15~~	4 / 6	13	0	0	0
3	0.65	0.65	0.40[e]	30	~~18~~ 16	5 / 8	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	~~18~~ 20 or 13 + 5	5 / 10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[g] ~~21~~	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	20 or 13+5[g] ~~21~~	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	24	19 / 21	30[f]	10/13	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

a through f (No change)

g. Any combination of insulation shall be permitted to meet the requirements through calculating an equivalent UA or by summing the R-value of the cavity insulation and the R-value of the 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, and shall also meet the minimum insulation requirements in Table 402.1.1, but in no case shall insulated sheathing be less than R-2.

h. (No change to current text)

TABLE 402.1.3 (Supp)
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	~~0.076~~ <u>0.082</u>	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	~~0.076~~ <u>0.073</u>	0.165	0.064	0.360	0.477
3	0.65	0.65	0.035	~~0.062~~ <u>0.073</u>	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	~~0.062~~ <u>0.058</u>	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	~~0.055~~ <u>0.058</u>	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	~~0.055~~ <u>0.058</u>	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.053	0.057	0.033	0.059	0.065

a. Nonfenestration U-factors shall be obtained from measurement, calculation, or an approved source.

Commenter's Reason: During the IECC Code Development Committee hearings in Palm Springs, the proponents worked with various opponents to develop modifications that would satisfy competing industry concerns. After considering the floor modifications, however, the committee disapproved EC-29 as modified, on the basis that the proposal had not received sufficient analysis. In the time since the hearing in Palm Springs, we have conducted additional analysis and given further consideration to the issues raised by the various parties.

This public comment reflects this further analysis and consideration. It is designed to be consistent with EC-28 in Climate Zones 5 and 6, as was approved by the committee in Palm Springs. The proposed insulation levels in the other climate zones were selected to produce reasonable and cost-effective levels of energy savings, and to ensure product neutrality in response to concerns raised by various insulation manufacturers.

Energy Savings Analysis: EC-29 is a critical part of a larger effort to achieve 30% improvement in home energy performance; it addresses the energy savings that would be required to meet that goal in wall insulation in Climate Zones 2 – 4. These three climate zones account for nearly 75% of national housing starts, and have historically been subject to substantially less stringent energy criteria than is justified in today's environment of rising energy costs and global warming concerns. This proposal achieves up to 8% purchased energy savings (based on total heating, cooling and hot water energy usage).

EC-29 is also part of a larger package of proposals that together would improve energy performance by up to 30%. Achieving 30% energy savings cost-effectively means that small energy improvements need to be made in each of the major components of the building. The walls account for a major fraction of home energy losses, typically accounting for more total energy losses than any other envelope component. In this context, the wall insulation improvements in EC-29 make sense, bringing energy savings to key components and climate zones that have been left off the table for too long.

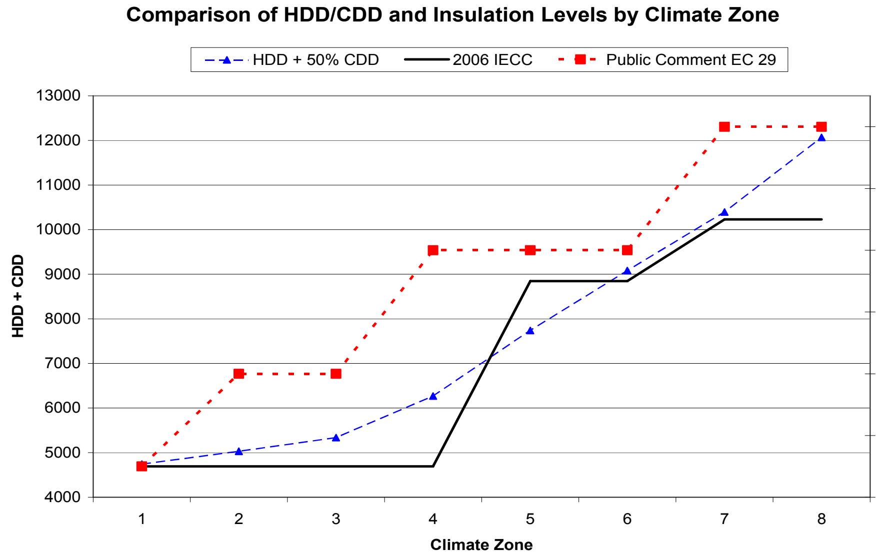
The most critical of the climate zones in this proposal is Climate Zone 4, which includes nearly 25% of all new housing starts in the country and currently has the same wall insulation requirement as Climate Zone 1; it simply does not make sense that Dade County (Miami, FL) and St. Louis County (Missouri) would have the same wall insulation requirements. In Climate Zone 4, by upgrading the wall insulation level to R-20 (or R-13 cavity plus R-5 sheathing), which is consistent with the R-Value approved by the committee in proposal EC-28 in Climate Zone 5 and Marine Climate Zone 4, with technologies that are readily available, the savings are significant, at 8% of total purchased energy. This analysis was conducted using the DOE-2 simulation model, and was based on the IECC methodology for calculating purchased energy.

A well-designed set of energy code thermal criteria would match R-values to weather-related energy loads. Heating and Cooling Degree Days (HDD and CDD) are accepted indicators of the impact of weather-related loads on the energy use of the home. In the graph below, we draw a simple comparison between HDD plus 50% CDD to IECC wall insulation criteria. The graph shows that the current 2006 IECC does not increase wall insulation criteria proportionally to the increase in weather-related load. The proposed wall criteria in our public comment on EC-29 would match IECC wall criteria more closely to weather loads.

The R-values in our public comment also represent compromises that preclude any claims that EC-29 creates competitive unfairness between insulation products. The greatest opposition to EC-29 and related earlier proposals was not that it doesn't save energy, but that it disadvantages some types of insulation. Based on discussions among cellulose, fiberglass, and foam insulation interests, we adjusted the R-values in EC-29 slightly, and made certain cavity-plus-sheathing solutions explicit, so that no one product type would have a perceived competitive advantage. While some may comment that the R-values in this public comment no longer correspond directly to traditional stock insulation products, they do not pose any compliance problems. It is important to remember that compliance with IECC 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 the nominal R-values in EC-29 as we have proposed to modify it.
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 IECC's compliance options, there is no basis to claims 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.



Public Comment 2:

John Evans, Icynene Inc., representing Icynene Inc. and Nu-Wool Inc. and U.S. Green Fiber, requests Disapproval.

Commenter's Reason: This proposal increases the R-value of wood frame walls, the increase in thermal values cannot be justified as either more energy efficient or cost effective. The increased R-values are product specific to glass fiber batts and will put low density spray foam insulations and cellulose insulations at a competitive disadvantage. This public comment is submitted by the largest low density foam supplier and two of the largest cellulose manufacturers in the United States. The increased R-values would allow only glass fiber batts to be installed since low density foam and cellulose insulation products cannot meet the proposed values with a single component thereby making this proposal proprietary. These increased values are only capable of be produced in 3.5 inch and 5.5 inch thicknesses for wood studs by glass fiber manufacturers. The added thermal values represent less than a 1 percent energy efficiency gain but will significantly increase cost of insulation. This proposal was recommended for Disapproved at the committee hearings, we recommend the same action at the final hearings.

Final Action: AS AM AMPC____ D

EC30-07/08

Table 402.1.1, Table 402.1.3

Proposed Change as Submitted:

Proponent: Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI)

Revise tables as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.37	30	13+3 or 15+2[g]	3 / 4	13	0	0	0
2	0.75	0.75	0.37	30	13+3 or 15+2[g]	4 / 6	13	0	0	0
3	0.65	0.65	0.40[e]	30	13+3 or 15+2[g]	5 / 8	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13+3 or 15+2[g]	5 / 10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a. through f. (No change to current text)

g. "13+3" means R-13 cavity insulation plus R-3 insulated sheathing. "15+2" means R-15 cavity insulation plus R-2 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.

h. (No change to current text)

TABLE 402.1.3 (Supp)
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~~ 0.065	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	~~0.082~~ 0.065	0.165	0.064	0.360	0.477
3	0.65	0.65	0.035	~~0.082~~ 0.065	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	~~0.082~~ 0.065	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 modifies the insulation requirements in climate zones 1-4.

By increasing the frame wall insulation by approximately R-3 in the climates 1, 2, 3 & 4, residential buildings can achieve approximately 2% in climate zone 1 to 5% in climate zone 4 for heating and cooling energy cost savings. This would entail an increase from R-13 in climates 1, 2, 3 & 4 to R-13+3 or 15+2. These savings are significant and when coupled with other proposed code modifications can lead to significant overall energy savings for homes.

As energy prices continue to climb, energy costs are becoming a burden to every person in the country, in addition to increasing energy imports that are becoming a burden on the US economy and energy independence. Residential buildings consume 22% of the United States primary energy and 37% of all electricity consumption (EIA 2005).

The residential building energy efficiency requirements in ICC codes have not had a substantial overall national improvement in many years. During that time, fuel prices have increased dramatically and environmental concerns from energy usage (notably global warming) have come to the forefront. Improving residential new construction energy efficiency is one of the most cost-effective ways to reduce consumption within the country. This proposal represents one reasonable and cost effective improvement that will provide states with an option to easily increase the efficiency of their code.

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

Committee Action: **Disapproved**

Committee Reason: The proponent requested disapproval. See EC31-07/08.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Steven Rosenstock, Edison Electric Institute, Harry Misuriello, American Council for Energy Efficient Economy, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.37	30	13~~+3 or 15+2~~[g]	3 / 4	13	0	0	0
2	0.75	0.75	0.37	30	15 ~~13+3 or 15+2~~[g]	4 / 6	13	0	0	0
3	0.65	0.65	0.40[e]	30	16 ~~13+3 or 15+2~~[g]	5 / 8	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	18 ~~13+3 or 15+2~~[g]	5 / 10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

a. through f. (No change to current text)

g. ~~"13+3" means R-13 cavity insulation plus R-3 insulated sheathing. "15+2" means R-15 cavity insulation plus R-2 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, but shall also meet the minimum insulation requirements in Table 402.1.1, but in no case shall insulated sheathing be less than R-2.

h. (No change to current text)

TABLE 402.1.3 (Supp)
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
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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)

Commenter's Reason: Improved wall insulation is a critical part of the effort to achieve 30% improvement in home energy performance; EC-30, as a slightly less stringent alternative to EC29, it is intended to achieve the energy savings that would be required in wall insulation in Climate Zones 2 – 4. These three climate zones account for nearly 75% of all new housing starts in the United States, and have historically been subject to substantially less stringent energy criteria than is justified in today's environment of rising energy costs and global warming concerns . This proposal achieves up to 6% purchased energy savings (based on total heating, cooling and hot water energy usage).

EC-30 is also part of a larger package of proposals that together would improve energy performance by up to 30%. Achieving 30% energy savings cost-effectively means that small energy improvements need to be made in each of the major components of the building. The walls account for a major fraction of home energy losses, typically accounting for more total energy losses than any other envelope component. In this context, the wall insulation improvements in EC-30 make sense, bringing energy savings to key components and climate zones.

The most critical of the climate zones in this proposal is Climate Zone 4, which houses nearly 25% of all new housing starts in the country and currently has the same wall insulation requirement as Climate Zone 1, which simply does not make any sense. In Climate Zone 4, by upgrading the wall insulation level to R-18, which is R-2 less than was approved by the committee in proposal EC-28 for Climate Zones Marine 4, 5 and 6, with technologies that are readily available, the savings are significant, at 6% of total purchased energy. This analysis was conducted using the DOE-2 simulation model, and was based on the IECC methodology for calculating purchased energy.

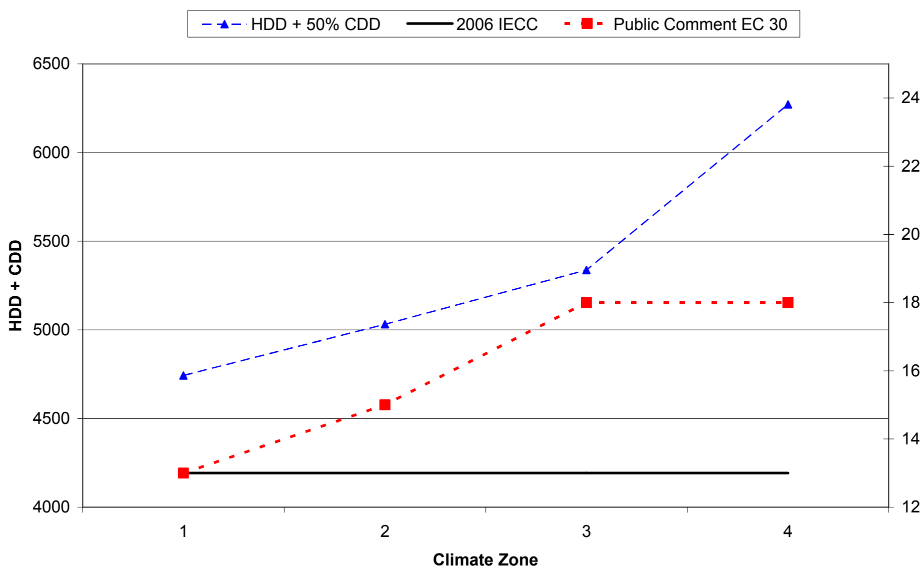
A well-designed set of energy code thermal criteria would match R-values to weather-related energy loads. Heating and Cooling Degree Days (HDD and CDD) are accepted indicators of the impact of weather-related loads on the energy use of the home. In the graph below, we draw a simple comparison between HDD plus 50% CDD to IECC wall insulation criteria. The graph shows that the current 2006 IECC does not increase in wall insulation between Climate Zone 1 and 4, even though heating and cooling loads increase by over 30%. The proposed wall criteria in our public comment on EC-30 would match IECC wall criteria more closely to weather loads.

The R-values in our public comment also represent compromises that are intended to preclude any claims that EC-30 creates competitive unfairness between insulation products. The greatest opposition to EC-30 and related earlier proposals was not that it doesn't save energy, but that it disadvantages some types of insulation. Based on discussions, we adjusted the R-values in EC-30 slightly, so that no one product type would have a perceived competitive advantage. While some may comment that the R-values in this public comment no longer correspond directly to traditional stock insulation products, they do not pose any compliance problems. It is important to remember that compliance with IECC 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 the nominal R-values in EC-30 as we have proposed to modify it.
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 IECC's compliance options, there is no basis to claims 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.

Comparison of HDD/CDD and Insulation Levels by Climate Zone



Final Action: AS AM AMPC____ D

EC33-07/08
Table 402.1.1, Table 402.1.3

Proposed Change as Submitted:

Proponent: Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI)

Revise tables as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.37	30	13	3 / 4	13	0	0	0
2	0.75	0.75	0.37	30	13	4 / 6	13	0	0	0
3	0.65	0.65	0.40[e]	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	~~10/13~~ 15/19	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	~~10/13~~ 15/19	10, 4 ft	10/13

a. (No change to current text)
b. (No change to current text)
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. ~~The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.~~
d. through h. (No change to current text)

TABLE 402.1.3 (Supp)
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	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	0.060	0.060	0.033	~~0.059~~ 0.050	0.065
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	~~0.059~~ 0.050	0.065

(Footnotes remain unchanged)

Reason: By increasing the basement wall insulation requirement from R-10 continuous or R-13 cavity insulation to R-15 continuous or R-19 cavity insulation in climates 6, 7 and 8, residential buildings can achieve approximately 4% to 6% heating and cooling energy cost savings. These savings are significant and when coupled with other proposed code modifications can lead to significant overall energy savings for homes. As energy prices continue to climb, energy costs are becoming a burden to every person in the country, in addition to increasing energy imports that are becoming a burden on the US economy and energy independence. Residential buildings consume 22% of the United States primary energy and 37% of all electricity consumption (EIA 2005).

The residential building energy efficiency requirements in ICC codes have not had a substantial overall national improvement in many years. During that time, fuel prices have increased dramatically and environmental concerns from energy usage (notably global warming) have come to the forefront. Improving residential new construction energy efficiency is one of the most cost-effective ways to reduce consumption within the country. This proposal represents one reasonable and cost effective improvement that will provide states with an option to easily increase the efficiency of their code.

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

Committee Action: **Approved as Submitted**

Committee Reason: This represents an opportunity for energy savings in insulating basements, an important area for energy conservation concerns.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself, requests Disapproval.

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation of for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC33 alignment: EC33 was submitted to the IECC, without a parallel comment to the IRC. To realign the two codes, EC33 should be Disapproved.

EC33 content: EC33 increases basement insulation in zones 6 to 8. No economic analysis or cost-effectiveness argument was provided.

Public Comment 2:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval this item. EC33 07/08 did not have a part II and therefore the IRC B/E committee did not hear this code change proposal.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 3:

Ken Sagan, National Association of Home Builders, requests Disapproval.

Commenter's Reason: In evaluations conducted by NAHBRC , this proposal does not appear to be cost-effective for the 4% to 6% savings that the proponent stated. This proposal increases the basement wall R-values in Zones 6, 7, and 8 from 10/13 to a 15/19 requirement making it that much more difficult and costly.

Final Action: AS AM AMPC____ D

EC35-07/08

Table 402.1.1, Table 402.1.3

Proposed Change as Submitted:

Proponent: Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI)

Revise tables as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.37	30	13	3 / 4	13	0	0	0
2	0.75	0.75	0.37	30	13	4 / 6	13	0	0	0
3	0.65	0.65	0.40[e]	30	13	5 / 8	19	0	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	~~30~~ 38[f]	10/13	10, 4 ft	10/13

(Footnotes remain unchanged)

TABLE 402.1.3 (Supp)
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	0.060	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~~ 0.028	0.059	0.065

(Footnotes remain unchanged)

Reason: By increasing the floor insulation from R-30 to R-38 in the climates 7 & 8, residential buildings can achieve energy cost savings in the coldest climates on heating costs, their largest portion of their energy bill.

As energy prices continue to climb, energy costs are becoming a burden to every person in the country, in addition to increasing energy imports that are becoming a burden on the US economy and energy independence. Residential buildings consume 22% of the United States primary energy and 37% of all electricity consumption (EIA 2005).

The residential building energy efficiency requirements in ICC codes have not had a substantial overall national improvement in many years. During that time, fuel prices have increased dramatically and environmental concerns from energy usage (notably global warming) have come to the forefront. Improving residential new construction energy efficiency is one of the most cost-effective ways to reduce consumption within the country. This proposal represents one reasonable and cost effective improvement that will provide states with an option to easily increase the efficiency of their code.

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

Committee Action: Approved as Submitted

Committee Reason: The IECC presently is lagging behind the state energy code for the State of Alaska. It is appropriate to make aggressive changes in these very cold climates, given that the local practices are more stringent than that of the national code.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself, requests Disapproval.

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC35 alignment: EC35 was submitted to the IECC, without a parallel comment to the IRC. <u>To realign the two codes, EC35 should be disapproved</u>.

EC35 content: EC35 increases floor insulation in zones 7 and 8. No economic or cost-effectiveness analysis was provided. The R-38 floor insulation will be about 12 inches thick, which is too large for the framing in many floors. Footnote f, which allows floor insulation as low as R-19 if it fills the framing cavity, makes it unlikely EC35 would have much effect.

Public Comment 2:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of this item. EC35 07/08 did not have a part II and therefore the IRC B/E committee did not hear this code change proposal.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 3:

Ken Sagan, National Association of Home Builders, representing same, requests Disapproval.

Commenter's Reason: The Department of Energy came out with insulation recommendations for new wood framed houses in 2008. The floor insulation recommendation is between R-25 and R-30. R-38 exceeds even their reasonable level of insulation.

Final Action: AS AM AMPC____ D

EC36-07/08, Part I
Table 402.1.1, Table 402.1.3

Proposed Change as Submitted:

Proponent: Ronald Majette, U. S. Department of Energy

PART I – IECC

Revise tables as follows:

TABLE 402.1.1 (Supp)
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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.37	30	13	3 / 4	13	0	0	0
2	0.75	0.75	0.37	30	13	4 / 6	13	0	0	0
3	0.65	0.65	0.40[e]	30	13	5 / 8	19	~~0~~ <u>5/13</u>[f]	0	5/13
4 except Marine	0.40	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	19 or 13+5[g]	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15 / 19	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19 / 21	30[f]	10/13	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

a. through e. (No change to current text)
f. Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

(Re-letter f. through h. to become g. through j.)

TABLE 402.1.3 (Supp)
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~~ 0.091[c]	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	0.060	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

a. Non-fenestration 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 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 and the same as the wood frame wall in 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.

Reason: The purpose of this proposal is to add basement wall insulation requirements for the colder regions of climate zone 3. Currently, no insulation is required for conditioned basements (floor insulation is required over unconditioned basements) in Zone 3. Though basements are uncommon in Zone 3, there are some and they tend to be in the colder parts of the zone where winter temperatures can reach as low as single digits. When basements are used as a conditioned living space, they often have furred in walls that allow space for insulation.

Energy simulation analyses shows that foundation wall insulation in cold climates is cost effective. For conditioned basements, the Building Foundation Design Handbook reports that R-5 insulation wall insulation 8 ft. deep saves 0.16 MBtu/lineal foot of foundation perimeter of heating energy use compared to an uninsulated wall in Atlanta. Assuming a house with a 130 ft. perimeter basement, this is 20.8 MBtus a year. Assuming $10/MBtu natural gas cost, this insulation will save $208 a year in heating costs. For example, with the NAHB estimated insulation cost of $990 (EC42-06/07 Public Comment), the simple payback will be in about five years in Atlanta. The lost floor space from insulating basement walls should be minimal as conditioned basements are normally finished, and exterior insulation is an option. On the cooling side, the Building Foundation Design Handbook reports that R-5 insulation wall insulation 8 ft. deep saves a modest 0.12 kWh/lineal foot of foundation perimeter of heating energy use compared to an uninsulated wall in Atlanta. For a house with the 130 ft. perimeter, this is a savings of 15.6 kWh, or a little over a dollar at typical electricity prices. A basement with insulated walls will still benefit from cool summer temperatures of the deep earth because the entire basement floor will be in direct contact with the earth.

This proposal has an important improvement over a similar proposal in the 06/07 code change cycle. A compliant about the proposal in the last cycle was that zone 3 had very mild climate, particularly in the southern areas of zone 3. This new proposal exempts the “warm-humid” region of zone 3 from basement wall insulation, which includes about half of zone 3 in the eastern U.S. Therefore, basement wall insulation would only be required in the areas where basement wall insulation makes the most sense-the colder areas.

It is important to understand the insulation options for basements currently in the IECC and IRC contain a perverse incentive. Consider two houses with basements that are identical in all ways but one has a conditioned basement and the other has an unconditioned basement. Which will use more energy? Clearly, the one with a conditioned basement. Therefore, logically the envelope of the house with a conditioned basement should be at least as well insulated than the house with an unconditioned basement. However, in climate zone 3 the IECC requires R-19 insulation in the ceiling above an unconditioned basement whereas a conditioned basement is not required to have any insulation at all in either the ceiling or walls of the basement. In terms of reducing construction costs, it is to the builder's economic advantage to build a “conditioned” basement, which will raise energy use.

Furthermore, under the IECC’s definitions, a basement will be a “conditioned space” simply if ducts in the basement are not insulated. It is not even necessary to install registers or otherwise provide a heating or cooling source. Therefore the builder can not only eliminate basement ceiling insulation but also not insulate the ducts, both of which will substantially increase energy use. This is in conflict with the IECC’s intent for the “effective use of energy”. The IECC allows trade-offs where the energy efficiency of one measure can be reduced below code if a compensating improvement is made to another measure. In this case, a reduction in energy efficiency (removing basement ceiling insulation) not only allows absolutely no compensating improvement, but illogically allows yet another reduction in efficiency (removal of duct insulation).

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

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

Committee Reason: This is a needed energy conservation measure for this region, the top of Zone 3. While there is argument as to affordability, the committee noted that this would be cost effective within the life of the project.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of Part I. EC36 Part II 07/08 was disapproved by the IRC B/E committee.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 2:

Ken Sagan, National Association of Home Builders, requests Disapproval.

Commenter's Reason: This proposal subdivides a climate zone, adding complications to the code that were eliminated in the 2004 rewrite of the IECC. Calculations by the NAHB Research Center show that basement insulation is not cost effective in the southern part of the climate zone and marginally cost-effectiveness in the north part of that Zone. DOE failed to provide documentation of the ratio of heat loss to heat gain in below grade walls. Based on these deficiencies, we urge disapproval on this proposal.

Final Action: AS AM AMPC____ D

EC36-07/08, Part II

IRC Table N1102.1, Table N1102.1.2

Proposed Change as Submitted:

Proponent: Ronald Majette, U. S. Department of Energy

PART II – IRC

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[h]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40[e]	30	13	5	19	~~0~~ 5/13[f]	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

a. through e. (No change to current text)

f. Basement wall insulation is not required in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.

(Re-letter f. and g. to become g. and h.)

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	0.75	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~~ 0.091[b]	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	0.060	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

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. Basement wall U-factor of 0.360 in warm-humid locations as defined by Figure N1101.2 and Table N1101.2.

Reason: The purpose of this proposal is to add basement wall insulation requirements for the colder regions of climate zone 3. Currently, no insulation is required for conditioned basements (floor insulation is required over unconditioned basements) in Zone 3. Though basements are uncommon in Zone 3, there are some and they tend to be in the colder parts of the zone where winter temperatures can reach as low as single digits. When basements are used as a conditioned living space, they often have furred in walls that allow space for insulation.

Energy simulation analyses shows that foundation wall insulation in cold climates is cost effective. For conditioned basements, the Building Foundation Design Handbook reports that R-5 insulation wall insulation 8 ft. deep saves 0.16 MBtu/lineal foot of foundation perimeter of heating energy use compared to an uninsulated wall in Atlanta. Assuming a house with a 130 ft. perimeter basement, this is 20.8 MBtus a year. Assuming $10/MBtu natural gas cost, this insulation will save $208 a year in heating costs. For example, with the NAHB estimated insulation cost of $990 (EC42-06/07 Public Comment), the simple payback will be in about five years in Atlanta. The lost floor space from insulating basement walls should be minimal as conditioned basements are normally finished, and exterior insulation is an option. On the cooling side, the Building Foundation Design Handbook reports that R-5 insulation wall insulation 8 ft. deep saves a modest 0.12 kWh/lineal foot of foundation perimeter of heating energy use compared to an uninsulated wall in Atlanta. For a house with the 130 ft. perimeter, this is a savings of 15.6 kWh, or a little over a dollar at typical electricity prices. A basement with insulated walls will still benefit from cool summer temperatures of the deep earth because the entire basement floor will be in direct contact with the earth.

This proposal has an important improvement over a similar proposal in the 06/07 code change cycle. A compliant about the proposal in the last cycle was that zone 3 had very mild climate, particularly in the southern areas of zone 3. This new proposal exempts the “warm-humid” region of zone 3 from basement wall insulation, which includes about half of zone 3 in the eastern U.S. Therefore, basement wall insulation would only be required in the areas where basement wall insulation makes the most sense-the colder areas.

It is important to understand the insulation options for basements currently in the IECC and IRC contain a perverse incentive. Consider two houses with basements that are identical in all ways but one has a conditioned basement and the other has an unconditioned basement. Which will use more energy? Clearly, the one with a conditioned basement. Therefore, logically the envelope of the house with a conditioned basement should be at least as well insulated than the house with an unconditioned basement. However, in climate zone 3 the IECC requires R-19 insulation in the ceiling above an unconditioned basement whereas a conditioned basement is not required to have any insulation at all in either the ceiling or walls of the basement. In terms of reducing construction costs, it is to the builders economic advantage to build a “conditioned” basement, which will raise energy use.

Furthermore, under the IECC’s definitions, a basement will be a “conditioned space” simply if ducts in the basement are not insulated. It is not even necessary to install registers or otherwise provide a heating or cooling source. Therefore the builder can not only eliminate basement ceiling insulation but also not insulate the ducts, both of which will substantially increase energy use. This is in conflict with the IECC’s intent for the “effective use of energy”. The IECC allows trade-offs where the energy efficiency of one measure can be reduced below code if a compensating improvement is made to another measure. In this case, a reduction in energy efficiency (removing basement ceiling insulation) not only allows absolutely no compensating improvement, but illogically allows yet another reduction in efficiency (removal of duct insulation).

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

PART II – IRC
Committee Action: Disapproved

Committee Reason: There is not enough numerical data to support the cost benefit to justify this change. It is too subjective for the Building Official to determine the warm-humid location in zone 3.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Craig Conner, Building Quality, representing himself, requests Approval as Submitted.

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC36 alignment: EC36 was approved as submitted in the IECC and Disapproved in the IRC. To realign the two codes, EC36 should be Approved as Submitted for the IRC.

EC36 content: EC36 increases the basement insulation in the northern portion of zone 3. The IECC committee rejected basement insulation further south in a separate comment (EC32). However, the IECC committee agreed that northern Zone 3 was cold enough to benefit from basement insulation.

The IRC committee commented, *"It is too subjective for the Building Official to determine the warm-humid location in Zone 3."* Given that these counties are labeled in the new Table N1102.1, identifying warm-humid locations does not seem to be an issue.

Final Action: AS AM AMPC____ D

EC37-07/08, Part I
Table 402.1.1

Proposed Change as Submitted:

Proponent: Ronald Majette, U.S. Department of Energy

PART I – IECC

Revise table footnote as follows:

TABLE 402.1.1 (Supp)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

(No change to table entries)

a. through c. (No change to current text)
d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be 2 ft in zones 1 through 3 for heated slabs.
e. through h. (No change to current text)

Reason: The purpose of this proposal is to clarify requirements for heated slabs in climate zones 1 through 3. DOE's Building Energy Codes Program technical support staff has fielded questions about what is required here. On the one hand, footnote d indicates that R-5 insulation is required for heated slabs. On the other hand, the table specifies an insulation depth of zero. This is confusing. This proposal would clarify that insulation is indeed always required for heated slabs. A hydronic slab radiant system in a slab under a carpeted floor should be heated to 130 F (http://oikos.com/esb/43/radiantfloor.html). Even with mild ground and air temperatures in zones 1 through 3, some insulation is merited because of the high temperature difference between the slab and the outside.

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

PART I – IECC
Committee Action: **Approved as Modified**

Modify the proposal as follows:

TABLE 402.1.1 (Supp)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]
(No change to table entries)

a. through c. (No change to current text)
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. through h. (No change to current text)

Committee Reason: The code, as written does not clarify what the needed amount of insulation is, in terms of depth into the ground. This proposal provides that clarification. The modification was added to limit depth to the depth of the footing, because it does not make sense to extend insulation beyond that depth.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of Part I. EC37 Part II 07/08 was disapproved by the IRC B/E committee.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 2:

Ken Sagan, National Association of Home Builders, representing same, requests Disapproval.

Commenter's Reason: The slab / footing required in Zone 1 may not be 24-inches in depth. There are very few heated slabs in these Climate Zones. The probability of not have a footing 2-feet in depth in Zone 1 is questionable as you may be in the water table at that point. The requirement to heat a slab in Miami Florida is neither cost-efficient nor commonly recommended. The IRC committee requested data for cost benefit and payback and has seen none. The slab R-values currently is zero due to the termite damage in zones 1, 2 and 3. This was defeated in Part 2, the IRC.

Final Action: AS AM AMPC____ D

EC37-07/08, Part II
IRC Table N1102.1

Proposed Change as Submitted:

Proponent: Ronald Majette, U.S. Department of Energy

PART II – IRC

Revise table footnote as follows:

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

(No change to table entries)

a. through c. (No change to current text)

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be 2 ft in zones 1 through 3 for heated slabs.

Reason: The purpose of this proposal is to clarify requirements for heated slabs in climate zones 1 through 3. DOE's Building Energy Codes Program technical support staff has fielded questions about what is required here. On the one hand, footnote d indicates that R-5 insulation is required for heated slabs. On the other hand, the table specifies an insulation depth of zero. This is confusing. This proposal would clarify that insulation is indeed always required for heated slabs. A hydronic slab radiant system in a slab under a carpeted floor should be heated to 130 F (http://oikos.com/esb/43/radiantfloor.html). Even with mild ground and air temperatures in zones 1 through 3, some insulation is merited because of the high temperature difference between the slab and the outside.

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

PART II – IRC
Committee Action: Disapproved

Committee Reason: The committee would like to see data for cost benefit and pay back. The 2 feet depth for zones 1 through 3 is unclear. The slab R-value and depth is zero as now shown due to termites in zones 1, 2 and 3. The footnote should only be located in cells that contain value. This change needs to be reworked and brought back.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE N1102.1.1 (Supp)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT
(No change to table entries)

a. through c. (No change to current text)
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. through h. (No change to current text)

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*
EC37 alignment: EC37 was Approved as Modified in the IECC, but Disapproved in the IRC. To realign the two codes, EC37 for the IRC should be approved as modified by the IECC committee.
EC37 content: EC37 applies only to heated slabs in zones 1 to 3. EC37 sets the insulation depth. The existing code is unclear. The depth set by EC37 might be taken as implied, but EC37 makes it explicit and clear. The IRC committee agreed the footnote was unclear. The IRC committee also commented that there was no cost-benefit analysis; however, specifying the depth is as more of a clarification than a new requirement because the R-value is already in the code.

Final Action: AS AM AMPC____ D

EC38-07/08
Table 402.1.3, 402.1.5 (New), Table 402.1.5 (New), Table 402.1.6 (New), Table 402.1.7 (New)

Proposed Change as Submitted:

Proponent: Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI)

1. Revise table as follows:

TABLE 402.1.3 (Supp)
EQUIVALENT U-FACTORS [a]

CLIMATE ZONE	FENES-TRATION U-FACTOR	SKY-LIGHT 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~~ 0.036	0.082	0.197	~~0.064~~ 0.060	0.360	0.477
2	0.75	0.75	~~0.035~~ 0.036	0.082	0.165	~~0.064~~ 0.060	0.360	0.477
3	0.65	0.65	~~0.035~~ 0.036	0.082	0.141	~~0.047~~ 0.046	0.360	0.136
4 except Marine	0.40	0.60	~~0.030~~ 0.031	0.082	0.141	~~0.047~~ 0.046	0.059	0.065
5 and Marine 4	0.35	0.60	~~0.030~~ 0.031	0.060	0.082	0.037	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	0.041	0.057

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 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 and the same as the wood frame wall in zones 5 through 8.

2. Add new text and tables as follows:

402.1.5 Envelope component default values. When calculating the U-factor of an assembly as part of Section 402.1.3, 402.1.4, or 404.5.2, the values in Table 402.1.5 through 402.1.7 shall be used unless alternate values are approved by the code official. In addition, the U-factor of the assembly shall be calculated using a series-parallel calculation.

TABLE 402.1.5
FRAME WALL COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.68	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 77%	Framing: 23%
Proposed Design Default Insulation / Framing Fraction	Insulation: 77%	Framing: 23%
Sheathing Layer R-Value	0.63	
Siding Layer R-Value	0.44	
Exterior Air Film R-Value	0.45	

TABLE 402.1.6
FLOOR COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.92	
Floor Covering R-Value	1.23	
Floor Subfloor R-Value	0.63	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 90%	Framing: 10%
Proposed Design Default Insulation / Framing Fraction	Insulation: 90%	Framing: 10%
Exterior Air Film R-Value	0.92	

TABLE 402.1.7
CEILING COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.61	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 89%	Framing: 11%
Proposed Design Default Insulation / Framing Fraction	Insulation: 89%	Framing: 11%
Exterior Air Film R-Value	0.61	

Reason: 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 requirements, but does change the U-factors to be calculated based on the component default value tables. 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.

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

Committee Action: **Disapproved**

Committee Reason: The proposed values would not be consistent with ASHRAE.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Steven Rosenstock, Edison Electric Institute, Harry Misuriello, American Council for Energy Efficient Economy, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.3
EQUIVALENT U-FACTORS [a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035 ~~36~~	0.081 ~~82~~	0.197	0.063 ~~60~~	0.360	0.477
2	0.75	0.75	0.035 ~~36~~	0.081 ~~82~~	0.165	0.063 ~~60~~	0.360	0.477
3	0.65	0.65	0.035 ~~36~~	0.081 ~~82~~	0.141	0.049 ~~46~~	0.360	0.136
4 except Marine	0.40	0.60	0.027 ~~31~~	0.081 ~~82~~	0.141	0.049 ~~46~~	0.059	0.065
5 and Marine 4	0.35	0.60	0.027 ~~31~~	0.059 ~~60~~	0.082	0.033 ~~37~~	0.059	0.065
6	0.35	0.60	0.021 ~~26~~	0.059 ~~60~~	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.021 ~~26~~	0.056 ~~57~~	0.057	0.033	0.041	0.057

b. Nonfenestration U-factors shall be obtained from measurement, calculation, or an approved source.

Add new text and tables as follows:

402.1.5 Envelope Component Descriptions and Default Values. When calculating the U-factor of an assembly as part of Section 402.1.3, 402.1.4, or 404.5.2, the values in Table 402.1.5.1 through 402.1.5.3~~7~~ shall be used unless alternate values are approved by the code official. In addition, the U-factor of the assembly shall be calculated using a series-parallel calculation with the default framing fractions in Table 402.1.5.1 through 402.1.5.3. Subject to approval by the code official, the frame fractions for the proposed design shall be permitted to be determined by the type of construction (Satisfactory, Intermediate or Advanced) as defined in sections 402.1.5.1 through 402.1.5.3.

402.1.5.1 Wood stud frame walls. The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood stud frame walls are defined as follows:

Satisfactory Insulation and Framing Fractions:
Satisfactory wood stud frame walls include studs framed on 16 inch centers with double top plate and single bottom plate. Corners use three studs and each opening is framed using two studs.

- Studs and plates: 21%
- Insulated cavity: 75%
- Headers: 4%

Intermediate Insulation and Framing Fractions:
Intermediate wood stud frame walls include studs framed on 16 inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and each opening is framed by two studs.

- Studs and plates: 18%
- Insulated cavity: 78%
- Headers: 4%

Advanced Insulation and Framing Fractions:
Advanced wood stud frame walls include studs framed on 24 inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and one stud is used to support each header.

- Studs and plates: 13%
- Insulated cavity: 83%
- Headers: 4%

TABLE 402.1.5.1
FRAME WALL COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.68	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: ~~77~~ 78%	Framing: ~~23~~ 22%
Proposed Design Default Insulation / Framing Fraction	Insulation: ~~77~~ 78%	Framing: ~~23~~ 22%
Insulating Sheathing Layer R-Value	0 or as installed	
Structural Sheathing Layer R-Value	0.62 ~~63~~	
Siding Layer R-Value	0.61 ~~44~~	
Exterior Air Film R-Value	0.25 ~~45~~	

402.1.5.2 Wood frame floors. The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood stud frame floors are defined as follows:

Satisfactory Insulation and Framing Fractions:
Satisfactory wood floors include open joist systems framed 12 inch centers or solid joists framed 16 inch centers.

- Framing: 12%
- Insulated cavity: 88%

Intermediate Insulation and Framing Fractions:
Intermediate wood floors include open joist systems framed 16 inch centers or solid joists framed 20 inch centers.

- Framing: 10%
- Insulated cavity: 90%

Advanced Insulation and Framing Fractions:
Advanced wood floors include open joist systems framed 20 inch centers or joists framed 24 inch centers.

Framing: 8%
Insulated cavity: 92%

TABLE 402.1.5.2 ~~6~~
FLOOR COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.92	
Floor Covering R-Value	1.23	
Floor Subfloor R-Value	0.94 ~~63~~	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 90%	Framing: 10%
Proposed Design Default Insulation / Framing Fraction	Insulation: 90%	Framing: 10%
Exterior Air Film R-Value	0.92	

402.1.5.3 Wood frame ceilings. The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood stud frame ceilings are defined as follows:

Satisfactory Insulation and Framing Fractions:
Satisfactory ceiling insulation and framing assumes tapering of insulation depth around the perimeter with resultant decrease in thermal resistance. An increased R-value is assumed in the center of the ceiling due to the effect of piling leftover insulation.

Framing: 11%
Insulated cavity: 89%

Intermediate Insulation and Framing Fractions:
Intermediate ceiling insulation and framing assumes tapering of insulation depth around the perimeter with resultant decrease in thermal resistance. An increased R-value is assumed in the center of the ceiling due to the effect of piling leftover insulation.

Framing: 9%
Insulated cavity: 91%

Advanced Insulation and Framing Fractions:
Advanced ceiling insulation and framing assumes full and even depth of insulation extending to the outside edge of exterior perimeter of the ceiling.

Framing: 7%
Insulated cavity: 93%

TABLE 402.1. 5.3 ~~7~~
CEILING COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.61	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: ~~89~~ 91%	Framing: ~~11~~ 9%
Proposed Design Default Insulation / Framing Fraction	Insulation: ~~89~~ 91%	Framing: ~~11~~ 9%
Exterior Air Film R-Value	0.61	

Commenter's Reason: EC-38 is an important proposal that offers an easy way to understand the true energy efficiency of the homes that are being constructed. By defining both the standard and proposed home default construction values, the home building industry is encouraged to meet the standard construction techniques and improve to the advanced framing construction techniques.

EC-38 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.

The language added is based on the Washington State Energy Code language that defines wall framing. While not all of the language defining the walls has been included in this proposal, the code language significantly adopts the structure and values already in use in the Washington State Code.

The committee had concerns with the values in the original EC-38 proposal. This public comment modifies the values to be based on ASHRAE where possible and further supplemented with Rescheck, HERS and Washington State Energy code information.

Final Action: AS AM AMPC____ D

EC39-07/08

Table 402.1.3, 402.1.5 (New), Table 402.1.5 (New), Table 402.1.6 (New), Table 402.1.7 (New)

Proposed Change as Submitted:

Proponent: Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI)

1. Revise table as follows:

TABLE 402.1.3 (Supp)
EQUIVALENT U-FACTORS [a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	~~0.082~~ 0.075	0.197	~~0.064~~ 0.060	0.360	0.477
2	0.75	0.75	0.035	~~0.082~~ 0.075	0.165	~~0.064~~ 0.060	0.360	0.477
3	0.65	0.65	0.035	~~0.082~~ 0.075	0.141	~~0.047~~ 0.046	0.360	0.136
4 except Marine	0.40	0.60	~~0.030~~ 0.029	~~0.082~~ 0.075	0.141	~~0.047~~ 0.046	0.059	0.065
5 and Marine 4	0.35	0.60	~~0.030~~ 0.029	~~0.060~~ 0.054	0.082	0.037	0.059	0.065
6	0.35	0.60	~~0.026~~ 0.024	~~0.060~~ 0.054	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	~~0.026~~ 0.024	~~0.057~~ 0.051	0.057	0.033	0.041	0.057

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 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 and the same as the wood frame wall in zones 5 through 8.

2. Add new text and tables:

402.1.5 Envelope Component Default Values. When calculating the U-factor of an assembly as part of Section 402.1.3, 402.1.4, or 404.5.2, the values in Table 402.1.5 through 402.1.7 shall be used unless alternate values are documented and approved by the code official. In addition, the U-factor of the assembly shall be calculated using a series-parallel calculation.

TABLE 402.1.5
FRAME WALL COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.68	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 86%	Framing: 14%
Proposed Design Default Insulation / Framing Fraction	Insulation: 77%	Framing: 23%
Sheathing Layer R-Value	0.63	
Siding Layer R-Value	0.44	
Exterior Air Film R-Value	0.45	

TABLE 402.1.6
FLOOR COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.92	
Floor Covering R-Value	1.23	
Floor Subfloor R-Value	0.63	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 92%	Framing: 8%
Proposed Design Default Insulation / Framing Fraction	Insulation: 90%	Framing: 10%
Exterior Air Film R-Value	0.92	

TABLE 402.1.7
CEILING COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.61	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 93%	Framing: 7%
Proposed Design Default Insulation / Framing Fraction	Insulation: 89%	Framing: 11%
Exterior Air Film R-Value	0.61	

Reason: This proposal is intended to make the calculations within the code and the use of code consistent and transparent. 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.

The standard reference design and proposed design default are proposed to be different to allow proposed residential buildings to take advantage of proper framing techniques. The changes in framing fractions for the Standard Reference Design are intended to represent current proper framing techniques, while the proposed design defaults are intended to represent typical framing techniques. While this proposal does not help to improve the worst framing techniques, which can include a significant number, such as 10-15 2x4's tacked side by side, this proposal does give guidance and opportunity to address framing of building envelopes.

By adopting explicit component default value tables, the industry tools can increase consistency in how buildings are modeled. By adopting improved standard reference design default values, builders can take advantage of having proper or improved framing techniques.

The residential building energy efficiency requirements in ICC codes have not had a substantial overall national improvement in many years. During that time, fuel prices have increased dramatically and environmental concerns from energy usage (notably global warming) have come to the forefront. Improving residential new construction energy efficiency is one of the most cost-effective ways to reduce consumption within the country. This proposal represents one reasonable and cost effective improvement that will provide states with an option to easily increase the efficiency of their code.

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

Committee Action: Disapproved

Committee Reason: The proposed values would not be consistent with ASHRAE.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Steven Rosenstock, Edison Electric Institute, Harry Misuriello, American Council for Energy Efficient Economy, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.1.3
EQUIVALENT U-FACTORS [a]

CLIMATE ZONE	FENES-TRATION U-FACTOR	SKY-LIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.034 ~~35~~	0.078 ~~75~~	0.197	0.063 ~~60~~	0.360	0.477
2	0.75	0.75	0.034 ~~35~~	0.078 ~~75~~	0.165	0.063 ~~60~~	0.360	0.477
3	0.65	0.65	0.034 ~~35~~	0.078 ~~75~~	0.141	0.048 ~~46~~	0.360	0.136
4 except Marine	0.40	0.60	0.027 ~~29~~	0.078 ~~75~~	0.141	0.048 ~~46~~	0.059	0.065
5 and Marine 4	0.35	0.60	0.027 ~~29~~	0.056 ~~54~~	0.082	0.032 ~~37~~	0.059	0.065
6	0.35	0.60	0.020 ~~24~~	0.056 ~~54~~	0.060	0.032 ~~33~~	0.059	0.065
7 and 8	0.35	0.60	0.020 ~~24~~	0.053 ~~51~~	0.057	0.032 ~~33~~	0.041	0.057

c. Nonfenestration U-factors shall be obtained from measurement, calculation, or an approved source.

Add new text and tables as follows:

402.1.5 Envelope Component Descriptions and Default Values. When calculating the U-factor of an assembly as part of Section 402.1.3, 402.1.4, or 404.5.2, the values in Table 402.1.5.1 through 402.1.5.3~~7~~ shall be used unless alternate values are approved by the code official. In addition, the U-factor of the assembly shall be calculated using a series-parallel calculation with the default framing fractions in Table 402.1.5.1 through 402.1.5.3. Subject to approval by the code official, the frame fractions for the proposed design shall be permitted to be determined by the type of construction (Satisfactory, Intermediate or Advanced) as defined in sections 402.1.5.1 through 402.1.5.3.

402.1.5.1 Wood stud frame walls. The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood stud frame walls are defined as follows:

Satisfactory Insulation and Framing Fractions:

Satisfactory wood stud frame walls include studs framed on 16 inch centers with double top plate and single bottom plate. Corners use three studs and each opening is framed using two studs.

- Studs and plates: 21%
- Insulated cavity: 75%
- Headers: 4%

Intermediate Insulation and Framing Fractions:

Intermediate wood stud frame walls include studs framed on 16 inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and each opening is framed by two studs.

- Studs and plates: 18%
- Insulated cavity: 78%
- Headers: 4%

Advanced Insulation and Framing Fractions:

Advanced wood stud frame walls include studs framed on 24 inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and one stud is used to support each header.

- Studs and plates: 13%
- Insulated cavity: 83%
- Headers: 4%

TABLE 402.1.5.1
FRAME WALL COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.68	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: ~~86~~ 83%	Framing: ~~14~~ 17%
Proposed Design Default Insulation / Framing Fraction	Insulation: ~~77~~ 78%	Framing: ~~23~~ 22%
Insulating Sheathing Layer R-Value	0 or as installed	
Structural Sheathing Layer R-Value	0.62 ~~63~~	
Siding Layer R-Value	0.61 ~~44~~	
Exterior Air Film R-Value	0.25 ~~45~~	

402.1.5.2 Wood frame floors. The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood stud frame floors are defined as follows:

Satisfactory Insulation and Framing Fractions:

Satisfactory wood floors include open joist systems framed 12 inch centers or solid joists framed 16 inch centers.

- Framing: 12%
- Insulated cavity: 88%

Intermediate Insulation and Framing Fractions:

Intermediate wood floors include open joist systems framed 16 inch centers or solid joists framed 20 inch centers.

- Framing: 10%
- Insulated cavity: 90%

Advanced Insulation and Framing Fractions:

Advanced wood floors include open joist systems framed 20 inch centers or joists framed 24 inch centers.

- Framing: 8%
- Insulated cavity: 92%

TABLE 402.1.5.2 ~~6~~
FLOOR COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.92	
Floor Covering R-Value	1.23	
Floor Subfloor R-Value	0.94 ~~63~~	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 92%	Framing: 8%
Proposed Design Default Insulation / Framing Fraction	Insulation: 90%	Framing: 10%
Exterior Air Film R-Value	0.92	

402.1.5.3 Wood frame ceilings. The type of construction (Satisfactory, Intermediate or Advanced) for determination of default framing fractions in wood stud frame ceilings are defined as follows:

Satisfactory Insulation and Framing Fractions:
Satisfactory ceiling insulation and framing assumes tapering of insulation depth around the perimeter with resultant decrease in thermal resistance. An increased R-value is assumed in the center of the ceiling due to the effect of piling leftover insulation.
Framing: 11%
Insulated cavity: 89%

Intermediate Insulation and Framing Fractions:
Intermediate ceiling insulation and framing assumes tapering of insulation depth around the perimeter with resultant decrease in thermal resistance. An increased R-value is assumed in the center of the ceiling due to the effect of piling leftover insulation.
Framing: 9%
Insulated cavity: 91%

Advanced Insulation and Framing Fractions:
Advanced ceiling insulation and framing assumes full and even depth of insulation extending to the outside edge of exterior perimeter of the ceiling.
Framing: 7%
Insulated cavity: 93%

TABLE 402.1. 5.3 ~~7~~
CEILING COMPONENT DEFAULT VALUES

Component	Default Value	
Interior Air Film R-Value	0.61	
Drywall Layer R-Value	0.45	
Cavity Layer R-Values	Insulation: As Specified	Framing: R-1.25 per inch of wood
Standard Reference Design Insulation / Framing Fraction	Insulation: 93%	Framing: 7%
Proposed Design Default Insulation / Framing Fraction	Insulation: ~~89~~ 91%	Framing: ~~11~~ 9%
Exterior Air Film R-Value	0.61	

Commenter's Reason: EC-39 is an important proposal that offers an easy way to understand the true energy efficiency of the homes that are being constructed while also promoting proper framing techniques for the envelope of the home. By defining both the standard and proposed home default construction values, the home building industry is encouraged to meet the standard construction techniques and improve to the advanced framing construction techniques which in turn create energy savings while also reducing the cost of material used to construct the home.

The language added is based on the Washington State Energy Code language that defines wall framing. While not all of the language defining the walls has been included in this proposal, the code language significantly adopts the structure and values already in use in the 2006 Washington State Energy Code.

The committee had concerns with the values in the original EC-39 proposal. This public comment modifies the values to be based on ASHRAE where possible and further supplemented with Rescheck, HERS and Washington State Energy code information.

Final Action: AS AM AMPC____ D

EC42-07/08, Part I

Table 402.1.3, Table 404.5.2(1)

Proposed Change as Submitted:

Proponent: Ronald Majette, U.S. Department of Energy

PART I – IECC

Revise tables as follows:

TABLE 402.1.3 (Supp)
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[c]	Crawl Space Wall U-Factor[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	~~0.360~~ <u>0.948</u>	~~0.477~~ <u>0.948</u>
2	0.75	0.75	0.035	0.082	0.165	0.064	~~0.360~~ <u>0.948</u>	~~0.477~~ <u>0.948</u>
3	0.65	0.65	0.035	0.082	0.141	0.047	~~0.360~~ <u>0.948</u>	~~0.136~~ <u>0.192</u>
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	~~0.059~~ <u>0.084</u>	~~0.065~~ <u>0.084</u>
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.033	~~0.059~~ <u>0.084</u>	~~0.065~~ <u>0.084</u>
6	0.35	0.60	0.026	0.060	0.060	0.033	~~0.059~~ <u>0.084</u>	~~0.065~~ <u>0.084</u>
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	~~0.059~~ <u>0.084</u>	~~0.065~~ <u>0.084</u>

a. Non-fenestration 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 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 and the same as the wood frame wall in zones 5 through 8.
<u>c. Foundation U-factor requirements include wall construction and interior air films but exclude soil conductivity and exterior air films.</u>

TABLE 404.5.2(1) (Supp)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Foundations	Type: same as proposed <u>foundation wall area above and below grade: same as proposed</u>	As proposed <u>As proposed</u>

(Portions of table and footnotes not shown remain unchanged)

Reason: The purpose of this code change is to remove the ground (earth) conductance from the U-factor requirements in the IECC and Chapter 11 of the IRC. The ground is not an inherent characteristic of the building construction and is therefore an unnecessary and confusing element to include 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.

PART I – IECC
Committee Action: **Approved as Modified**

Modify the proposal as follows:

TABLE 402.1.3 (Supp)
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[c]	Crawl Space Wall U-Factor[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.948	0.948
2	0.75	0.75	0.035	0.082	0.165	0.064	0.948	0.948
3	0.65	0.65	0.035	0.082	0.141	0.047	0.948	0.192
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.084	0.084
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.033	0.084	0.084
6	0.35	0.60	0.026	0.060	0.060	0.033	0.084	0.084
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.084	0.084

a. Non-fenestration 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 0.17 in zone 1, 0.14 in zone 2, 0.12 in zone 3, 0.10 in zone 4 and the same as the wood frame wall in zones 5 through 8.
c. 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 via Section 402.1.4 (Total UA alternative) of Section 405 (Simulated Performance Alternative) shall be modified to include soil conductivity and exterior air films.

TABLE 404.5.2(1) (Supp)
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 and soil characteristics: same as proposed	As proposed As proposed

(Portions of table and footnotes not shown remain unchanged)

Committee Reason: This approach makes the application of code requirements simpler. The modification makes the approach clearer, with an explanation in the footnotes that is consistent with ASHRAE 25.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Ronald Majette, U.S. Department of Energy, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

TABLE 402.1.3
EQUIVALENT U-FACTORS(A)

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor(b)	Floor U-Factor	Basement Wall U-Factor(c)	Crawl Space Wall U-Factor(c)
1	1.20	0.75	0.035	0.082	0.197	0.064	0.948	0.948
2	0.75	0.75	0.035	0.082	0.165	0.064	0.948	0.948
3	0.65	0.65	0.035	0.082	0.141	0.047	0.948	0.192
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.084	0.084
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.037	0.084	0.084
6	0.35	0.60	0.026	0.060	0.060	0.033	~~0.084~~0.059	0.084
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	~~0.084~~0.059	0.084

(Portions of the Table and footnotes not shown remain unchanged from the approved version of EC42)

(Portions of proposal not shown remain unchanged)

Commenter's Reason: This public comment does not change foundation insulation requirements, but rather creates consistency with EC33, which was approved by the committee vote. This public comment only modifies Zone 7 and 8 basement wall U-factors to be correct for the approved EC33. EC42 only changes how foundation U-factors are calculated, by removing the effects of the soil from the U-factor calculation. EC42 was approved by the IECC committee.

Public Comment 2:

Ronald Majette, U.S. Department of Energy, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

TABLE 402.1.3
EQUIVALENT U-FACTORS[A]

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor[b]	Floor U-Factor	Basement Wall U-Factor[c]	Crawl Space Wall U-Factor[c]
1	1.20	0.75	0.035	0.082	0.197	0.064	0.948	0.948
2	0.75	0.75	0.035	0.082	0.165	0.064	0.948	0.948
3	0.65	0.65	0.035	0.082	0.141	0.047	~~0.948~~0.192	0.192
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.084	0.084
5 and Marine 4	0.35	0.60	0.030	0.060	0.082	0.037	0.084	0.084
6	0.35	0.60	0.026	0.060	0.060	0.033	0.084	0.084
7 and 8	0.35	0.60	0.026	0.057	0.057	0.033	0.084	0.084

(c) Basement wall U-factor of ~~0.360~~0.948 in warm-humid locations as defined by Figure 301.1 and Table 301.2.

(Portions of the Table and footnotes not shown remain unchanged from the approved version of EC42)

(Portions of proposal not shown remain unchanged)

Commenter's Reason: This public comment does not change foundation insulation requirements, but rather creates consistency with EC36, which was approved by the committee vote. This public comment only modifies the Zone 3 basement wall U-factor to correct for the approved EC36. EC42 only changes how foundation U-factors are calculated, by removing the effects of the soil from the U-factor calculation. EC42 was approved by the IECC committee.

Public Comment 3:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of Part I. EC42 Part II 07/08 was disapproved by the IRC B/E Committee.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 4:

Ken Sagan, National Association of Home Builders, representing same, requests Disapproval.

Commenter's Reason: The proponent, DOE, did not provide any justification to the exclusion to airfilms nor did it provide any data to define soil conductivity. The definition of Soil conductivity is not listed in the Definitions Section of any of the codes. This proposal adds confusion on how to calculate the baseline basement and crawl space Wall U-Factors. Where do the soil characteristics come from? DOE did not provide that data in this proposal. How is this to be applied to calculate the Total UA Alternative? EC-42 modifications will only add to confusion on handling foundation walls.

Analysis. Regarding Public Comment No.1, there are public comments submitted on both EC33 and EC36.

Final Action: AS AM AMPC____ D

EC42-07/08, Part II
IRC Table N1102.1.2

Proposed Change as Submitted:

Proponent: Ron Majette, U.S. Department of Energy

PART II – IRC

Revise table 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[b]	Crawl Space Wall U-Factor[b]
1	1.20	0.75	0.035	0.082	0.197	0.064	~~0.360~~ 0.948	~~0.477~~ 0.948
2	0.75	0.75	0.035	0.082	0.165	0.064	~~0.360~~ 0.948	~~0.477~~ 0.948
3	0.65	0.65	0.035	0.082	0.141	0.047	~~0.360~~ 0.948	~~0.136~~ 0.192
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	0.033	~~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. Foundation U-factor requirements include wall construction and interior air films but exclude 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 construction and is therefore an unnecessary and confusing element to include 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.

PART II – IRC
Committee Action: **Disapproved**

Committee Reason: The proposal needs to be reworked and brought back to include the modification that was ruled out of order.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Ronald Majette, U.S. Department of Energy, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE N1102.1.2
EQUIVALENT U-FACTORS[a]

(No change to proposed table)

a. (No change)
b. Foundation U-factor requirements shown in Table N1102.1.2 include wall construction and interior air films but exclude soil conductivity and exterior air films. U-factors for determining code compliance via Section N1102.1.3 (Total UA alternative) shall be modified to include soil conductivity and exterior air films.

Commenter's Reason: (Conner) *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC42 alignment: EC42 was Approved as Modified in the IECC, but Disapproved in the IRC. To realign the two codes, EC42 should also be Approved as Modified for the IRC.

EC42 content: EC42 removes the ground (earth) conductance from the U-factor requirements, making the required calculation easier. The required R-value is already in the code, so EC42 is not a change in insulation levels.

Commenter's Reason: (Majette) The purpose of this proposed 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 construction and is therefore an unnecessary and confusing element to include 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.

An identical proposal was unanimously approved by the IECC committee. This proposal was disapproved by the IRC because a floor modification was ruled out of order. This floor modification added clarifying text to footnote b and is included in this public comment.

This public comment does not change foundation insulation requirements.

Final Action: AS AM AMPC____ D

EC43-07/08, Part I
402.1.4, Table 402.1.4

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART I – IECC

Add new text and table as follows:

402.1.4 Insulation tradeoff. The insulation requirements in Table 402.1.4 shall be permitted as a tradeoff for the specified improvement.

(Renumber subsequent section)

TABLE 402.1.4
INSULATION TRADEOFFS

Climate Zone	Improvement from Minimum Requirement	Reduction in Prescriptive Insulation Requirement
4	SEER 14 with AFUE 90, or SEER 14 with HSPF 8.5, or Ground source heat pump, or Reduced leakage residence, or Reduced leakage ducts	R-38 → R-30 ceiling
5 and 4 Marine	AFUE 90, or SEER 14 with HSPF 8.5, or Ground source heat pump, or Reduced leakage residence, or Reduced leakage ducts	R-19 → R-13 wall
5 and 4 Marine	Ground source heat pump, or AFUE 90 with reduced leakage residence or ducts, or SEER 14 with HSPF 8.5 with reduced leakage residence or ducts	R38 → R-30 ceiling, R-19 → R-13 wall, and R-30 → R-19 floor
6	AFUE 90, or Ground source heat pump, or Reduced leakage residence, or Reduced leakage ducts	R-19 → R-13 wall
6	Ground source heat pump, or AFUE 90 with reduced leakage residence, or AFUE 90 with reduced leakage ducts	R-49 → R-38 ceiling, R-19 → R-13 wall, and R-30 → R-19 floor

Notes:
1. Residences with electric furnaces or electric baseboard heating as the primary heat source are not eligible to use this table.
2. Oil boiler or oil furnace with AFUE 85 meets the AFUE requirement.
3. Ground source heat pump minimum is 2.9 COP with 13 EER.

4. An approved person shall conduct airtight testing and provide written results to the code official.
5. "Reduced leakage residence" means leakage does not exceed 4 air changes per hour at 50 Pascals when tested as specified by ASTM E779-03.
6. "Reduced leakage ducts" means duct and plenum leakage does not exceed 3 CFM per 100 ft^2 of conditioned floor area when tested at 25 Pascals (0.1" w.g.) as specified by ASTM E1554-2003. All ducts and HVAC air handler within conditioned space meets the reduced leakage duct requirement.

Reason: Many builders settle for the prescriptive table out of frustration with the complex IECC performance method, even though they would rather incorporate alternative energy improvements in lieu of some prescriptive requirements. The tradeoff table allows some common energy-efficient upgrades that trade off on some more costly and/or difficult prescriptive requirements without the need to hire energy experts to calculate code compliance for every house as is already allowed in IECC Section 405 Simulated Performance Alternative.

The improvements listed in Table 402.1.4 / N1102.1.4 have been tested by the NAHB Research Center for multiple homes within multiple cities for each climate zone to ensure that the net energy used in the home will be LESS after the tradeoff than before. Baseline simulations were performed using the Standard Reference Design as defined in Table 404.5.2.1. Baseline homes were constructed on a vented crawlspace.

Several specifics in the tradeoff table deserve comment:

1) The AFUE 90 furnace requirement represents a threshold for condensing furnaces, even though an AFUE less than 90 that would meet the energy equivalency requirement energy efficiencies between 83 and 90 are not available in the market.
2) Heat pumps become less efficient (and less common) in northern climates, and therefore are not included in zone 6. The new Energy Star criteria also specifies a heat pump HSPF of 8.5 in zones 4 and 5, and requires a performance path (Section 405 in this code) in zones 6 and above.
3) The airtightness of new homes varies considerably; however, a 4 ACH (under house airtightness testing pressure) would represent a tight home; in most situations it would exceed the airtightness required by Energy Star.
4) Duct losses are often stated to be in the 15% to 25% range; therefore, moving the ducts indoor or testing ducts for air tightness can save substantial energy.
5) Users are not eligible to use this table for residences primarily heated with electric resistance furnaces and electric baseboard heating because of the poor efficiency of electric resistance heating.
6) Oil boilers and furnaces are allowed to have a lower AFUE because the available AFUEs do not go as high as gas AFUEs.
7) The airtightness tests for the house and the ducts are specified at the most commonly used pressures for those tests.

Including this "prescriptive" tradeoff table in the code encourages users to use the efficiency improvements in the table. The table streamlines compliance with these tradeoffs. These tradeoffs are conservative. In some cases the optional improvement saves significantly more energy than the allowed tradeoff. Overall, the table nets additional energy efficiency because code users choose the option of using energy efficiency improvements that may more than compensate for the insulation levels allowed.

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

PART I – IECC
Committee Action: Disapproved

Committee Reason: Based upon IRC B/E Committee action on Part II, and in accordance with the proponent's request.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

James D. Bowman, American Forest and Paper Association, requests Approval as Submitted.

Commenter's Reason: Approving this proposal provides flexible options for achieving equivalent energy efficiency. One of the biggest challenges with prescriptive code requirements is that, by nature, they are – inflexible. It makes sense that the IECC process maximize – not restrict -- the flexibility in meeting prescriptive requirements wherever it can by including language such as this. Since the level of energy efficiency is not diminished by the alternative options of the proposal, there is no fundamentally sound reason for denial.

Some might say that the precise technical equivalencies have not been demonstrated. That might be technically true but the same could be said about virtually any prescriptive alternatives in any building code. In this case, the differences are not that fundamentally significant. There are many examples in the energy provisions and building codes in general where rough equivalencies are balanced with the practical realities of accepted design and construction practices. This is one of those cases where an opportunity is being proposed that will make compliance much easier for many. When compliance options are practical and more accommodating, such as those proposed, they are more likely to be attained.

Enforcement, design and construction stakeholders must have every available tool to facilitate compliance while conforming to the intent of the provisions in order to make compliance a practical reality. The argument that allowing these tradeoffs somehow "limits" future changes or the adoption of advanced technologies in the future is faulty logic. Opponents promote the notion that this proposal "paddle locks" the future and that once adopted cannot be changed. To the contrary, any code language can be changed in the future if it conforms to the evolving will of the membership. In all likelihood, the tradeoff provisions will be made more restrictive in the future but that does not mean they should be ignored in the present.

Opponents should be reminded that provisions such as these are minimum code requirements, not "placeholders" for the future. Retaining current, limited options because of what might be done in the future doesn't make a lot of sense. This code is about providing what every designer and code official wants in a building code – flexibility to use different options. This proposal simply provides more options without compromising energy efficiency and should be approved by the membership.

Public Comment 2:

Mark Halverson, American Forest and Paper Association, requests Approval as Submitted.

Commenter's Reason: APA would like to challenge the IECC Committee's decision to disapprove EC43-07/08 based on the following considerations:

- The U.S. Department of Energy through their Building Codes Assistance Project (BCAP) supports the concept of trade-offs in the prescriptive part of the energy code. Note the following paragraph taken from the BCAP website: "Energy codes generally provide two methods for compliance. The first, and most common method (though, this tends to vary by locality) is referred to as the prescriptive approach. In this approach, a structure must be built to the prescribed insulation and other values found in the code. Trade-offs are allowed between certain building components that have different energy performances, giving an added degree of flexibility." It is reasonable to assume that basic, commonsense trade-off opportunities from the prescriptive envelope requirements found in Table 402.1.4 should not only be allowed, but welcomed into Chapter 4 of the International Energy Conservation Code.
- All of the proposed energy neutral trade-offs found in this proposal are already available to builders in the performance part of the energy code by use of approved computer programs and commonly used by builders as reported during testimony by a representative from the National Association of Home Builders Research Center (NAHB-RC). Furthermore, these trade-off requirements have been documented through software analysis by the proponent as well as the NAHB-RC to provide energy efficiency equal to or better than the prescribed envelop requirements dictated in Table 402.1.4.
- The advantage of this proposal to the Plans Examiner/Building Official is that he can immediately recognize the correctness of some of the most common tradeoffs without having to review the input and output of a computer program. A quick look at the prescriptive tradeoffs proposed in the Energy Code will be all that is required. Certainly the computer programs will still be available to the builder if additional alternative energy conservation methods are desirable. This proposal will go a long way toward making energy efficiency more palatable by providing an easy and cost effective solution to incorporate the most common trade-offs.
- This proposal will allow builders to use a wider variety of construction techniques and products to provide enhanced value to the home buyer and better control the cost of the building while continuing to maintain or improve the energy efficiency.
- Builders will have an opportunity to use more structural sheathing products that will more easily meet the wall bracing requirements of the code through the prescriptive method of the energy code.

Builders in climate zones 5 & 6 will be able to use methods such as full sheathing with wood structural panels in building 2x4 framed walls by using the prescriptive portion of the building codes. This method provides superior damage resistance from wind loads in all directions as well as the opportunity for builders to use all varieties of siding materials including vinyl siding which is recommended to be installed over only structural sheathing materials as found in the ES-Reports of the vinyl siding manufacturers.

Final Action: AS AM AMPC____ D

EC43-07/08, Part II

IRC N1102.1.4, Table N1102.1.4

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART II – IRC

Add new text and table as follows:

N1102.1.4 Insulation tradeoff. The insulation requirements in Table 402.1.4 shall be permitted as a tradeoff for the specified improvement.

TABLE N1102.1.4
INSULATION TRADEOFFS

Climate Zone	Improvement from Minimum Requirement	Reduction in Prescriptive Insulation Requirement
4	SEER 14 with AFUE 90, or SEER 14 with HSPF 8.5, or Ground source heat pump, or Reduced leakage residence, or Reduced leakage ducts	R-38 → R-30 ceiling
5 and 4 Marine	AFUE 90, or SEER 14 with HSPF 8.5, or Ground source heat pump, or Reduced leakage residence, or Reduced leakage ducts	R-19 → R-13 wall
5 and 4 Marine	Ground source heat pump, or AFUE 90 with reduced leakage residence or ducts, or SEER 14 with HSPF 8.5 with reduced leakage residence or ducts	R38 → R-30 ceiling, R-19 → R-13 wall, and R-30 → R-19 floor
6	AFUE 90, or Ground source heat pump, or Reduced leakage residence, or Reduced leakage ducts	R-19 → R-13 wall
6	Ground source heat pump, or AFUE 90 with reduced leakage residence, or AFUE 90 with reduced leakage ducts	R-49 → R-38 ceiling, R-19 → R-13 wall, and R-30 → R-19 floor

Notes:
1. Residences with electric furnaces or electric baseboard heating as the primary heat source are not eligible to use this table.
2. Oil boiler or oil furnace with AFUE 85 meets the AFUE requirement.
3. Ground source heat pump minimum is 2.9 COP with 13 EER.
4. An approved person shall conduct airtight testing and provide written results to the code official.
5. "Reduced leakage residence" means leakage does not exceed 4 air changes per hour at 50 Pascals when tested as specified by ASTM E779-03.
6. "Reduced leakage ducts" means duct and plenum leakage does not exceed 3 CFM per 100 ft^2 of conditioned floor area when tested at 25 Pascals (0.1" w.g.) as specified by ASTM E1554-2003. All ducts and HVAC air handler within conditioned space meets the reduced leakage duct requirement.

Reason: Many builders settle for the prescriptive table out of frustration with the complex IECC performance method, even though they would rather incorporate alternative energy improvements in lieu of some prescriptive requirements. The tradeoff table allows some common energy-efficient upgrades that trade off on some more costly and/or difficult prescriptive requirements without the need to hire energy experts to calculate code compliance for every house as is already allowed in IECC Section 405 Simulated Performance Alternative.

The improvements listed in Table 402.1.4 / N1102.1.4 have been tested by the NAHB Research Center for multiple homes within multiple cities for each climate zone to ensure that the net energy used in the home will be LESS after the tradeoff than before. Baseline simulations were performed using the Standard Reference Design as defined in Table 404.5.2.1. Baseline homes were constructed on a vented crawlspace.

Several specifics in the tradeoff table deserve comment:

1) The AFUE 90 furnace requirement represents a threshold for condensing furnaces, even though an AFUE less than 90 that would meet the energy equivalency requirement energy efficiencies between 83 and 90 are not available in the market.
2) Heat pumps become less efficient (and less common) in northern climates, and therefore are not included in zone 6. The new Energy Star criteria also specifies a heat pump HSPF of 8.5 in zones 4 and 5, and requires a performance path (Section 405 in this code) in zones 6 and above.
3) The airtightness of new homes varies considerably; however, a 4 ACH (under house airtightness testing pressure) would represent a tight home; in most situations it would exceed the airtightness required by Energy Star.
4) Duct losses are often stated to be in the 15% to 25% range; therefore, moving the ducts indoor or testing ducts for air tightness can save substantial energy.
5) Users are not eligible to use this table for residences primarily heated with electric resistance furnaces and electric baseboard heating because of the poor efficiency of electric resistance heating.
6) Oil boilers and furnaces are allowed to have a lower AFUE because the available AFUEs do not go as high as gas AFUEs.
7) The airtightness tests for the house and the ducts are specified at the most commonly used pressures for those tests. Including this "prescriptive" tradeoff table in the code encourages users to use the efficiency improvements in the table. The table streamlines compliance with these tradeoffs. These tradeoffs are conservative. In some cases the optional improvement saves significantly more energy than the allowed tradeoff. Overall, the table nets additional energy efficiency because code users choose the option of using energy efficiency improvements that may more than compensate for the insulation levels allowed.

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

PART II – IRC
Committee Action: Disapproved

Committee Reason: The committee has multiple issues with this proposal. There was no data provided that this was a cost savings. An oil furnace only has AFUE of 85. Why was 90 AFUE set as the limit? Are the tradeoffs equivalent? This should be reworked and brought back.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

James D. Bowman, American Forest and Paper Association, requests Approval as Submitted.

Commenter's Reason: Approving this proposal provides flexible options for achieving equivalent energy efficiency. One of the biggest challenges with prescriptive code requirements is that, by nature, they are – inflexible. It makes sense that the IECC process maximize – not restrict -- the flexibility in meeting prescriptive requirements wherever it can by including language such as this. Since the level of energy efficiency is not diminished by the alternative options of the proposal, there is no fundamentally sound reason for denial.

Some might say that the precise technical equivalencies have not been demonstrated. That might be technically true but the same could be said about virtually any prescriptive alternatives in any building code. In this case, the differences are not that fundamentally significant. There are many examples in the energy provisions and building codes in general where rough equivalencies are balanced with the practical realities of accepted design and construction practices. This is one of those cases where an opportunity is being proposed that will make compliance much easier for many. When compliance options are practical and more accommodating, such as those proposed, they are more likely to be attained.

Enforcement, design and construction stakeholders must have every available tool to facilitate compliance while conforming to the intent of the provisions in order to make compliance a practical reality. The argument that allowing these tradeoffs somehow "limits" future changes or the adoption of advanced technologies in the future is faulty logic. Opponents promote the notion that this proposal "paddle locks" the future and that once adopted cannot be changed. To the contrary, any code language can be changed in the future if it conforms to the evolving will of the membership. In all likelihood, the tradeoff provisions will be made more restrictive in the future but that does not mean they should be ignored in the present.

Opponents should be reminded that provisions such as these are minimum code requirements, not "placeholders" for the future. Retaining current, limited options because of what might be done in the future doesn't make a lot of sense. This code is about providing what every designer and code official wants in a building code – flexibility to use different options. This proposal simply provides more options without compromising energy efficiency and should be approved by the membership.

Public Comment 2:

Mark Halverson, American Forest and Paper Association, requests Approval as Submitted.

Commenter's Reason: APA would like to challenge the IECC Committee's decision to disapprove EC43-07/08 based on the following considerations: (The tradeoffs would be from the prescriptive requirements found in Table N1102.1.4.)

- The U.S. Department of Energy through their Building Codes Assistance Project (BCAP) supports the concept of trade-offs in the prescriptive part of the energy code. Note the following paragraph taken from the BCAP website: "Energy codes generally provide two methods for compliance. The first, and most common method (though, this tends to vary by locality) is referred to as the prescriptive approach. In this approach, a structure must be built to the prescribed insulation and other values found in the code. Trade-offs are allowed between certain building components that have different energy performances, giving an added degree of flexibility." It is reasonable to assume that basic, commonsense trade-off opportunities from the prescriptive envelope requirements found in Table 402.1.4 should not only be allowed, but welcomed into Chapter 4 of the International Energy Conservation Code.
- All of the proposed energy neutral trade-offs found in this proposal are already available to builders in the performance part of the energy code by use of approved computer programs and commonly used by builders as reported during testimony by a representative from the National Association of Home Builders Research Center (NAHB-RC). Furthermore, these trade-off requirements have been documented through software analysis by the proponent as well as the NAHB-RC to provide energy efficiency equal to or better than the prescribed envelop requirements dictated in Table 402.1.4.
- The advantage of this proposal to the Plans Examiner/Building Official is that he can immediately recognize the correctness of some of the most common tradeoffs without having to review the input and output of a computer program. A quick look at the prescriptive tradeoffs proposed in the Energy Code will be all that is required. Certainly the computer programs will still be available to the builder if additional alternative energy conservation methods are desirable. This proposal will go a long way toward making energy efficiency more palatable by providing an easy and cost effective solution to incorporate the most common trade-offs.
- This proposal will allow builders to use a wider variety of construction techniques and products to provide enhanced value to the home buyer and better control the cost of the building while continuing to maintain or improve the energy efficiency.
- Builders will have an opportunity to use more structural sheathing products that will more easily meet the wall bracing requirements of the code through the prescriptive method of the energy code.

Builders in climate zones 5 & 6 will be able to use methods such as full sheathing with wood structural panels in building 2x4 framed walls by using the prescriptive portion of the building codes. This method provides superior damage resistance from wind loads in all directions as well as the opportunity for builders to use all varieties of siding materials including vinyl siding which is recommended to be installed over only structural sheathing materials as found in the ES-Reports of the vinyl siding manufacturers.

Public Comment 3:

Ken Sagan, National Association of Home Builders, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE N1102.1.4
INSULATION TRADEOFFS

(No change to proposed table)

Notes:
1. (No change)
2. ~~Oil boiler or oil furnace with AFUE 85 meets the AFUE requirement.~~
(Renumber 3 through 6)

(Portions of proposal not shown remain unchanged)

Commenter's Reason: Tradeoffs were not equivalent for using an 85 AFUE oil furnace. All changes have been verified to be at worst, energy neutral to the prescriptive baseline. Verifications were done using RESCheck or REM/Rate software tools in multiple cities in each applicable climate zone.

Public Comment 4:

Ken Sagan, National Association of Home Builders, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE N1102.1.4
INSULATION TRADEOFFS

Climate Zone	Improvement from Minimum Requirement	Reduction in Prescriptive Insulation Requirement
4	SEER 14 with AFUE 90, or SEER 14 with HSPF 8.5, or Ground source heat pump, or Reduced leakage residence, or Reduced leakage ducts	R-38 → R-30 ceiling
5 and 4 Marine	AFUE ~~90~~ 93, or SEER 14 with HSPF ~~8.5~~ 8.8, or Ground source heat pump, or Reduced leakage residence, or Reduced leakage ducts	R-~~19~~ 20 → R-13 wall
5 and 4 Marine	Ground source heat pump, or AFUE ~~90~~ 93 with reduced leakage residence or ducts, or SEER 14 with HSPF ~~8.5~~ 8.8 with reduced leakage residence or ducts	R38 → R-30 ceiling, R-~~19~~ 20 → R-13 wall, and R-30 → R-~~19~~ 20 floor
6	AFUE ~~90~~ 93, or Ground source heat pump, or Reduced leakage residence, or Reduced leakage ducts	R-~~19~~ 20 → R-13 wall
6	Ground source heat pump, or AFUE ~~90~~ 93 with reduced leakage residence, or AFUE ~~90~~ 93 with reduced leakage ducts	R-49 → R-38 ceiling, R-~~19~~ 20 → R-13 wall, and R-30 → R-~~19~~ 20 floor

Notes:
1 Residences with electric furnaces or electric baseboard heating as the primary heat source are not eligible to use this table.
~~2. Oil boiler or oil furnace with AFUE 85 meets the AFUE requirement.~~
~~3~~ 2. Ground source heat pump minimum is 2.9 COP with 13 EER.
4 3. An approved person shall conduct airtight testing and provide written results to the code official.
~~5~~ 4. "Reduced leakage residence" means leakage does not exceed 4 air changes per hour at 50 Pascals when tested as specified by ASTM E779-03.
~~6~~ 5. "Reduced leakage ducts" means duct and plenum leakage does not exceed 3 CFM per 100 ft^2 of conditioned floor area when tested at 25 Pascals (0.1" w.g.) as specified by ASTM E1554-2003. All ducts and HVAC air handler within conditioned space meets the reduced leakage duct requirement.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: AFUE and HSPF changes are to account for R-20 wall requirements in Climate Zones 5 and 6 that are part of EC28. Tradeoffs were not equivalent using an 85 AFUE oil furnace. All changes have been verified to be at worst, energy neutral to the prescriptive baseline. Verifications were done using RESCheck or REM/Rate software tools in multiple cities in each applicable climate zone.

Final Action: AS AM AMPC____ D

EC46-07/08
402.2

Proposed Change as Submitted:

Proponent: Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, American Council for an Energy Efficient Economy (ACEEE); Jeff Harris, Alliance to Save Energy (ASE); Steven Rosenstock, Edison Electric Institute (EEI)

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) <u>or 20%</u> of <u>the total insulated</u> ceiling area<u>, which ever is less</u>.

Reason: The current language in the code allows for homes of any size to have a 500 square foot exception for ceiling insulation to be reduced in cathedral ceilings. In the current language, a small home could have close to 100% of the ceiling meet the cathedral ceiling exception. This proposal removes this loophole, by setting a maximum exception equal to either 20% of the ceiling area or 500 square feet, which ever is less.

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

Committee Action: **Approved as Submitted**

Committee Reason: The reduction in insulation R-value needs to be limited. On small residences, such as 1000 sq. ft. residences, this is a major reduction in insulation for the entire structure.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself requests Disapproval.

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC46 alignment: EC46 was submitted to the IECC, without a parallel comment to the IRC. <u>To realign the two codes, EC46 should be Disapproved</u>.

EC46 content: EC46 limits the ceiling areas eligible for reduced R-value due to a framing cavity restriction. The code already has a limit (500 ft^2). This additional limit adds a calculation to determine the second limit and therefore is more confusing than it is worth.

Public Comment 2:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of this item. EC46 07/08 did not have a part II and therefore the IRC B/E committee did not hear this code change proposal.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 3:

Ken Sagan, National Association of Home Builders, requests Disapproval.

Commenter's Reason: Changing the area from 500 square feet being exempted to 500 square feet or 20%, whichever is less, unfairly penalized smaller homes. 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. What can be the case is that just adding insulation can sometimes be cost effective, but when having to upsize the rafters in order to allow for additional insulation to meet minimum levels, energy saving is extremely small and would not be considered cost justified. This proposal will hurt the "Affordable Housing" segment and will prohibit first-time homebuyers from acquiring a home because of the added costs.

Final Action: AS AM AMPC____ D

EC48-07/08, Part I
402.2.3

Proposed Change as Submitted:

Proponent: Lawrence Brown, CBO, National Association of Home Builders

PART I – IECC

Revise as follows:

402.2.3 (Supp) Access hatches ~~and doors~~. Access ~~doors~~ hatches from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be ~~weatherstripped and~~ insulated ~~to a level equivalent~~ to the required minimum insulation rating of the adjacent thermal envelope ~~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 shall be installed to ~~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~~ conditioned space when the ~~attic access~~ hatch is opened~~, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation~~.

> **Exception:** Vertically installed access doors, from conditioned spaces to unconditioned spaces, shall meet the requirements of typical exterior doors.

Reason: What is being described in this Section is a "hatch" as used elsewhere in the I-Codes, not particularly a door. The aspect of weather-stripping is explicitly covered in Section N1102.4.1, Item 10. The rating of the envelope separating the conditioned spaces to unconditioned spaces is already covered in Table N1102.1. Also, the Exception is added as typical exterior doors are allowed in any thermal envelope as covered in Chapter 11.

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

PART I – IECC
Committee Action: **Disapproved**

Committee Reason: The committee felt that the language proposed was unclear. What is the minimum required rating of the adjacent thermal envelope? The present code language simply makes the hatch meet the same insulation values for the surrounding assembly. This is simple, and cost effective. In addition, the proposal would eliminate weatherstripping requirements for these assemblies.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

402.2.3 (Supp) Access hatches. Access hatches from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be insulated to the required minimum insulation rating of the adjacent thermal envelope. A wood framed or equivalent baffle or retainer shall be installed to prevent loose fill insulation from spilling into the conditioned space when the hatch is opened.

Exception: Vertically installed access doors, from conditioned spaces to unconditioned spaces, shall meet the requirements of ~~typical~~ this code for exterior doors.

Commenter's Reason: The Colorado Chapter requests approval as modified of Part I as modified to be consistent with Part II as modified and approved by the IRC B/E committee.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Final Action: AS AM AMPC____ D

EC48-07/08, Part II
IRC N1102.2.3

Proposed Change as Submitted:

Proponent: Lawrence Brown, CBO, National Association of Home Builders

PART II – IRC

Revise as follows:

N1102.2.3 (Supp) Access hatches ~~and doors~~. Access ~~doors~~ hatches from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be ~~weatherstripped and~~ insulated ~~to a level equivalent~~ to the required minimum insulation rating of the adjacent thermal envelope ~~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 shall be installed to ~~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~~ conditioned space when the ~~attic access~~ hatch is opened~~, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation~~.

> **Exception:** Vertically installed access doors, from conditioned spaces to unconditioned spaces, shall meet the requirements of typical exterior doors.

Reason: What is being described in this Section is a "hatch" as used elsewhere in the I-Codes, not particularly a door. The aspect of weather-stripping is explicitly covered in Section N1102.4.1, Item 10. The rating of the envelope separating the conditioned spaces to unconditioned spaces is already covered in Table N1102.1. Also, the Exception is added as typical exterior doors are allowed in any thermal envelope as covered in Chapter 11.

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

PART II – IRC
Committee Action: **Approved as Modified**

Modify proposal as follows:

N1102.2.3 (Supp) Access hatches. Access hatches from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be insulated to the required minimum insulation rating of the adjacent thermal envelope A wood framed or equivalent baffle or retainer shall be installed to prevent loose fill insulation from spilling into the conditioned space when the hatch is opened.

> **Exception:** Vertically installed access doors, from conditioned spaces to unconditioned spaces, shall meet the requirements of ~~typical~~ this code for exterior doors.

Committee Reason: This change clearly states the requirement when access is by hatch or by door. The modification removes the ambiguity caused by the word "typical".

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself, requests Disapproval.

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation of their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC48 alignment: EC48 was Disapproved in the IECC. EC48 was Approved as Modified in the IRC. <u>To realign the two codes, EC42 could be Disapproved for the IRC</u>.

EC48 content: EC48 requires that vertical attic access meet the exterior door requirement. EC48 probably removes the weather stripping requirements; however, weather stripping seems to be a reasonable requirement for an energy code.

Public Comment 2:

Donald J. Vigneau, Northeast Energy Efficiency Partnerships, Inc., representing himself, requests Disapproval.

Commenter's Reason: The proposal was correctly disapproved by the IECC Committee, which reasoned: "…the language proposed was unclear. What is the minimum required rating of the adjacent thermal envelope?" The Committee recognized the possibility of several ratings, based upon where and how access was provided.

The IECC Committee also noted: "…In addition, the proposal would eliminate weatherstripping requirements for these assemblies." Since thermal envelope performance is severely compromised by air infiltration resulting from poor construction methods and the lack of sealing of the inevitable joints, cracks and openings even in good construction, elimination of weatherstripping for these envelope components provides yet another path for energy to be wasted over the life of the building. Section 1102.4.2.3 (new in 2007) identified these overlooked components of the thermal envelope that have historically been neither insulated or sealed to any consistent standard.

Eliminating weatherstripping is a disservice to the homeowner who is trusting in the code to provide a quality-built dwelling. The proposed change should be disapproved for the above stated reasons, and that it will unnecessarily introduce another conflict between envelope requirements between the IECC and IRC, thereby complicating enforcement of the codes.

Final Action: AS AM AMPC____ D

EC50-07/08, Part I
402.2.4

Proposed Change as Submitted:

Proponent: Jonathan Humble, AIA, American Iron and Steel Institute (AISI), representing AISI and the Steel Framing Institute

PART I – IECC

Revise as follows:

402.2.4 Steel-frame ceilings, walls, and floors. Steel frame ceilings, walls, and floors shall meet the insulation requirements of Table 402.2.4 or shall meet the U-factor requirements in Table 402.1.3. The calculation of the U-factor for a steel frame envelope assembly shall use a series-parallel path calculation method.

> <u>**Exception:** In climate zones 1 and 2, the continuous insulation in Table N1102.2.4 shall not be required for steel frame wall assemblies.</u>

Reason: The purpose of this proposal is to delete the requirement for continuous insulation in climate zones where the continuous insulation would result in a steel wall assembly substantially exceeding the requirements for other materials.

The proposed language is superior to the existing language because it creates equal requirements for energy efficiency for all materials by removing a requirement that unnecessarily adds to the cost of building with steel. Further, the cost of continuous insulation is an undue burden on a material that offers great durability benefits. Steel offers protection over the life of the home, but the current requirement for continuous insulation is too expensive for those in the affordable housing market to exercise this option.

From an energy efficiency standpoint, simulations run with REM Design for a typical home in New Orleans (climate Zone 2) show that the energy use in a home built with steel walls and R-13 in the cavity is within 1% of the energy used by a similar home with wood walls and R-13 cavity insulation. The differences only begin to become significant in colder climate zones, but not in zones 1 and 2.

The basis for the equivalency table in the current Table N1102.2.4, which applies an across the board fix that is independent of climate zone, is simplistic and not economically defensible. The steel industry recognizes the need to develop economics-based solutions to energy efficiency for all materials. Until this work can be accomplished, this proposed change will immediately correct one of the most glaring deficiencies in the code that does not pass the test of being economically justified.

From an economics standpoint, the installed cost of continuous insulation, including labor and materials for jamb extensions, extended length fasteners with specialty washers, and the insulation itself, is estimated at just under $1000 ($980) for a typical 1200 Sq. Ft home. For a larger home of 2100 Sq. Ft., the cost of the continuous insulation adds over $1800. This extra cost buys the homeowner negligible to no energy savings.

Cost Impact: This proposal will not increase the cost of construction. It will reduce the cost of a steel framed building.

PART I – IECC
Committee Action: Approved as Modified

Modify the proposal as follows:

402.2.4 Steel-frame ceilings, walls, and floors. Steel frame ceilings, walls, and floors shall meet the insulation requirements of Table 402.2.4 or shall meet the U-factor requirements in Table 402.1.3. The calculation of the U-factor for a steel frame envelope assembly shall use a series-parallel path calculation method.

> **Exception:** In climate zones 1 and 2, the continuous insulation requirements in Table 402.2.4 ~~shall not be required~~ shall be permitted to be reduced to R-3 for steel frame wall assemblies with studs spaced at 24 inches on center.

Committee Reason: The proposal would enable a wider choice of materials that can be used in this application. The modification would limit the reduction in insulation to R-3 rather than not require any insulation at all.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of Part I. EC50 Part II 07/08 was disapproved by the IRC B/E committee.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Final Action: AS AM AMPC____ D

EC50-07/08, Part II
IRC N1102.2.4

Proposed Change as Submitted:

Proponent: Jonathan Humble, AIA, American Iron and Steel Institute (AISI), representing AISI and the Steel Framing Institute

PART II – IRC

Revise as follows:

N1102.2.4 Steel-frame ceilings, walls, and floors. Steel frame ceilings, walls, and floors shall meet the insulation requirements of Table N1102.2.4 or shall meet the U-factor requirements in Table N1102.1.2. The calculation of the U-factor for a steel frame envelope assembly shall use a series parallel path calculation method.

> **Exception:** In climate zones 1 and 2, the continuous insulation in Table N1102.2.4 shall not be required for steel frame wall assemblies.

Reason: The purpose of this proposal is to delete the requirement for continuous insulation in climate zones where the continuous insulation would result in a steel wall assembly substantially exceeding the requirements for other materials.

The proposed language is superior to the existing language because it creates equal requirements for energy efficiency for all materials by removing a requirement that unnecessarily adds to the cost of building with steel. Further, the cost of continuous insulation is an undue burden on a material that offers great durability benefits. Steel offers protection over the life of the home, but the current requirement for continuous insulation is too expensive for those in the affordable housing market to exercise this option.

From an energy efficiency standpoint, simulations run with REM Design for a typical home in New Orleans (climate Zone 2) show that the energy use in a home built with steel walls and R-13 in the cavity is within 1% of the energy used by a similar home with wood walls and R-13 cavity insulation. The differences only begin to become significant in colder climate zones, but not in zones 1 and 2.

The basis for the equivalency table in the current Table N1102.2.4, which applies an across the board fix that is independent of climate zone, is simplistic and not economically defensible. The steel industry recognizes the need to develop economics-based solutions to energy efficiency for all materials. Until this work can be accomplished, this proposed change will immediately correct one of the most glaring deficiencies in the code that does not pass the test of being economically justified.

From an economics standpoint, the installed cost of continuous insulation, including labor and materials for jamb extensions, extended length fasteners with specialty washers, and the insulation itself, is estimated at just under $1000 ($980) for a typical 1200 Sq. Ft home. For a larger home of 2100 Sq. Ft., the cost of the continuous insulation adds over $1800. This extra cost buys the homeowner negligible to no energy savings.

Cost Impact: This proposal will not increase the cost of construction. It will reduce the cost of a steel framed building.

PART II – IRC
Committee Action: Disapproved

Committee Reason: Steel framing is very conductive and there was no information provided to justify the elimination of continuous insulation.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

N1102.2.4 Steel-frame ceilings, walls, and floors. Steel frame ceilings, walls, and floors shall meet the insulation requirements of Table N1102.2.4 or shall meet the U-factor requirements in Table N1102.1.2. The calculation of the U-factor for a steel frame envelope assembly shall use a series-parallel path calculation method.

> Exception: In climate zones 1 and 2, the continuous insulation <u>requirements</u> in Table N1102.2.4 ~~shall not be required~~ <u>shall be permitted to be reduced to R-3</u> for steel frame wall assemblies <u>with studs spaced at 24 inches on center</u>.

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC50 alignment: EC50 was Approved as Modified by the IECC and Disapproved in the IRC. <u>Approving the same modification for the IRC would align the two codes.</u>

EC50 content: EC50 modifies the requirement for continuous insulation over steel framing in zones 1and 2. The IECC committee specified that the R-value was reduced to R-3 and stipulated that for this option the walls were spaced 24 inches on center. Both IECC committee modifications are carried through here.

Public Comment 2:

Larry Williams, Steel Framing Alliance, requests Approval as Modified by this Public Comment.

(See Public Comment 1 for modification)

Commenter's Reason: The original EC-50 proposal was on the IECC and IRC agendas. Initially, the proposal called for removing the requirement for continuous insulation on steel framed assemblies in climate zones 1 and 2 based on lack of cost effectiveness of this measure. The IRC committee held their hearings first, and rejected the proposal because it would have allowed the steel assembly to perform at a slightly lower energy efficiency than a wood framed assembly. To address the IRC committee's concerns, we modified the proposal before it was heard by the IECC, to require an R-3 for continuous insulation on steel wall assemblies in climate zones 1 and 2. This change both addresses the IRC committee's concerns, and is in keeping with the IECC's desire to maintain thermal equivalence between competing wall systems. The IECC committee subsequently approved the modified proposal.

Final Action: AS AM AMPC____ D

EC51-07/08, Part I
Table 402.2.4

Proposed Change as Submitted:

Proponent: Jonathan Humble, AIA, American Iron and Steel Institute (AISI), representing AISI and the Steel Framing Institute

PART I – IECC

Revise table as follows:

TABLE 402.2.4
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 <u>or R-0+8.5</u>
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

(Portions of table and footnotes not shown remain unchanged)

Reason: The proposal is requesting the inclusion of an additional tabular R-value to the steel framed wall category of Table N1102.2.4. In this case the value proposed would represent an assembly with only continuous insulation (No cavity insulation) on cold-formed steel framed walls for the equivalent wood walls category R-13. The basis for this proposal is to permit another method of installing insulation to a cold-formed steel framed wall assembly. This method is used in the field, but if applied to the strict application of the IECC would require the homeowner or builder to seek permission, through IRC Section 103 (Alternative Materials – Methods of Construction, Design or Insulating Systems), in order to comply with the provisions. We feel this unnecessary since this application is readily used in both the non-residential building construction and residential building today.

Using the IRC Table N1102.1.2 we simply take the wood wall tabular R-value for Climate zones #1, #2, #3, or #4 which equals R-13 and use that as our goal. Wood framed wall is calculated (Source ASHRAE Handbook-Fundamentals):

R(Cavity)	R(Studs)	Descriptions
0.17	0.17	Outside air film
0.62	0.62	Wood Panels
13.00	--	Cavity insulation
--	4.38	Wood Stud Framing
0.45	0.45	Gypsum board interior side
0.68	0.68	Inside air film
14.92	6.3	***R-value Totals***
0.0670	0.1587	***U-factor Totals***

U-Factor = (0.25 (25% studs) x R(Studs)) + (0.75 (75% cavity) x R(Cavity)) =
U-Factor = (0.25 x 0.1587) + (0.75 x 0.0670) = 0.0900 Btu/h*ft2*Degrees F, or R-value = R-11.12

To find out the necessary value for the minimum R-value for the rigid board insulation we use the following analysis:

R(w/Plywood)	R(w/o Plywood)	Descriptions
0.17	0.17	Outside air film
0.62	---	20% wood panels and 80% no wood panels on wall framing (IRC minimum wall sheathing requirements)
8.50	8.50	Continuous insulation
1.14	1.14	Benefit for a cavity wall with no insulation (Source- ASHRAE Handbook of Fundamentals)
0.45	0.45	Gypsum board interior side
0.68	0.68	Inside air film
12.56	10.94	***R-value Totals***
0.0865	0.0914	***U-factor Totals***

U-Factor = (0.20 (20% panels) x 0.0914) + (0.80 (80% no panels) x 0.0865) = 0.0877 Btu/h*ft2*Degrees F

As a result, the use of R-8.5 continuous insulation should be deemed an acceptable alternative to an R-13 Wood Frame Wall.

Bibliography:
ASHRAE, ASHRAE Handbook-Fundamentals, American Society of Heating, Refrigerating and Air-conditioning Engineers, Atlanta, GA, 2005 edition, Chapter 25.

Cost Impact: The proposal may decrease the cost of construction by permitting the application of only one insulation, versus two as required in the other equivalency measures.

PART I – IECC
Committee Action: Disapproved

Committee Reason: The committee believed that the concept of this proposal was good, but was concern that the values were calculated correctly. (Should the value be R-0 +10?)

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Approval as Submitted.

Commenter's Reason: The Colorado Chapter requests approval as submitted of Part I. EC51 Part II 07/08 was approved as submitted by the IRC B/E committee.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 2:

Larry Williams, Steel Framing Alliance, requests Approval as Submitted.

Commenter's Reason: The IECC committee disapproved this proposal. The IRC committee approved it as submitted. By approving this for the IECC, the assembly will bring consistency to the options available for compliance when steel framing is used on a home.

The IECC committee indicated their support for the concept but they were concerned with the selection of R-8.5 as the acceptable alternative to R-13 in the cavity. The following illustrates how these assemblies are equivalent:

First, we start by determining what effective R-value is achieved with the R-13 cavity insulation in a wood framed wall, taking into account framing effects and the other materials. This is the same level of performance we should meet if moving the insulation from the cavity to the exterior only.

- Hot box tests and analytical methods conducted by Oak Ridge National Laboratory (ORNL1) conclude that a wood framed wall has an effective, whole wall R-value of about R-10.5 when considering a framing factor between 22 and 25%. This is the range of framing factors that one finds with conventional framing in homes.
- Calculation methods give varying results due to slight differences in assumptions for what constitutes a typical assembly and the R-values of components. Using a parallel path method would yield the following:

Component	R-values of path through wood stud	R-values of path through cavity
Outside air film	0.17	0.17
wood sheathing	0.62	0.62
2x4 wood stud	4.38	
Cavity insulation		13
Gypsum board	0.45	0.45
Inside air film	0.68	0.68
Total path R	6.3	14.92
Path U (1/R)	0.159	0.067

Total U-Factor (assuming 25% framing factor) = 0.159*25% +0.067*75% = 0.089 or an R value of 11.2.

This yields a U-Factor identical to the published results in ASHRAE 90.1-2007, Table A3.4 for a wood framed wall with R-13 insulation and 2x4 studs spaced at 16 inched on center.

In our original submission, we showed with calculations how a steel framed wall with R-0+8.5 continuous insulation results in equivalent performance. Some of the assumptions in our calculations were questioned in the initial hearings. As additional support for the adequacy of R-8.5 continuous insulation, we refer to Table A 3.3 of ASHRAE 90.1-2007. Interpolating as permitted by the standard between R-8 and R-9 exterior insulation on a steel framed wall with 2x4 studs at 16 inches on center and zero cavity insulation, yields a U-Factor of 0.088, slightly better than the equivalent wood assembly.

The ASHRAE standard and calculations show that the thermal performance of a steel framed wall with R-8.5 continuous insulation is almost identical to a wood wall with R-13 in the cavity. Using R-8.5 continuous insulation will in reality produce a better-performing wall because the calculation method is conservative compared to test results and because continuous insulation does not suffer from the quality issues documented with cavity insulation. The R-8.5 continuous insulation offers a superior wall system from a thermal performance perspective and it provides a better wall from a moisture control perspective. For these reasons, it should be listed as an option for compliance within the prescriptive tables.

Reference: ORNL1 – *Effects of Framing on the Thermal Performance of Wood and Steel-Framed Walls*, Kosny et.al., Oak Ridge National Laboratory, Oak Ridge, TN.

Public Comment 3:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 402.2.4
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+~~8.5~~ 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

(Portions of table and footnotes not shown remain unchanged)

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC51 alignment: EC51 was Disapproved in the IECC and Approved as Modified in the IRC. To realign the two codes, EC51 could be Approved with Modification suggested by the IECC committee for both codes. The IECC committee suggested a specific modification.

EC51 content: EC51 adds a steel framing insulation option equivalent to R-13 walls based on continuous insulation. The IECC committee suggested the appropriate R-value for the continuous insulation was R-10, rather than the R-8.5 originally proposed. The R-10 R-value suggested by the IECC committee is used in this change.

Final Action: AS AM AMPC____ D

EC51-07/08, Part II
IRC Table N1102.2.4

Proposed Change as Submitted:

Proponent: Jonathan Humble, AIA, American Iron and Steel Institute (AISI), representing AISI and the Steel Framing Institute

PART II – IRC

Revise table as follows:

TABLE N1102.2.4
STEEL FRAMED 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+8.5
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

(Portions of table and footnotes not shown remain unchanged)

Reason: The proposal is requesting the inclusion of an additional tabular R-value to the steel framed wall category of Table N1102.2.4. In this case the value proposed would represent an assembly with only continuous insulation (No cavity insulation) on cold-formed steel framed walls for the equivalent wood walls category R-13. The basis for this proposal is to permit another method of installing insulation to a cold-formed steel framed wall assembly. This method is used in the field, but if applied to the strict application of the IECC would require the homeowner or builder to seek permission, through IRC Section 103 (Alternative Materials – Methods of Construction, Design or Insulating Systems), in order to comply with the provisions. We feel this unnecessary since this application is readily used in both the non-residential building construction and residential building today.

Using the IRC Table N1102.1.2 we simply take the wood wall tabular R-value for Climate zones #1, #2, #3, or #4 which equals R-13 and use that as our goal. Wood framed wall is calculated (Source ASHRAE Handbook-Fundamentals):

R(Cavity)	R(Studs)	Descriptions
0.17	0.17	Outside air film
0.62	0.62	Wood Panels
13.00	--	Cavity insulation
--	4.38	Wood Stud Framing
0.45	0.45	Gypsum board interior side
0.68	0.68	Inside air film
14.92	6.3	***R-value Totals***
0.0670	0.1587	***U-factor Totals***

U-Factor = (0.25 (25% studs) x R(Studs)) + (0.75 (75% cavity) x R(Cavity)) =
U-Factor = (0.25 x 0.1587) + (0.75 x 0.0670) = 0.0900 Btu/h*ft2*Degrees F, or R-value = R-11.12

To find out the necessary value for the minimum R-value for the rigid board insulation we use the following analysis:

R(w/Plywood)	R(w/o Plywood)	Descriptions
0.17	0.17	Outside air film
0.62	---	20% wood panels and 80% no wood panels on wall framing (IRC minimum wall sheathing requirements)
8.50	8.50	Continuous insulation
1.14	1.14	Benefit for a cavity wall with no insulation (Source- ASHRAE Handbook of Fundamentals)
0.45	0.45	Gypsum board interior side
0.68	0.68	Inside air film
12.56	10.94	***R-value Totals***
0.0865	0.0914	***U-factor Totals***

U-Factor = (0.20 (20% panels) x 0.0914) + (0.80 (80% no panels) x 0.0865) = 0.0877 Btu/h*ft2*Degrees F

As a result, the use of R-8.5 continuous insulation should be deemed an acceptable alternative to an R-13 Wood Frame Wall.

Bibliography:
ASHRAE, ASHRAE Handbook-Fundamentals, American Society of Heating, Refrigerating and Air-conditioning Engineers, Atlanta, GA, 2005 edition, Chapter 25.

Cost Impact: The proposal may decrease the cost of construction by permitting the application of only one insulation, versus two as required in the other equivalency measures.

PART II – IRC
Committee Action: Approved as Submitted

Committee Reason: This change is an improvement to the code and add the option of continuous insulation for cold-formed steel framed walls.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE N1102.2.4
STEEL FRAMED 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+~~8.5~~ <u>10</u>
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

(Portions of table and footnotes not shown remain unchanged)

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC51 alignment: EC51 was Disapproved in the IECC and Approved as Modified in the IRC. <u>To realign the two codes, EC51 could be Approved with Modification suggested by the IECC committee for both codes. The IECC committee suggested a specific modification.</u>

EC51 content: EC51 adds a steel framing insulation option equivalent to R-13 walls based on continuous insulation. The IECC committee suggested the appropriate R-value for the continuous insulation was R-10, rather than the R-8.5 originally proposed. The R-10 R-value suggested by the IECC committee is used in this change.

Final Action: AS AM AMPC____ D

EC58-07/08, Part I
402.3.4

Proposed Change as Submitted:

Proponent: Chuck Murray, Washington State University Extension Energy Program, representing Northwest Energy Code Group

PART I – IECC

Revise as follows:

402.3.4 Opaque door exemption. One opaque door assembly <u>up to 24 square feet (2.22 m^2) in area</u> is exempted from the *U*-factor requirement in Section 402.1.1.

Reason: This change limits the area of the exempt door allowed in section 402.1.1.

Under the current standard, any size opaque door assembly is exempt from the door requirement. This includes anything from a reasonable wood entry door to a large roll up door. This proposal maintains a reasonable exemption for most opaque entry doors. Larger doors will be required to either meet the minimum U-factor under the prescriptive option or include the door u-factor in a u-factor trade off approach.

This exception, with the 24 square foot limit, has been in effect in Washington State since 1991.

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

PART I – IECC
Committee Action: **Approved as Modified**

Modify the proposal as follows:

402.3.4 Opaque door exemption. One <u>side-hinged</u> opaque door assembly up to 24 square feet (2.22 m^2) in area is exempted from the *U*-factor requirement in Section 402.1.1.

Committee Reason: The amount of door area that qualifies for this exemption should be limited, to prevent the application of the exemption to large doors. The modification further restricts the application of this exemption.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

David S. Collins, FAIA, The Preview Group, Inc., representing The American Institute of Architects, requests Disapproval.

Commenter's Reason: Creation of a limitation on the exemption for opaque doors to a single 24 sf. door is arbitrary and restricts options for designed solutions for a given building. Options for dealing with heat loss or gain with various elements of fenestration should be dealt with more holistically, not by creating arbitrary thresholds, which may be appropriate for one application and not for another.

Public Comment 2:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of Part I. EC58 Part II 07/08 was disapproved by the IRC B/E committee.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 3:

Ken Sagan, National Association of Home Builders, requests Disapproval.

Commenter's Reason: The word "assembly" complicates the proposal. The Proposal is not clear in the description of assembly. Does it include the sidelights and transoms or just the door itself? If this is the case , then architectural front doors would not be allowed. There are a lot of Spanish style doors that are double 3-0x8-0, 3-6x8-0, etc., that also have leaded glass with sidelights along with leaded glass transoms. This proposal as proposed would eliminate the use of such doors and limit the door to specific manufacturers.

Final Action: AS AM AMPC____ D

EC58-07/08, Part II
IRC N1102.3.4

Proposed Change as Submitted:

Proponent: Chuck Murray, Washington State University Extension Energy Program, representing Northwest Energy Code Group

Revise as follows:

N1102.3.4 Opaque door exemption. One opaque door assembly <u>up to 24 square feet (2.22 m^2) in area</u> is exempted from the *U*-factor requirement in Section N1102.1.

Reason: This change limits the area of the exempt door allowed in section 402.1.1.

Under the current standard, any size opaque door assembly is exempt from the door requirement. This includes anything from a reasonable wood entry door to a large roll up door. This proposal maintains a reasonable exemption for most opaque entry doors. Larger doors will be required to either meet the minimum U-factor under the prescriptive option or include the door u-factor in a u-factor trade off approach.

This exception, with the 24 square foot limit, has been in effect in Washington State since 1991.

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

PART II – IRC
Committee Action: Disapproved

Committee Reason: The current code language is too broad and a limit on size is needed. Different sizes were suggested but no documentation or justification was provided. The inclusion of assembly in the size limit might be a cause for confusion. The proponent needs to rework and bring back.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Chuck Murray, Washington State University Energy Program, representing Northwest Energy Code Group, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

N1102.3.4 Opaque door exemption. One side-hinged opaque door assembly up to 24 square feet (2.22 m2) in area is exempted from the U-factor requirement in Section N1102.1.1.

Commenter's Reason: (Conner) *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC58 alignment: EC48 was Approved as Modified in the IECC and Disapproved in the IRC. To realign the two codes, EC48 could be Disapproved in the IECC.

EC58 content: The intent of the existing section is to allow one door, perhaps a durative front door, to be exempt. EC58 limits the door based on door size. It is better to keep it simple--just exempt one door.

Commenter's Reason: (Murray) EC58 Part I was approved as modified by the IECC committee. This public comment adopts the original code change language, and inserts "side-hinged" to the exception, consistent with the IECC committee action.

Final Action: AS AM AMPC____ D

EC60-07/08, Part I
402.4.1

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART I – IECC

Revise as follows:

402.4.1 (Supp) 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 joists.

~~11~~12. Other sources of infiltration.

Reason: Rim joists, also called band joists, are a important source of infiltration. In principle, rim joists are already sealed. In practice, rim joists are more likely to be sealed when named as a specific area to seal.

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

PART I – IECC
Committee Action: **Approved as Modified**

Modify the proposal as follows:

402.4.1 (Supp) 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~~s~~ <u>junction.</u>
12. Other sources of infiltration.

Committee Reason: The rim joist area is a source of a large amount of air leakage that requires sealing. The modification better describes what is to be sealed; it is not possible to seal the rim joist itself, but it is possible to seal the junction of the rim joist to the bottom plate and to the sheathing.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of Part I. EC60 Part II 07/08 was disapproved by the IRC B/E committee.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Final Action: AS AM AMPC____ D

EC60-07/08, Part II
IRC N1102.4.1

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART II – IRC

Revise as follows:

N1102.4.1 (Supp) 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 joists.

~~11~~12. Other sources of infiltration.

Reason: Rim joists, also called band joists, are a important source of infiltration. In principle, rim joists are already sealed. In practice, rim joists are more likely to be sealed when named as a specific area to seal.

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

PART II – IRC
Committee Action: **Disapproved**

Committee Reason: The proposal is not clear on how or where the rim joist is to be sealed.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Craig Conner, Building Quality, representing himself, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

N1102.4.1 (Supp) 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 joists junction.
12. Other sources of infiltration.

Commenter's Reason: *Jurisdictions legitimately expect the I-codes to be an internally consistent family of model codes that they can use as the foundation for their own building code. This change is one of a series of changes intended to correct a large number of inconsistencies in the residential energy requirements in the IECC and IRC. Greater detail is provided in the reason statements for EC6 and RE6.*

EC60 alignment: EC60 was Approved as Modified in the IECC, but Disapproved in the IRC. To realign the two codes, EC60 for the IRC should be Approved as Modified by the IECC committee.

EC60 content: EC60 adds "rim joists junction" to the list of areas to be air sealed. Rim joists are common sources of infiltration. The IRC committee commented that, "*The proposal is not clear on how or where the rim joist is to be sealed,*" which was corrected by the IECC committee modification.

Final Action: AS AM AMPC____ D

EC64-07/08, Part I

202 (New), 402.4.2 (New), Table 402.4.2 (New), 402.4.3 (New), 403.6 (New)

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART I – IECC

Add new text and table as follows:

SECTION 202
GENERAL DEFINITIONS

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.

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 7 ACH when tested with a blower door at a pressure of 50 pascals. 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.

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.

(Renumber subsequent sections)

TABLE 402.4.2
AIR BARRIER AND INSULATION INSPECTION

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal insulation 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.
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 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.

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

(Renumber subsequent sections)

Reason: This proposal is intended to reduce the energy lost to infiltration and to improve insulation installation. The details that seal against air infiltration also tend to benefit the thermal integrity of the wall, and vise versa. The energy code requirements for infiltration control have changed little in the last 15 years, except for the addition of recessed lighting specifications. This would be a substantial change that would lead to significant energy savings.

In principal there are no infiltration leaks. Everything is supposed to be sealed. The IECC and IRC both specify “all joints, seams and penetrations”, add a list of specific items, and to cover anything that was missed include “other sources of infiltration” are to be “sealed with an air barrier material …” (IECC 402.4.1, IRC N1102.4.1). In practice energy losses from infiltration are large. Infiltration is 16% of the cooling load and 28% of the heating load (2006 Buildings Energy Data Book). Others have higher estimates of infiltration energy loads.

Air infiltration requires air movement. Controlling air means enclosing air, eliminating big holes and paying attention to important details. This proposal includes two methods for showing a home includes at least a moderate level of air control. The first option is a “blower door” test, a house pressurization test with a specified a maximum air leakage. The maximum is 7 ACH50, or 7 Air Changes per Hour at 50 pascals. The ACH50 is a common measurement made where doing air infiltration tests and therefore a reasonable metric for use in the code. ACH50 can be roughly translated into “natural air changes” by dividing by 20. Therefore the 7 ACH50 translated into a natural air change rate of 0.35.

The second option is a visual inspection of many air sealing elements and items that relate to the quality of insulation installation. Most of the items listed in the visual inspection are already in code, this adds a specific requirement to inspect for them as a way of showing compliance with the air-sealing requirement. Two examples of existing requirements specified for inspection in the table-- the 2006 IRC (N1102.4) and IECC (402.4) specify “*The building thermal envelope shall be durably sealed to limit infiltration.”*, which covers most of the items in the table. Many items are covered explicitly, either on the list of items in IRC Section N1102.4 and IECC Section 402.4, or explicitly in another section. An example of a section with explicit requirements would be the IECC Section 402.2.5 and IRC Section N1102.2.5 both require insulation to “*maintain permanent contact with the underside of the subfloor.”*

This proposal adds a requirement for better performing fireplaces, including gasketed doors and outside combustion air, both for the energy savings and the indoor air quality. It also adds a definition of “air barrier”, principally to make it clear that an air barrier can be a combination of materials, rather

Measured data shows a wide variation in the air tightness of individual homes. The biggest effect of this proposal would be to improve the underperforming half of new homes. (Nevada Study, Page 32; Washington State Study, Page 11; Wisconsin Study, Page 30) A secondary effect would be to improve the air sealing in most homes due to the increased attention to the important areas. Improved air sealing and better insulation installation is also likely to increase comfort, for example decreasing cold spots; and to improve the structures resistance to moisture problems.

The cost for a blower door test varies from about $200 to perhaps $400. The energy savings from reduced infiltration is harder to estimate. As noted already, summaries of infiltration measurements show large variations in the infiltration rates for actual homes, for example a study of infiltration measurements (LBNL study, page 2) showed the standard deviation in “normalized leakage area”, which relates directly to infiltration, was almost as big as the mean; therefore bringing the high infiltration homes down to average would be significant by itself. The same study compared conventional new homes to energy efficient new homes and showed that reductions in air leakage of 40-50% are common in energy efficient homes (LBNL study, page 6). Based on the range of infiltration seen in new housing and the large reduction in infiltration in energy efficiency programs, it seems reasonable to estimate that this code change could produce a 20-30% the reduction in air infiltration rates with a similar reduction in energy costs for infiltration.

Bibliography
David Hales. Washington State University Extension Energy Program. December 2001. *Washington State Energy Code Duct Leakage Study Report.* WSUCEEP01105. Olympia, WA.

Michelle Britt, Eric Makela. Britt/Makela Group. June 2003. *Final Report – Volume I, In-Field Residential Energy Code Compliance Assessment and Training Project.* Nevada State Office of Energy.

Scott Pigg and Monica Nevius. Energy Center of Wisconsin. November 2000. *Energy and Housing in Wisconsin: A Study of Single-Family Owner-Occupied Homes Volume 2: Data Book*. Research Report, *199-2*

Max Sherman and Nance Matson. March 2002. *Air Tightness of New U.S. Houses: A Preliminary Report.* LBNL-48671. Lawrence Berkeley National Laboratory (LBNL) Berkeley, CA

US DOE. September 2006. 2006 Buildings Energy Data Book.
http://buildingsdatabook.eren.doe.gov/
Cost Impact: The code change proposal will increase the cost of construction.

PART I – IECC
Committee Action: Approved as Modified

Modify the proposal as follows:

TABLE 402.4.2
AIR BARRIER AND INSULATION INSPECTION

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.
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 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.

(Portions of proposal not shown remain unchanged)

Committee Reason: The code change proposal will add some clarity to inspection requirements of the code for insulation and air barriers. The modification clarifies that the issue for air barrier and thermal barrier requirements relate to framed walls.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Brian Dean, ICF International, representing the Energy Efficient Codes Coalition; Bill Prindle, Energy Efficient Codes Coalition; Jeff Harris, Alliance to Save Energy; Steven Rosenstock, Edison Electric Institute, Harry Misuriello, American Council for Energy Efficient Economy, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

SECTION 202
GENERAL DEFINITIONS

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.

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~~ requirements established by Section 402.4.2.1 ~~or~~ and 402.4.2.2:

402.4.2.1 Performance ~~t~~esting ~~option~~. Building envelope tightness ~~and insulation installation~~ shall be ~~considered acceptable when~~ tested to have an air leakage ~~is~~ less than 0.00036 SLA ~~7 ACH~~ when tested with a blower door at a pressure of 50 pascals (0.2 inch w.g.). Testing shall occur any time after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances and sealing thereof. Where required by the code official, an approved party independent from the builder shall conduct the building envelope tightness test. A written test report showing compliance shall be provided to the code official.

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 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 duct~~s~~ systems shall ~~not~~ be sealed~~;~~ and ~~7. S~~supply and return registers shall not be sealed.

402.4.2.2 Visual inspection requirement. ~~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 to meet the 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 before interior finish materials are applied.

(Renumber subsequent sections)

TABLE 402.4.2
~~AIR BARRIER AND~~ INSULATION INSPECTION

COMPONENT	CRITERIA
~~Air barrier and t~~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.~~
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 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.~~

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

(Renumber subsequent sections)

Commenter's Reason: Properly controlling air leakage and properly installing insulation are both critical to achieve more 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 of the home.

EC64 as written (and modified by the IECC Code Development Committee) improves existing code language by setting out clear steps for inspection and offers a testing option for air leakage. EC64 is an improvement over the existing code and the EECC supported it before the IECC Code Development Committee, in lieu of our own air leakage/sealing proposal.

However, we are submitting this public comment with a proposed modification because we believe that this proposal can be substantially improved. For example, while the testing option as written will address air leakage, 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 does the following:

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. Allows the infiltration testing to be done "any time after rough in" to alleviate concerns about timing of sealing holes and infiltration testing.
5. Makes the infiltration testing units consistent with other infiltration units in the IECC with Specific Leakage Area (SLA) and improves the testing protocol; and
6. Removes the exception for recessed lights that penetrate into spaces that can be interpreted as "conditioned", such as spaces between the ceiling and floor.

These changes will make this code change more enforceable and an improvement in energy efficiency over the language in the original proposal.

Public Comment 2:

Ronald Majette, U.S. Department of Energy, requests Approval as Modified by this Public Comment.

Further modify proposal as follows:

SECTION 202
GENERAL DEFINITIONS

~~**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.~~

402.4.2 Air sealing testing~~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 or equal to 7 ACH when tested ~~with a blower door~~ at a pressure of 50 pascals. Testing shall occur any time 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; and
6. ~~HVAC ducts shall not be sealed; and~~
~~7.~~ Supply and return registers shall be open~~not be sealed~~.

~~**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.~~

~~**TABLE 402.4.2**~~
~~**AIR BARRIER AND INSULATION INSPECTION**~~

~~**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.~~
~~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 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.~~

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

403.7 Ventilation fans. Bathrooms and kitchens shall be provided with ventilation that meets the requirements of Section M1507.3 of the *International Residential Code*. Alternately, the code official may approve other means of ventilation.

Commenter's Reason: This proposal is intended to reduce the energy lost to infiltration and to improve insulation installation. The energy code requirements for infiltration control have changed little in the last 15 years, except for the addition of recessed lighting specifications. This would be a substantial change that would lead to significant energy savings.

This proposal differs from the original proposal approved by the IECC committee by deleting the visual inspection option and requiring pressure testing of the building envelope. It is difficult to impossible to accurately check for all sources of potential leakage by visual inspection. Pressure testing is the only way to ensure an adequate level of sealing.

The proposal addresses all the reasons for disapproval provided by the IRC committee:
"*This proposal would make it extremely difficult or impossible to achieve 7 ACH with a blower door test after rough in*". The proposal clarifies that the test can occur any time after rough in. Once the house is completed and all penetrations are sealed, the 7 ACH rate is not only possible, but is very reasonable. "*The issue of air quality needs to be addressed.*" The proposal now requires kitchen and bathroom ventilation as specified in the IRC. "The test method is not stated". We believe the test method is adequately specified. "Blower door" envelope pressure tests have been widely used in Energy Star Homes for many years. "*The visual option would require returning to the site 5 or 6 times or obtain a third party and would be added expense for the local jurisdiction.*" The revision of the original proposal deletes the visual inspection option. The envelope pressurization test only needs to occur once.

In principal there are no infiltration leaks. Everything is supposed to be sealed. The IECC and IRC both say "all joints, seams and penetrations", add a list of items, and to cover anything that was missed include "other sources of infiltration" are to be "sealed with an air barrier material …" (IECC 402.4.1, IRC N1102.4.1). In practice energy losses from infiltration are large. Infiltration is 16% of the cooling load and 28% of the heating load (2006 Buildings Energy Data Book). Others have higher estimates.

Air infiltration requires air movement. Controlling air means enclosing air, eliminating big holes and paying attention to important details. This proposal requires a "blower door" test, a house pressurization test with a specified a maximum air leakage. The maximum is 7 ACH50, or 7 Air Changes per Hour at 50 pascals. The ACH50 is a common measurement made where doing air infiltration tests and therefore a reasonable metric for use in the code. ACH50 can be roughly translated into "natural air changes" by dividing by 20. Therefore the 7 ACH50 translated into a natural air change rate of 0.35.

This proposal retains proposed requires approved by the IECC committee for better performing fireplaces, including gasketed doors and outside combustion air, both for the energy savings and the indoor air quality. It also retains specifies kitchen and bathroom ventilation fans specified in the IRC for air quality.

Measured data shows a wide variation in the air tightness of individual homes. The biggest effect of this proposal would be to improve the underperforming half of new homes. (Nevada Study, Page 32; Washington State Study, Page 11; Wisconsin Study, Page 30) A secondary effect would be to improve the air sealing in most homes due to the increased attention to the important areas. Improved air sealing and better insulation installation is also likely to increase comfort, for example decreasing cold spots; and to improve the structures resistance to moisture problems.

The cost for a blower door test varies from about $200 to perhaps $400. The energy savings from reduced infiltration is harder to estimate. As noted already, summaries of infiltration measurements show large variations in the infiltration rates for actual homes, for example a study of infiltration measurements (LBNL study, page 2) showed the standard deviation in "normalized leakage area", which relates directly to infiltration, was almost as big as the mean; therefore bringing the high infiltration homes down to average would be significant. The same study compared conventional new homes to energy efficient new homes and showed that reductions in air leakage of 40-50% are common in energy efficient homes (LBNL study, page 6). Based on the range of infiltration seen in new housing and the large reduction in infiltration in energy efficiency programs, it seems reasonable to estimate that this code change might produce a 10-30% the reduction in air infiltration rates with a similar reduction in energy costs for infiltration.

References:

David Hales. Washington State University Extension Energy Program. December 2001. *Washington State Energy Code Duct Leakage Study Report.* WSUCEEP01105. Olympia, WA.

Michelle Britt, Eric Makela. Britt/Makela Group. June 2003. *Final Report – Volume I, In-Field Residential Energy Code Compliance Assessment and Training Project.* Nevada State Office of Energy.

Scott Pigg and Monica Nevius. Energy Center of Wisconsin. November 2000. *Energy and Housing in Wisconsin: A Study of Single-Family Owner-Occupied Homes Volume 2: Data Book*. Research Report, *199-2*

Max Sherman and Nance Matson. March 2002. *Air Tightness of New U.S. Houses: A Preliminary Report.* LBNL-48671. Lawrence Berkeley National Laboratory (LBNL) Berkeley, CA

US DOE. September 2006. 2006 Buildings Energy Data Book.
http://buildingsdatabook.eren.doe.gov/

Public Comment 3:

Shaunna Mozingo, City of Westminster, CO, representing the Colorado Chapter of the International Code Council, requests Disapproval.

Commenter's Reason: The Colorado Chapter requests disapproval of Part I. EC64 Part II 07/08 was disapproved by the IRC B/E committee.

The results of the Palm Springs hearings have established Chapter 4 of the IECC and Chapter 11 of the IRC as two separate, distinct sets of minimum standards for the same structure, while the physical dynamics are the same in both.

Divergent actions on this item will lead to confusion and inconsistency in code enforcement and construction. Conflicting requirements devalue the benefits of the IRC as an effective stand alone document. When the differences are justified based on technical merit, we can all readily provide a reasonable explanation and achieve code compliance.

This is one of a series of public comments attempting to bring consistency back to the family of I-codes.

Public Comment 4:

Ken Sagan, National Association of Home Builders, requests Disapproval.

Commenter's Reason: The air leakage inspection requirement is already part of the IECC and covered under the mandatory section 402.4. In addition, insulation installation already has a dedicated inspection in most jurisdictions performed by code officials. The proposal's testing option does not explain or define ACH nor does it list a specific test method. The proposal only states 7 ACH at a pressure of 50 Pascals. A check-list could be more appropriately developed for building departments based on the local need.

Final Action: AS AM AMPC____ D