INTERNATIONAL ENERGY CONSERVATION CODE

EC7-06/07, Part I
101.4.4

Proposed Change as Submitted:

Proponent: Chuck Murray, Washington State University, representing Northwest Energy Code Group

PART I - IECC

Add new text as follows:

<u>**101.4.4 Change in space conditioning.** Any nonconditioned space that is altered to become conditioned space shall be required to be brought into full compliance with this code.</u>

(Renumber subsequent sections)

Reason: (IECC) When nonconditioned spaces are converted to conditioned space, the impacts on the community energy resources are the same as new construction. As such, they should be required to meet the minimum standards set by the IECC for new construction.

This approach is consistent with ASHRAE Standard 90.1, 2004, Section 4.1.1.5.

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

Committee Action: **Approved as Submitted**

Committee Reason: This proposed language would prevent the possible "game playing" where one builds a building with a non-conditioned room or space, and then decides shortly afterwards to provide heating or cooling to that space. While the Energy Code requires this, the redundant language provides clear direction.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Mason Knowles, Spray Polyurethane Foam Alliance requests Disapproval for Part I.

Commenter's Reason: In order to create a conditioned attic space with any product might require the complete redo of mechanical and electrical system or changes in rafter depths because of some live load revisions that have gone into force since the building was built. Not only would the result be higher cost for energy retro, but this cost will impact overall energy use reductions that could otherwise take place if they were affordable. We urge disapproval of this code change proposal.

Final Action: AS AM AMPC____ D

EC7-06/07, Part II
IRC R102.7.2

Proposed Change as Submitted:

Proponent: Chuck Murray, Washington State University, representing Northwest Energy Code Group

PART II – IRC BUILDING/ENERGY

Add new text as follows:

<u>**R102.7.2 Change in space conditioning.** Any nonconditioned space that is altered to become conditioned space shall be required to be brought into full compliance with Chapter 11 of this code.</u>

Reason: (IRC) When nonconditioned spaces are converted to conditioned space, the impacts on the community energy resources are the same as new construction. As such, they should be required to meet the minimum standards included in chapter 11 of the IRC. For example, this provision would require a basement or bonus room to be insulated when space heating or cooling is added to these spaces. This provision would also apply when a garage is converted to a habitable space.

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

Committee Action: **Disapproved**

Committee Reason: This proposal could have an adverse impact on existing equipment and building. This could require removal of adequate operating equipment just to comply with the Energy Code. Also, may require the removal of existing finish material.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

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

Modify proposal as follows:

R102.7.2 Change in space conditioning. Any nonconditioned space that is altered to become conditioned space shall be required to be brought into full compliance with Chapter 11 of this code.

> <u>**Exception:** Existing heating and/or cooling equipment used to condition the space shall not be required to be brought into compliance with Chapter 11 of this code.</u>

Commenter's Reason: This modification to the original proposal is being submitted to address the primary concern of the IRC committee. The IRC committee noted that existing HVAC equipment frequently has the capacity to provide space conditioning to additional square footage. The exception has been added to the original proposal to allow the use of existing equipment.

Final Action: AS AM AMPC____ D

EC9-06/07

102.1.3, 102.1.3.1 (New), 202, Chapter 6

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself; Greg Carney, Glass Association of North America, Building Envelope Contractors Division; Greg Patzer, Aluminum Extruders Council

1. Revise as follows:

102.1.3 Fenestration product rating. U-factors of fenestration products ~~(windows, doors and skylights)~~ shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled U-factor shall be assigned a default U-factor from Table 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:

<u>**102.1.3.1 Commercial building fenestration rating alternative.** U-factors and SHGC for fenestration used in commercial buildings shall be permitted to be determined in accordance with AAMA 507-03 and documented by a certificate of compliance submitted to the code official by the glazing contractor or registered design professional.</u>

3. Revise definition as follows:

SECTION 202
GENERAL DEFINITIONS

FENESTRATION. Skylights, roof windows, vertical windows (fixed or moveable), <u>curtain wall, storefront glazing,</u> 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

<u>507-03 Rev. 4/2004</u> <u>Standard Practice for Determining the Thermal Performance Characteristics of Fenestration Systems Installed in Commercial Buildings</u>

Reason: This proposal adds a useable method for complying with the IECC's commercial glazing U-factor and SHGC requirements, especially commercial glazing that is assembled in the field.

The existing section of the code specifies NFRC procedures for rating window U-factor and SHGC. The existing procedures (NFRC 100 and NFRC 200) were originally developed for residential windows. These procedures work well for residential windows, which are produced in a factory where the manufacturer produces the final product and knows the specifications for that product. NFRC labels are very commonly seen on residential windows.

In contrast, no workable procedure exists for rating commercial glazing, particularly for products that are glazed and/or assembled in the field. Although NFRC has added a procedure for site-built fenestration, the evidence that the existing procedures are not working for commercial buildings is the lack of NFRC labels on curtain wall and storefront fenestration in the field. Most commercial inspectors have never seen a single rating label on curtain wall or storefront windows.

Lacking a label, this section of the code assigns a default value for U-factors and SHGC from the tables in this section. A quick comparison of the default values with the code requirements in Table 502.3 shows that curtain wall and storefront fenestration would never meet the code requirements based on the default values. This fenestration will always fail the SHGC requirements in zones 1, 2 and 3; and always fail the U-factor requirements in zones 4 through 8.

Curtain wall and storefront fenestration, common types of commercial glazing, are assembled in the field. The specific combination of frame, glazing, and sizes are determined by the professional who designs the fenestration for a particular building. The glass fabricator assembles the glass and spacer into a sealed IG unit. This fabrication step alone can have many combinations of glass type (different low-e coatings, reflective coatings, tints, thickness, tempered, laminated, etc), spacer type, and gas fill. Similarly, the large variety of framing components leads to a huge number of possible configurations in the final product assembled in the field by the glazing contractor. To increase enforcement of the code for these commercial products, there is a need for a standard to more easily rate these products in a realistic, cost-effective, and simple manner.

With the AAMA 507-03 procedure, once the thermal test procedure has been performed then the AAMA 507-03 charts can be used for the specific fenestration size, glazing, and framing used. This system is by far the most cost effective because the glass and framing options are only tested once; then the charts and linear interpolation are used to quickly produce a value for each product.

The AAMA procedure uses the same test and computer simulation tools required by NFRC. From a technical perspective they are very similar and result in similar values for U-factor and SHGC. The main difference in the two procedures is that the AAMA procedure combines frame and glass ratings to provide an overall system rating without requiring additional project specific simulations and lab fees.

AAMA 507-03 can also be used to easily calculate performance of actual products with the real size and real spandrel area, not just some hypothetical model size from the NFRC procedure. Using the NFRC model size gives a comparative value which is not appropriate for estimating actual demands and HVAC sizing when the real product varies from the model size.

AAMA 507-03 is a simple, usable, and enforceable option for rating commercial windows, and is well suited to the process used to construct commercial fenestration.

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

Note: The following analysis was not in the Code Change Proposal book but was published in the "Errata to the 2006/2007 Proposed Changes to the International Codes and Analysis of Proposed Reference Standards" provided at the code development hearings:

Analysis: Review of proposed new standard indicated that, in the opinion of ICC Staff, the standard did comply with ICC standards criteria.

Committee Action: Disapproved

Committee Reason: The proposed AAMA standard does not require third-party certification of manufacturers. While the standard does require laboratories to be accredited by NFRC, the committee questioned what they would be accredited for–the AAMA standard or the NFRC standard. In addition, there is still some concern as to whether the values determined in the AAMA standard always match the values determined from the NFRC standard.

The proponent's point about the lack of enforcement of the NFRC requirements was noted and the committee acknowledged was a concern. However, the lack of enforcement of the NFRC method is not completely the fault of the standard, and therefore the addition of the proposed new standard does not necessarily assure better enforcement.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Craig Conner, Building Quality, representing himself, and Julie Ruth, P.E., JRuth Code Consulting, representing American Architectural Manufacturers Association, request Approval as Modified by this Public Comment.

Modify proposal as follows:

102.1.3.1 Commercial building fenestration rating alternative. U-factors and SHGC for fenestration used in commercial buildings shall be permitted to be determined in accordance with AAMA 507-~~03~~ 07. The product performance shall be documented by a certificate of compliance, as described in AAMA 507, ~~and documented by a certificate of compliance~~ 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.

AAMA
507-~~03~~ 07 Standard Practice for Determining the Thermal Performance Characteristics of Fenestration Systems Installed in Commercial Buildings

Commenter's Reason (Craig Conner): This is simple. Commercial windows should be rated. 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 rating procedure takes months. The AAMA 507 procedure can be used to rate a window in days or less and produces the same window 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 windows.

The modifications in this public comment respond to committee concerns.

Commenter's Reason (Julie Ruth): Although the NFRC certification program is accepted for residential windows, data from NFRC's own website indicates that NFRC certification was provided for less than 1% of the fenestration systems installed in commercial buildings in 2005 and 2006. Many manufacturers of commercial fenestration products and AAMA members have been attempting to work with NFRC for a number of years in the development of thermal certification programs for their products that meet the needs of their industry, but the resultant NFRC program currently available is one that they find too time consuming and difficult for their customers to use. Of particular frustration to them is the anticipated 100 day delay, as described on the NFRC website, from application for certification to actual certification. If any component of the system is changed, as often happens as the design of a building develops, the certification process has to be begun again. AAMA 507 meets the needs of the industry in that it provides accurate data, is less expensive to use, and provides timely data that meets the aggressive schedules associated with the commercial market.

By using AAMA 507, the manufacturers of commercial fenestration systems can provide the user of their product with a design tool for determining the thermal rating of the actual product, as it will be installed in the field, which can be performed in a matter of hours rather than months. The manufacturer develops the information needed for the thermal design and use of their product through product line testing and simulation and provides it to the end user in the form of a matrix. By specifying that the product line testing and simulation, as described in AAMA 507, is to be done in accordance with NFRC 100 and NFRC 200 by accredited laboratories, the proposed code language would provide the same level of accuracy for products rated in accordance with AAMA 507 as is currently provided for products rated by NFRC, using the same procedures.

Although disapproved by the IECC committee a number of IECC committee members encouraged the proponents of EC9 to bring back a modified version that addressed their concerns for consideration at the Final Action Hearings. This Public Comment responds to that request.

Specifically, the concerns raised by the IECC committee, and the response given in the revised proposal, are as follows:

1. Concern that the proposed referenced standard does not require third party certification of manufacturers.

The revised proposal would require third party verification of the installed assembly at various levels within the design and installation process.

First, the U-factors are determined for the required range of vision area percentages, using computer simulations that are conducted in accordance with the NFRC Simulation manual by an approved, accredited, independent laboratory. If required, the product's SHGC is also determined using computer simulations that are done in accordance with NFRC procedures by an approved, accredited, independent laboratory.

Secondly, the U-factors determined through computer simulations are verified through product testing in accordance with NFRC 100. An approved, accredited, independent laboratory also conducts this testing.

Third, the approved, accredited, independent laboratory develops a matrix of U-factors for the full range of available center-of-glass U-factors, using information developed and verified through the first two steps. SHGC values for the full range of available center of glass SHGCs are also developed during this stage by the approved, accredited, independent laboratory and included in the matrix, if the information needed for same was developed during the computer simulation step. This matrix is included on the certificate of compliance described in AAMA 507.

Finally, the 2007 edition of AAMA 507 will require that the certificate of compliance be provided on each job. The certificate is to include the name of the framing manufacturer, the accrediting laboratory, the name of the glass supplier and values for the glass used as well as the matrix values developed during the product line testing and simulation. Further, the certificate of compliance is to be signed by the glazing contractor or registered design professional for the project, verifying compliance of the installed system with the code.

2. Are the laboratories to be accredited for the AAMA standard or the NFRC standard?

The proposed new code language clarifies that the laboratories are to be accredited to the NFRC standards.

3. Will the values determined in the AAMA standard always match the values determined in the NFRC standard?

Since the proposal clarifies that the methods specified in NFRC 100 and NFRC 200 are to be used, the values determined in accordance with the AAMA standard will match the values determined in accordance with the NFRC standard, for assemblies of the exact same size, configuration of glass/spacer/framing system, etc. A study by Architectural Testing Incorporated compared 135 different options with 9 different product types, including glazed wall systems, sliding patio doors, fixed windows, casement windows, awning windows, and double hung windows. Each product was analyzed with 15 different glazing options covering the complete range of IG units available today. The maximum difference between the NFRC and AAMA 507 U-factor rating was only 0.006, demonstrating that both standards agree to well within 1 percent.

Final Action: AS AM AMPC____ D

EC11-07, Part I
102.1.4 (New), Chapter 6

Proposed Change as Submitted:

Proponent: Chuck Murray, Washington State University, representing Northwest Energy Code Group

PART I – IECC

1. Add new text as follows:

<u>**102.1.4 Insulation product rating.** The thermal resistance *(R-value)* of insulation shall be determined in accordance with CFR Title 16, Part 460 in units of h·ft^2·°F/Btu at a mean temperature of 75°F.</u>

2. Add standard to Chapter 6 as follows:

US FTC
<u>R-value rule, May 31, 2005, CFR Title 16, Part 460</u>

Reason: Currently there is no reference in the IECC for testing and listing of insulation R-values. The addition of this specification brings two important requirements to the code.

- First, the Federal Trade Commission R-value rule details specific test standards for insulation. The test standards are specific to the type of insulation and intended use. This clarifies any questions on the rating conditions to be used for insulation materials.
- Second, the text above specifies the rating temperature to be used when evaluating the R-value of the product, providing consistency not currently in the IECC. Insulation products somtimes list several R-values based on different test temperatures. This eliminates any question as to which R-value to use. The temperature selected is a standard rating condition.

The purpose of the proposed change is to provide a specific standard for the evaluation of insulation R-value.

Bibliography:
Federal Trade Commission 16 CFR Part 460 Labeling and Advertising of Home Insulation: Trade Regulation Rule; Final Rule, May 31, 2005
An electronic copy is available on line at:
http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title16/16cfr460_main_02.tpl

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

Note: The following analysis was not in the Code Change Proposal book but was published in the “Errata to the 2006/2007 Proposed Changes to the International Codes and Analysis of Proposed Reference Standards” provided at the code development hearings:

Analysis: Review of proposed new standard indicated that, in the opinion of ICC Staff, the standard did not comply with ICC standards criteria.

Committee Action: **Approved as Submitted**

Committee Reason: Even though this reference is Federal Law and therefore applicable, it is desirable to reference this specific method for determination of R-Values to assure compliance and assure a level playing field.

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 for Part I.

Commenter's Reason: The IRC committee was correct in rejecting this code change. The ICC staff analysis says the referenced standard does not comply with ICC guidelines for standards referenced in the I-codes. The IECC should not reference a non-complying standard or a Federal regulation. Building code enforcement staff should not be made responsible for enforcing Federal law.

Public Comment 2:

Mason Knowles, Spray Polyurethane Foam Alliance, requests Disapproval for Part I.

Commenter's Reason: SPFA opposes the inclusion of the FTC R-value Rule for the following reasons:

1. The FTC rule identifies test procedures and allowable temperatures to provide R-values of insulation materials for reporting and advertising purposes. However building codes address climate zones that fall far outside of the temperature ranges listed in the FTC R-value regulation. If an insulation performs much better or much worse in varying climate zones from the FTC tested R-value, the building code official should have the right to evaluate that data and to make corrections as needed. For this reason, it is valuable to be able to provide building code officials with test data (based on test methods in accordance with FTC and ASTM standards) that show how specific materials and assemblies perform in varying climates and conditions.
2. While suppliers may not use this type of data to advertise the R-value of their material, building code officials have no restrictions in this regard and can use this type of data to more accurately identify the performance of insulation systems and materials in varying climates and conditions. Adoption of this code change would limit the building code official to only the temperature variations listed in the FTC and make it harder to specify insulation systems properly.

Final Action: AS AM AMPC____ D

EC11-06/07, Part II
IRC N1101.6 (New), Chapter 43

Proposed Change as Submitted:

Proponent: Chuck Murray, Washington State University, representing Northwest Energy Code Group

PART II – IRC BUILDING/ENERGY

1. Add new text as follows:

N1101.6 Insulation product rating. The thermal resistance *(R-value)* of insulation shall be determined in accordance with the CFR Title 16, Part 460, in units of h·ft^2·°F/Btu at a mean temperature of 75°F.

(Renumber subsequent sections)

2. Add standard to Chapter 43 as follows:

US FTC
R-value rule, May 31, 2005, CFR Title 16, Part 460

Reason: Currently there is no reference in the IECC for testing and listing of insulation R-values. The addition of this specification brings two important requirements to the code.

- First, the Federal Trade Commission R-value rule details specific test standards for insulation. The test standards are specific to the type of insulation and intended use. This clarifies any questions on the rating conditions to be used for insulation materials.
- Second, the text above specifies the rating temperature to be used when evaluating the R-value of the product, providing consistency not currently in the IECC. Insulation products somtimes list several R-values based on different test temperatures. This eliminates any question as to which R-value to use. The temperature selected is a standard rating condition.

The purpose of the proposed change is to provide a specific standard for the evaluation of insulation R-value.

Bibliography:
Federal Trade Commission 16 CFR Part 460 Labeling and Advertising of Home Insulation: Trade Regulation Rule; Final Rule, May 31, 2005
An electronic copy is available on line at:
http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&tpl=/ecfrbrowse/Title16/16cfr460_main_02.tpl

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

Note: The following analysis was not in the Code Change Proposal book but was published in the "Errata to the 2006/2007 Proposed Changes to the International Codes and Analysis of Proposed Reference Standards" provided at the code development hearings:

Analysis: Review of proposed new standard indicated that, in the opinion of ICC Staff, the standard did not comply with ICC standards criteria.

Committee Action: Disapproved

Committee Reason: Federal regulations should not be in a building code. The proposed referenced standard does not comply with the ICC criteria.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Charles Cottrell, North American Insulation Manufacturers Association, requests Approval as Submitted for Part II.

Commenter's Reason: A definition of R-value is needed in the codes so that building officials can determine if materials meet the code requirements. Currently there are manufacturers that use terms, such as "effective R-value", and these can be used to exaggerate the thermal performance of their products. The IRC and IECC, which contain R-value requirements, need to have a clear definition of R-value that is consistent with the Federal Trade Commission's definition.

The IECC in part I of this code proposal approved adding the FTC definition of R-value and the IRC should contain the same definition to be consistent and help building officials determine how the thermal performance of insulation materials is measured.

Public Comment 2:

Chuck Murray, Washington State University Energy Program, representing The Northwest Energy Code Group, requests Approval as Submitted for Part II.

Commenter's Reason: Including this reference in the code book provides code enforcement community the supporting documentation they need in the event there is a disagreement about the insulation R-value.

This code change was approved by the IECC committee but denied by the IRC committee. The IECC committee approved the addition of this language because they understood that this is the best reference for insulation testing and labeling available. It is comprehensive, providing requirements for testing 11 different classes of insulation. It incorporates 12 ASTM test methods, one ASHRAE approved calculation method and one test method developed by the U.S. General Services Administration. The FTC rule was developed through an extensive public process. Public comment was provided by 42 different manufacturers and/or industry representatives.

- This language will also provide clear direction on the rating of insulation, without adding extensive lists of test methods to this code book.
- Adopting this language in the IRC will maintain consistency between the IECC and IRC.
- There is really no other way to do this. It's the law.

The FTC rulemaking process and final rule may be viewed at this web site.
http://www.ftc.gov/os/2005/05/050531homeinsulationfrn.pdf

Public Comment 3:

Lorraine Ross, Intech Consulting Inc., representing Alliance for the Polyurethanes Industry, requests Approval as Submitted for Part II.

Commenter's Reason: EC 11 adds 16 CFR 16 Part 460 (Labeling and Advertising of Home Insulation, commonly called the "R-Value Rule") to the IECC. This Federal Law requires any insulation used in residential construction be tested in accordance with ASTM standards at a consistent 75°F mean temperature in order to ensure "apples to apples" R-value comparison of different insulation types. This citation especially belongs in the IRC since it specifically governs construction covered by the scope of the IRC. Inclusion of the "R-Value Rule" will fill a current gap in the code regarding testing of R-values. Since all insulation manufacturers who sell to this sector and all installers and sellers of new homes MUST COMPLY with 16 CFR Part 460, there should be no objection to including it in the IRC. It will, however, serve notice to producers of innovative materials that there are R-value testing and labeling requirements. Although the IRC Committee, in its disapproval of EC 11-Part II proposal, stated that "Federal Regulations do not belong in a building code", the 2006 IRC Chapter 43 already contains the following Federal Regulations:

CPSC Consumer Product Safety Commission
4330 East West Highway
Bethesda, MD 20814-4408

Standard number	Title	Referenced reference in code section number
16 CFR Part 1201—(1977)	Safety Standard for Architectural Glazing	R308.1.1, R308.3
16 CFR Part 1209—(1979)	Interim Safety Standard for Cellulose Insulation	R316.3
16 CFR Part 1404—(1979)	Cellulose Insulation	R316.3

Please overturn the IRC Committee disapproval and approve EC Part II as submitted.

Public Comment 4:

Lorraine Ross, Intech Consulting Inc., representing Polyiso Insulation Manufacturers Association (PIMA), requests Approval as Submitted for Part II.

Commenter's Reason: Although the Energy Code is replete with references to "R-value", there is no indication of the required testing that is needed in order for an insulation material to qualify that it meets these R-value levels. Referencing the FTC R-value Rule (16 CFR Part 460) provides an expedient means of filling this gap. Further, The FTC R-value Rule applies exclusively to insulation sold into the residential market, so that all consideration of conditions that exist in residential construction has been taken into account. The inclusion of the FTC R-value Rule will greatly increase enforcement of the energy code because R-value claims made by the insulation manufacturer must be technically supported by very rigid R-value testing requirements at specific temperatures so that there is assurance that the R-value requirements are being met. The R-value Fact Sheet that is required may be submitted to the building department with the permit application.

Finally, to the IRC's point that Federal regulations do not belong in the code, there is already 3 regulations promulgated by the Consumer Product Safety Commission cited in IRC Chapter 43. Please approve EC11-06/07 Part II as submitted.

Public Comment 5:

Donald J. Vigneau, Northeast Energy Efficiency Partnerships, requests Approval as Submitted for Part II.

Commenter's Reason: Without a fixed standard, even one developed by the Federal government and not under a recognized consensus process, there is no way for the code official or the consumer to determine what a listed insulation value represents. CFR Title 16, Part 460 establishes a reference measurement standard that is a competent yardstick against which products can be effectively measured.
The original proponent's reasons are valid; the proposal even offered a specific link to the precise information.

The decision of the Residential Building/Energy Committee is based only on the validity of the process establishing the measurement tool.

Final Action: AS AM AMPC____ D

EC13-06/07

103.1, 103.1.1 through 103.2 (New)

Proposed Change as Submitted:

Proponent: Rebecca Baker, Jefferson County, CO, Chair, ICC Ad Hoc Committee on the Administrative Provisions in the I-Codes (AHC-Admin)

Add new text as follows:

SECTION 103
ALTERNATE MATERIALS—METHOD
OF CONSTRUCTION, DESIGN
OR INSULATING SYSTEMS

103.1 Alternative materials, methods, and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any method of construction, design or insulating system not specifically prescribed by this code, provided that any such alternative design or insulating system has been approved. An alternative material or method of construction shall be approved where the code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. ~~**General.** This code is not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design or insulating system has been approved by the code official as meeting the intent of this code.~~

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

103.1.2 Required testing. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternate materials or methods, the code official shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction.

103.1.2.1 Test methods. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the code official shall approve the testing procedures.

103.1.2.2 Testing agency. All tests shall be performed by an approved agency.

103.1.2.3 Test reports. Reports of tests shall be retained by the code official for the period required for retention of public records.

103.1.3 ~~103.1.1~~ Above code programs. (No change to current text.)

103.2 Modifications. Whenever there are practical difficulties involved in carrying out the provisions of this code, the code official shall have the authority to grant modifications for individual cases, upon application of the owner or owner's representative provided the code official shall first find that special individual reason makes the strict letter of this code impractical and the modification is in compliance with the intent and purpose of this code and does not lessen health, life and fire safety requirements. The details of action granting modifications shall be recorded and entered in the files of the department.

Reason: Consistency and coordination among the I-Codes is one of the cornerstones of the ICC Code Development Process. This holds true for not only the technical code provisions but also for the administrative code provisions as contained in Chapter 1 of all the I-Codes.

In response to concerns raised by the ICC membership since publication of the first editions of the I-Codes, the ICC Board established the Ad Hoc Committee on the Administrative Provisions in the I-Codes (AHC-Admin) to review Chapter 1 administrative provisions in each code in the International Codes family and improve the correlation among the I-Codes through the code development process. In order to ensure that this correlation process will continue in an orderly fashion, it is also anticipated that future code development and maintenance of the administrative provisions of the I-Codes family will be overseen by a single, multi-discipline code development committee.

The AHC-Admin is submitting a series of code change proposals designed to provide consistent and correlated administrative provisions among the I-Codes using existing I-Code texts, as noted. The intent of this correlation effort is not to have absolutely identical text in each of the I-Codes but, rather, text that has the same intent in accomplishing the administrative tasks among the I-Codes. While some proposed text may be "new" because it was judged by the AHC to be necessary to this particular code, it is not new to the I-Code family, since it already exists in one or more of the International Codes. Unless otherwise noted, there are no technical changes being proposed to these sections. A comparative matrix of current I-Codes Chapter 1 text may be found on the ICC website at www.iccsafe.org/cs/cc/admin/index.html.

This proposal focuses on alternative methods and materials provisions for the IECC. The purpose of this proposed change is to provide expanded administrative provisions and additional ones not currently in the IECC, the source text for which is Sections 104.10 and104.11 of the *International Building Code*, *International Existing Building Code* and *International Residential Code.* A section-by-section discussion follows:

103.1: The purpose of this proposed change is to provide what the AHC-Admin felt is a more comprehensive approach to the subject of alternative materials than the current text and that is correlated with the I-Codes family, the source text for which is Section 104.11 of the *International Building Code*, *International Existing Building Code* and *International Residential Code*. Note that the IECC-specific "design or insulating system" language has been retained in the expanded text.

103.1.1: The source text for this section is Section 104.11.1 of the *International Building Code*, *International Existing Building Code* and *International Residential Code.* When an alternative material or method is proposed, it is incumbent upon the code official to determine whether this alternative is, in fact, an equivalent to the methods prescribed by the code. This section provides the code official with a useful administrative tool in considering alternative materials.

> A research report issued by an authoritative agency is particularly useful in providing the code official with the technical basis for evaluation and approval of new and innovative materials and methods of construction. The use of authoritative research reports can greatly assist the code official by reducing the time-consuming engineering analysis necessary to review these materials and methods. Such reports are required to be supplied by an approved source, meaning a source that the code official considers to be reliable and accurate.

103.1.2 through 103.1.2.3: The source text for these sections is Section 104.11.2 of the *International Building Code*, *International Existing Building Code* and *International Residential Code.* These sections provide the code official with useful tools in formulating approvals of alternative materials. The code official must require the submission of any appropriate information and data to assist in the determination of equivalency before a permit can be issued. The type of information required includes test data in accordance with appropriate standards, evidence of compliance with the referenced standard specifications and design calculations. Failure to substantiate adequately a request for the use of an alternative is a valid reason for the code official to deny a request. Any tests submitted in support of an application must have been performed by an agency approved by the code official based on evidence that the agency has the technical expertise, test equipment and quality assurance to properly conduct and report the necessary testing. The test reports submitted to the code official must be retained in accordance with the requirements stated.

The proposed change also Aunpacks@ the single long paragraph of the source text that contains a number of separate enforcement elements that really should be set apart from one another to emphasize their importance in the code hierarchy. There are no technical changes being proposed to these source texts.

103.2: The source text for this section is Section 104.10 of the *International Building Code*, *International Existing Building Code* and *International Residential Code.* This section would allow the code official to amend or make exceptions to the code as needed where strict compliance is deemed to be impractical. Only the code official has authority to grant modifications. Consideration of a particular difficulty is to be based on the application of the owner and a demonstration that the intent of the code is accomplished.

This section is not intended to permit setting aside or ignoring a code provision; rather, it is intended to provide for the acceptance of equivalent protection. Such modifications would not, however, extend to actions that are necessary to correct violations of the code, such as the expense of correcting one. For the future protection of the code official as well as the permit holder granted the modification, adequate records must be kept of the details of all modifications given.

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

Committee Action: Disapproved

Committee Reason: The committee voted disapproval for the following reasons:

1. The alternative materials section does not mention energy efficiency.
2. The proposed section on modifications, based upon "practical difficulties" could be a license to allow anything, because "practical difficulties" is not narrowly defined.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Rebecca Baker, Jefferson County, CO, representing, as Chair, the ICC Ad Hoc Committee on the Administrative Provisions in the I-Codes, requests Approval as Submitted.

Commenter's Reason: The ICC Ad-Hoc Committee on the Administrative Provisions in the I-Codes (AHC-Admin) was tasked with reviewing Chapter 1 administrative provisions in each of the I-Codes and attempting to correlate applicable provisions through the code development process.

In disapproving this code change, the IECC Committee cited two specific perceived shortcomings in the proposal. First, the Committee expressed concern that the proposed revision to Section 103.1 on alternative materials does not mention "energy efficiency" as a criterion for approving alternative materials. The AHC-Admin considered this concern and noted that the current text of Section 103.1 does not mention "energy efficiency" either, so the proposal does no harm in that regard. Energy efficiency is a measure of performance or effectiveness of the energy conservation design of a building. The proposed revision to Section 103.1 greatly improves the text by including "equivalent of that prescribed in this code in...effectiveness..." as a key minimum requirement for approving any alternative material, method or equipment.

The IECC Committee also expressed concern that the phrase "...practical difficulties..." could be a license to allow anything, because..." it is not narrowly defined. The AHC-Admin considered this concern and noted that the phrase "practical difficulties" currently exists in the text of Section 104.10 "Modifications" of the *International Building Code*, *International Existing Building Code* and *International Residential Code* and existed in the "modifications" section of two of the legacy building codes. In one legacy code, that text has existed as far back as 1960 with no traceable code change history to indicate that the phrase has ever caused a problem. Consideration of a "practical difficulty" depends on the experienced judgment of the code official, based on the application of the owner and a demonstration that the intent of the code will be accomplished. Accordingly, the AHC-Admin is not proposing any change to what is clearly a well-proven and useful code provision.

The proposed provisions in this code change appear in the IBC, IRC and IEBC (the three other "I" codes that would be used in conjunction with the IECC) because it is a critical tool used by the Building Official when administering the codes in order to allow for new products and technologies. The AHC-Admin believes that this code change should be approved as it was submitted in order to provide a needed administrative tool to the code official in administering the IECC and to provide correlation among the IECC and the three most closely related I-Codes.

Final Action: AS AM AMPC____ D

EC28-06/07, Part I

IECC: 202, 402.5, 402.5.1 (New), Table 402.5.1 (New), 402.5.2 (New), 402.5.3 (New), 402.2.8, 502.5, 502.5.1 (New), Table 502.5.1 (New), 502.5.2 (New), 502.5.3 (New)

Proposed Change as Submitted:

Proponent: Joseph Lstiburek, Building Science Corporation, representing himself

PART I – IECC

1. Delete and substitute as follows:

~~**VAPOR RETARDER.** A vapor resistant material, membrane or covering such as foil, plastic sheeting, or insulation facing having a permeance rating of 1 perm (5.7 X 10-11 kg/Pa ⋅ s ⋅ m2) or less when tested in accordance with the dessicant method using Procedure A of ASTM E 96. Vapor retarders limit the amount of moisture vapor that passes through a material or wall assembly.~~

VAPOR RETARDER CLASS. A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method of ASTM E-96 as follows:

Class I: 0.1 perm or less
Class II: 0.1 < perm >= 1.0 perm
Class III: 1.0 < perm >= 10 perm
Class IV: Greater than 10 perm

~~**402.5 Moisture control. (Mandatory).** The building design shall not create conditions of accelerated deterioration from moisture condensation. Above-grade frame walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder. The vapor retarder shall be installed on the warm-in-winter side of the thermal insulation.~~

~~**Exceptions:**~~

1. ~~In construction where moisture or its freezing will not damage the materials.~~
2. ~~Frame walls, floors and ceilings in jurisdictions in Zones 1, 2, 3, 4A and 4B. (Crawl space floor vapor retarders are not exempted.)~~
3. ~~Where other approved means to avoid condensation are provided.~~

402.5 Vapor retarders. Class I or II vapor retarders are required on the interior side of walls in Zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
2. Below grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

2. Add new text as follows:

402.5.1 Class III vapor retarders. Class III vapor retarders shall be permitted where the conditions in Table 402.5.1 are met.

TABLE 402.5.1
CLASS III VAPOR RETARDERS

Zone	Class III vapor retarders permitted for:
Marine 4	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 2.5 in 2x4 wall Insulated sheathing with R-value >= 3.75 in 2x6 wall
5	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 5 in 2x4 wall Insulated sheathing with R-value >= 7.5 in 2x6 wall
6	Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 7.5 in 2x4 wall Insulated sheathing with R-value >= 11.25 in 2x6 wall
7 and 8	Insulated sheathing with R-value >= 10 in 2x4 wall Insulated sheathing with R-value >= 15 in 2x6 wall

402.5.2 Material vapor retarder class. The vapor retarder class shall be based on the manufacturer's certified testing or a tested assembly.

The following shall be deemed to meet the class specified:

Class I: Sheet polyethylene, non-perforated aluminum foil
Class II: Kraft faced fiberglass batts
Class III: Latex paint
Class IV: House wrap, building paper.

402.5.3 Minimum clear air spaces and vented openings. For the purposes of this section vented shall include the following minimum clear air spaces. Other openings with the equivalent net free area shall be permitted.

1. Stucco with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at the top and bottom of each wall.
2. Brick with a 2 inch clear airspace behind the brick with vents at both the top and bottom of the brick. The vents shall be 3/8 inch x 2.5 inch openings every third brick at both the bottom and top course of each wall.

3. Stone or Masonry Veneer with a 2 inch clear airspace behind the stone with vents at the top and bottom. The vents shall have at least 1 square inch of vent area for every 24 inches of wall.
4. Panel Siding with 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.
5. Wood, Wood Based, or Fiber Cement Siding with either a 1/4 inch clear airspace; or alternatively a 1/4 inch gap between the horizontal siding laps
6. Other approved clear air spaces and vented openings.

3. Revise as follows:

402.2.8 Crawl space walls. As an alternative to insulating floors over crawl spaces, crawl space walls shall be permitted to be insulated when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished grade level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder. All joints of the vapor retarder shall overlap by 6 inches (153 mm) and be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (153 mm) up the stem wall and shall be attached to the stem wall.

4. Delete and substitute as follows:

~~**502.5 Moisture control. (Mandatory).** All framed walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm (5.7 °x10 –11 kg/Pa · s · m2) or less, when tested in accordance with the dessicant method using Procedure A of ASTM E 96. The vapor retarder shall be installed on the warm-in-winter side of the insulation.~~

~~**Exceptions:**~~

1. ~~Buildings located in Climate Zones 1 through 3 as indicated in Figure 301.1 and Table 301.1.~~
2. ~~In construction where moisture or its freezing will not damage the materials.~~
3. ~~Where other approved means to avoid condensation in unventilated framed wall, floor, roof and ceiling cavities are provided.~~

502.5 Vapor retarders. Class I or II vapor retarders are required on the interior side of walls in zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
2. Below grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

5. Add new text as follows:

502.5.1 Class III vapor retarders. Class III vapor retarders shall be permitted where the conditions in Table 502.5.1 are met.

TABLE 502.5.1
CLASS III VAPOR RETARDERS

Zone	Class III vapor retarders permitted for:
Marine 4	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 2.5 in 2x4 wall Insulated sheathing with R-value >= 3.75 in 2x6 wall
5	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 5 in 2x4 wall Insulated sheathing with R-value >= 7.5 in 2x6 wall
6	Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 7.5 in 2x4 wall Insulated sheathing with R-value >= 11.25 in 2x6 wall
7 and 8	Insulated sheathing with R-value >= 10 in 2x4 wall Insulated sheathing with R-value >= 15 in 2x6 wall

502.5.2 Material vapor retarder class. The vapor retarder class shall be based on the manufacturer's testing or a tested assembly.

The following shall be deemed to meet the class specified:

Class I: Sheet polyethylene, non-perforated aluminum foil
Class II: Kraft faced fiberglass batts
Class III: Latex paint
Class IV: House wrap, building paper.

502.5.3 Minimum clear air spaces and vented openings. For the purposes of this section vented shall include the following minimum clear air spaces. Other openings with the equivalent net free area shall be permitted.

1. Stucco with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at the top and bottom of each wall.
2. Brick with a 2 inch clear airspace behind the brick with vents at both the top and bottom of the brick. The vents shall be 3/8 inch x 2.5 inch openings every third brick at both the bottom and top course of each wall.
3. Stone or Masonry Veneer with a 2 inch clear airspace behind the stone with vents at the top and bottom. The vents shall have at least 1 square inch of vent area for every 24 inches of wall.
4. Panel Siding with 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.
5. Wood, Wood Based, or Fiber Cement Siding with either a 1/4 inch clear airspace; or alternatively a 1/4 inch gap between the horizontal siding laps
6. Other approved clear air spaces and vented openings.

Reason: Wall assemblies can be designed and constructed to dry inwards, outwards and to both sides in all climate zones. Requiring vapor barriers and vapor retarders to always be installed on the interior of wall assemblies inhibits the use of wall designs that promote inward drying thereby increasing the risk of mold and moisture damage. This code change allows more flexibility in the design and construction of moisture forgiving wall systems.

These requirements for vapor retarder have been in the development process for at least 4 years. That process has included two Building America meetings, coordination with personnel at the Oakridge National Laboratory and the University of Waterloo, presentations before ASHRAE committees, and interactions with private companies.

These requirements recognize that many common materials function to various degrees to slow the passage of moisture. In many situations common materials such as the kraft facing on a fiberglass batt, or latex paint may serve to retard moisture sufficiently. In particular, the "standard" sheet of polyethylene is usually not required as a vapor retarder in walls.

This change includes modification of existing vapor retarder requirements and instances in the code to use the vapor retarder classes proposed here.

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

Note: The following analysis was not in the Code Change Proposal book but was published in the "Errata to the 2006/2007 Proposed Changes to the International Codes and Analysis of Proposed Reference Standards" provided at the code development hearings:

Analysis: Review of proposed new standard indicated that, in the opinion of ICC Staff, the standard did not comply with ICC standards criteria.

Committee Action: Approved as Modified

Modify proposal as follows:

VAPOR RETARDER CLASS. A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method with Procedure A of ASTM E-96 as follows:

Class I: 0.1 perm or less
Class II: 0.1 < perm <= 1.0 perm
Class III: 1.0 < perm <= 10 perm
~~Class IV: Greater than 10 perm~~

402.5 Vapor retarders. Class I or II vapor retarders are required on the interior side of frame walls in zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
2. Below grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

402.5.2 Material vapor retarder class. The vapor retarder class shall be based on the manufacturer's certified testing or a tested assembly. The following shall be deemed to meet the class specified:

Class I: Sheet polyethylene, non-perforated aluminum foil
Class II: Kraft faced fiberglass batts
Class III: Latex paint
~~Class IV: House wrap, building paper.~~

402.5.3 Minimum clear air spaces and vented openings for vented cladding. For the purposes of this section vented cladding shall include the following minimum clear air spaces. Other openings with the equivalent ~~net free~~ vent area shall be permitted.

1. Stucco with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at the top and bottom of each wall.
2. Brick with a 2 inch clear airspace behind the brick with vents at both the top and bottom of the brick. The vents shall be 3/8 inch x 2.5 inch openings every third brick at both the bottom and top course of each wall.
3. Stone or Masonry Veneer with a 2 inch clear airspace behind the stone with vents at the top and bottom. The vents shall have at least 1 square inch of vent area for every 24 inches of wall.
4. Panel Siding with 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.
5. Wood, Wood Based, or Fiber Cement Siding with either a 1/4 inch clear airspace; or alternatively a 1/4 inch gap between the horizontal siding laps
6. Vinyl lap siding applied directly to a weather resistive barrier.
7. Manufactured Stone Veneer with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.

~~6~~ 8. Other approved clear air spaces and vented openings.

502.5 Vapor retarders. Class I or II vapor retarders are required on the interior side of frame walls in Zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
2. Below grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

502.5.2 Material vapor retarder class. The vapor retarder class shall be based on the manufacturer's certified testing or a tested assembly.

The following shall be deemed to meet the class specified:

Class I: Sheet polyethylene, non-perforated aluminum foil
Class II: Kraft faced fiberglass batts
Class III: Latex paint
~~Class IV: House wrap, building paper.~~

502.5.3 Minimum clear air spaces and vented openings for vented cladding. For the purposes of this section vented cladding shall include the following minimum clear air spaces. Other openings with the equivalent ~~net free~~ vent area shall be permitted.

1. Stucco with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at the top and bottom of each wall.
2. Brick with a 2 inch clear airspace behind the brick with vents at both the top and bottom of the brick. The vents shall be 3/8 inch x 2.5 inch openings every third brick at both the bottom and top course of each wall.
3. Stone or Masonry Veneer with a 2 inch clear airspace behind the stone with vents at the top and bottom. The vents shall have at least 1 square inch of vent area for every 24 inches of wall.
4. Panel Siding with 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.
5. Wood, Wood Based, or Fiber Cement Siding with either a 1/4 inch clear airspace; or alternatively a 1/4 inch gap between the horizontal siding laps
6. Vinyl lap siding applied directly to a weather resistive barrier.
7. Manufactured Stone Veneer with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.

~~6.~~ 8. Other approved clear air spaces and vented openings.

(Portions of proposal not shown remain unchanged)

Committee Reason: The proposed change introduces advances in technology related to vapor retarders, and provides for more flexibility in exterior wall design. The proposal moves the code forward from the "one size fits all" approach that is presently in the code, while at the same time not eliminating any construction that was previously done using the present code. The modification eliminates reference to Class IV, as it is not used in the I-codes anywhere. In addition, the modification adds exceptions regarding clear air space that enable construction of common applications without change to the standard methods for installing vinyl siding and manufactured stone veneer.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Mason Knowles, Spray Polyurethane Foam Alliance, requests Approval as Modified by this Public Comment for Part I.

Further modify proposal as follows:

TABLE 402.5.1
CLASS III VAPOR RETARDERS

Zone	Class III vapor retarders permitted for:
Marine 4	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Closed Cell Sprayfoam or Insulated sheathing with R-value >= ~~2.5~~ 5, in 2x4 wall Closed Cell Sprayfoam or Insulated sheathing with R-value >= ~~3.75~~ 7.5, in 2x6 wall
5	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Closed Cell Sprayfoam or Insulated sheathing with R-value >= ~~5~~ 7.5, in 2x4 wall Closed Cell Sprayfoam or Insulated sheathing with R-value >= ~~7.5~~ 11.25, in 2x6 wall
6	Vented cladding over Fiberboard Vented cladding over Gypsum Closed Cell Sprayfoam or Insulated sheathing with R-value >= ~~7.5~~ 10, in 2x4 wall Closed Cell Sprayfoam or Insulated sheathing with R-value >= ~~11.25~~ 15, in 2x6 wall
7 and 8	Closed Cell Sprayfoam or Insulated sheathing with R-value >= ~~10~~ 15, in 2x4 wall Closed Cell Sprayfoam or Insulated sheathing with R-value >= ~~15~~ 18, in 2x6 wall

(Portions of proposal not shown remain unchanged)

Commenter's Reason: This is to clarify that closed cell SPF can be used with Class III vapor retarders in Climate Zones 4, 5, 6, 7 and 8. Closed cell SPF in the thickness required by codes in those climates has a perm rating of less than 1.0 perms and as such does not require an additional Class I or II vapor retarder.

It is the opinion of SPFA that higher r-values (than proposed by Joe Lstiburek's EC28 modification) are required to conservatively minimize the potential for condensation against the surface of the impermeable insulation in unvented attics and cathedral ceilings.

Public Comment 2:

Joseph Lstiburek, Building Science Corporation, representing himself, requests Approval as Modified by this Public Comment for Part I.

Further modify proposal as follows:

402.5.1 Class III vapor retarders. Class III vapor retarders shall be permitted where any one of the conditions in Table 402.5.1 are met.

TABLE 402.5.1
CLASS III VAPOR RETARDERS

Zone	Class III vapor retarders permitted for:
Marine 4	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= R2.5 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= R3.75 ~~in~~ over 2x6 wall
5	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= R5 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= R7.5 ~~in~~ over 2x6 wall
6	Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= R7.5 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= R11.25 ~~in~~ over 2x6 wall
7 and 8	Insulated sheathing with R-value >= R10 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= R15 ~~in~~ over 2x6 wall

402.5.2 Material vapor retarder class. The vapor retarder class shall be based on the manufacturer's certified testing or a tested assembly. The following shall be deemed to meet the class specified:

Class I: Sheet polyethylene, non-perforated aluminum foil
Class II: Kraft faced fiberglass batts or low perm paint (paint with 0.1 < perm <= 1.0)
Class III: Latex or enamel paint

402.5.3 Minimum clear air spaces and vented openings for vented cladding. For the purposes of this section vented cladding shall include the following minimum clear air spaces. Other openings with the equivalent vent area shall be permitted.

1. ~~Stucco with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at the top and bottom of each wall.~~
2. ~~Brick with a 2 inch clear airspace behind the brick with vents at both the top and bottom of the brick. The vents shall be 3/8 inch x 2.5 inch openings every third brick at both the bottom and top course of each wall.~~

~~3. Stone or Masonry Veneer with a 2 inch clear airspace behind the stone with vents at the top and bottom. The vents shall have at least 1 square inch of vent area for every 24 inches of wall.~~
~~4. Panel Siding with 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.~~
~~5. Wood, Wood Based, or Fiber Cement Siding with either a 1/4 inch clear airspace; or alternatively a 1/4 inch gap between the horizontal siding laps.~~
~~6.~~ 1. Vinyl lap or horizontal aluminum siding applied ~~directly to~~ over a weather resistive barrier as specified in IRC Table R703.4.
2. Brick veneer with a clear airspace as specified in IRC Section R703.7.4.2.
~~7. Manufactured Stone Veneer with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.~~
~~8.~~ 3. Other approved vented claddings ~~clear air spaces and vented openings~~.

502.5.1 Class III vapor retarders. Class III vapor retarders shall be permitted where any one of the conditions in Table 402.5.1 are met.

TABLE 502.5.1
CLASS III VAPOR RETARDERS

Zone	Class III vapor retarders permitted for:
Marine 4	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= R2.5 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= R3.75 ~~in~~ over 2x6 wall
5	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= R5 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= R7.5 ~~in~~ over 2x6 wall
6	Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= R7.5 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= R11.25 ~~in~~ over 2x6 wall
7 and 8	Insulated sheathing with R-value >= R10 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= R15 ~~in~~ over 2x6 wall

502.5.2 Material vapor retarder class. The vapor retarder class shall be based on the manufacturer's certified testing or a tested assembly. The following shall be deemed to meet the class specified:

Class I: Sheet polyethylene, non-perforated aluminum foil
Class II: Kraft faced fiberglass batts or low perm paint (paint with 0.1 < perm <= 1.0)
Class III: Latex or enamel paint

502.5.3 Minimum clear air spaces and vented openings for vented cladding. For the purposes of this section vented cladding shall include the following minimum clear air spaces. Other openings with the equivalent vent area shall be permitted.

~~1. Stucco with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at the top and bottom of each wall.~~
~~2. Brick with a 2 inch clear airspace behind the brick with vents at both the top and bottom of the brick. The vents shall be 3/8 inch x 2.5 inch openings every third brick at both the bottom and top course of each wall.~~
~~3. Stone or Masonry Veneer with a 2 inch clear airspace behind the stone with vents at the top and bottom. The vents shall have at least 1 square inch of vent area for every 24 inches of wall.~~
~~4. Panel Siding with 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.~~
~~5. Wood, Wood Based, or Fiber Cement Siding with either a 1/4 inch clear airspace; or alternatively a 1/4 inch gap between the horizontal siding laps~~
~~6.~~ 1. Vinyl lap or horizontal aluminum siding applied ~~directly to~~ over a weather resistive barrier as specified in IRC Table R703.4.
2. Brick veneer with a clear airspace as specified in IRC Section R703.7.4.2.
~~7. Manufactured Stone Veneer with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.~~
~~8.~~ 3. Other approved vented claddings ~~clear air spaces and vented openings~~.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: This change updates the vapor retarder requirements to allow more design flexibility and better reflect current methods of construction. This change allows wall assemblies to be constructed to dry inwards, outwards, or to both sides in all climate zones. This change also recognizes that all construction materials have greater or lesser vapor retarding characteristics themselves. The results of a dialogue on vapor retarders that has occurred over four years with a wide range of interested parties are incorporated in the code text proposed here.

Part I (IECC): Part I is the largest part of the change, affecting both the residential and commercial requirements. The IECC committee, with modifications, approved it. This public comment updates the change already approved, primarily to meet deal with concerns expressed by home builders. The most important modification since the first hearing is in the descriptions of the vented openings (IECC Sections 402.5.3 and 502.5.3).

Parts IV, V and VI. No public comments were filed on these three parts. Either the parts of the code they modified were removed by other code changes or further discussion with interested parties showed them to be unnecessary.

Public Comment 3:

Lorraine Ross, Intech Consulting Inc. representing Polyiso Insulation Manufacturers Association (PIMA), requests Disapproval for Part I.

Commenter's Reason: EC 28 is a major change in the definition of vapor retarders and establishes a classification system that is not currently represented in ASTM E96, or by any other consensus standard. The directions in the code change proposal for the use of particular classes of vapor retarders in specific types of construction are not supported by the original reason statement.

EC 28 was also heard and Disapproved by 5 other ICC Committees: Part II – IRC; Part III – IBC General; Part IV – IBC Fire Safety; Part V – IBC Structural; Part VI – IMC.

While EC 28 may represent new thinking on the use of vapor retarders, it needs additional work and should be submitted for the next ICC code change cycle.

Final Action: AS AM AMPC____ D

EC28-06/07 Part II

IRC: 202, R318, R318.1, R408.3, R702.3.8, R806.2, N1102.2.8, N1102.5, N1102.5.1 (New), Table N1102.5.1 (New), N1102.5.2 (New), N1102.5.3 (New)

Proposed Change as Submitted:

Proponent: Joseph Lstiburek, Building Science Corporation, representing himself

PART II – IRC BUILDING/ENERGY

1. Revise as follows:

SECTION R202
GENERAL DEFINITIONS

UNUSUALLY TIGHT CONSTRUCTION. Construction in which:

1. Walls and ceilings comprising the building thermal envelope have a continuous ~~water~~ Class I or II vapor retarder ~~with a rating of 1 perm (5.7 x E10-11 kg/Pa · E s · E m^2) or less~~ with openings therein gasketed or sealed.
2. Storm windows or weatherstripping is applied around the threshold and jambs of opaque doors and openable windows.
3. Caulking or sealants are applied to areas such as joints around window and door frames between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines, and at other openings.

2. Delete and substitute as follows:

~~**VAPOR RETARDER.** A vapor resistant material, membrane or covering such as foil, plastic sheeting, or insulation facing having a permeance rating of 1 perm (5.7 X 10-11 kg/Pa · E s · Em2) or less when tested in accordance with the dessicant method using Procedure A of ASTM E 96. Vapor retarders limit the amount of moisture vapor that passes through a material or wall assembly.~~

VAPOR RETARDER CLASS. A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method of ASTM E-96 as follows:

Class I: 0.1 perm or less
Class II: 0.1 < perm >= 1.0 perm
Class III: 1.0 < perm >= 10 perm
Class IV: Greater than 10 perm

3. Delete without substitution:

~~**SECTION R318**~~
~~**MOISTURE VAPOR RETARDERS**~~

~~**R318.1 Moisture control.** In all framed walls, floors and roof/ceilings comprising elements of the building thermal envelope, a vapor retarder shall be installed on the warm-in-winter side of the insulation.~~

~~**Exceptions:**~~

1. ~~In construction where moisture or freezing will not damage the materials.~~
2. ~~Where the framed cavity or space is ventilated to allow moisture to escape.~~
3. ~~In counties identified as in climate zones 1 through 4 in Table N1101.2.~~

(Renumber subsequent sections)

4. Revise as follows:

R408.3 Unvented crawl space. Ventilation openings in under-floor spaces specified in Sections R408.1 and R408.2 shall not be required where:

1. Exposed earth is covered with a continuous Class I vapor retarder. Joints of the vapor retarder shall overlap by 6 inches (152 mm) and shall be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (152 mm) up the stem wall and shall be attached and sealed to the stem wall; and

R702.3.8 Water-resistant gypsum backing board. Gypsum board used as the base or backer for adhesive application of ceramic tile or other required nonabsorbent finish material shall conform to ASTM C 630 or C 1178. Use of water-resistant gypsum backing board shall be permitted on ceilings where framing spacing does not exceed 12 inches (305 mm) on center for 1/2-inch-thick (13 mm) or 16 inches (406 mm) for 5/8-inch-thick (16 mm) gypsum board. Water-resistant gypsum board shall not be installed over a Class I or II vapor retarder in a shower or tub compartment. Cut or exposed edges, including those at wall intersections, shall be sealed as recommended by the manufacturer.

R806.2 Minimum area. The total net free ventilating area shall not be less than 1/150 of the area of the space ventilated except that reduction of the total area to 1/300 is permitted, provided that at least 50 percent and not more than 80 percent of the required ventilating area is provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above the eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents. As an alternative, the net free cross-ventilation area may be reduced to 1/300 when a Class I or II vapor barrier ~~having a transmission rate not exceeding 1 perm~~ ~~(5.7 E10-11 kg/Pa E s E m^2)~~ is installed on the warm-in-winter side of the ceiling.

N1102.2.8 Crawl space walls. As an alternative to insulating floors over crawl spaces, crawl space walls shall be permitted to be insulated when the crawl space is not vented to the outside. Crawl space wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished grade level and then vertically and/or horizontally for at least an additional 24 inches (610 mm). Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder. All joints of the vapor retarder shall overlap by 6 inches (153 mm) and be sealed or taped. The edges of the vapor retarder shall extend at least 6 inches (153 mm) up the stem wall and shall be attached to the stem wall.

5. Delete and substitute as follows:

~~**N1102.5 Moisture control.** The building design shall not create conditions of accelerated deterioration from moisture condensation. Above-grade frame walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder. The vapor retarder shall be installed on the warm-in-winter side of the thermal insulation.~~

~~**Exceptions:**~~

1. ~~In construction where moisture or its freezing will not damage the materials.~~
2. ~~Frame walls, floors and ceilings in jurisdictions in Zones 1, 2, 3, 4A, and 4B. (Crawl space floor vapor retarders are not exempted.)~~
3. ~~Where other approved means to avoid condensation are provided.~~

N1102.5 Vapor retarders. Class I or II vapor retarders are required on the interior side of walls in zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
2. Below grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

6. Add new text as follows:

N1102.5.1 Class III vapor retarders. Class III vapor retarders shall be permitted where the conditions in Table N1102.5.1 are met.

TABLE N1102.5.1
CLASS III VAPOR RETARDERS

Zone	Class III vapor retarders permitted for:
Marine 4	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 2.5 in 2x4 wall Insulated sheathing with R-value >= 3.75 in 2x6 wall
5	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 5 in 2x4 wall Insulated sheathing with R-value >= 7.5 in 2x6 wall
6	Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 7.5 in 2x4 wall Insulated sheathing with R-value >= 11.25 in 2x6 wall
7 and 8	Insulated sheathing with R-value >= 10 in 2x4 wall Insulated sheathing with R-value >= 15 in 2x6 wall

N1102.5.2 Material vapor retarder class. The vapor retarder class shall be based on the manufacturer's testing or a tested assembly.

The following shall be deemed to meet the class specified:

Class I: Sheet polyethylene, non-perforated aluminum foil
Class II: Kraft faced fiberglass batts
Class III: Latex paint
Class IV: House wrap, building paper.

N1102.5.3 Minimum clear air spaces and vented openings. For the purposes of this section vented shall include
the following minimum clear air spaces. Other openings with the equivalent net free area shall be permitted.

1. Stucco with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at the top and bottom of each wall.
2. Brick with a 2 inch clear airspace behind the brick with vents at both the top and bottom of the brick. The vents shall be 3/8 inch x 2.5 inch openings every third brick at both the bottom and top course of each wall.
3. Stone or Masonry Veneer with a 2 inch clear airspace behind the stone with vents at the top and bottom. The vents shall have at least 1 square inch of vent area for every 24 inches of wall.
4. Panel Siding with 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.
5. Wood, Wood Based, or Fiber Cement Siding with either a 1/4 inch clear airspace; or alternatively a 1/4 inch gap between the horizontal siding laps
6. Other approved clear air spaces and vented openings.

Reason: Wall assemblies can be designed and constructed to dry inwards, outwards and to both sides in all climate zones. Requiring vapor barriers and vapor retarders to always be installed on the interior of wall assemblies inhibits the use of wall designs that promote inward drying thereby increasing the risk of mold and moisture damage. This code change allows more flexibility in the design and construction of moisture forgiving wall systems.

These requirements for vapor retarder have been in the development process for at least 4 years. That process has included two Building America meetings, coordination with personnel at the Oakridge National Laboratory and the University of Waterloo, presentations before ASHRAE committees, and interactions with private companies.

These requirements recognize that many common materials function to various degrees to slow the passage of moisture. In many situations common materials such as the kraft facing on a fiberglass batt, or latex paint may serve to retard moisture sufficiently. In particular, the "standard" sheet of polyethylene is usually not required as a vapor retarder in walls.

This change includes modification of existing vapor retarder requirements and instances in the code to use the vapor retarder classes proposed here.

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

Committee Action: Disapproved

Committee Reason: The proposed new text, Section N1102.5.3, is confusing, unclear and belongs in the wall covering chapter. The committee likes this concept and this is needed in the code. However, this is a much larger problem and this proposal does not fully solve it. The proponent should work with industry and more research and development is needed in order to find the proper solution.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Joseph Lstiburek, Building Science Corporation, representing himself, requests Approval as Modified by this public comment for Part II.

Modify proposal as follows:

VAPOR RETARDER CLASS. A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method of ASTM E-96 as follows:

Class I: 0.1 perm or less
Class II: 0.1 < perm >= 1.0 perm
Class III: 1.0 < perm >= 10 perm
~~Class IV: Greater than 10 perm~~

N1102.5 Vapor Retarders. Class I or II vapor retarders are required on the interior side of frame walls in zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
2. Below grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

N1102.5.1 Class III vapor retarders. Class III vapor retarders shall be permitted where any one of the conditions in Table N1102.5.1 are met.

TABLE N1102.5.1
CLASS III VAPOR RETARDERS

Zone	Class III vapor retarders permitted for:
Marine 4	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 2.5 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= 3.75 ~~in~~ over 2x6 wall
5	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 5 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= 7.5 ~~in~~ over 2x6 wall
6	Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with R-value >= 7.5 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= 11.25 ~~in~~ over 2x6 wall
7 and 8	Insulated sheathing with R-value >= 10 ~~in~~ over 2x4 wall Insulated sheathing with R-value >= 15 ~~in~~ over 2x6 wall

N1102.5.2 Material vapor retarder class. The vapor retarder class shall be based on the manufacturer's certified testing or a tested assembly.

The following shall be deemed to meet the class specified:

Class I: Sheet polyethylene, non-perforated aluminum foil
Class II: Kraft faced fiberglass batts
Class III: Latex paint
~~Class IV: House wrap, building paper.~~

N1102.5.3 Minimum clear air spaces and vented openings for vented cladding. For the purposes of this section vented cladding shall include the following minimum clear air spaces. Other openings with the equivalent ~~net free~~ vent area shall be permitted.

1. ~~Stucco with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at the top and bottom of each wall.~~
2. ~~Brick with a 2 inch clear airspace behind the brick with vents at both the top and bottom of the brick. The vents shall be 3/8 inch x 2.5 inch openings every third brick at both the bottom and top course of each wall.~~
3. ~~Stone or Masonry Veneer with a 2 inch clear airspace behind the stone with vents at the top and bottom. The vents shall have at least 1 square inch of vent area for every 24 inches of wall.~~
4. ~~Panel Siding with 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.~~
5. ~~Wood, Wood Based, or Fiber Cement Siding with either a 1/4 inch clear airspace; or alternatively a 1/4 inch gap between the horizontal siding laps~~
6. ~~Other approved clear air spaces and vented openings.~~

1. Vinyl lap or horizontal aluminum siding applied over a weather resistive barrier as specified in IRC Table R703.4
2. Brick veneer with a clear airspace as specified in IRC Section R703.7.4.2.
3. Other approved vented claddings.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: This change updates the vapor retarder requirements to allow more design flexibility and better reflect current methods of construction. This change allows wall assemblies to be constructed to dry inwards, outwards, or to both sides in all climate zones. This change also recognizes that all construction materials have greater or lesser vapor retarding characteristics themselves. The results of a dialogue on vapor retarders that has occurred over four years with a wide range of interested parties are incorporated in the code text proposed here.

Part II (IRC): Part II is for the IRC, including all modifications already approved in the IECC (Part I). Several portions of the code are updated to use the new vapor retarder class definitions.

Parts IV, V and VI. No public comments were filed on these three parts. Either the parts of the code they modified were removed by other code changes or further discussion with interested parties showed them to be unnecessary.

Public Comment 2:

Donald J. Vigneau, Northeast Energy Efficiency Partnerships requests Approval as Modified by this Public Comment for Part II.

Modify proposal as follows:

VAPOR RETARDER CLASS. A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method with Procedure A of ASTM E-96 as follows:

Class I: 0.1 perm or less
Class II: 0.1 < perm <= 1.0 perm
Class III: 1.0 < perm <= 10 perm
~~Class IV: Greater than 10 perm~~

N1102.5 Vapor retarders. Class I or II vapor retarders are required on the interior side of frame walls in zones 5, 6, 7, 8 and Marine 4.

Exceptions:

1. Basement walls.
2. Below grade portion of any wall.
3. Construction where moisture or its freezing will not damage the materials.

N1102.5.2 Material vapor retarder class. The vapor retarder class shall be based on the manufacturer's certified testing or a tested assembly.
The following shall be deemed to meet the class specified:

Class I: Sheet polyethylene, non-perforated aluminum foil
Class II: Kraft faced fiberglass batts
Class III: Latex paint
~~Class IV: House wrap, building paper.~~

N1102.5.3 Minimum clear air spaces and vented openings for vented cladding. For the purposes of this section vented cladding shall include the following minimum clear air spaces. Other openings with the equivalent ~~net free~~ vent area shall be permitted.

1. Stucco with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at the top and bottom of each wall.

2. Brick with a 2 inch clear airspace behind the brick with vents at both the top and bottom of the brick. The vents shall be 3/8 inch x 2.5 inch openings every third brick at both the bottom and top course of each wall.
3. Stone or Masonry Veneer with a 2 inch clear airspace behind the stone with vents at the top and bottom. The vents shall have at least 1 square inch of vent area for every 24 inches of wall.
4. Panel Siding with 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.
5. Wood, Wood Based, or Fiber Cement Siding with either a 1/4 inch clear airspace; or alternatively a 1/4 inch gap between the horizontal siding laps
6. Vinyl lap siding applied directly to a weather resistive barrier.
7. Manufactured Stone Veneer with a 3/8 inch clear airspace with 3/8 inch continuous slot vent openings at both the top and bottom of each wall.

~~6.~~ 8. Other approved clear air spaces and vented openings.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: Proposal is a comprehensive approach to advances in technology and application of vapor retarders. The listed floor modifications corrected deficiencies in the proposed language. The proposal creates a section that covers multiple variations in the real, technical requirements for vapor barriers across a wide range of climactic conditions.

The original proponent's reasons are valid.

The decision of the Residential Building/Energy Committee is based their belief that the requirements belong in Chapter 7 as an exterior wall covering, when the proposal addresses problems with current energy envelope construction issues, not the cladding materials themselves as addressed in Chapter 7.

Final Action: AS AM AMPC____ D

EC28-06/07, Part III

IBC: 202, 1203.2, 1203.3.2, 1403.2, 1910.1, 2509.3, 2510.6

Proposed Change as Submitted:

Proponent: Joseph Lstiburek, Building Science Corporation, representing himself

PART III – IBC GENERAL

1. Delete and substitute as follows:

SECTION 202
GENERAL DEFINITIONS

~~**VAPOR RETARDER.** A vapor resistant material, membrane or covering such as foil, plastic sheeting, or insulation facing having a permeance rating of 1 perm (5.7 X 10-11 kg/Pa ¨E s ¨Em2) or less when tested in accordance with the dessicant method using Procedure A of ASTM E 96. Vapor retarders limit the amount of moisture vapor that passes through a material or wall assembly.~~

VAPOR RETARDER CLASS. A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method of ASTM E-96 as follows:

Class I: 0.1 perm or less
Class II: 0.1 < perm >= 1.0 perm
Class III: 1.0 < perm >= 10 perm
Class IV: Greater than 10 perm

2. Revise as follows:

1203.2 Attic spaces. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof framing members shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. A minimum of 1 inch (25 mm) of airspace shall be provided between the insulation and the roof sheathing. The net free ventilating area shall not be less than 1/150 of the area of the space ventilated, with 50 percent of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents.

Exception: The minimum required net free ventilating area shall be 1/300 of the area of the space ventilated, ~~provided a vapor retarder having a transmission rate not exceeding 1 perm in accordance with ASTM E 96 is~~

~~installed on the warm side of the attic insulation and~~ provided 50 percent of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents, with the balance of the required ventilation provided by eave or cornice vents.

1203.3.2 Exceptions. The following are exceptions to Sections 1203.3 and 1203.3.1:

1. Where warranted by climatic conditions, ventilation openings to the outdoors are not required if ventilation openings to the interior are provided.
2. The total area of ventilation openings is permitted to be reduced to 1/1,500 of the under-floor area where the ground surface is ~~treated~~ <u>covered</u> with ~~an approved~~ a <u>Class I</u> vapor retarder material and the required openings are placed so as to provide cross ventilation of the space. The installation of operable louvers shall not be prohibited.
3. Ventilation openings are not required where continuously operated mechanical ventilation is provided at a rate of 1.0 cubic foot per minute (cfm) for each 50 floor area and the ground surface is covered with ~~an approved~~ <u>a Class I</u> vapor retarder.
4. Ventilation openings are not required when the ground surface is covered with ~~an approved~~ <u>a</u> <u>Class I</u> vapor retarder, the perimeter walls are insulated and the space is conditioned in accordance with the *International Energy Conservation Code*.
5. For buildings in flood hazard areas as established in Section 1612.3, the openings for under-floor ventilation shall be deemed as meeting the flood opening requirements of ASCE 24 provided that the ventilation openings are designed and installed in accordance with ASCE 24.

Reason: Wall assemblies can be designed and constructed to dry inwards, outwards and to both sides in all climate zones. Requiring vapor barriers and vapor retarders to always be installed on the interior of wall assemblies inhibits the use of wall designs that promote inward drying thereby increasing the risk of mold and moisture damage. This code change allows more flexibility in the design and construction of moisture forgiving wall systems.

These requirements for vapor retarder have been in the development process for at least 4 years. That process has included two Building America meetings, coordination with personnel at the Oakridge National Laboratory and the University of Waterloo, presentations before ASHRAE committees, and interactions with private companies.

These requirements recognize that many common materials function to various degrees to slow the passage of moisture. In many situations common materials such as the kraft facing on a fiberglass batt, or latex paint may serve to retard moisture sufficiently. In particular, the "standard" sheet of polyethylene is usually not required as a vapor retarder in walls.

This change includes modification of existing vapor retarder requirements and instances in the code to use the vapor retarder classes proposed here.

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

Committee Action: Disapproved

Committee Reason: The committee disapproved the proposal primarily because as proposed the provisions requiring net free ventilating area of not less than 1/150 would never apply. Committee members support deleting the exception in its entirety and revising the main section to use 1/300 instead of 1/150. It should also be noted that the committee felt the proponents proposed modification to the new definition of VAPOR RETARDER CLASS to delete Class IV was appropriate.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Joseph Lstiburek, Building Science Corporation, representing himself, requests Approval as Modified by this Public Comment for Part III.

Modify proposal as follows:

VAPOR RETARDER CLASS. A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method of ASTM E-96 as follows:

Class I: 0.1 perm or less
Class II: 0.1 < perm >= 1.0 perm
Class III: 1.0 < perm >= 10 perm
~~Class IV: Greater than 10 perm~~

1203.2 Attic spaces. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof framing members shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. A minimum of 1 inch (25 mm) of airspace shall be provided between the insulation and the roof sheathing. The net free ventilating area shall not be less than ~~1/150~~ 300 of the area of the space ventilated, with 50 percent of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents with the balance of the required ventilation provided by eave or cornice vents.

> ~~**Exception:** The minimum required net free ventilating area shall be 1/300 of the area of the space ventilated provided 50 percent of the required ventilating area provided by ventilators located in the upper portion of the space to be ventilated at least 3 feet (914 mm) above eave or cornice vents, with the balance of the required ventilation provided by eave or cornice vents.~~

(Portions of proposal not shown remain unchanged)

Commenter's Reason: This change updates the vapor retarder requirements to allow more design flexibility and better reflect current methods of construction. This change allows wall assemblies to be constructed to dry inwards, outwards, or to both sides in all climate zones. This change also recognizes that all construction materials have greater or lesser vapor retarding characteristics themselves. The results of a dialogue on vapor retarders that has occurred over four years with a wide range of interested parties are incorporated in the code text proposed here.

Part III (IBC). Part III revises the IBC vapor retarder requirements to be consistent with the commercial requirements in the IECC. It updates the use of the term "vapor retarder" to use the new vapor retarder class definitions. It also removes a redundant exception, as suggested by the committee.

Parts IV, V and VI. No public comments were filed on these three parts. Either the parts of the code they modified were removed by other code changes or further discussion with interested parties showed them to be unnecessary.

Final Action: AS AM AMPC____ D

EC31-06/07, Part I
401.3

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART I – IECC

Revise as follows:

401.3 Certificate. A permanent certificate shall be posted on or in the electrical distribution panel. The certificate shall be completed by the builder or registered design professional. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the ~~type~~ types and ~~efficiency~~ efficiencies of heating, cooling and service water heating equipment Where a gas fired unvented room heater, electric furnace, and/or baseboard electric heater is installed in the residence, the certificate shall list "gas fired unvented room heater", "electric furnace", or "baseboard electric heater" as appropriate. An efficiency shall not be listed for gas fired unvented room heaters, electric furnaces, or electric base board heaters.

Reason: Electric furnaces and baseboard heaters sound efficient, since they are virtually 100% efficient at turning electricity into heat. However this is not a good use of electricity and the consumer should not be led to believe electric resistance heating is preferable because its measure of efficiency has a higher number.

Gas fired unvented room heaters are becoming more common, at least according to their trade association. Unvented heater manufacturer's and their trade association advertise that they are 99% or more efficient. Consumers could easily consider a 99% efficient heater better than at 90 AFUE furnace. By design unvented heaters vent the moisture they produce into the residence, a bad design should not be encouraged or made to appear to be a better way to heat.

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

Committee Action: **Approved as Submitted**

Committee Reason: The proposal is a good idea for giving occupants of the building some idea of the equipment being used in a building in order to allow them to make appropriate decisions regarding energy use.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

David C. Delaquila, GAMA-An Association of Appliance and Equipment Manufacturers, requests Disapproval for Part I.

Commenter's Reason: GAMA believes this proposal should be disapproved. The intent of the requirement is to note the claimed "certified" efficiencies of heating and cooling equipment. Since unvented heaters do not have their efficiencies "certified" there is no reason to mention the appliances at all in the certificate.

Final Action: AS AM AMPC____ D

EC31-06/07, Part II
IRC N1101.8

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1101.8 Certificate. A permanent certificate shall be posted on or in the electrical distribution panel. The certificate shall be completed by the builder or registered design professional. The certificate shall list the predominant *R*-values of insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall and/or floor) and ducts outside conditioned spaces; *U*-factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the ~~type~~ types and ~~efficiency~~ efficiencies of heating, cooling and service water heating equipment. Where a gas fired unvented room heater, electric furnace, and/or baseboard electric heater is installed in the residence, the certificate shall list "gas fired unvented room heater", "electric furnace", or "baseboard electric heater" as appropriate. An efficiency shall not be listed for gas fired unvented room heaters, electric furnaces, or electric base board heaters.

Reason: Electric furnaces and baseboard heaters sound efficient, since they are virtually 100% efficient at turning electricity into heat. However this is not a good use of electricity and the consumer should not be led to believe electric resistance heating is preferable because its measure of efficiency has a higher number.

Gas fired unvented room heaters are becoming more common, at least according to their trade association. Unvented heater manufacturer's and their trade association advertise that they are 99% or more efficient. Consumers could easily consider a 99% efficient heater better than at 90 AFUE furnace. By design unvented heaters vent the moisture they produce into the residence, a bad design should not be encouraged or made to appear to be a better way to heat.

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

Committee Action: **Approved as Submitted**

Committee Reason: The use of efficiencies may be misleading in some cases. This change eliminates the listing of the efficiencies that could be misleading to the consumer.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

David C. Delaquila, GAMA-An Association of Appliance and Equipment Manufacturers, requests Disapproval for Part II.

Commenter's Reason: GAMA believes this proposal should be disapproved. The intent of the requirement is to note the claimed "certified" efficiencies of heating and cooling equipment. Since unvented heaters do not have their efficiencies "certified" there is no reason to mention the appliances at all in the certificate.

Final Action: AS AM AMPC____ D

EC34-06/07, Part II
IRC Table N1102.1, Table N1102.1.2, N1102.1.2, N1102.2.3

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART II – IRC BUILDING/ENERGY

Revise tables as follows:

TABLE N1102.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT(a)

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[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	0.75	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[c]	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 g. (No change to current text)
h. The second R-value applies when more than half the insulation is on the interior of the mass wall.

TABLE N1102.1.2.
EQUIVALENT U-FACTORS(a)

Climate Zone	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	0.037	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. 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.

N1102.1.2 *U*-factor alternative. An assembly with a *U*-factor equal to or less than that specified in Table N1102.1.2 shall be permitted as an alternative to the *R*-value in Table N1102.1.

~~**Exception:** For mass walls not meeting the criterion for insulation location in Section N1102.2.3, the *U*-factor shall be permitted to be:~~

1. ~~*U*-factor of 0.17 in Climate Zone 1~~
2. ~~*U*-factor of 0.14 in Climate Zone 2~~
3. ~~*U*-factor of 0.12 in Climate Zone 3~~
4. ~~*U*-factor of 0.10 in Climate Zone 4 except Marine~~
5. ~~*U*-factor of 0.082 in Climate Zone 5 and Marine 4~~

N1102.2.3 Mass walls. Mass walls for this chapter shall be considered above-grade walls of concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth (adobe, compressed earth block, rammed earth) and solid timber/logs. ~~The provisions of Section N1102.1 for mass walls shall be applicable when at least 50 percent of the required insulation *R*-value is on the exterior of, or integral to, the wall. Walls not meeting this criterion for insulation placement shall meet the wood frame wall insulation requirements of Section N1102.1.~~

> ~~**Exception:** For walls that do not meet this criterion for insulation placement, the minimum added insulation R-value shall be permitted to be:~~
>
> 1. ~~*R*-value of 4 in Climate Zone 1~~
> 2. ~~*R*-value of 6 in Climate Zone 2~~
> 3. ~~*R*-value of 8 in Climate Zone 3~~
> 4. ~~*R*-value of 10 in Climate Zone 4 except Marine~~
> 5. ~~*R*-value of 13 in climate Zone 5 and Marine 4~~

Reason: The mass wall insulation requirements are confusing as written. Moving the mass wall R-values and U-factors to their respective tables makes the requirements clearer.

This clarifies that basement walls are not mass walls. This aligns the IRC and IECC.

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

Committee Action: **Disapproved**

Committee Reason: No technical data was submitted to justify the change for some of the U-factor.

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 Submitted for Part II.

Commenter's Reason: The mass wall insulation requirements in the 2006 IECC and IRC are very confusing and difficult to explain to code users. The existing mass wall insulation requirements are spread over two tables and two sections of the code in both the IECC and IRC. This code change reformats those requirements to be simpler to understand, and places the reformatted requirements in the same tables as the other insulation requirements. This code change also corrects minor differences between the IRC and IECC.

The IECC committee passed this format revision. The IRC should also make this format revision.

Public Comment 2:

Ronald Majette, United States Department of Energy, requests Approval as Submitted for Part II.

Commenter's Reason: The proposal simplifies insulation requirements for mass walls while maintaining essentially the same stringency levels as are already in the IRC. This proposal was approved for inclusion in the IECC and should be approved for the IRC as well to maintain code consistency.

Public Comment 3:

Donald J. Vigneau, Northeast Energy Efficiency Partnerships, requests Approval as Submitted for Part II.

Commenter's Reason: Proposal correlates differences between frame walls with alternate stud path U-factors and mass walls with continuous insulation. Simple inspection of R-values proposed and currently existing within the table suggests that a mass wall with the proposed continuous R-values performs as least as efficiently as the complying frame wall.

The proponent's original reasons stated in the hearings monograph are valid.

The decision of the Residential Building/Energy Committee is based on lack of submitted data.

Final Action: AS AM AMPC____ D

EC36-06/07, Part I
402.1.2, Table 402.1

Proposed Change as Submitted:

Proponent: Ronald Majette, representing the United States Department of Energy

PART I – IECC

Revise as follows:

402.1.2 R-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value. For walls, structural wall panels with an area equal to but not greater than the area required for bracing by Chapter 6 of the *International Residential Code* are permitted to replace insulating sheathing in locations with a seismic design categories A, B, and C or in locations with a 50-year wind speed of less than 110 mph as specified in Chapter 3 of the *International Residential Code*. The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films.

TABLE 402.1.
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

g. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing~~. If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~

(Portions of table and footnotes not shown remain unchanged)

Reason: The purpose of this code change is to provide simple, complete, unambiguous, and appropriate allowances for structural bracing panels in walls that have insulating sheathing. The code currently only provides guidance on how much structural sheathing is allowed for the rather unusual combination of R-15 cavity insulation and R-5 sheathing insulation. The combination of wind and seismic zones where bracing panels are permitted to replace insulating sheathing ensures that most of the wall will be mostly covered by insulating sheathing.

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

Committee Action: **Disapproved**

Committee Reason: The proponent requested disapproval to allow time to remove ambiguous and unclear language.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Ronald Majette, United States Department of Energy, requests Approval as Modified by this Public Comment for Part I.

Modify proposal as follows:

402.1.2 R-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value. ~~For walls, structural wall panels with an area equal to but not greater than the area required for bracing by Chapter 6 of the *International Residential Code* are permitted to replace insulating sheathing in locations with a seismic design categories A, B, and C or in locations with a 50-year wind speed of less than 110 mph as specified in Chapter 3 of the *International Residential Code*.~~ The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films.

Exception: For the purposes of Section 402.1.1, walls with insulating sheathing are allowed to contain structural sheathing in place of insulating sheathing and still receive credit of the R-value of the insulating sheathing for the entire sheathed wall area if one of the two following conditions is met:

1. Structural sheathing covers an area not exceeding 25% of the gross sheathed wall area.
2. Structural sheathing exceeds 25% of the gross sheathed wall area, but the structural sheathing is supplemented with insulating sheathing of at least R-2.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: The purpose of this code change is to provide simple, complete, unambiguous, and appropriate allowances for structural bracing panels in walls that have insulating sheathing while still allowing credit for the R-value of the insulating sheathing. The original proposal was disapproved at the request of the proponent in order to submit a Public Comment to clarify the proposed language and to closer match the existing language in the code. These improvements have been made.

The code currently only provides guidance on how much structural sheathing is allowed for the combination of R-13 cavity insulation and R-5 sheathing insulation. This proposal expands the structural sheathing allowance to any combination of cavity and sheathing insulation for the prescriptive component approach in Section 402.1.1 of the IECC and N1102.1.1 of the IRC. The structural sheathing limit of 25% without loss of credit for insulating sheathing is unchanged from the existing requirement in footnote (g) in the tables of R-value requirements in the IECC and IRC.

Final Action: AS AM AMPC____ D

EC36-06/07, Part II

IRC N1102.1.1, Table N1102.1

Proposed Change as Submitted:

Proponent: Ronald Majette, representing the United States Department of Energy

PART II – IRC BUILDING/ENERGY

N1102.1.1 R-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value. <u>For walls, structural wall panels with an area equal to but not greater than the area required for bracing by Chapter 6 of the *International Residential Code* are permitted to replace insulating sheathing in locations with a seismic design categories A, B, and C or in locations with a 50-year wind speed of less than 110 mph as specified in Chapter 3 of the *International Residential Code*.</u> The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films.

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

g. "13+5" means R-13 cavity insulation plus R-5 insulated sheathing~~. If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.~~

(Portions of table and footnotes not shown remain unchanged)

Reason: The purpose of this code change is to provide simple, complete, unambiguous, and appropriate allowances for structural bracing panels in walls that have insulating sheathing. The code currently only provides guidance on how much structural sheathing is allowed for the rather unusual combination of R-15 cavity insulation and R-5 sheathing insulation. The combination of wind and seismic zones where bracing panels are permitted to replace insulating sheathing ensures that most of the wall will be mostly covered by insulating sheathing.

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

Committee Action: **Disapproved**

Committee Reason: Based on proponent's request, proponent will revise this and bring it back at another time.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Ronald Majette, United States Department of Energy, requests Approval as Modified by this Public Comment for Part II.

Modify proposal as follows:

N1102.1.1 R-value computation. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value. ~~For walls, structural wall panels with an area equal to but not greater than the area required for bracing by Chapter 6 of the *International Residential Code* are permitted to replace insulating sheathing in locations with a seismic design categories A, B, and C or in locations with a 50-year wind speed of less than 110 mph as specified in Chapter 3 of the *International Residential Code*.~~ The manufacturer's settled R-value shall be used for blown insulation. Computed R-values shall not include an R-value for other building materials or air films.

Exception: For the purposes of Section N1102.1, walls with insulating sheathing are allowed to contain structural sheathing in place of insulating sheathing and still receive credit of the R-value of the insulating sheathing for the entire sheathed wall area if one of the two following conditions is met:

1. Structural sheathing covers an area not exceeding 25% of the gross sheathed wall area.
2. Structural sheathing exceeds 25% of the gross sheathed wall area, but the structural sheathing is supplemented with insulating sheathing of at least R-2.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: The purpose of this code change is to provide simple, complete, unambiguous, and appropriate allowances for structural bracing panels in walls that have insulating sheathing while still allowing credit for the R-value of the insulating sheathing. The original proposal was disapproved at the request of the proponent in order to submit a Public Comment to clarify the proposed language and to closer match the existing language in the code. These improvements have been made.

The code currently only provides guidance on how much structural sheathing is allowed for the combination of R-13 cavity insulation and R-5 sheathing insulation. This proposal expands the structural sheathing allowance to any combination of cavity and sheathing insulation for the prescriptive component approach in Section 402.1.1 of the IECC and N1102.1.1 of the IRC. The structural sheathing limit of 25% without loss of credit for insulating sheathing is unchanged from the existing requirement in footnote (g) in the tables of R-value requirements in the IECC and IRC.

Final Action: AS AM AMPC____ D

EC39-06/07

Table 402.1.1

Proposed Change as Submitted:

Proponent: Steven Ferguson, ASHRAE, representing the American Society of Heating Refrigeration and Air-Conditioning Engineers

Revise table 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	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~~ 0.37	30	13	3	13	0	0	0
2	0.75	0.75	~~0.40~~ 0.37	30	13	4	13	0	0	0

(Portions of table not shown remain unchanged)

Reason: These proposed changes to the SHGC requirements for hot climates (zones 1 & 2) are equal to those contained in Table 5.2 of ANSI/ASHRAE Standard 90.2-2004 *Energy-Efficient Design of Low-Rise Residential Buildings*.

Another reason to lower the SHGC requirement is to set a more appropriate reference design for windows in the hottest climate zones (zones 1 and 2). These values are critically important when using the simulated performance alternative (Section 404), as well as when establishing the baseline for beyond-code programs. For example, with the current 0.40 SHGC reference case, up to 20% of the improvement over code needed to qualify for Energy Star Homes in hot southern climates can be obtained by typical low-E windows with a 0.32 SHGC. The 0.40 SHGC requirement in the IECC was established in 1997 when SHGC ratings by the National Fenestration Rating Council (NFRC) was still in its infancy and few products were rated and therefore is not necessarily the most appropriate value. Today, these SHGC values are widely available and often the norm.

SHGC ratings for all horizontal slider windows from the on-line NFRC database were reviewed in July 2005. There were 50,367 products, of which 35,114 were rated for SHGC. The most common product used to meet the 0.40 SHGC requirement are low-E windows. Low-E technologies have experienced dramatic growth in the last decade and are now included in over 60% percent of the residential market (Door & Window Maker Magazine, April 2005). There are 13,672 horizontal slider double-glazed low-E windows that are rated for SHGC and 93% of these are 0.37 SHGC or below. Lower SHGC levels can be easily met by windows with any type of frames. For example, 91%, 94%, and 97% of rated low-E horizontal slider windows with aluminum, vinyl, and wood frames now easily meet (or are lower than) this proposed 0.37 SHGC requirement.

Cost Impact: There will most likely be no cost impact from this code proposal since these technologies are now the norm and widely available in all climate zones.

Committee Action: **Approved as Submitted**

Committee Reason: The study cited justifies the 0.37 for these two zones. Products are still available to meet this number, which is a reasonable, achievable SHGC rating.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association, requests Disapproval.

Commenter's Reason: EC 39 revised the maximum SHGC permitted in Climate zones 1 and 2 from 0.40 to 0.37 in the prescriptive provisions of the IECC for residential construction. No technical justification was provided for this change. In addition, revising the maximum SHGC only in the residential prescriptive provisions of the IECC makes them inconsistent with those of the IRC and the prescriptive provisions of the IECC for fenestration in commercial buildings.

Final Action: AS AM AMPC____ D

EC42-06/07, Part I
Table 402.1.1

Proposed Change as Submitted:

Proponent: Ronald Majette, representing the United States Department of Energy

PART I – IECC

Revise table 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	Floor R-Value	Basement[(c)] Wall R-Value	Slab[(d)] R-Value & Depth	Crawl Space[(c)] Wall R-Value
1	1.20	1.60	0.40	30	13	6	13	0	0	0
2	0.75	1.05	0.40	30	13	6	13	0	0	0
3	0.65	0.90	0.40[(e)]	30	13	6	19	~~0~~ 5/13	0	5/13
4 except Marine	0.40	0.60	NR	38	13	8	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	21	30[(f)]	10 / 13	10, 4 ft	10 / 13

(Portions of table not shown do not change)

Reason: The purpose of this proposal is to add basement wall insulation requirements for 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 an estimated insulation cost of $900, the simple payback will be in less than 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.

Basement wall insulation is a necessary requirement to alleviate perverse incentives that now exist in the code and in above-code programs for climate zone 3. A builder can lower construction costs by classifying the basement as conditioned, which eliminates the requirement to insulate the floor above the basement and to insulate ducts in the basement. In other words, the code now penalizes the builder in terms of code compliance for building more energy efficiently. Worse yet, the code (as well as beyond-code programs based on it such as Energy Star Homes, and the Federal tax credit) provides a considerable credit for putting all ducts inside the "conditioned space," which may often be the case in homes with conditioned basements. Clear reductions in energy efficiency (conditioned basements with uninsulated ducts and no insulation in the building envelope) should not be rewarded by by allowing yet more reductions in energy efficiency for code compliance as a trade-off credit.

Cost Impact: A Midwest builder estimated the cost of basement wall insulation at $900 (Energy Design Update, August 1998). *Builder Magazine* reports that a Colorado builder estimates total costs of $500 to $1000 for R-11 vinyl wrap (NAHB September 1996). This code change will increase the cost of construction.

Committee Action: Approved as Modified

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	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~~ <u>0.220</u>	0.136

(Portions of table not shown remain unchanged)

(Portions of proposal not shown remain unchanged)

Committee Reason: Providing insulation on basement walls in Zone 3 will provide for significant energy savings, as indicated in the proponent's reason. The modification simply adds a correlating change to the U-factor table.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Lawrence Brown, CBO, National Association of Home Builders (NAHB), requests Disapproval for Part I.

Commenter's Reason: This proposal wants to mandate wall insulation in basements in zone 3 where previously none has been required. Zone 3 extends down into Southern Georgia, Alabama, MS, New Mexico, and Arizona. Zone 3 is a fairly mild climate with much less energy being lost through the basement walls. Energy simulations performed by the NAHB Research Center show only a $75 dollars per year savings in Oklahoma City (one of the coldest Zone 3 Cities- 3742 HDD65) at a RS Means estimated cost of $990 this amounts to an approximate 13 year payback period. Clearly there is no economic justification for installing additional insulation in those areas.

Public Comment 2:

Stephen V. Skalko, P.E., Portland Cement Association, requests Disapproval for Part I.

Commenter's Reason: This public comment is to recommend that EC42-06/07 Part I be disapproved consistent with the committee action on Part II for the following reasons.

First, contrary to the statement of the proponent, basement wall insulation is not justified in Climate Zone 3. Representative cities in this climate zone include the mild climates of Memphis, El Paso, and San Francisco. The proponent considered energy savings during the heating season in his reasoning statement, but did not consider that energy use *increases* in the cooling season if basement wall insulation is added in these climates. Normally the cool soil temperature will conduct through the wall and radiate from the wall, thereby cooling the conditioned basement. But, the placement of insulation on the basement wall retards this temperature influence effectively requiring more energy to provide cooling to this space.

Second, for the cities listed above the average yearly temperatures for these climates range between 62^{O} and 65^{O}F. The soil acts as a buffer to the outside air temperature in these climates, and the soil temperature is fairly close to the average yearly temperature. Therefore, the temperature difference between the soil and interior basement temperature is reasonably constant so basement wall insulation in these climates is not needed.

Third, the proponent assumes conditioned basements have furred walls that allow space for insulation, when, in fact, this is not the most economical method of finishing a basement wall. Basement walls in conditioned spaces are often finished by direct painting or with decorative coating. In these cases, the cost of furring must be considered in the cost of insulating. If furring costs are included in the evaluation of energy savings the cost effectiveness of insulating the basement wall is minimal.

Finally, as pointed out by the IRC Code Change Committee in recommending disapproval of Part II of this change, the insulation cost used to perform the analysis is outdated by at least ten years. Without up-to-date data the analysis erroneously arrives at the conclusion that the simple payback is five years when in fact it will be longer, especially if the cooling season and furring costs are included.

Final Action: AS AM AMPC____ D

EC42-06/07, Part II
IRC Table N1102.1

Proposed Change as Submitted:

Proponent: Ronald Majette, representing the United States Department of Energy

PART II – IRC BUILDING/ENERGY

Revise table as follows:

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

Climate Zone	Fenestration U-Factor	Skylight(b) U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement(c) Wall R-Value	Slab(d) R-Value & Depth	Crawl Space(c) Wall R-Value
1	1.20	1.60	0.40	30	13	6	13	0	0	0
2	0.75	1.05	0.40	30	13	6	13	0	0	0
3	0.65	0.90	0.40(e)	30	13	6	19	~~0~~ 5/13	0	5/13
4 except Marine	0.40	0.60	NR	38	13	8	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	21	30(f)	10 / 13	10, 4 ft	10 / 13

(Portions of table not shown do not change)

Reason: The purpose of this proposal is to add basement wall insulation requirements for 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 an estimated insulation cost of $900, the simple payback will be in less than 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.

Basement wall insulation is a necessary requirement to alleviate perverse incentives that now exist in the code and in above-code programs for climate zone 3. A builder can lower construction costs by classifying the basement as conditioned, which eliminates the requirement to insulate the floor above the basement and to insulate ducts in the basement. In other words, the code now penalizes the builder in terms of code compliance for building more energy efficiently. Worse yet, the code (as well as beyond-code programs based on it such as Energy Star Homes, and the Federal tax credit) provides a considerable credit for putting all ducts inside the "conditioned space," which may often be the case in homes with conditioned basements. Clear reductions in energy efficiency (conditioned basements with uninsulated ducts and no insulation in the building envelope) should not be rewarded by allowing yet more reductions in energy efficiency for code compliance as a trade-off credit.

Cost Impact: A Midwest builder estimated the cost of basement wall insulation at $900 (Energy Design Update, August 1998). *Builder Magazine* reports that a Colorado builder estimates total costs of $500 to $1000 for R-11 vinyl wrap (NAHB September 1996). This code change will increase the cost of construction.

Committee Action: **Disapproved**

Committee Reason: This proposal does not provide adequate tradeoff for the payback period. The data used is 10 years old and outdated.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Note: The following individuals separately submitted public comments with the same proposed modification. Their separate reason statements are provided below the proposed modification.

Ronald Majette, United States Department of Energy, requests Approval as Modified by this Public Comment for Part II.

Charles Cottrell, North American Insulation Manufacturers Association, requests Approval as Modified by this Public Comment for Part II.

Donald J. Vigneau, Northeast Energy Efficiency Partnerships, requests Approval as Modified by this Public Comment for Part II.

Modify proposal as follows:

TABLE N1102.1.2
EQUIVALENT U-FACTORS[A]

Climate Zone	Fenestration U-Factor	Skylight U-Factor	Ceiling U-Factor	Frame Wall U-Factor	Mass Wall U-Factor	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~~ <u>0.220</u>	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.								

(Portions of proposal not shown remain unchanged)

Commenter's Reason (Majette): The purpose of this proposal is to add basement wall insulation requirements for conditioned basements in climate zone 3. Though winter conditions in zone 3 can generally be classified as "mild", temperatures can reach as low as single digits in the colder parts of zone 3 (basements are very rare in the warmer parts of zone 3).

The published reason for the IRC committee action of disapproval stated "the proposal does not provide adequate tradeoff for the payback period. The data used is 10 years old and outdated".

While the cost data (two independent published sources) provided in the reason statement in support of the original proposal was about 10 years old, the cost of insulation has not increased dramatically. A more recent source provides an estimated insulation cost of $840 (Building Science Corporation, 2002—see below). As documented in the reason statement for the original proposal, assuming $10/MBtu (million Btu) natural gas cost, this insulation is estimated to save $208 a year in heating costs and have a tiny reduction in cooling costs in Atlanta according to the Building Foundation Design Handbook (University of Minnesota, 1988). This results in a simple payback of only four years.

Estimating below-grade foundation heat transfer is very complicated and varies by the foundation layout, soil characteristics, and climate. However, the heat loss from the top few feet of a concrete basement wall alone (where the ground effect is minimal) should justify the cost of insulation. The potential magnitude of the energy savings can be illustrated with simplified calculations. The 2005 ASHRAE Handbook of Fundamentals, page 29.12, states the R-value of an uninsulated concrete basement wall (including interior air film) is R-1.47, or a U-factor of 0.68. Assuming a climate with 3000 heating degree days and a basement with a 130 ft. perimeter and one foot of the basement wall being above-grade, the annual heat loss of just this top foot of the wall based on a simple steady-state conduction heat transfer is 0.68x130x3000 x24 = 6.4 MBtu, or $64 a year at $10/MBtu fuel cost. Heat transfer from the first few feet below grade is less, but is still significant (e.g., $40 for just the first foot below grade). These basic calculations indicate how substantial the heat transfer from a bare, uninsulated wall can be.

The lost floor space from insulating basement walls should be minimal as conditioned basements are normally finished, and exterior insulation is an option.

Basement wall insulation requirements correct a perverse incentive in the code. A builder can lower construction costs by classifying the basement as conditioned, which eliminates the requirement to insulate the floor above the basement and to insulate ducts in the basement. In other words, the code now penalizes the builder in terms of code compliance for building more energy efficiently. Worse yet, the code (as well as beyond-code programs based on it such as Energy Star Homes, and the Federal tax credit) provides a considerable credit for putting all ducts inside the "conditioned space," which may often be the case in homes with conditioned basements. Clear reductions in energy efficiency (conditioned basements with uninsulated ducts and no insulation in the building envelope) should not be rewarded by allowing yet more reductions in energy efficiency for code compliance as a trade-off credit. This proposal would correct this defect in the code.

Cost data: A Midwest builder estimated the cost of basement wall insulation at $900 (Energy Design Update, August 1998). *Builder Magazine* reports that a Colorado builder estimates total costs of $500 to $1000 for R-11 vinyl wrap (NAHB September 1996). Building Science Corporation estimates a cost of $840 (2002. Basement Insulating Systems, ttp://www.eere.energy.gov/buildings/building_america/pdfs/db/35017.pdf)

This proposal was approved by the IECC committee with the identical modification proposed here for the IRC.

Commenter's Reason (Cottrell): The IECC Committee approved part I of this proposal to increase the R-value (and a corresponding decrease in U-value) for basement walls in climate zone 3. The increase was from "no requirement" to R-5 on the exterior or R-13 on the interior of the wall and was supported with a cost-effectiveness analysis from the Department of Energy that showed a simple payback of less than 5 years.

This change should be approved as modified because the change is clearly cost-effective and it will make the IECC and IRC energy efficiency requirements consistent.

Commenter's Reason (Vigneau): Proposal introduces energy conservation requirements for conditioned space basement walls where the zone boundaries reach 5400 HDD and 6300 CDD. The floor modification to add the U-factor requirement to the corresponding Table 402.1.3 is simply a correlative cleanup of the proposal.

The proponent's original reasons stated in the hearings monograph are valid.

The decision of the Residential Building/Energy Committee is based on disagreements with the validity of submitted data, without contrary data against the submission.

Final Action: AS AM AMPC____ D

EC46-06/07
Table 402.1.3

Proposed Change as Submitted:

Proponent: Garrett Stone, Brickfield Burchette Ritts & Stone, P.C., representing Cardinal Glass Industries

Revise table 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	1.2	0.75	~~0.035~~ 0.030	0.082	0.197	0.064	0.360	0.477
2	0.75	0.75	~~0.035~~ 0.030	0.082	0.165	0.064	0.360	0.477
3	0.65	0.65	~~0.035~~ 0.030	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	~~0.030~~ 0.025	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	~~0.030~~ 0.025	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	~~0.026~~ 0.020	0.060	0.06	0.033	0.059	0.065
7 and 8	0.35	0.60	~~0.026~~ 0.020	0.057	0.057	0.033	0.059	0.065

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

Reason: The purpose of this proposal is to correct the equivalent U-factors for ceilings to reflect conservative assumptions and ensure that trade-offs developed on the basis of these values produce homes that are at least as energy efficient as a home built to meet the prescriptive path under the code.

The equivalent U-factor table in the IECC is intended to provide a conversion from the insulation R-values in Table 402.1.1 to component (wall, floor, ceiling) U-factors (that incorporate the effects of framing). A review of the equivalent U-factors for ceilings in the existing table suggests that these values may be too high. The values in the table are generally higher than those produced by RES*Check* (the code compliance software produced by Pacific Northwest National Laboratory for the U.S. Department of Energy) as well as the values from the appendix of the 2003 IECC (which set forth equivalent U-factors based on the insulation R-value in various configurations of building components – Table 502.2.3.2). The following table sets forth the values from the various sources (the RES*Check* values were obtained by running the software).

Table 402.1.1	Table 402.1.3	RESCheck	2003 IECC Appendix
R-30	0.035	0.032	0.030
R-38	0.030	0.025	0.025
R-49	0.026	0.020	No value

It is unclear why the U-factors set forth in the IECC are higher (less energy efficient) than the values from these other sources. As a result, this proposal replaces the higher U-factors in the table with the most conservative (lowest, most energy efficient) U-factors from these sources.

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

Committee Action: Approved as Submitted

Committee Reason: The proposed values are necessary corrections to the equivalent U-Factors for ceilings.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Lawrence Brown, CBO, National Association of Home Builders (NAHB), requests Disapproval.

Commenter's Reason: This proposal increases the stringency without any analysis or economic justification. The origin of this table is based on overall ceiling R-value and is not a direct conversion from the cavity insulation provisions. When an 11% framing factor (24 inch o.c. joist or rafter spacing) for ceiling framing is calculated with the prescriptive level of insulation, the numbers match the U-factors that appear in Table 402.1.3. No change is necessary for this table. Also, this proposal would create a discrepancy between the IECC and the IRC. Disapprove EC46.

Public Comment 2:

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

Commenter's Reason: The proponent incorrectly implies that the R-values and U-factors in the 2006 IECC do not match. Furthermore, the proponent "corrected" only the IECC, leaving a difference between the U-factor table in the IECC and the exact same table in the IRC (Table N1102.1.2).

The proponent says DOE's REScheck software was his source. However, REScheck shows the ceiling R-values in the 2006 IECC (R30, R38 and R49) already match the existing U-factors in the 2006 IECC based on a "standard truss". Assuming the proponents U-factors, REScheck would require ceiling R-values that are much higher; R38, R51 and well over R60 respectively for a standard truss; clearly incorrect R-values. It appears the proponent confused a "standard truss" with a "raised truss". The IECC assumes a "standard truss" for the prescriptive requirements.

Final Action: AS AM AMPC____ D

EC49-06/07, Part I
402.2.3 (New)

Proposed Change as Submitted:

Proponent: John Neff, Washington State Building Code Council

PART I – IECC

Add new text as follows:

<u>**402.2.3 Access hatches and doors:** Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment which prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.</u>

(Renumber subsequent sections)

Reason: Section 402.2 is incomplete as it does not address a common construction situation. This proposal provides guidance for access hatches and doors so as to achieve more consistent implementation. This has been in the Washington state code for 15 years and is typical construction practice.

Cost Impact: The code change proposal will not increase the cost of construction as Section 402 already requires opaque surfaces to be insulated. Compliance costs may be reduced due to fewer corrections during plan review and inspection that will need to be responded to.

Committee Action: Approved as Submitted

Committee Reason: This proposed text addresses a hole in the building envelope that the code presently does not address.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Lawrence Brown, CBO, National Association of Home Builders (NAHB), requests Disapproval for Part I.

Commenter's Reason: Carefully reading this proposal, as it requires raised walkways to get to attic equipment so as not to compress insulation. With limited headroom already an issue in most attics, this presents a real construction problem, not to mention mechanical servicing and replacement issues. This proposal goes way beyond the pretense of weather-stripping and baffles as outlined in the Reason for this change. Please understand, this provision would apply to low-rise residential and light-weight wood frame commercial construction where this would pose an inherent problem.

In addition, the area relative to a typical 54" x 24" for a pull-down ladder, and 24"x24" for a hatch is so small, that it is insignificant when compared to the total area of the ceiling of even a townhouse. Assuming that multifamily flats are multistory and that townhouse type construction is built under the IRC, the relevance of the attic access is limited - there is likely only one access point between firewalls.

Final Action: AS AM AMPC____ D

EC49-06/07 Part II
IRC N1102.2.3 (New)

Proposed Change as Submitted:

Proponent: John Neff, Washington State Building Code Council

PART II – IRC BUILDING/ENERGY

Add new text as follows:

1102.2.3 Access hatches and doors: Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment which prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.

(Renumber subsequent sections)

Reason: Section 402.2 is incomplete as it does not address a common construction situation. This proposal provides guidance for access hatches and doors so as to achieve more consistent implementation. This has been in the Washington state code for 15 years and is typical construction practice.

Cost Impact: The code change proposal will not increase the cost of construction as Section 402 already requires opaque surfaces to be insulated. Compliance costs may be reduced due to fewer corrections during plan review and inspection that will need to be responded to.

Committee Action: Disapproved

Committee Reason: This would not be practical to implement. This would be overly restrictive for small access hatches. The second sentence contains confusing language. The third sentence is commentary.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

John Neff, Washington State Building Code Council, requests Approval as Submitted for Part II.

Commenter's Reason: For consistency with the International Energy Conservation Code. This proposal would address a lack of clarity in the existing code and help close holes in the building envelope to prevent energy loss.

Public Comment 2:

Donald J. Vigneau, Northeast Energy Efficiency Partnerships, requests Approval as Submitted for Part II.

Commenter's Reason: Proposal introduces new text to clarify requirements that specific holes in the envelope are not exempted due to not being specifically listed in code text. Clarification would recognize that these intentional holes for required or convenience access must be treated in the same manner as the remainder of the entire envelope.

The proponent's original reasons stated in the hearings monograph are valid.

The decision of the Residential Building/Energy Committee for denial is based on their view that this would be impractical to implement, not on any information in the codes or from the hearings processes that this is not an envelope requirement and the proposal simply a clarification of the code.

Final Action: AS AM AMPC____ D

EC54-06/07, Part II
IRC N1102.3.7 (New), Table N1102.3.7 (New)

Proposed Change as Submitted:

Proponent: Thomas D. Culp, Birch Point Consulting LLC, representing Aluminum Extruders Council

PART II – IRC BUILDING/ENERGY

Add new text as follows:

<u>**N1102.3.7 Combined U-Factor and SHGC Alternative.** In Zones 6 through 8, fenestration shall be permitted to meet the maximum *U*-factor requirement corresponding to the SHGC listed in Table N1102.3.7. Fenestration meeting the requirements of Table N1102.3.7 shall be considered in compliance with the fenestration requirements of Table N1102.1.</u>

<u>TABLE N1102.3.7</u>
<u>ALTERNATIVE FENESTRATION *U*-FACTOR AND SHGC REQUIREMENTS IN ZONES 6 THROUGH 8</u>

<u>GLAZED FENESTRATION SHGC</u>	<u>MAXIMUM FENESTRATION *U*-FACTOR</u>
<u>≤ 0.40</u>	<u>0.35</u>
<u>0.40 < SHGC ≤ 0.43</u>	<u>0.36</u>
<u>0.43 < SHGC ≤ 0.45</u>	<u>0.37</u>
<u>0.45 < SHGC ≤ 0.48</u>	<u>0.38</u>
<u>0.48 < SHGC ≤ 0.51</u>	<u>0.39</u>
<u>0.51 < SHGC ≤ 0.54</u>	<u>0.40</u>

Reason: The purpose of this proposal is to increase the flexibility and usability of the code, by adding an alternative method for complying with the residential fenestration requirements with equivalent energy performance. Currently, the code treats windows like walls in the north by only specifying the U-factor, while ignoring the influence of solar heat gain coefficient. Obviously, a window is not opaque, and the complete energy balance of a window must consider both U-factor and SHGC (as well as air infiltration to a lesser extent). Whereas solar heat gain is detrimental in the cooling-dominant south, solar heat gain is beneficial in the heating-dominated north by providing free solar energy to offset heating demand. As heating fuel prices continue to increase to record highs, it is important to utilize every available resource to reduce overall energy demand. This proposal introduces an alternative method of compliance for residential fenestration in zones 6-8 which includes the benefit of solar heat gain in heating-dominated climates.

Specifically, this proposal provides combinations of U-factor and SHGC which are equivalent in energy performance to the current fenestration requirements of Table 402.1.1 / Table N1102.1. As the beneficial solar heat gain coefficient increases, maximum U-factors are given which provide equivalent overall performance. The proposed values are taken exactly from the report by Lawrence Berkeley National Laboratory prepared for the U.S. Department of Energy as part of their recent analysis for the Energy Star® program for windows. *(J. Huang, R. Mitchell, S. Selkowitz, and D. Arasteh, "Analysis Results for Performance-based Ratings for the Energy Star® Windows Program", Windows and Daylighting Group, Lawrence Berkeley National Laboratory for the U.S. Department of Energy, October 2004.)* This analysis explicitly examined what combinations of U-factor and SHGC have equivalent energy performance as the prescriptive 0.35 U-factor requirement for residential windows in 23 cities throughout zones 5-8. The analysis included detailed hour-by-hour simulations, calculation of total annual source energy consumption (heating and cooling), and population weighting. The results are the values given in Table 402.3.7 / Table N1102.3.7, although this proposal is more conservative by limiting the alternative values to just zones 6-8.

Some have argued that this type of alternative compliance method is unnecessary as it is already allowed by Section 404 of the IECC. It has also been argued that there is increased variability in the assumptions used in the LBNL report compared to Section 404, which requires a complete simulation for each individual building including the specific orientation. However, it should be noted that any variability in the LBNL report is certainly less than the variability assumed in the prescriptive requirements by ignoring SHGC in the north altogether. The LBNL report also uses source energy in its analysis, resulting in values that are more conservative than if they had used either site energy or energy cost, particularly with the recent very large increase in heating fuel prices. Finally, we have made this proposal even more conservative by limiting the alternative values to zones 6-8 rather than zones 5-8 used in the report. Therefore, for this type of fenestration performance trade-off, Section 404 needlessly adds complexity and expense. This proposal achieves the same purpose in a manner which greatly simplifies the use for both code officials and builders. This facilitates enforcement, while also promoting the use of technologies to reduce heating demand in the north.

Others have argued that the proposed values could somehow lead to problems with condensation, thermal comfort, peak heating demand, or peak cooling demand. These concerns are exaggerated and unfounded. First of all, the current requirements allow any SHGC value in these heating-dominated zones, so if anything, the top SHGC value of 0.54 in this proposed alternative would limit or reduce peak cooling demand compared to the current requirements. Furthermore, the Energy Star® Windows program has determined that a maximum SHGC of 0.55 in the North Central zone (roughly zone 4) is sufficient for mitigating any peak cooling demand or comfort issues there, so the top SHGC value of 0.54 in this proposal is certainly satisfactory for zones 6-8. As for U-factor, the top value in this proposal is 0.40 which is consistent with the maximum value allowed by Section 402.5.1 of the IECC. When this value was placed in Section 402.5.1, the proponent specifically selected this value to avoid any comfort, condensation, or peak heating demand problems, so it is clearly also acceptable here. The IRC has determined that even higher values are acceptable in Section N1102.5.1, but we have chosen to use the more conservative value in this proposal. The LBNL report also concluded that "the impacts on heating or cooling peaks are minor and do not appear to be a major determinant for the performance tradeoff approach."

This proposal is a unique case where product flexibility and energy efficiency are not at odds with one another. The proposal includes a simple and easily enforceable alternative method for complying with the residential fenestration requirements. At the same time, it encourages product flexibility and availability while guaranteeing equivalent energy performance. In the end, consumers, builders, code officials, manufacturers, and energy efficiency advocates all benefit.

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

Committee Action: Approved as Submitted

Committee Reason: The "*analysis*", referred to in the proponent's published reason, shows there is equivalency in terms of energy performances. The "*analysis*" assumed equal orientation for all four sides and this is an appropriate assumption. This will give the builder an option without having to use the IECC which would require demonstration of equivalents that are different.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Chuck Murray, Washington State University Energy Program, representing The Northwest Energy Code Group, requests Disapproval for Part II.

Commenter's Reason: To move this proposal forward on its technical merits, you will have to agree that the LBL study referenced in the proponent's statement provides a reasonable analysis. Specifically, that the prototype building used in the study is representative of most buildings constructed using the IRC.

The report referenced in the proponent's statement only analyzes single prototype home. The prototype is a 2000 square foot single story home. The analysis assumes that a home will always have 25 percent of the windows facing south where solar gains will provide heat to the structure. This study certainly can not be seen as representative of the many single family, duplex and townhouse designs constructed under the IRC. Many of which will have limited views of the low winter sun.

Solar designs should be encouraged. But the applicant should perform the systems analysis calculations needed to assure that the specific design will be successful.

1.. Huang, R. Mitchell, S. Selkowitz, and D. Arasteh, "Analysis Results for Performance-based Ratings for the Energy Star® Windows Program", Windows and Daylighting Group, Lawrence Berkeley National Laboratory for the U.S. Department of Energy, October 2004.)

Public Comment 2:

Garrett A. Stone, Brickfield, Burchette, Ritts & Stone, PC, representing Cardinal Glass Industries, requests Disapproval for Part II.

Commenter's Reason: The IECC Committee correctly disapproved of Part 1 of this code change proposal (EC 54, Part 1), acknowledging the inherent problems in promoting high solar heat gain windows in heating-dominated climate zones as a trade-off for insulating value (U-factor). Unfortunately, the IRC Building & Energy Committee disregarded the actions of the IECC Committee and a majority voted to approve Part 2 of this code change for the IRC energy chapter. Disapproval of this code change (EC 54, Part 2) will maintain the level of stringency currently found in the IECC and IRC energy chapter and maintain the consistency between the two codes.

The concerns of the IECC Committee are underscored by the very analysis cited by both the proponent and IRC Building & Energy Committee in support of the code change (Joe Huang, et. al., Lawrence Berkeley National Laboratory, *Analysis Results for Performance-based Ratings for the Energy Star Windows Program*, October 1, 2004). In analyzing the Energy Star windows program, the report actually concluded that trade-offs of U-factor for SHGC should not result in the allowable U-factor going higher than the 0.35 presently permitted by the IECC and IRC in northern heating climates (*Id.* at p. 21). In support of this conclusion, the report identifies several factors that support the disapproval of the code change. Namely, increasing the U-factor by trading it off for a higher SHGC as proposed by this change will mean reduced insulating value and resulting colder interior glass surfaces in the winter. (*Id.*) This will cause all sorts of problems like: (i) increased peak heating loads (due to poorer insulating value at night during peak heating hours), (ii) reduced thermal comfort and (iii) increased probability of harmful condensation. (*Id.*) In short, the report relied upon by the IRC Building & Energy Committee and the proponent does not support the code change and actually shows why the change should be disapproved.

This proposal also suffers from several other flaws:

- This trade-off is based on the incorrect premise that a higher SHGC in a northern climate will result in energy savings sufficient to justify reducing U-factor (insulating value) stringency in all cases. Building science shows that this is only the case under certain scenarios, such as with a passive solar house. Few passive solar homes are built each year, yet this proposal would potentially apply to all northern homes. Furthermore, as noted by the IECC Committee in its reason, the benefits of high solar gain, if any, are highly dependent on the orientation and distribution of the windows. Unfortunately, there is no constraint on orientation/distribution in this proposal, which could easily result in windows located in a direction that gets little or no solar gain (such as the north), yet still be permitted to use a less stringent insulating value.
- The IRC Building & Energy Committee found that the proposal was justified based on an assumption (in the study noted above) of equal distribution of windows on the four sides of the house (the study also assumed a single house type with outdated assumptions and ignores potential home and occupant variability). Anyone in the building industry knows that few, if any, homes have windows equally distributed on four sides – rather, the majority are typically found on the front and back sides of the home. This is why trade-offs such as this, if allowed at all, are properly accomplished only under the simulated performance analysis path of the IECC (section 404), which analyzes the effect of the trade-off on the specific proposed house. By contrast, this proposal ignores the specific house.
- There is no compelling reason to establish this kind of trade-off. If high solar gain windows are warranted in certain locations, they can certainly be installed without reducing the U-factor or insulating value of the window. Like low solar gain low-e windows, high solar gain low-e windows can meet the existing 0.35 U-factor prescriptive value in northern climates. Allowing an increase in window U-factor would be a step backward and gives away energy efficiency for no good reason.
- As noted by the IECC Committee, the promotion of high solar gain in this proposal also ignores the negative impact of such gain on cooling energy use and summer electric peak demand, particularly due to longer cooling seasons (even in northern climates) resulting from behavioral and climate changes.
- This proposal, if adopted, 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 US DOE 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 an energy code that was just simplified in the 2006 version.

Finally, as noted above, the approval of the code change for the IRC will result in unwarranted inconsistencies between the IECC and IRC energy chapter. The two codes should not diverge in their basic underlying requirements. The IECC is the lead energy code and the IRC references the IECC. The IRC energy chapter should not serve as a weaker alternative to the IECC requirements. Section 1.3.1 of the ICC *CP# 28-05 Code Development* states: "The provisions of all Codes shall be consistent with one another so that conflicts between the codes do not occur." It should be noted that the IRC Building & Energy Committee cited "consistent with the IECC Committee's action" in the reasoning statements to their decisions on code proposals EC15, EC32 and EC41, and consistency of codes in the reasoning statements supporting their actions on RB27, RB30, RB118 and RB315. The IRC Building & Energy Committee should have acted consistently here.

Final Action: AS AM AMPC____ D

EC56-06/07, Part I

402.4.3, 502.4.7

Proposed Change as Submitted:

Proponent: Chuck Murray, Washington State University, representing Northwest Energy Code Group

PART I – IECC

1. Revise as follows:

402.4.3 Recessed lighting. Recessed luminaries installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. ~~by being:~~ All recessed luminaries shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All recessed luminaries and shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

1. ~~IC-rated and labeled with enclosures that are sealed or gasketed to prevent air leakage to the ceiling cavity or unconditioned space; or~~
2. ~~IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity; or~~
3. ~~Located inside an airtight sealed box with clearances of at least 0.5 inch (12.7 mm) from combustible material and 3 inches (76 mm) from insulation.~~

2. Delete and substitute as follows:

502.4.7 ~~**Recessed luminaires.** When installed in the building envelope, recessed luminaires shall meet one of the following requirements:~~

1. ~~Type IC rated, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.~~
2. ~~Type IC or non-IC rated, installed inside a sealed box constructed from a minimum 0.5-inch-thick (12.7 mm) gypsum wallboard or constructed from a preformed polymeric vapor barrier, or other air-tight assembly manufactured for this purpose, while maintaining required clearances of not less than 0.5 inch (12.7 mm) from combustible material and not less than 3 inches (76 mm) from insulation material.~~
3. ~~Type IC rated, in accordance with ASTME 283 admitting no more than 2.0 cubic feet per minute (cfm) (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. The luminaire shall be tested at 1.57 psf (75 Pa) pressure difference and shall be labeled.~~

502.4.7 Recessed lighting. Recessed luminaries installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. ~~by being:~~ All recessed luminaries shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All recessed luminaries and shall be sealed with a gasket or caulk between the housing and interior wall or ceiling covering.

Reason: Air leakage testing for recessed fixtures has been an option for compliance in energy codes since 1991[1]. At that time fixtures the market was not ready for mandatory testing of all fixtures, so alternatives were included in the code. In 2005, the California Energy Code[2] mandated testing of all recessed luminaries. This made a significant change in the market place. This market is now ready for a uniform standard for air sealing, verified through testing.

Inspections and building air leakage testing by WSU[3] noted that even when sealed luminaries are used, air leakage will occur if the luminaries are not properly sealed to the wall or ceiling covering. Text has been added to emphasize the importance of installation practices that include sealing details. We do not think this is a new requirement, simply a clarification.

Luminaries installed in airtight sealed box are inside the thermal envelope. This application would not require air tight luminaries. The code text for option 3 is not needed.

The purpose of the code change proposal is to require testing of all recessed luminaries installed in insulated assembly. Add a requirement to seal the fixture to the penetration in the assembly. Delete unneeded text. Provide consistency between chapter 4 and 5.

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

Committee Action: **Approved as Submitted**

Committee Reason: The use of recessed luminaries is increasing. The present code requirements are too liberal regarding allowances. This eliminates loopholes for the use of recessed luminaries.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

Richard Heinisch, Lithonia Lighting, requests Approval as Modified by this Public Comment for Part I.

Modify proposal as follows:

Chapter 2
Definitions

Recessed luminaire. A luminaire that is mounted above the ceiling (or behind a wall or other surface) with the opening of the luminaire level with the surface.

402.4.3 Recessed lighting. Recessed ~~luminaries~~ Luminaires installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. All such recessed ~~luminaries~~ Luminaires shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All such recessed ~~luminaries~~ luminaires ~~and~~ shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

502.4.7 Recessed lighting. Recessed ~~luminaries~~ luminaires installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. by being: All such recessed ~~luminaries~~ luminaires shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All such recessed ~~luminaries~~ luminaires ~~and~~ shall be sealed with a gasket or caulk between the housing and interior wall or ceiling covering.

Commenter's Reason:
1. Change all occurrences of 'luminaries' to 'luminaires'
2. Change both occurrences of "All recessed luminaries…" in 502.4.7 to "All such recessed luminaires…".
3. Change last sentence of 502.4.7 from "…recessed luminaries and shall…" to "…such recessed luminaires shall…".
4. Add term 'Recessed Luminaires" to Section 202.
5. To correct the spelling.
6. Without adding the word 'such', there is no way to connect the subsequent sentences to the first one and therefore they would apply to all recessed luminaires, not just those installed in the building thermal envelope.
7. The presence of the word 'and' makes no sense in that sentence.
8. For those that might not know what a recessed luminaire is.

Public Comment 2:

Lawrence Brown, CBO, National Association of Home Builders (NAHB), requests Disapproval for Part I.

Commenter's Reason: This proposal mandates a specially manufactured fixture, and eliminates the use of designer, imported fixtures. No study data was provided to show the current construction practices do not achieve the required air leakage rates. There is no supporting evidence that indicates "IC rated and labeled with enclosures that are sealed or gasketed to prevent air leakage to the ceiling cavity or unconditioned spare" is not sufficiently tight.

Final Action: AS AM AMPC____ D

EC56-06/07 Part II
IRC N1102.4.3

Proposed Change as Submitted:

Proponent: Chuck Murray, Washington State University, representing Northwest Energy Code Group

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1102.4.3 Recessed lighting. Recessed luminaries installed in the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces. ~~by being:~~ All recessed luminaries shall be IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. All recessed luminaries and shall be sealed with a gasket or caulk between the housing and the interior wall or ceiling covering.

1. ~~IC-rated and labeled with enclosures that are sealed or gasketed to prevent air leakage to the ceiling cavity or unconditioned space; or~~
2. ~~IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity; or~~
3. ~~Located inside an airtight sealed box with clearances of at least 0.5 inch (12.7 mm) from combustible materlal and 3 inches (76 mm) from insulation.~~

Reason: Air leakage testing for recessed fixtures has been an option for compliance in energy codes since 1991[1]. At that time fixtures the market was not ready for mandatory testing of all fixtures, so alternatives were included in the code. In 2005, the California Energy Code[2] mandated testing of all recessed luminaries. This made a significant change in the market place. This market is now ready for a uniform standard for air sealing, verified through testing.

Inspections and building air leakage testing by WSU[3] noted that even when sealed luminaries are used, air leakage will occur if the luminaries are not properly sealed to the wall or ceiling covering. Text has been added to emphasize the importance of installation practices that include sealing details. We do not think this is a new requirement, simply a clarification.

Luminaries installed in airtight sealed box are inside the thermal envelope. This application would not require air tight luminaries. The code text for option 3 is not needed.

The purpose of the code change proposal is to require testing of all recessed luminaries installed in insulated assembly. Add a requirement to seal the fixture to the penetration in the assembly. Delete unneeded text. Provide consistency between chapter 4 and 5.

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

Committee Action: Disapproved

Committee Reason: This proposal is not clear and will cause confusion and may cause misinterpretation. It eliminates the option of an airtight sealed box.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Chuck Murray, Washington State University Energy Program, representing The Northwest Energy Code Group, requests Approval as Submitted for Part II.

Commenter's Reason: Adopting mandatory use of the air leakage test method as proposed in this language will simplify the inspection process. The inspector will simply have to look in the can for the label certifying the test has been completed. Adoption of this section in the IRC provide consistence between the IRC and the IECC.

Final Action: AS AM AMPC____ D

EC58-06/07, Part I
402.6

Proposed Change as Submitted:

Proponent: Vickie Lovell, representing the Association of Industrial Metallized Coaters and Laminators, Inc.

PART I – IECC

Delete without substitution:

~~**402.6 Maximum fenestration U-factor and SHGC. (Mandatory).** The area weighted average maximum fenestration U-factor permitted using trade offs from Section 402.1.4 or Section 404 shall be 0.48 in zones 4 and 5 and 0.40 in zones 6 through 8 for vertical fenestration, and 0.75 in zones 4 through 8 for skylights. The area weighted average maximum fenestration SHGC permitted using trade-offs from Section 404 in Zones 1 through 3 shall be 0.50.~~

Reason: Section 402.6 (IECC) and Section N1102.5.1 (IRC) are the remaining confusing provisions in an energy code that was drastically simplified in the 2006 version The language, as currently in the code, is unenforceable. One must first determine what the term "area weighted average maximum" means and then determine how to apply this to their design. Separate calculation(s) will then need to be conducted for both the UA trade off approach and also performance based approach to ensure that the SHGC and U-factor caps are met for both vertical fenestration and skylights.

Even if it could be effectively enforced, this provision adds an unnecessary burden to the trade off approaches within the IECC when using Section 402.1.4 and Section 404.

This requirement places a cap on window U-factor and SHGC, the only component in the residential provisions of the IECC to have restrictions placed on it. It is important to note that when a proposal was brought before the IECC Code Development Committee during the 2004/2005 Cycle that would have placed mandatory minimums on insulation levels, it was disapproved. One of the reasons for disapproval was that "it would somewhat circumvent the trade off procedure and the simulated performance methods."

Those who argue in favor of the window efficiency minimums claim that an unlimited amount of glazing can be installed in any building therefore certain minimums must be put in place. Technically under Section 404, this assumption is incorrect because a proposed building with greater than or equal to 18% glass to floor is now compared to a base case building with 18% glass, making the high glass building more difficult to comply and essentially placing and energy penalty on these types of buildings.

Finally, this confusing, unenforceable provision restricts product choices for use in the field – which is in conflict with Section 101.3, the intent of the IECC. The impacts of this provision directly eliminates the use of glazed block as the only window type in small additions in several climate zones, rather than to "provide flexibility and to permit the use of innovative approaches and techniques". Fenestration products, such as glazed block with a U-factor of 0.60 cannot be used in Climate Zones 4 and above as the sole window in a small addition such as a bathroom unless other windows are installed to meet the weighted average maximum limits.

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

Committee Action: Disapproved

Committee Reason: Limits on window factors are important because the impact of the SHGC rating and U-factor for fenestration is dependent upon the season and the time of day. Therefore, the limits are needed to assure that other factors created by windows, such as moisture condensation and creation of hot spots do not cause a need to adjust the thermostat a great degree.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Vickie J. Lovell, InterCode Incorporated, representing the Association of Industrial Metallized Coaters and Laminators, Inc., requests Approval as Submitted for Part I.

Commenter's Reason: The IRC committee passed EC58-06/07 that eliminated the maximum weighted average caps for glazing U-factors. The provision of the code used the vague and unenforceable term "area weighted average maximum" to reduce the possibility of installing inefficient glass in a cold climates. The IRC Committee essentially stated that the market has eliminated the need for this provision as single pane windows are not being installed in cold climates.

The IECC Code Development committee disapproved this identical code change that would eliminate the need for an "area weighted average maximum" for SHGC and U-factor. This decision has set up a conflict between the IECC and IRC that will lead to confusion and potential gaming when trying to apply the codes. The decision by the IRC committee reflected a market trend toward the installation of better windows in cold climates. Hot climates are also experiencing the same market trend as large production builders are installing vinyl frame, low E windows, with an SHGC of less than 0.40 in markets such as Southern Nevada and Southern California.

There is no need for this confusing and unenforceable code language within the IECC as the market has made this provision irrelevant. Please overturn the IECC Committees decision by approving EC58.

Final Action: AS AM AMPC____ D

EC58-06/07, Part II
IRC N1102.5.1

Proposed Change as Submitted:

Proponent: Vickie Lovell, representing the Association of Industrial Metallized Coaters and Laminators, Inc.

PART II – IRC BUILDING/ENERGY

Delete without substitution:

~~**N1102.5.1 Maximum fenestration *U*-factor.** The area weighted average maximum fenestration *U*-factor permitted using tradeoffs from Section N1102.1.3 in Zones 6 through 8 shall be 0.55. To comply with this section, the maximum *U*-factor for skylights shall be 0.75 in zones 6 through 8.~~

Reason: Section 402.6 (IECC) and Section N1102.5.1 (IRC) are the remaining confusing provisions in an energy code that was drastically simplified in the 2006 version The language, as currently in the code, is unenforceable. One must first determine what the term "area weighted average maximum" means and then determine how to apply this to their design. Separate calculation(s) will then need to be conducted for both the UA trade off approach and also performance based approach to ensure that the SHGC and U-factor caps are met for both vertical fenestration and skylights.

Even if it could be effectively enforced, this provision adds an unnecessary burden to the trade off approaches within the IECC when using Section 402.1.4 and Section 404.

This requirement places a cap on window U-factor and SHGC, the only component in the residential provisions of the IECC to have restrictions placed on it. It is important to note that when a proposal was brought before the IECC Code Development Committee during the 2004/2005 Cycle that would have placed mandatory minimums on insulation levels, it was disapproved. One of the reasons for disapproval was that "it would somewhat circumvent the trade off procedure and the simulated performance methods."

Those who argue in favor of the window efficiency minimums claim that an unlimited amount of glazing can be installed in any building therefore certain minimums must be put in place. Technically under Section 404, this assumption is incorrect because a proposed building with greater than or equal to 18% glass to floor is now compared to a base case building with 18% glass, making the high glass building more difficult to comply and essentially placing and energy penalty on these types of buildings.

Finally, this confusing, unenforceable provision restricts product choices for use in the field – which is in conflict with Section 101.3, the intent of the IECC. The impacts of this provision directly eliminates the use of glazed block as the only window type in small additions in several climate zones, rather than to "provide flexibility and to permit the use of innovative approaches and techniques". Fenestration products, such as glazed block with a U-factor of 0.60 cannot be used in Climate Zones 4 and above as the sole window in a small addition such as a bathroom unless other windows are installed to meet the weighted average maximum limits.

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

Committee Action: Approved as Submitted

Committee Reason: It has been shown that the market has taken care of this as single-pane glazing is not being installed in cold climates, therefore this code section is no longer needed. Also, this will eliminate the undefined term "area weighted average maximum".

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

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

Commenter's Reason: This code change proposes to entirely remove necessary limits (mandatory maximums) on window U-factors and SHGCs from the IECC and IRC. In disapproving this proposal (part I), the IECC Committee correctly recognized that such mandatory limits were necessary to ensure reasonable protection from condensation and protection of occupant comfort. As the Committee reasoned, protection of occupant comfort, while important in and of itself, would also avoid substantial increased energy use resulting from uncomfortable occupants that adjust their thermostats to compensate. These protections are particularly critical since unlimited window area (without an increase in stringency) is now allowed by the energy code, a feature newly included in the both the 2006 IRC and 2006 IECC. It should also be kept in mind that the maximum U-factors in the IECC still provide less insulating value than an un-insulated wall. The maximums use an area-weighted average approach to permit reasonable flexibility in choosing individual windows for specialized applications. The maximums contained in the IECC are reasonable and should be retained for the IECC and included in the IRC.

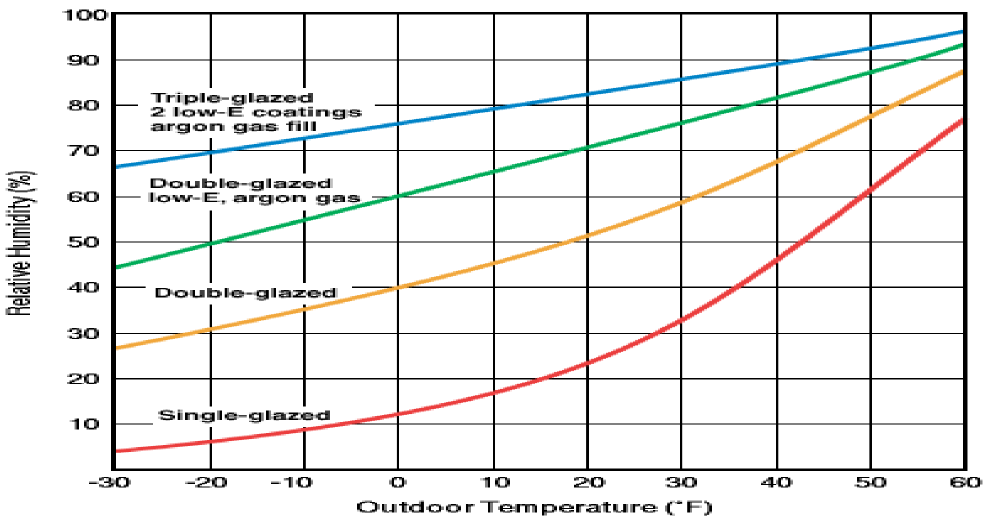
At the outset, it should be noted that the version of the maximums presently in the IRC is already weaker than the version in the IECC (for example, the IRC version uses a 0.55 U-factor maximum while the IECC uses a 0.48 U-factor in zones 4 – 5 and 0.40 in zones 6 – 8). The IRC Building & Energy Committee was presented with the opportunity to correct this problem by adopting proposed code change RE 3, which would have strengthened the existing IRC requirement and made the IRC consistent with the IECC. Instead, the IRC Committee disapproved RE 3 and voted to approve this code change for the IRC energy chapter, eliminating the maximums entirely from the IRC (EC 58, Part II).

We believe that the correct action on this issue is to approve RE 3 as submitted (we have also submitted a public comment on RE 3). To be consistent, however, we also recommend disapproving EC 58, Part II. These actions would result in consistent provisions in both the IECC and IRC and retain these necessary limits at the appropriate stringency levels in both codes.

As noted above, condensation and comfort both compel reasonable minimum performance from windows. Other benefits include reduced energy use and reduced peak demands. The IRC Building & Energy Committee ignored these issues.

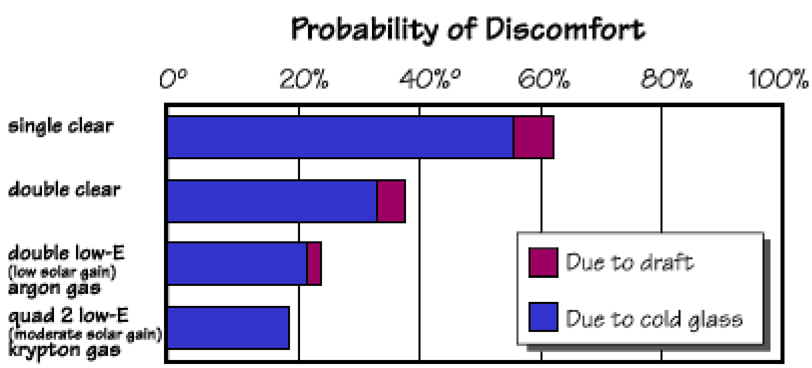
The likelihood of condensation is directly related to window U-factors, outdoor temperatures and indoor relative humidity. Windows with a lower U-factor have a higher inside glass temperature and are resistant to condensation at higher levels of humidity. In heating climates, with low design temperatures, the lack of U-factor maximums will lead to significant condensation problems. According to the analysis by the Lawrence Berkeley National Laboratory (under the supervision of the US Department of Energy) in the chart below, improved window U-factors result in a much smaller range of conditions where condensation will occur. Specifically, the chart demonstrates when condensation occurs for different glass types based on the outdoor temperature and relative humidity. It should be noted that the double glazed product is what is required to meet a 0.55 U-factor as presently contained in the IRC, while the double-glazed low-E product would satisfy the requirements of the IECC in the colder zones (0.40 U-factor in zones 6 – 8).

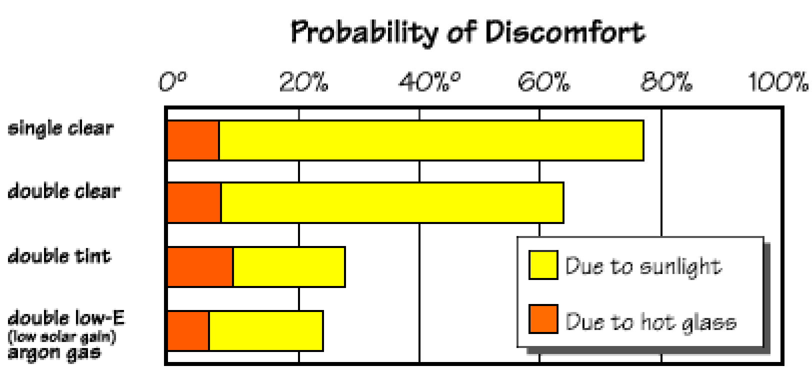
Condensation Curves Based on Outdoor Temperature and Relative Humidity for Different Glass Types



This graph shows that condensation will occur at any point at or above the curves for each type of glass. For example, at zero degrees F, there is condensation at less than 15% humidity for single-glazed, 40% for double-glazed and 60% for low-E.

Furthermore, U-factor and SHGC play a significant role in occupant comfort, which is as important as condensation resistance. As with condensation, lower U-factors mean greater insulation from the glazing, which in turn results in higher room-side glass temperatures and comfort. While occupant comfort is an important factor on its own, it is also a crucial factor when energy conservation is considered. An occupant's likely response to room temperature discomfort is to change the thermostat level, thereby increasing energy usage and negating the positive effects of the energy code. Likewise, lower SHGC limits in the south (contained in the IECC) will provide for greater comfort and reduce summer peak cooling demand because occupants will not turn to lower summer thermostat set-points to resolve comfort issues. The following graphs were also prepared by Lawrence Berkeley National Laboratory and illustrate the probability of discomfort with various glass products due to unwanted heat loss in the winter (the first graph) and unwanted heat gain in the summer (the second graph):





The three graphs prepared by Lawrence Berkeley National Laboratory correctly illustrate the same conclusion reached by the IECC Committee and ignored by the IRC Committee – reasonable minimum performance requirements (e.g., maximum U-factors and SHGCs) are needed to assure occupant comfort, reduce condensation, control peak demands and avoid increased energy consumption through thermostat adjustments.

In support of their decision, the IRC Building & Energy Committee conceded that at least single pane glass should not be installed in colder climates, but claimed that the market had taken care of the concern. Unfortunately nothing in the market precludes the sale of single pane windows in colder climates; moreover, the code should not rely on market forces alone to prevent unreasonable practices. Second, this argument ignores the fact that double pane clear windows in northern climates present the same condensation and comfort problems, although not as severe, as demonstrated above. The IECC maximum levels best address this concern and should be adopted per RE 3. The IRC Building & Energy Committee also criticized the term "area weighted average maximum" as undefined. We disagree – no definition is necessary (note the same committee approved the language in the previous code cycle – they must have known what it meant then). The concept of area-weighted averaging is used throughout the energy code. For example, see IECC sections 402.3.1 and 402.3.2. The term maximum simply means that the area weighted average value cannot exceed the maximum.

Finally, as noted above, the approval of the code change for the IRC will result in unwarranted inconsistencies between the IECC and IRC energy chapter. The two codes should not diverge in their basic underlying requirements. The IECC is the lead energy code and the IRC references the IECC. The IRC energy chapter should not serve as a weaker alternative to the IECC requirements. Section 1.3.1 of the ICC *CP# 28-05 Code Development* states: "The provisions of all Codes shall be consistent with one another so that conflicts between the codes do not occur." It should be noted that the IRC Building & Energy Committee cited "consistent with the IECC Committee's action" in the reasoning statements to their decisions on code proposals EC15, EC32 and EC41, and consistency of codes in the reasoning statements supporting their actions on RB27, RB30, RB118 and RB315. The IRC Building & Energy Committee should have acted consistently here.

Final Action: AS AM AMPC____ D

EC59-06/07, Part I
402.6

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART I – IECC

Delete without substitution:

~~**402.6 Maximum fenestration *U*-factor and SHGC. (Mandatory).** The area weighted average maximum fenestration *U*-factor permitted using trade offs from Section 402.1.4 or Section 404 shall be 0.48 in zones 4 and 5 and 0.40 in zones 6 through 8 for vertical fenestration, and 0.75 in zones 4 through 8 for skylights. The area weighted average maximum fenestration SHGC permitted using trade-offs from Section 404 in Zones 1 through 3 shall be 0.50.~~

Reason: This section should be deleted because it has proven to be confusing, limits flexibility, and does not save energy.

This section limits tradeoffs to the prescriptive requirements, including placing a limit on performance-based compliance. More than half the code users confuse the main prescriptive code requirements for windows (IECC Table 402.1 and IRC Table N1102.1) and this section's limits on tradeoff flexibility. I have tried to explain this section to many code users who are still confused after my explanation.

The IRC text has remained as originally submitted by DOE. As originally submitted, this section was intended to eliminate single-pane glazing and unimproved aluminum frames from northern climates (zones 6, 7 and 8). The market has already eliminated these condensation-prone windows, so the code requirement is not needed.

Some common products, such as glass block and garden windows, never meet these "hard limits." In principal, a calculation or exemption would be required if more than a small area of these common products are used in new residences. Additions or renovations with significant areas of these glazing products would be technically illegal unless they include other glazing products, even when the addition or renovation includes increased efficiency such as improved HVAC efficiency or increased insulation levels.

The IRC and IECC, which are identical on most energy requirements, differ on this requirement. This code change eliminates the difference.

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

Committee Action: **Disapproved**

Committee Reason: See the committee reason stated in Code Change Proposal EC58-06/07.

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 for Part I.

Commenter's Reason: This is an artificial constraint on design without any net energy savings. These constraints on design flexibility in Section 402.6 get confused with the actual fenestration requirements for U-factor and SHGC in Table 402.1.1. The terms in this section can be difficult to explain, try explaining "*area weighted average maximum*" which is used twice in the section. These artificial constraints on performance were removed by the IRC committee and should also be removed from the IECC.

Final Action: AS AM AMPC____ D

EC64-06/07, Part I

403.2.2

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART I – IECC

Revise as follows:

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 M1601.3.1 of the *International Residential Code*.
<u>Air handlers with a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested at an air pressure of 1-inch water gauge when all air inlets, air outlets, and condensate drain port(s) are sealed shall be deemed sealed. Air handlers with filter boxes shall be tested with the filter box in place.</u>

Reason: The 2006 IECC and IRC have new requirements for sealed air handlers, but do not include a specification of what would be considered "sealed." This proposal adds a measure for "sealed" air handler based on an existing "credit" in the Florida building code.

Some air handler manufacturers already produce "air-tight" air handlers. Some manufacturers use Florida's measure of air tightness. Manufacturers that seal, test, and label their air handlers as "sealed in the factory" to meet the code-specified air tightness provide a practical way to encourage sealed air handlers, allow manufacturers to provide their customers with code-compliant products and encourage energy efficiency. A manufacturer's label is a practical way to verify code compliance in the field.

The IBC (Section 1702.1) defines "Manufacturer's Designation" as, "an identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules." Therefore, "Manufacturer's Designation" is the appropriate wording for this section.

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

Committee Action: **Approved as Submitted**

Committee Reason: The proposed text provides a specific way for manufacturers to comply as an option.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment 1:

David C. Delaquila, GAMA-An Association of Appliance and Equipment Manufacturers, requests Disapproval for Part I.

Commenter's Reason: GAMA believes this proposal should be disapproved. This proposal seeks to limit energy loss by addressing air handler and duct system leakage. Currently, a national test procedure does not exist. An ASHRAE committee is being formed to begin development of such a procedure. Any air handler leak standard must be held pending completion of that standard.

Public Comment 2:

Patrick A. McLaughlin, McLaughlin & Associates, representing Air-Conditioning and Refrigeration Institute, requests Disapproval for Part I.

Commenter's Reason: The proposed code change should be disapproved because of technical and editorial flaws. The language, as proposed is suitable for "Commentary" not a code requirement. The section currently requires that ducts, air handlers, filter boxes and building cavities used as duct, be sealed. The proposed code change adds a leakage rate criterion for air handlers as an example when an air handler might be considered sealed. Specifically, it states that if the criteria is met the handler shall be "deemed" sealed. As written it could still be sealed if it doesn't meet the criteria. This will create confusion within the industry and the enforcement community. Furthermore, even if the language was corrected, the requirements should not be approved because it is not justified and because there is no established test methodology to qualify air handlers. The leakage rate, which is found in the Florida Building Code, is not a code a requirement. The 2 percent leakage rate is only mentioned under residential as a credit factor for Method A performance calculations. Also, the leakage rate was developed from a very limited study of only 69 units of which 60 were heat pumps and only 9 forced air furnaces. It is not reasonable to establish a national requirement on air leakage for all air handlers based on 9 forced air furnaces. Furthermore, there is no existing standardize method of testing air handlers to determine compliance. It is premature to require a level of performance without establishing the testing criteria to gage the performance. This code change proposal was also heard by the International Residential Code Building/Energy Code Development Committee and was overwhelmingly defeated.

Final Action: AS AM AMPC____ D

EC64-06/07, Part II
IRC N1103.2.2

Proposed Change as Submitted:

Proponent: Craig Conner, Building Quality, representing himself

PART II – IRC BUILDING/ENERGY

Revise as follows:

N1103.2.2 Sealing. Ducts, air handlers, filter boxes and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.4.1.

Air handlers with a manufacturer's designation for an air leakage of no more than 2 percent of the design air flow rate when tested at an air pressure of 1-inch water gauge when all air inlets, air outlets, and condensate drain port(s) are sealed shall be deemed sealed. Air handlers with filter boxes shall be tested with the filter box in place.

Reason: The 2006 IECC and IRC have new requirements for sealed air handlers, but do not include a specification of what would be considered "sealed." This proposal adds a measure for "sealed" air handler based on an existing "credit" in the Florida building code.

Some air handler manufacturers already produce "air-tight" air handlers. Some manufacturers use Florida's measure of air tightness. Manufacturers that seal, test, and label their air handlers as "sealed in the factory" to meet the code-specified air tightness provide a practical way to encourage sealed air handlers, allow manufacturers to provide their customers with code-compliant products and encourage energy efficiency. A manufacturer's label is a practical way to verify code compliance in the field.

The IBC (Section 1702.1) defines "Manufacturer's Designation" as, "an identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules." Therefore, "Manufacturer's Designation" is the appropriate wording for this section.

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

Committee Action: **Disapproved**

Committee Reason: There is no standard or method specified for the testing. This is based on the Florida Code and this may not be appropriate for the rest of the nation. Also, this will allow sealing the air handler with tape and this could effect the warranty and may give the appearance to the homeowner of an inferior product.

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 Submitted for Part II.

Commenter's Reason: The IECC committee approved this code change. As the IECC committee reason notes-- the code change provides a specific option to meet the code. Without this option, it is difficult to judge if an air handler meets the existing requirement for a "sealed air handler".

Code enforcement benefits from an easy way to judge compliance. Many equipment manufacturers will choose to test and label their air handlers as "sealed". Without such a label it is difficult to demonstrate an air handler is "sealed".

The IRC committee seemed to think this code change added a requirement that would lead to using tape to seal air handlers. However, the requirement for sealing air handlers is already in the 2006 IRC and IECC. This is simply an option for demonstrating that the air handler is "sealed".

Public Comment 2:

Donald J. Vigneau, Northeast Energy Efficiency Partnerships, requests Approval as Submitted for Part II.

Commenter's Reason: Proposal simply offers a valid manufacturing test procedure to certify equipment. There would be no field testing of units certified as meeting this provision when properly labeled as such. The proponent's original reasons stated in the hearings monograph are valid.

The decision of the Residential Building/Energy Committee for denial is based on their erroneous view that this could invalidate manufacturer's warrantees when, in fact, it would eliminate unnecessary field-application of tapes and other sealants that could affect warranty protection.

Final Action: AS AM AMPC____ D

EC68-06/07

202 (New), 404 (New), 404.1 (New)

Proposed Change as Submitted:

Proponent: Chuck Murray, Washington State University, representing Northwest Energy Code Group

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

HIGH-EFFICACY LUMINAIRE. A lighting fixture that does not contain a medium screw base socket (E24/E26) and whose lamps have 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.

SECTION 404
ELECTRICAL POWER AND LIGHTING SYSTEMS

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

Exception: Dwelling units.

Reason: Lighting in corridors and other common areas operates 24 hours per day and should be energy efficient. The requirements in Section 505.5 already apply to these areas in buildings over three stories. Adding the definition for High Efficiency Luminaries supports the prescriptive method for meeting the code requirements.

The purpose of the proposed change is to provide minimum requirements for lighting in corridors and other common areas.

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

Committee Action: **Approved as Submitted**

Committee Reason: This proposal would provide for regulations that provide a cost effective way to save energy in the use of lighting in common areas.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Lawrence Brown, CBO, National Association of Home Builders, requests Disapproval.

Commenter's Reason: This proposal does not belong in the residential chapter, let alone the performance section. It adds a definition of high efficiency lighting and places reference in chapter four, but exempts dwelling units – which are the residential occupancies covered under Chapter 4. Another problem is that the proposed text is poorly written. The text of the provision contains the same exception for dwellings as shown in the Exception. This will have the effect of creating confusion when applying this provision. The scope of this proposal is poorly written and vague. It could be interpreted to exclude halogen and incandescent lighting for wall art or even direct stair step lighting. Alternative lighting for these are not widely available and represent a minimal amount of energy savings.

Final Action: AS AM AMPC____ D

EC73-06/07
404.4.3

Proposed Change as Submitted:

Proponent: John R. Addario, P.E., New York State Department of State Codes Division, representing himself

Revise as follows:

404.4.3 Additional documentation. The code official shall be permitted to require the following documents:

1. Documentation of the building component characteristics of the standard reference design.
2. A certification signed by the builder providing the building component characteristics of the proposed design as given in Table 404.5.2(1).
3. <u>Documentation of the actual values used in the software calculations for the proposed design.</u>

Reason: The purpose of this proposal is to allow the code official to require documentation that provides the minimum and/or maximum valves allowed by the code, specifically for the proposed design. Some software applications allow values to be entered for the proposed design, which are not allowed when used to calculate compliance. As an example a proposed building might be estimated to have a 0.20 ACH, this value is entered into the software and carried through on all printouts/documentation. The actual software calculations are or should be based on the code minimum of 0.35 ACH. The code official has no way of verifying this unless the proper documentation is provided.

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

Committee Action: **Disapproved**

Committee Reason: The proposed text for EC72-06/07 was preferred, given the intent of the two proposals was the same.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

John R. Addario, P.E., New York State Department of State – Division of Code Enforcement and Administration, requests Approval as Submitted.

Commenter's Reason: The committee disapproved EC73-06/07 on the basis that the intent of EC-73-06/07 was the same as EC72-06/07, as indicated by the proponent of EC-72 as part of the reason for its approval (EC-72 was approved as submitted). But this is incorrect, EC-72 addresses the documentation of the *user input*, while EC-73 addresses providing the documentation of the *actual values used within the software*. One example of the difference between the two proposals would be the user input of 0.20 air changes hour (ACH)** for the proposed infiltration rate, but the actual limit by code is 0.35 ACH. The majority of software available will provide the output of 0.20 ACH (user input), while the code official needs to verify compliance with the code and the limiting value of 0.35 ACH (actual value used in software? or should be; *case in point*). This code compliance verification is provided for in EC73-06/07.

** The values below 0.35ACH (code limit) indicate tight construction (such as the commonly used value of 0.20ACH) and are used by some modeling software as a promotional tool to demonstrate energy saving to the home owner.

Final Action: AS AM AMPC____ D

EC78-06/07
403, 404.2, Table 404.5.2(2)

Proposed Change as Submitted:

Proponent: Ronald Majette, representing the United States Department of Energy

Revise as follows:

SECTION 403
SYSTEMS (MANDATORY)

List all subsections of Section 403 except for 403.2.1 as "Mandatory".

404.2 Mandatory Requirements. Compliance with this section requires that the criteria of Section 401, 402.4, 402.5, 402.6, and ~~403~~ all sections of 403 except 403.2.1 be met. Supply and return ducts not completely inside the building thermal envelope shall be insulated to a minimum of R-4.

TABLE 404.5.2(2)
DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS ~~(A)~~

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION:	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS (~~b~~ a)
Distribution system components located in unconditioned space (b)	0.80	0.95
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 (b)	0.88	--
"Ductless" systems (e)	1.00	--

Notes:

~~a. Default values given by this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.~~

~~b~~ a. Hydronic Systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed loop piping and that do not depend on ducted, forced air flows to maintain space temperatures.

b. Reduction in duct insulation from R-8 to R-6 shall reduce the distribution system efficiency by 0.01 for forced air systems not located entirely within the conditioned space. Further reductions from R-6 to R-4 shall reduce the distribution system efficiency by 0.02 below that for R-6. Other distribution system efficiencies between R-4 and R-8 shall be obtained by linear interpolation.

c. Entire system in conditioned space shall mean that no component of the distribution system, including the air handler unit, is located outside of the conditioned space.

d. Proposed "reduced leakage" shall mean leakage to outdoors not greater than 3 cfm per 100 ft^2 of conditioned floor area and total leakage not greater than 9 cfm per 100 ft^2 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 ft^2 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. Ductless systems may have forced airflow across a coil but shall not have any ducted airflows external to the manufacturer's air handler enclosure.

Reason: The purpose of this code change is to allow duct insulation to be reduced to R-4 in the simulated performance path. The current code requires R-8 duct insulation for all but ducts in floor trusses with no possibility for trade-offs. R-4 is a more reasonable mandatory minimum value. The proposed reductions in the distribution system efficiencies are based on an extensive research project conducted in 1996. The exact impact of duct insulation is highly complicated and depends on factors such as duct types, lengths, and location, heating system type, climate, and other variables. This proposal presents a reasonable simplification that permits duct-R trade-offs without requiring thorough testing of the distribution system.

Footnote (a) should be deleted as the values are not all for untested systems and this proposal addresses minimum duct insulation requirements in section 404.2.

Bibliography:

Triedler. B., R. G. Lucas, M. P. Modera, and J. D. Miller. 1996. "Impacts of Residential Duct Insulation on HVAC Energy Use and Life-Cycle Cost to Consumers." ASHRAE Transactions 102 (1). AT-96-13-4.

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

Committee Action: Disapproved

Committee Reason: Consistency with action taken on EC62-06/07.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Ronald Majette, United States Department of Energy, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 404.5.2(2)
DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION:	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS [(a)]
Distribution system components located in unconditioned space ~~[(b)]~~	0.80 [(b)]	0.95
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[(b)]	0.88	--
"Ductless" systems [(e)]	1.00	--

a. Hydronic Systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed loop piping and that do not depend on ducted, forced air flows to maintain space temperatures.

b. ~~Reduction in duct insulation from R-8 to R-6 shall reduce the distribution system efficiency by 0.01 for forced air systems not located entirely within the conditioned space. Further reductions from R-6 to R-4 shall reduce the distribution system efficiency by 0.02 below that for R-6. Other distribution system efficiencies between R-4 and R-8 shall be obtained by linear interpolation.~~ Reduction in duct insulation from R-8 to R-6 shall reduce the distribution system efficiency by 0.01 to 0.79 for forced air systems with supply ducts in an unconditioned attic. Reductions from R-6 to R-4 shall reduce the distribution system efficiency by 0.02, to either 0.77 if the system has supply ducts in attics or to 0.78 is the system does not have supply ducts in attics. Other distribution system efficiencies between R-4 and R-8 shall be obtained by linear interpolation.

c. Entire system in conditioned space shall mean that no component of the distribution system, including the air handler unit, is located outside of the conditioned space.

d. Proposed "reduced leakage" shall mean leakage to outdoors not greater than 3 cfm per 100 ft^2 of conditioned floor area and total leakage not greater than 9 cfm per 100 ft^2 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 ft^2 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. Ductless systems may have forced airflow across a coil but shall not have any ducted airflows external to the manufacturer's air handler enclosure.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: The purpose of this code change is to allow for the possibility of duct insulation to be reduced to R-4 in the simulated performance path. The current code requires either R-6 or R-8 duct insulation (based on approved code change EC62-06/07) with no possibility for trade-offs. R-4 is a more reasonable mandatory minimum value. The proposed reductions in the distribution system efficiencies are based on an extensive research project conducted in 1996. The exact impact of duct insulation is highly complicated and depends on factors such as duct types, lengths, and location, heating system type, climate, and other variables. This proposal presents a reasonable simplification that permits duct-R trade-offs without requiring thorough testing of the distribution system. This proposal adds a uniform method that will help prevent gaming.

Footnote (a) should be deleted as the values are not all for untested systems and this proposal addresses minimum duct insulation requirements in section 404.2.

Substantiation: Triedler. B., R. G. Lucas, M. P. Modera, and J. D. Miller. 1996. "Impacts of Residential Duct Insulation on HVAC Energy Use and Life-Cycle Cost to Consumers." ASHRAE Transactions 102 (1). AT-96-13-4.

Final Action: AS AM AMPC____ D

EC79-06/07
Table 404.5.2(1), Chapter 6

Proposed Change as Submitted:

Proponent: Ronald Majette, representing the United States Department of Energy

1. Revise table as follows:

TABLE 404.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

Thermal distribution systems	A thermal distribution system efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies	Same as standard reference design, except as specified by Table 404.5.2(2). Alternatively, system shall be permitted to be tested in accordance with ASHRAE Standard 152-2004 and DSE determined by calculations in accordance with ASHRAE Standard 152-2004 or hour-by-hour simulation.

(Portions of table not shown do not change)

2. Add standard to Chapter 6 as follows:

ASHRAE
152-2004 Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution System

Reason: The current provisions do not allow compliance of thermal distribution systems based on specific pressure test results other than the "reduced leakage" package described in Table 404.5.2(2).

The purpose of the code change proposal is to allow compliance credit in the performance path for distribution system designs other than the fixed cases currently listed in Table 404.5.2(2).

The proposed approach is taken directly from a procedure developed by the Residential Energy Services Network for performance calculations related to tax credit qualification: "Procedures for Certifying Residential Energy Efficiency Tax Credits for New Homes," RESNET Publication No. 05-001, November, 2005. See http://www.natresnet.org/standards/tax_credits/procedures.pdf.

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

Note: The following analysis was not in the Code Change Proposal book but was published in the "Errata to the 2006/2007 Proposed Changes to the International Codes and Analysis of Proposed Reference Standards" provided at the code development hearings:

Analysis: Review of proposed new standard indicated that, in the opinion of ICC Staff, the standard did not comply with ICC standards criteria.

Committee Action: **Disapproved**

Committee Reason: The proposed standard does not comply with ICC Standards Criteria.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Ronald Majette, the United States Department of Energy, requests Approval as Submitted.

Commenter's Reason: Allowing the analysis of duct tightness based on ASHRAE Standard 152 will allow flexibility in complying with the code by giving value to proven-tight ducts and will bring the IECC performance compliance calculations closer to those in widespread use by Home Energy Rating Systems, Tax Credit qualification programs, DOE's Building America program, Energy Star, and other voluntary beyond-code programs. Industry professionals are familiar with ASHRAE 152. Approval of EC79 will allow them to transfer the knowledge and tools of voluntary, better-than-code programs to the task of demonstrating compliance with the code.

Final Action: AS AM AMPC____ D

EC82-06/07
501.1, 501.2, 502.1.1, 502.1.2 (New), 502.1.3 through 502.1.3.2 (New)

Proposed Change as Submitted:

Proponent: John Neff, Washington State Building Code Council

1. Revise as follows:

501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. ~~These commercial buildings shall meet either the requirements of ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*, or the requirements contained in this chapter.~~

501.2 Application. The requirements in Sections 502 (Building envelope), 503 (Building mechanical systems), 504 (Service water heating) and 505 (Lighting) shall each be satisfied on an individual basis. ~~Where one or more of these sections is not satisfied, compliance for that section(s) shall be demonstrated in accordance with the applicable provisions of ASHRAE/IESNA 90.1.~~

Exceptions:

1. Buildings conforming to Section 506, provided Sections 502.4, 502.5, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied.
2. As an alternative to sections 503, 504 or 505, compliance shall be permitted to be demonstrated using requirements of ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*.

SECTION 502
BUILDING ENVELOPE REQUIREMENTS

502.1 General. (Prescriptive).

502.1.1 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Tables 502.2(1) and 502.3 based on the climate zone specified in Chapter 3. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table 502.3 ~~comply with the building envelope provisions of ASHRAE/IESNA 90.1.~~ shall show compliance using Section 502.1.3. ~~vertical fenestration area or skylight area~~

2. Add new text as follows:

502.1.2 U-factor alternative. An assembly with a U-factor, C-factor, or F-factor equal or less than that specified in Table 502.1.2 shall be permitted as an alternative to the R-value in Table 502.2 (1). Assembly U-factor calculations shall be done using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials.

502.1.3 Total UA and total SHGCA alternative.

502.1.3.1 Total UA. If the total proposed building thermal envelope UA (sum of U-factor, C-factor or F-factor times assembly area for each assembly) is less than or equal to the total standard building UA resulting from using the opaque assembly U-factors in Table 502.1.2, opaque door U-factors in Table 502.2(1), and fenestration U-factors in Table 502.3 the building shall be considered in compliance with Tables 502.2(1) and 502.3. For this calculation, the standard building assembly areas shall be the same as the proposed building assembly areas, provided that the proposed building vertical fenestration area does not exceed the maximum vertical fenestration area allowed in Table 502.3 and the skylight area does not exceed the maximum skylight area in Table 502.3.

1. If the proposed building vertical fenestration area exceeds the maximum vertical fenestration area allowed in Table 502.3, then the standard building shall use the maximum vertical fenestration area allowed in Table 502.3 and the opaque above grade wall assembly area shall be increased so that the gross above grade wall area (vertical fenestration area plus opaque above grade wall area plus opaque door area) is the same as the proposed building.

2. If the proposed building skylight area exceeds the maximum skylight area allowed in Table 502.3, then the standard building shall use the maximum skylight area allowed in Table 502.3 and the opaque roof assembly area shall be increased so that the gross roof area (skylight area plus opaque roof area) is the same as the proposed building.

502.1.3.2 Total SHGCA. If the total proposed building fenestration (vertical fenestration plus skylight) SHGCA (sum of SHGC times fenestration area for each fenestration type) is less than or equal to the total standard building SHGCA resulting from using the fenestration SHGC in Table 502.3, the building shall be considered in compliance with Tables 502.2(1) and 502.3. For this calculation, the standard building fenestration areas shall be the same as the proposed building fenestration areas, provided that the proposed building vertical fenestration area does not exceed the maximum vertical fenestration area allowed in Table 502.3 and the skylight area does not exceed the maximum skylight area in Table 502.3.

1. If the proposed building vertical fenestration area exceeds the maximum vertical fenestration area allowed in Table 502.3, then the standard building shall use the maximum vertical fenestration area allowed in Table 502.3.
2. If the proposed building skylight area exceeds the maximum skylight area allowed in Table 502.3, then the standard building shall use the maximum skylight area allowed in Table 502.3.

TABLE 502.1.2
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ELEMENT, MAXIMUM U-FACTORS

CLIMATE ZONE	**1**	**2**	**3**	**4 except Marine**	**5 and Marine 4**	**6**	**7**	**8**
Roof	-	-	-	-	-	-	-	-
Insulation entirely above deck	U-0.063	U-0.063	U-0.063	U-0.063	U-0.048	U-0.048	U-0.039	U-0.039
Metal buildings (with R-5 thermal block)	U-0.052	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.052	U-0.052
Attic and other	U-0.034	U-0.034	U-0.034	U-0.034	U-0.034	U-0.034	U-0.027	U-0.027
Walls, Above Grade	-	-	-	-	-	-	-	-
Mass	U-0.580	U-0.580	U-0.151	U-0.151	U-0.123	U-0.104	U-0.090	U-0.080
Metal building	U-0.113	U-0.113	U-0.113	U-0.113	U-0.057	U-0.057	U-0.057	U-0.057
Metal framed	U-0.124	U-0.124	U-0.124	U-0.124	U-0.084	U-0.084	U-0.064	U-0.064
Wood framed and other	U-0.089	U-0.089	U-0.089	U-0.089	U-0.089	U-0.089	U-0.089	U-0.051
Walls, Below grade	-	-	-	-	-	-	-	-
Below grade wall	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-0.119	C-0.119
Floors	-	-	-	-	-	-	-	-
Mass	U-0.322	U-0.123	U-0.123	U-0.076	U-0.076	U-0.076	U-0.055	U-0.055
Joist/Framing	U-0.350	U-0.052	U-0.052	U-0.052	U-0.052	U-0.038	U-0.038	U-0.038
Slab-on-Grade Floors	-	-	-	-	-	-	-	-
Unheated Slabs	F-0.730	F-0.730	F-0.730	F-0.730	F-0.730	F-0.730	F-0.730	F-0.540
Heated Slabs	F-1.020	F-1.020	F-1.020	F-1.020	F-0.950	F-0.840	F-0.840	F-0.780

Reason: Since 1991, the Washington State Building Code has implemented a nonresidential building envelope standard. This standard uses either a prescriptive R-value, a prescriptive U-factor, or a total UA alternative. The total UA alternative is by far the most common method used in the state. The IECC in contrast does not include the total UA alternative and is restricted to the prescriptive R-value method unless the applicant applies the requirement of ASHRAE/IESNA Standard 90.1.

The building envelope standard in Washington is comprehensive. It is used for all nonresidential structures, without the need to refer applicants to alternative codes. The IECC in contrast can not be used for most nonresidential structures without referring the applicant to a second code book, ASHRAE/IESNA Standard 90.1.

The Washington State Building Code Council (SBCC)would like move to adoption of a comprehensive national energy code, but the two shortcomings illustrated above make the adoption of the IECC difficult. A recent study conducted by the SBCC identified these two issues as major problems with respect to adoption of the code. The Washington State Building Code Council is submitting this proposal to alleviate these shortcomings.

* This proposal eliminates reference to ASHRAE 90.1 for building envelope compliance.
* This proposal adds a opaque U-factor table to the IECC, to accommodate both the prescriptive U-factor and UA alternative methods.
* This proposal provides a UA alternative method.
* This proposal provides a method to apply the IECC standard to buildings that exceed the maximum glazing areas, by using the UA alternative.

These features allow the IECC to be used exclusively on all nonresidential projects, without the need to refer the applicant to ASHRAE 90.1

The purpose of the code change proposal is to require the application of the requirements of the IECC building envelope requirements when this code is adopted. Add a total UA alternative to chapter 5 of the IECC. Provide a method for exceeding the maximum fenestration limits listed in table 502.3 when using the IECC.

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

Committee Action: Approved as Submitted

Committee Reason: The committee agreed with the proponent that the total UA alternative should be contained within the pages of the IECC. This will give designers ready access to that alternative. The committee acknowledged that the values in this proposed change are more stringent than ASHRAE 90.1 in some cases.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Steve Ferguson, American Society of Heating Refrigerating and Air-Conditioning Engineers, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. These commercial buildings shall meet either the requirements of ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*, or the requirements contained in this chapter.

501.2 Application. The requirements in Sections 502 (Building envelope), 503 (Building mechanical systems), 504 (Service water heating) and 505 (Lighting) shall each be satisfied on an individual basis. Where one or more of these sections is not satisfied, compliance for that section(s) shall be demonstrated in accordance with the applicable provisions of ASHRAE/IESNA 90.1.

Exception~~s~~:

~~1.~~ Buildings conforming to Section 506, provided Sections 502.4, 502.5, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied.

~~2. As an alternative to sections 503, 504 or 505, compliance shall be permitted to be demonstrated using requirements of ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*.~~

(Portions of proposal not shown remain unchanged)

Commenter's Reason: The first part of this public comment adds back the deleted language in Section 501.1 of the IECC, which permits ANSI/ASHRAE/IESNA Standard 90.1-2004 to be used as a compliance measure for Chapter 5 of the IECC. The only reason given by the proponent to remove this alternative is because the Washington State Building Code Council (WSBCC) considers referring to an alternative code as an unacceptable practice in adoption of model codes. Though the State of Washington may find this format unacceptable, other states have adopted the IECC with this compliance alternative in place thus there is no reason to remove the alternative just to satisfy one state or region of the country.

In addition, listing other codes and standards within the body of a model code is not something new. Throughout all of the I-codes it is common practice to list these alternative codes and standards as a means to bring these options for compliance to the attention of code user. For example, compliance with the wind load section of the International Building Code (Section 1609.1.1) can be met by demonstrating compliance using SBCCI SSTD 10 or the AF&PA Wood Frame Construction Manual. Another example is the calculation method for fire resistance of building assemblies in Section 721 of the IBC. ACI Standard 216.1 for concrete and masonry assemblies and ASCE Standard 29 for steel assemblies are listed alternatives to the calculation methods of Section 721. Listing Standard 90.1-2004 as an alternative to the provisions of Chapter 5 of the IECC is consistent with the other I-codes.

Furthermore, eliminating Standard 90.1-2004 as a compliance alterative to Chapter 5 will not allow the Energy Cost Budget (ECB) method of 90.1-2004 as an alternate compliance path to Section 506. The ECB method is a valuable tool for showing compliance using integrated design and should be allowed. Occasions exist where one particular prescriptive criterion may not be cost effective or desirable for a particular building type in a particular climate, but the overall energy savings can be demonstrated using the ECB method.

The second part of this public comment adds back the deleted language in Section 501.2 to permit the envelope provisions of Section 502 to be met individually by showing compliance with Standard 90.1-2004 like that permitted for Sections 503 (Mechanical), 504 (Service Water Heating) and 505 (Electrical). The proponent gives the conclusions of the WSBCC on the IECC as the reason for not listing Section 502 as one of the sections that Standard 90.1-2004 can be used to demonstrate compliance. Like the change to Section 501.1, this should be a decision made locally and not dictated for all code adopting authorities by one state or region's preference for energy code provisions.

EC82, section 501.2, as submitted, complicates the IECC and is confusing to the user. It basically states that the envelope provisions of ASHRAE/IESNA Standard 90.1-2004 cannot be used to satisfy the IECC and allows some portions of 90.1-2004 for compliance but not others. The reason the IECC committee gave for not allowing the provisions of the envelope portion of 90.1-2004 are not clear. While some of the envelope provisions of 90.1-2004 are less stringent than the IECC, some others are more stringent. In particular, many of the envelope provisions for residential (other than low rise) are more stringent in 90.1-2004.

Public Comment 2:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

501.2 Application. The requirements in Sections 502 (Building envelope), 503 (Building mechanical systems), 504 (Service water heating) and 505 (Lighting) shall each be satisfied on an individual basis.

Exceptions:

1. Buildings conforming to Section 506, provided Sections 502.4, 502.5, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied.
2. As an alternative to Sections <u>502,</u> 503, 504 or 505, compliance shall be permitted to be demonstrated using-requirements of
3. ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-RiseResidential Buildings*.

Commenter's Reason: The provisions of the original proposal for consideration of the UA of the entire building envelop as an alternate path of compliance are consistent with the requirements of the legacy code the *International Energy Conservation Code* (IECC) is based upon, the CABO *Model Energy Code,* for area weighted average U-factors for each exterior building envelope component. As such it is appropriate that the *International Energy Conservation Code* permit use of this method of energy conservation compliance, as is the provisions of the original proposal for the SHGCA of the entire fenestration area in the exterior building envelop.

Including these alternate paths of compliance, however, does not justify no longer permitting use of the building envelope requirements of ASHRAE 90.1. Historically the *International Energy Conservation Code* has been developed as an equivalent to ASHRAE 90.1, which is recognized in the 1992 Energy Policy Act. Also, ASHRAE 90.1 contains prescriptive provisions for the building exterior that are different from those of the IECC, but which provide a similar level of energy efficiency. Retaining reference to these in the IECC, along with consideration of UA and SHGCA, would provide the building designer with maximum flexibility.

This public comment seeks approval of the original proposal, with a modification that permits use of ASHRAE 90.1 as an alternate to Section 502. Section 502 provides the prescriptive provisions for exterior building envelopes in commercial buildings.

Public Comment 3:

Susan Herrenbruck, Extruded Polystyrene Foam Association (XPSA), requests Disapproval.

Commenter's Reason: At the Detroit hearings in September 2005, EC 16 was defeated. The net effect of this action was to roll-back the required minimum levels of energy-efficiency performance codes required under the IECC. This was done with the understanding that the committee was setting a base level of performance code and that trade-offs against this standard were not going to be easily given in the future.

The proposal is an attempt to substitute energy performance standards for the consensus-standard recommendations for insulation in ASHRAE 90.1. XPSA believes this sets a dangerous precedent and is just the beginning for others to start to introduce industry-interested trade-offs in the form of code language. While it is clear that this proposal only affects door and fenestration factors, it is clear this is the beginning of the trade-off against building envelope ASHRAE-set standards and as such reflects an attempt to write standard in the guise of building code language. A more proper forum to achieve the intended effects of this language is to bring these standards into the ASHRAE consensus-standard development process. Here, both intended and unintended effects can be thoroughly vetted by all those with an interest in building envelope insulation and fenestration criteria and the test methods used to determine such final levels of performance.

XPSA urges disapproval of the committee's action so that the baseline energy code is not further compromised.

Public Comment 4:

Daniel J. Walker, P.E., Thomas Associates, Inc., representing Metal Building Manufacturers Association, Inc., requests Disapproval.

Commenter's Reason: The proposed change takes away the designer's option to use ASHRAE 90.1 to show energy code compliance for the building envelope (IECC Section 502), which is a step in the wrong direction if we're trying to promote energy efficiency. All of the requirements in ASHRAE 90.1 are determined using a technically and economically justified model to perform calculations for the determination of appropriate levels for performance of HVAC, lighting and the building envelope. Without the reference to ASHRAE 90.1 as an alternative for showing compliance for the building envelope, this proposed change reduces the effectiveness of the code and will prevent jurisdictions from enforcing ASHRAE 90.1 where appropriate.

Final Action: AS AM AMPC____ D

EC87-06/07
Table 502.2(1)

Proposed Change as Submitted:

Proponent: John Neff, Washington State Building Code Council

Revise table as follows:

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ~~ASSEMBLIES~~ ELEMENTS

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Roofs								
Insulation entirely above deck	R-15 ci	R-15 ci	R-15 ci	R-15 ci	R-20 ci	~~R-20 ci~~ R-25 ci	R-25 ci	R-25 ci
Metal buildings (with R-5 thermal blocks[a])[b]	R-19 + R-10	R-19	R-19	R-19	R-19	R-19 + R-10	R-19 + R-10	R-19 + R-10
Attic and other	R-30	R-30	R-30	R-30	R-30	~~R-30~~ R-38	R-38	R-38
Walls, Above Grade								
Mass	NR	NR	R-5.7 ci[c,e]	R-5.7 ci[c]	R-7.6 ci	R-9.5 ci	R-11.4 ci	R-13.3 ci
Metal building2	R-13	R-13	R-13	R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13
Metal framed	R-13	R-13	R-13	R-13	R-13 + R-3.8 ci	R-13 + R-3.8 ci	R-13 + R-7.5 ci	R-13 + R-7.5 ci
Wood framed and other	R-13	R-13	R-13	R-13	R-13 + R-3.8 ci	R-13 + R-3.8 ci	R-13 + R-7.5 ci	R-13 + R-7.5 ci
Walls, Below Grade								
Below grade wall[d]	NR	NR	NR	NR	~~NR~~ R-10 ci	~~NR~~ R-10 ci	~~R-7.5 ci~~ R-10 ci	~~R-7.5 ci~~ R-10 ci
Floors								
Mass	NR	R-5 ci	R-5 ci	R-10 ci	R-10 ci	~~R-10 ci~~ R-15 ci	R-15 ci	R-15 ci
Joist/Framing	NR	R-19	R-19	R-19	R-19	R-30	R-30	R-30
Slab-on-Grade Floors								
Unheated Slabs	NR	NR	NR	NR	~~NR~~ R-10 for 24 in. below	~~NR~~ R-10 for 24 in. below	~~NR~~ R-10 for 24 in. below	R-10 for 24 in. below
Heated Slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 24 in. below	R-10 for 36 in. below	R-10 for 36 in. below	R-10 for 48 in. below
Opaque Doors								
Swinging	U – 0.70	U – 0.70	U – 0.70	U – 0.70	~~U – 0.70~~ U-0.60	~~U – 0.70~~ U-0.60	~~U – 0.70~~ U-0.60	U – 0.50
Roll-up or sliding	U – 1.45	U – 1.45	U – 1.45	U – 1.45	~~U – 1.45~~ U-0.60	U – 0.50	U – 0.50	U – 0.50

For SI: 1 inch = 25.4 mm
ci — Continuous Insulation
NR – No Requirement
a. Thermal blocks are a minimum R-5 of rigid insulation, which extends 1-inch beyond the width of the purlin on each side, perpendicular to the purlin.
b. Assembly descriptions can be found in Table 502.2(2)
c. R-5.7 ci may be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 in. or less on center vertically and 48 in. or less on center horizontally, with ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu-in./h-f^2 F.
d. When heated slabs are placed below grade, below grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.
e. Insulation is not required for mass walls in Climate Zone 3A located below the "Warm-Humid" line, and in Zone 3B.

Reason: Some of the insulation criteria for Climate Zones 5 and 6 are below those that have been enforced in State Energy Codes for a number of years. The proposed revisions reflect requirements from the Washington State Energy Code. Changes were made for colder climate zones for consistency. The purpose of the code change proposal is to increase insulation levels in certain climate zones.

Cost Impact: The code change proposal will not increase the cost of construction in those states that already have this stringency, such as Washington State. The code change proposals may increase the cost of construction in other locations where these standards are not common practice.

Committee Action: Disapproved

Committee Reason: The proposed changes to these climate zones is based upon the regulations imposed by a single state. While any state or jurisdiction can modify the energy code to use different values, there has been no technical data or analysis provided to justify these proposed values for this national code.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Lorraine Ross, Intech Consulting Inc., representing the Alliance for the Polyurethanes Industry, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES ELEMENTS

CLIMATE ZONE	**5 and Marine 4**	**6**	**7**	**8**
Roofs				
Insulation entirely above deck	R-20 ci	R-25 ci	R-25 ci	R-25 ci
Metal buildings (with R-5 thermal blocks[a])[b]	R-19	R-19 + R-10	R-19 + R-10	R-19 + R-10
Attic and other	R-30	R-30 ~~R-38~~	R-38	R-38
Walls, Above Grade				
Mass	R-7.6 ci	R-9.5 ci	R-11.4 ci	R-13.3 ci
Metal building2	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13
Metal framed	R-13 + R-3.8 ci	R-13 + R-3.8 ci	R-13 + R-7.5 ci	R-13 + R-7.5 ci
Wood framed and other	R-13 + R-3.8 ci	R-13 + R-3.8 ci	R-13 + R-7.5 ci	R-13 + R-7.5 ci
Walls, Below Grade				
Below grade walld	R-10 ci	R-10 ci	R-10 ci	R-10 ci
Floors				
Mass	R-10 ci	R-15 ci	R-15 ci	R-15 ci
Joist/Framing	R-19	R-30	R-30	R-30
Slab-on-Grade Floors				
Unheated Slabs	R-10 for 24 in. below	R-10 for 24 in. below	R-10 for 24 in. below	R-10 for 24 in. below
Heated Slabs	R-7.5 for 24 in. below	R-10 for 36 in. below	R-10 for 36 in. below	R-10 for 48 in. below
Opaque Doors				
Swinging	U-0.60	U-0.60	U-0.60	U – 0.50
Roll-up or sliding	U-0.60	U – 0.50	U – 0.50	U – 0.50

(Portions of table not shown remain unchanged)

Commenter's Reason: EC 87 proposes to change Table 502.2(1) to reflect common construction practices in Climate Zones 5 and Marine 4, 6, 7, and 8.

Final Action: AS AM AMPC____ D

EC88-06/07
Table 502.2(1)

Proposed Change as Submitted:

Proponent: Daniel J. Walker, P.E., Metal Building Manufacturers Association, Inc. (MBMA)

Revise table as follows:

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Roofs								
Metal buildings (with R-5 thermal spacer blocks[a])[b]	R-19 ~~+ R-10~~	R-19	R-19	R-19	R-19	R-19	R-19 ~~+ R-10~~	R-19 + R-~~10~~13
Walls, Above Grade								
Metal building[b]	R-13	R-13	R-13	R-13	R-13 ~~+ R-13~~	R-13 ~~+ R-13~~	R-13 + R-13	R-13 + R-13

a. Thermal spacer blocks are 1" thick x 3" wide and are a minimum R-5 of rigid insulation~~, which extends 1-inch beyond the width of the purlin on each side, perpendicular to the purlin~~.

(Portions of table and footnotes not shown remain unchanged)

Reason: The data that was submitted to ICC in 2004 incorrectly states the data from ASHRAE/IESNA 90.1-2004 Tables 5.5.1-1 through 5.5.1-8.

The purpose of this code change proposal is to correct the information that was previously inserted into the code, which is inconsistent with ASHRAE 90.1-2004.

The information contained in the tables for walls was incorrectly taken from ASHRAE 90.1-2004. The proposed code change accurately reflects what is contained in ASHRAE 90.1-2004 for metal building roofs and walls. The thermal spacer blocks for standing seam metal roofs in ASHRAE 90.1 are not defined as being "1 in. beyond the width of the purlin…". In fact, there is no description of the thermal spacer blocks in the ASHRAE standard at all. The information provided in this proposal accurately reflects the original data that was submitted to ASHRAE by the North American Insulation Manufacturers Association (NAIMA), and was the basis for the ASHRAE 90.1 values. Finally, the metal building roof insulation values for zones 1, 7 and 8; and the metal building wall insulation values shown for zones 7 and 8 are inconsistent with ASHRAE 90.1. The information shown in this proposal reflects the corrected values for commercial metal building roof and wall constructions from ASHRAE 90.1-2004, and brings the two documents into sync. The term "spacer" has also been inserted in the table and footnote to differentiate this common metal building industry term from the term "thermal block", which is already defined within ASHRAE 90.1 and has to do with HVAC systems.

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

Committee Action: **Disapproved**

Committee Reason: This proposed change would provide an undesirable reduction in the energy efficiency requirements of the code, with no technical justification.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Daniel J. Walker, P.E., Thomas Associates, Inc., representing Metal Building Manufacturers Association, Inc., requests Approval as Submitted.

Commenter's Reason: The proposed change takes the minimum insulation requirements for Metal Buildings directly from ASHRAE 90.1-2004, which is an ANSI approved standard referenced in the 2006 IECC. The ASHRAE method for determining the minimum required levels of insulation for each climate zone is a fair and equitable method that uses a combination of economic and performance factors to justify the required minimum levels of insulation for each climate zone. The minimum insulation levels for Metal Buildings currently in the International Energy Conservation Code were not derived using technical justification, and were arbitrarily selected without performing a cost-benefit analysis.

Final Action: AS AM AMPC____ D

EC89-06/07

Table 502.2(2)

Proposed Change as Submitted:

Proponent: Daniel J. Walker, P.E., Metal Building Manufacturers Association, Inc. (MBMA)

Revise table as follows:

TABLE 502.2(2)
METAL BUILDING ASSEMBLY DESCRIPTIONS

ROOFS	DESCRIPTION	REFERENCE
~~R-19 + R-10~~	~~Filled cavity roof.~~ ~~Thermal blocks are a minimum, R-5 of rigid insulation, which extends 1 in. beyond the width of the purlin on each side, perpendicular to the purlin.~~ ~~This construction is R-10 insulation batts draped perpendicularly over the purlins, with enough looseness to allow R-19 batt to be laid above it, parallel to the purlins.~~ ~~Thermal blocks are then placed above the purlin/batt, and the roof deck is secured to the purlins. In the metal building industry, this is known as the "sag and bag" insulation system.~~	~~ASHRAE/IESNA 90.1 Table A2.3~~
R-19	Standing seam with single insulation layer. Thermal spacer blocks are a minimum 1" thick x 3" wide R-5 of rigid insulation~~, which extends 1 in. beyond the width of the purlin on each side, perpendicular to the purlin~~. ~~This construction~~ R-19 fiberglass insulation batts are draped perpendicular~~ly~~ over the purlins. Thermal spacer blocks are then placed above the purlin/batt, and the roof deck is secured to the purlins.	ASHRAE/IESNA 90.1 Table A2.3
R-19 + R13	Filled Cavity roof. Thermal spacer blocks are a minimum, 1" thick x 3" wide R-5 of rigid insulation. R-13 fiberglass insulation batts are draped perpendicular over the purlins with enough looseness to allow R-19 batt to be laid above it, parallel to the purlins. Thermal spacer blocks are then placed above the purlin/batt, and the roof deck is secured to the purlins,	ASHRAE/IESNA 90.1 Table A2.3
Walls		

(Portions of table not shown remain unchanged)

Reason: The data that was submitted to ICC in 2004 incorrectly states the data and references from ASHRAE/IESNA 90.1 Table A2.3 and ASHRAE 90.1-2004 Tables 5.5.1-1 through 5.5.1-8.

The purpose of this code change proposal is to correct the information that was inserted into the code in the 2004 cycle, which is incorrect.

The information contained in the tables was incorrectly taken from ASHRAE 90.1-2004. The proposed code change accurately reflects what is contained in ASHRAE 90.1-2004 for metal building roofs and walls. The thermal blocks for standing seam metal roofs in ASHRAE 90.1 are not defined as being “1 in. beyond the width of the purlin…”. In fact, there is no description of the thermal blocks in the ASHRAE standard at all. The description provided in this proposal accurately reflects the original data that was submitted to ASHRAE by the North American Insulation Manufacturers Association (NAIMA), and was the basis for the ASHRAE 90.1 values. Furthermore, the term “sag and bag” is not common within the metal building industry, and this term is not referenced anywhere in ASHRAE 90.1. The information shown in this proposal reflects the corrected descriptions for commercial metal building roof and wall constructions from ASHRAE 90.1-2004 and synchronizes the two documents. The term “spacer” has also been inserted in the table to differentiate this common metal building industry term from the term “thermal block”, which is already defined within ASHRAE 90.1 and has to do with HVAC systems.

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

Committee Action: **Disapproved**

Committee Reason: The proposed deletion of the row for R19 + R 10 is a problem because the information is still needed, while the proposed new row for R 19 + R 13 is not needed because this is not specified anywhere in the code.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Daniel J. Walker, P.E., Thomas Associates, Inc., representing Metal Building Manufacturers Association, Inc., requests Approval as Submitted.

Commenter’s Reason: This change seeks to correct what was approved during the last code cycle in Table 502.2(2), and also cleans up some terminology. The term “sag and bag” is not a common term in the metal building industry, and has no place in the code. The addition of the word “spacer” clarifies the term used to describe the insulation block used on top of cold-formed purlins to minimize thermal bridging. By adding the word “spacer” it also would mirror the use of this term in ASHRAE 90.1. In ASHRAE 90.1, the term “thermal block”, without the addition of “spacer”, would be confusing because that term is already defined as a collection of zones in an HVAC system.

Throughout the table other changes are shown to clarify the description of the thermal spacer block, which are consistent with the original modeling of this system that was performed by the North American Insulation Manufacturers Association (NAIMA).

Final Action: AS AM AMPC____ D

EC90-06/07

202 (New), 502.3, 502.3.1, 502.3.1.1 (New), Table 502.3.1 (New), 502.3.2, 505.2.5 (New), Chapter 6 (New)

Proposed Change as Submitted:

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

Charlie Curcija, Carlie, Inc., representing the American Architectural Manufacturers Association

1. Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

DAYLIT AREA UNDER SKYLIGHTS. The area underneath the skylight that retains at least 70% of the daylight luminance directly under the skylight. The daylit area shall be taken as the sum of the following:

1. The horizontal projection of the outline of the skylight glazed opening onto the floor directly beneath the skylight,

2. Additional areas around the perimeter of the area defined in Item 1 above. The width of these areas shall be the lesser of the following:
   2.1. 70% of the height between the floor directly beneath the skylight and the underside of the skylight,
   2.2. 50% of the horizontal distance from the skylight to the edge of glazing in the nearest adjacent skylight, or
   2.3. The distance to the nearest vertical surface of any permanent partition that is farther away from the horizontal projection of the outline of the skylight upon the floor below than 70% of the distance between the top of the partition and the ceiling. If a ceiling is not provided, the distance shall be measured from the top of the partition to the underside of the roof slab above.

AMBIENT LIGHTING. Luminaires that provide ambient diffuse lighting in a space. Ambient lighting includes, but is not limited to, lighting by linear fluorescent luminaires (direct, indirect or direct/indirect), high bay or low bay luminaires.
Lighting not considered ambient lighting includes: emergency lighting, electric signs, display lighting, decorative lighting (such as chandeliers), theatrical lighting, or wall sconces less than 150 W.

MULTI LEVEL DAYLIGHTING CONTROLS. Systems that reduce the lighting power draw in a series of at least two levels or by continuous dimming in response to availability of daylight within the interior space (sometimes referred to as "photo control").

HAZE VALUE. The ratio of diffusely transmitted light to total light transmitted.

2. Revise as follows:

502.3 Fenestration. (Prescriptive). Fenestration shall comply with ~~Table 502.3~~ Sections 502.3.1 and 502.3.2.

502.3.1 Maximum area. The vertical fenestration area (not including opaque doors) shall not exceed the percentage of the gross wall area specified in Table 502.3. The skylight area shall not exceed the percentage of the gross roof area specified in Table 502.3 or Section 502.3.1.1.

3. Add new text as follows:

502.3.1.1 Buildings with daylighting controls: In Use Group M, S-1 and S-2 buildings the percentage of gross roof assembly area that is permitted to be skylights shall be limited to 6%, when the following criteria are met:

1. The haze value of the combined skylight glazing materials or diffuser in the skylight assembly shall be 90% or greater when tested according to ASTM D1003, without consideration of the scope of maximum haze.
2. All ambient lighting in daylit areas under skylights is controlled by multi-level daylighting controls that comply with Section 505.2.5,
3. The area weighted average U-factor and SHGC of the skylight does not exceed the values given in Table 502.3.1

TABLE 502.3.1
MAXIMUM U-FACTOR AND SHGC FOR SKYLIGHTS
IN BUILDINGS WITH DAYLIGHTING CONTROLS

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 & MARINE 4	6	7	8
U-factor	1.35	0.95	0.90	0.90	0.90	0.90	0.90	0.60
SHGC	0.35	0.50	0.55	0.55	0.55	0.60	NR	NR

4. Revise as follows:

502.3.2 Maximum *U*-factor and SHGC. For vertical fenestration, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3, based on the window projection factor. For skylights, the maximum *U* factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3.

The window projection factor shall be determined in accordance with Equation 5-1.

PF = *A*/*B* **(Equation 5-1)**

where:

PF = Projection factor (decimal).
A = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently
attached shading device to the vertical surface of the glazing.
B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.

Where different windows or glass doors have different *PF* values, they shall each be evaluated separately, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

Exception: The maximum U-factor and solar heat gain coefficient (SHGC) of skylights in buildings that meet the criteria of Section 502.3.1.1 shall be as specified in Table 502.3.1.

5. Add new text as follows:

505.2.5 Automatic daylighting controls. When automatic daylighting controls are required by this code, the level of ambient lighting in the daylit areas shall be separately controlled by at least one multi-level daylighting control. The multi-level daylighting control shall reduce electric lighting in response to available daylight in steps or uniformly as described in Section 505.2.2.1 and shall automatically reduce ambient lighting power in the daylit area in direct proportion to the amount of lighting provided by daylighting to 50% of rated power or less. The multi-level daylighting control shall be located so that calibration and set point adjustment controls are readily accessible. The calibration adjustment controls shall also be located in such a manner as to not receive direct lighting from the skylights.

ASTM
D1003-00 Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics

Reason: This proposal permits the maximum skylight roof area to be increased from 3% to 6% of the roof area in buildings that are equipped with multilevel daylighting controls, when the skylights meet certain criteria for U-factor, SHGC and haze.

A study conducted by Carli, Inc, based on research conducted by Heschong Mahone Group, Inc. on 24 different types of skylights in 21 cities show that tremendous savings in both energy consumption and energy cost can be achieved by combining increased skylight area with multilevel daylighting controls in mercantile and warehouse buildings. These types of occupancies commonly consist of large open areas with high ceilings. The study is titled "Energy Study in Support of the Proposed Revision of the International Energy Conservation Code (IECC), Skylight Portion of Table 502.3 – Part 1: Daylighting Controls", dated February 14, 2006 by Carli, Inc. This report can be downloaded from www.fenestration.com/Codes/Skylights/Skylight-Energy-Analysis_Daylighting_rev5.pdf. Additional information and more detailed data can be found at www.fenestration.com/skylights.php.

The savings occur in all climate zones, and are optimized on average when the skylight area is approximately 6% of the roof area.

Based on the research results, this proposal would increase the maximum skylight roof area percentage permitted under prescriptive design from 3% to 6%, when the following criteria are met:

1. The building is Use Group M, S-1 or S-2 occupancy. Most of the studies conducted to date have focused upon these types of structures. Although there is indication that these benefits might also apply in other occupancies, further study is needed. So this proposal is limited to Use Group M, S-1 and S-2 occupancies.
2. The haze of the combined glazing material in the skylight assembly is 90% or greater. The benefit of daylighting in reducing additional lighting needs is dependent upon the distribution of daylight that is provided to the space through the skylight, as indicated by the haze of the glazing material. The studies conducted assumed a glazing material with a haze of 90% or greater.
3. All ambient lighting in the daylit areas under the skylight is controlled by two step (On/50%/Off) or greater (multi-step or continuous) lighting controls. The studies looked at the more conservative scenario, which is the two-step lighting control system. It is anticipated that multi-step or continuous lighting controls, which would respond more closely to the amount of actual daylighting being provided to the space, would provide even greater energy savings, but with somewhat increased capital cost.
4. The area weighted average U-factor and SHGC of the skylights does not exceed the values given below:

Climate Zone	**1**	**2**	**3**	**4 except Marine**	**5 & Marine**	**6**	**7**	**8**
U-Factor	1.35	0.95	0.90	0.90	0.90	0.90	0.90	0.60
SHGC	0.35	0.50	0.55	0.55	0.55	0.60	NR	NR

These are the values derived from the wide variety of skylights considered in the study. The study showed energy cost savings in several climate zones for skylights that did not meet this criterion, but the proposal is being limited to skylights that meet this criterion, because energy use savings and cost savings were seen in all climate zones for all skylight that met this criteria, except for one skylight in one of the studied cities in climate zone 4.

The energy cost saving achieved for buildings equipped with skylights and lighting controls that met the above criteria, with skylights at 6% of roof area, in comparison to buildings with skylights that meet current code criteria at 3% of roof area and no lighting controls, is shown in the table below.

Energy Cost Savings (in percent)

Climate Zone		1	2	3	4 except Marine	5 & Marine	6	7	8
Warehouse	**Glass**	25-35	24-32	27-40	(5)-31	18-31	15-23	32-40	27-37
	Plastic	26-32	24-29	23-38	6-32	25-32	22-25	37-39	26
Big Box Store	**Glass**	15-22	13-19	13-28	6-15	7-15	6-11	5-15	9-15
	Plastic	9-12	9-13	10-26	5-17	6-17	4-12	2-10	15
Grocery	**Glass**	7-10	5-7	5-8	2-5	2-9	2-4	2-3	2-4
	Plastic	5-7	4-5	3-8	2-7	3-6	1-4	1-4	4

The area daylit by the skylight is that area directly underneath the skylight, and the perimeter area within 0.70 times the height between the floor below the skylight and the underside of the skylight, unless two or more skylights are close enough to each other that the 0.70 distance between them overlaps, or there is a permanent partition within the perimeter zone that is high enough to block the light from the skylight reaching some portion of the floor in what would otherwise be considered part of the daylit zone. Figure 1 explains how the permanent partitions could block daylight from some portion of the otherwise daylit area.

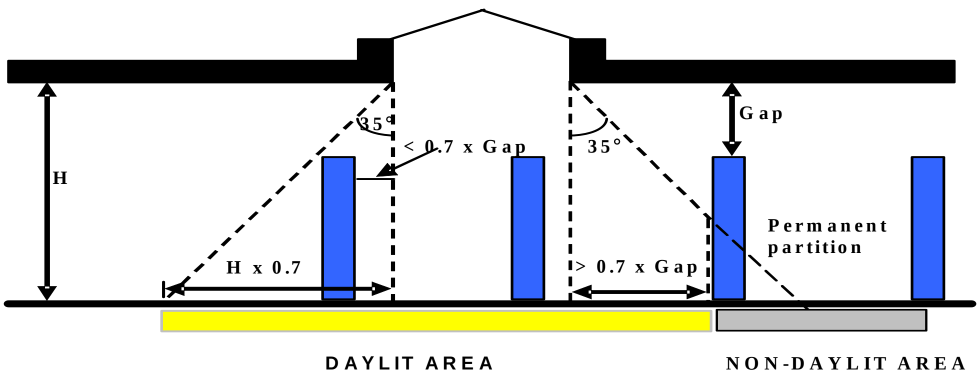


FIGURE 1: DAYLIT AREA UNDER SKYLIGHT

It should be noted that the proposed criteria resulted in an energy loss in only one of the configurations studied – in a warehouse equipped with one of the skylights studied in Seattle, when compared with the a similar building with glass skylights at 3% of the roof area, that met the current code criteria. In all other cases energy use and cost savings were achieved, and in many cases that energy cost savings exceeded 20 or even 30%.

Therefore we urge the committee to approve this proposal and permit the benefit of daylighting to reduce lighting load to be used in buildings that are designed under the prescriptive method of the IECC.

Cost Impact: The code change proposal will not increase the cost of construction, as it provides an alternate method of providing lighting to a building that is not required to be used.

Note: The following analysis was not in the Code Change Proposal book but was published in the "Errata to the 2006/2007 Proposed Changes to the International Codes and Analysis of Proposed Reference Standards" provided at the code development hearings:

Analysis: Review of proposed new standard indicated that, in the opinion of ICC Staff, the standard did comply with ICC standards criteria.

Committee Action: Disapproved

Committee Reason: The proposed new text would reduce stringency of U-Factors in some climate zones. In addition, the committee was concerned with ability to apply this method and enforce the code, given the possibility that changes in locations of partitions on the interior could affect the values determined.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment 1:

Jonathan R. McHugh, P.E., LC, Heschong Mahone Group, representing The Wal-Mart Company, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

SECTION 202
GENERAL DEFINITIONS

DAYLIT AREA UNDER SKYLIGHTS. ~~The area underneath the skylight that retains at least 70% of the daylight luminance directly under the skylight~~ . The dimensions of the daylit area under skylights shall be ~~taken as the sum of~~ the following:

1. The horizontal projection of the outline of the skylight glazed opening or the opening at the base of the light well onto the floor directly beneath the skylight,
2. ~~Additional areas around the perimeter of the area defined in Item 1 above. The width of these areas shall be~~ Plus in each horizontal direction, the lesser of the following:
   2.1. 70% of the height between the floor directly beneath the skylight and the ~~underside of the skylight~~ the ceiling,
   2.2. 50% of the horizontal distance from the skylight to the edge of glazing in the nearest adjacent skylight, or
   2.3. The distance to the nearest vertical surface of any permanent partition that is farther away from the horizontal projection of the outline of the skylight upon the floor below than 70% of the distance between the top of the partition and the ceiling. If a ceiling is not provided, the distance shall be measured from the top of the partition to the underside of the roof slab above.

~~**AMBIENT LIGHTING.** Luminaires that provide ambient diffuse lighting in a space. Ambient lighting includes, but is not limited to, lighting by linear fluorescent luminaires (direct, indirect or direct/indirect), high bay or low bay luminaires. Lighting not considered ambient lighting includes: emergency lighting, electric signs, display lighting, decorative lighting (such as chandeliers), theatrical lighting, or wall sconces less than 150 W.~~

Lighting, general: lighting that provides a substantially uniform level of illumination throughout an area. General lighting includes, but is not limited to, lighting by linear fluorescent luminaires (direct, indirect or direct/indirect), high bay or low bay luminaires. General lighting shall not include emergency lighting, decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialized application or feature within such area.

MULTI LEVEL DAYLIGHTING CONTROLS. Systems that automatically reduce the lighting power draw in a series of at least two levels or by continuous dimming in response to availability of daylight within the interior space (sometimes referred to as "photo control").

HAZE VALUE. The ratio of diffusely transmitted light to total light transmitted as defined in ASTM D1003-00 notwithstanding its scope.

502.3 Fenestration. (Prescriptive). Fenestration shall comply with Table 502.3 Sections 502.3.1 and 502.3.2.

502.3.1 Maximum area. The vertical fenestration area (not including opaque doors) shall not exceed the percentage of the gross wall area specified in Table 502.3. The skylight area shall not exceed ~~the percentage~~ three percent (3%) of the gross roof area ~~specified in Table 502.3 or Section 502.3.1.1~~.

Exception: The skylight area is allowed up to 6 percent (6%) of the gross roof area, provided:

1. Skylighting systems having a glazing material or diffuser with a measured haze value greater than 90% when tested according to ASTM D1003-00 (notwithstanding its scope of maximum haze), and
2. Skylight visible light transmittance is 40% or greater, and
3. *General lighting* in *daylit areas under skylights* are controlled by automatic multi-level daylighting controls as defined in Section 505.2.5.

~~**502.3.1.1 Buildings with daylighting controls:** In Use Group M, S-1 and S-2 buildings the percentage of gross roof assembly area that is permitted to be skylights shall be limited to 6%, when the following criteria are met:~~

~~1. The haze value of the combined skylight glazing materials or diffuser in the skylight assembly shall be 90% or greater when tested according to ASTM D1003, without consideration of the scope of maximum haze.~~
~~2. All ambient lighting in daylit areas under skylights is controlled by multi-level daylighting controls that comply with Section 505.2.5,~~
~~3. The area weighted average U-factor and SHGC of the skylight does not exceed the values given in Table 502.3.1~~

~~**TABLE 502.3.1**~~
~~**MAXIMUM U-FACTOR AND SHGC FOR SKYLIGHTS**~~
~~**IN BUILDINGS WITH DAYLIGHTING CONTROLS**~~

~~**CLIMATE ZONE**~~	~~**1**~~	~~**2**~~	~~**3**~~	~~**4 EXCEPT MARINE**~~	~~**5 & MARINE 4**~~	~~**6**~~	~~**7**~~	~~**8**~~
~~U-factor~~	~~1.35~~	~~0.95~~	~~0.90~~	~~0.90~~	~~0.90~~	~~0.90~~	~~0.90~~	~~0.60~~
~~SHGC~~	~~0.35~~	~~0.50~~	~~0.55~~	~~0.55~~	~~0.55~~	~~0.60~~	~~NR~~	~~NR~~

502.3.2 Maximum *U*-factor and SHGC. For vertical fenestration, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3, based on the window projection factor. For skylights, the maximum *U* factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3.

The window projection factor shall be determined in accordance with Equation 5-1.

$PF = A/B$ **(Equation 5-1)**

where:

PF = Projection factor (decimal).
A = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing.
B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.

Where different windows or glass doors have different *PF* values, they shall each be evaluated separately, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

Exceptions: ~~The maximum U-factor and solar heat gain coefficient (SHGC) of skylights in buildings that meet the criteria of Section 502.3.1.1 shall be as specified in Table 502.3.1.~~

Skylighting systems are exempt from the SHGC requirements provided:

1. Skylighting systems having a glazing material or diffuser with a measured haze value greater than 90% when tested according to ASTM D1003-00 (notwithstanding its scope of maximum haze), and
2. Skylight visible light transmittance is 40% or greater, and
3. *General lighting* in *daylit areas under skylights* are controlled by automatic multi-level daylighting controls as defined in Section 505.2.5.

505.2.5 Automatic daylighting controls. When automatic daylighting controls are required by this code, ~~the level of ambient~~ *general lighting* in the daylit areas shall be separately controlled by at least one *multi-level daylighting control*. The *multi-level daylighting control* shall reduce electric lighting in response to available daylight in steps or uniformly as described in Section 505.2.2.1 and shall automatically reduce ~~ambient~~ *general lighting* power in the daylit area in ~~direct proportion~~ response to the amount ~~of lighting provided by daylighting to 50% of rated power or less~~. of daylight available in the space. When the daylit illuminance in the space is greater than the rated illuminance of the *general lighting* of *daylit areas under skylight*, the *general lighting* shall be automatically controlled so that its power draw is no greater than 35% of its rated power. The multi-level daylighting control shall be located so that calibration and set point adjustment controls are readily accessible. ~~The calibration adjustment controls shall also be located in such a manner as to not receive direct lighting from the skylights~~.

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS - FENESTRATION

Climate Zone	**1**	**2**	**3**	**4 except Marine**	**5 and Marine 4**	**6**	**7**	**8**
Vertical Fenestration (40% maximum of above-grade wall)								
U-Factor								
Framing materials other than metal with or without metal reinforcement or cladding								
U-Factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront *U*-Factor	1.20	0.70	0.60	0.50	0.45	0.45	0.45	0.45
Entrance Door U-Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other-U-Factor[1]	1.20	0.75	0.65	0.55	0.55	0.55	0.50	0.50
SHGC-All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	NR	NR
SHGC: 0.25 < PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (low diffusion or no photocontrols - 3% maximum, high diffusion with photocontrols - 6% maximum)								
Glass								
U-Factor	1.60	1.05	0.90	0.60	0.60	0.60	0.60	0.60
SHGC	0.40	0.40	0.40	0.40	0.40	0.40	NR	NR
Plastic								
U-Factor	1.90	1.90	1.30	1.30	1.30	0.90	0.90	0.60
SHGC	0.35	0.35	0.35	0.62	0.62	0.62	NR	NR

NR = No requirement.
PF = Projection factor (See Section 802.3.2)
[1] All others includes operable windows, fixed windows and non-entrance doors.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: The EC-90-06/07 proposal attempts to correct a major shortcoming in the IECC, namely that that the skylighting systems with the most savings are prescriptively prohibited from use. The current IECC fenestration requirements assume that the presence of skylights results in heating and cooling impacts but has NO impact on electric lighting use. Under such assumptions it is imperative to limit solar heat gains in mild and warm climates.

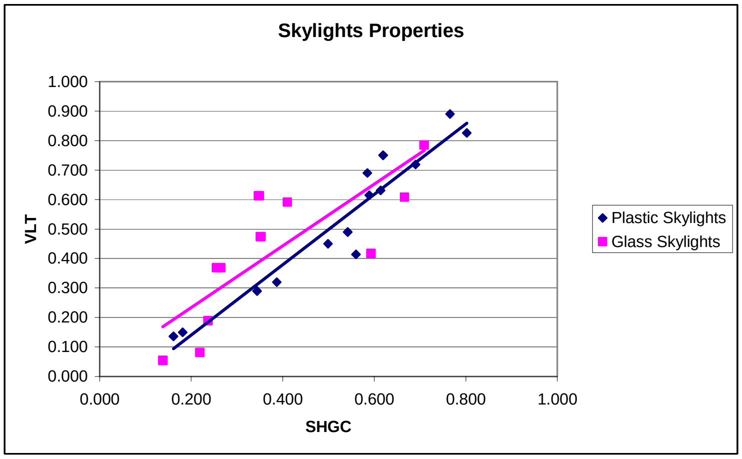


Figure 1: Relationship between SHGC and Visible Light transmittance (VLT)

However, the current IECC prescriptive fenestration requirements (§502.3) have no accommodation for skylighting systems that are used specifically to displace electric lighting loads. For skylighting systems that are displacing electric lighting, the systems that transmit the most light (high VLT) save the most total energy costs (including lighting, heating and air conditioning). Since 54% of the heat content of solar radiation is in the visible spectrum (2005 ASHRAE Fundamentals p. 31.14), visible light transmittance and solar heat gain coefficient are highly correlated especially for plastic glazings, typically used in commercial unit skylights (see Figure 1).

Figure 2 plots the total annual energy savings energy cost savings (lighting, heating and cooling) relative to a base building with no skylights for two sets of runs: 1) with photocontrols and 2) without photocontrols. These runs reflect the maximum energy savings for a given skylight as long as it is does not exceed 6%. The y axis of this plot is energy cost savings in units of $/sf-yr. The x-axis is the SHGC of a variety of real plastic skylight properties. The results on the bottom half of the graph are the negative energy savings that result from adding skylights **without photocontrols**. For the no photocontrols case, as SHGC is increased, the negative savings become even more negative (or energy consumption increases more). This is the case that the IECC addresses by limiting the SHGC of photocontrols especially in the warmer climate zones (e.g climate zones 1, 2, and 3).

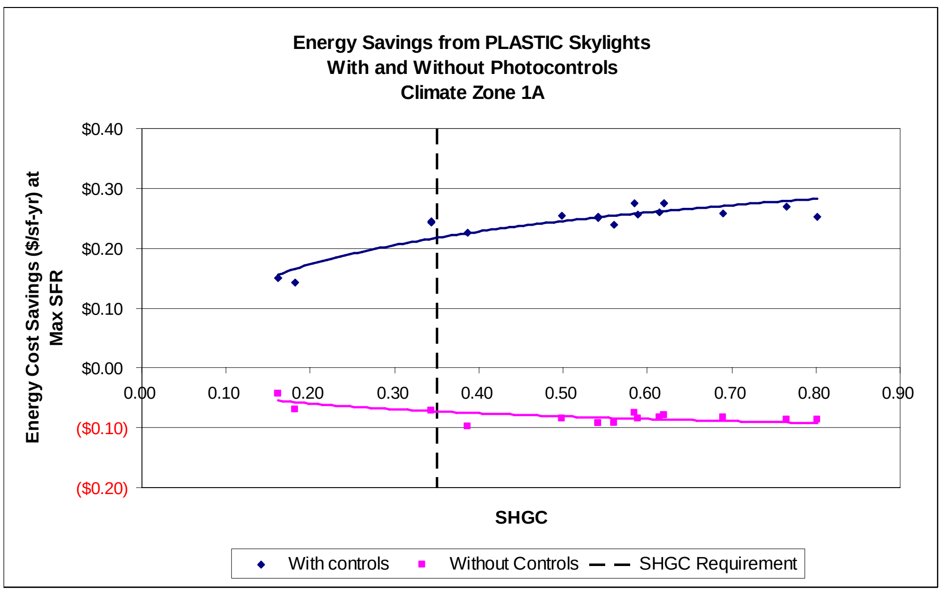


Figure 2: Energy Cost Savings versus Plastic Skylight Solar Heat Gain Coefficients

The results on the top half of Figure 2, illustrates that when diffusing skylights are used **with photocontrols**, those skylights with a **higher SHGC** (a proxy for high VLT) **save more total energy costs** than those with a lower SHGC in climate zone 1. We have conducted the same analysis for all other climate zones and found the same pattern. Thus SHGC requirements are not beneficial in any climate zone for skylighting systems designed to displace electric lighting and have automatic photocontrol systems that reduce electric lighting consumption. SHGC requirements limit the amount of energy savings for these systems.

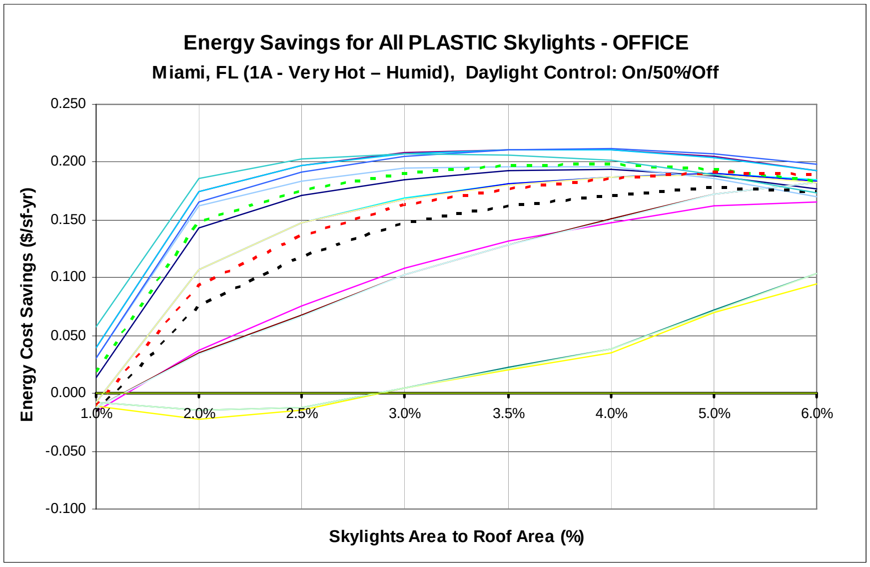


Figure 3: Office - Energy Cost Savings versus Skylight to Roof Area Ratio

The other problem with the IECC requirements is also related to its assumption that skylights are used without photocontrols. If electric lighting is not turned off in response to daylight, one would want to minimize the amount of skylight area that admits solar gains and transmits heat losses. However, in many cases, total energy cost savings (sum of lighting, heating and cooling costs) is maximized above 3%. Figure 3, shows the energy cost savings with respect to the skylight to roof area varies by skylight type and in many cases, the optimum skylight area is above 3%. Figure 4 is the same plot but for retail spaces with higher lighting power densities (LPD) and illuminance setpoints. More skylight area is required to provide more light to these occupancies with higher illuminance setpoints. These graph help illustrate why a 6% maximum skylight area to roof area ratio is deemed an appropriate upper limit for skylight area.

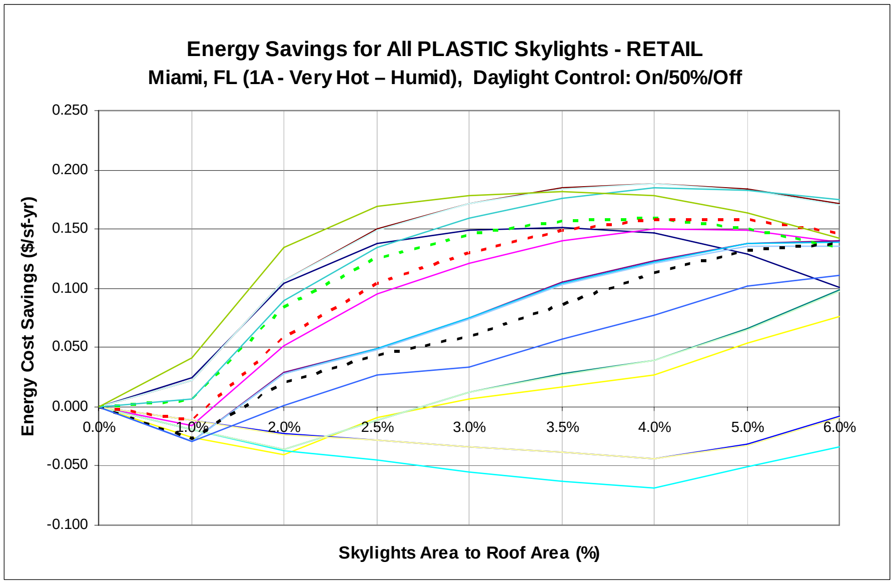


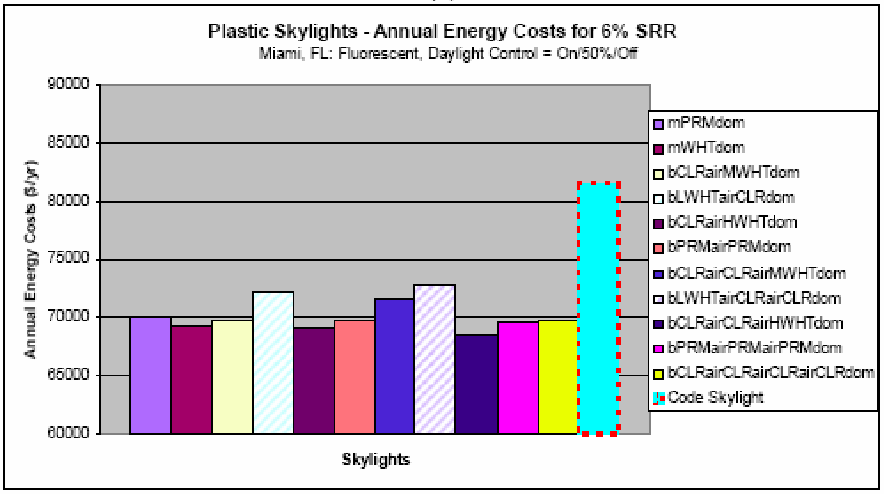
Figure 4: Retail - Energy Cost Savings versus Skylight to Roof Area Ratio

The problem with the AAMA proposal (EC90-06/07) is that it is: overly complex, it does not rectify the problem of disallowing high transmittance skylights in all climate zones, and it does not make use of pre-existing definitions in the ASHRAE standard.

Complexity. Given that SHGC limitations do not save energy for systems with photocontrols but actually reduce the maximum savings opportunities, SHGC requirements should simply be removed for these systems. An additional table of values is not necessary.

Does not rectify problem for all climate zones. The AAMA proposal still requires a SHGC of 35% for climate zone 1. The figures above clearly show that there are additional savings to be obtained from higher SHGCs. The other SHGC's in this proposed table are still lower than a high performance skylight that combines a high white prismatic with clear prismatic. This type of skylight exhibits excellent diffusion properties (greater than 90% haze) with high visible light transmittance. This skylight has a SHGC of 61% and has been successfully used by Wal-Mart in stores across the country.

Though the AAMA proposal was a step in the right direction, it did not go far enough. From the technical support document for the AAMA proposal, it is clear that retail buildings with photocontrols and with SHGC's lower than the AAMA proposed maximum consume more energy than high SHGC skylights. Figure 5, reproduces a figure from that technical support document.[1] The patterned bars indicate the energy consumption of the code allowed skylights, where the solid bars indicate the energy consumption of skylights that are disallowed. The disallowed skylights result in lower building energy consumption. This is the wrong outcome for an energy efficiency code.



(b)

Figure 4. Annual Energy Costs for Big Box Retail Building with 6% SRR Skylights and Code Skylight in Miami, FL (Zone 1) – (a) Glass skylights, (b) Plastic skylights

Note: The skylights that meet the proposed code values (from Table 6) are represented by patterned colors and those that do not are represented by solid colors.

Figure 5: Retail - Energy Cost Consumption Graph from AAMA technical support document.

Does not make use of pre-existing definitions in ASHRAE standard. The IECC and the ASHRAE standards reference to each other. In the case where a term is already defined by the other standard it makes sense to use it rather than creating a new name for the same term. This helps prevent confusion. Thus it makes sense to delete all references to "ambient lighting" and make use of the term "general lighting" which is in the ASHRAE standard and means the same thing. This should also address the concerns of the ASHRAE/IESNA 90.1 lighting subcommittee.

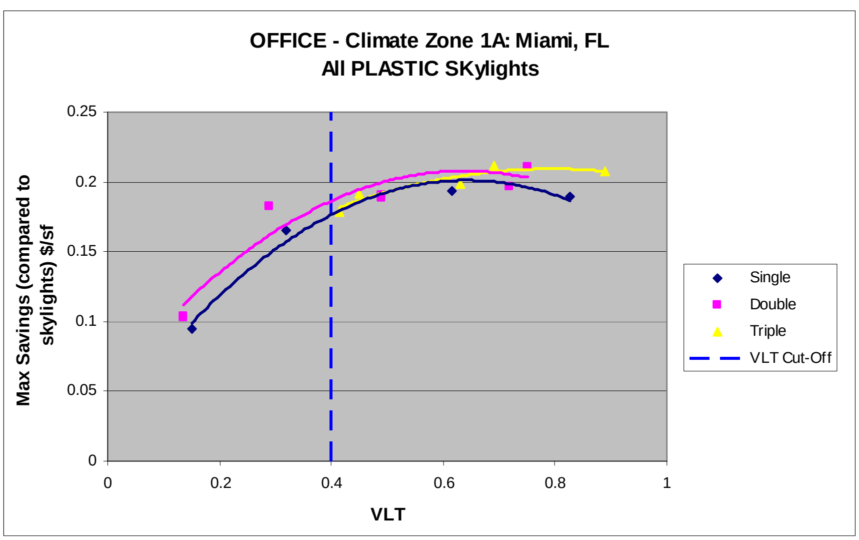


Figure 6: Office - Energy Cost Savings versus VLT

[1] Carli Inc. *Technical Report: Energy Study in Support of the Proposed Revision of the International Energy Conservation Code (IECC), Skylight Portion of Table 502.3 – Part 1: Daylighting Controls* Prepared for: Skylight Collaborative, February 23, 2006

Addition of VLT to qualify for the skylight area and SHGC exemptions. Combining high VLT, diffusion and photocontrols as the criteria that qualify for the 3% area and SHGC exceptions provides the appropriate signals for what qualifies as a high performance skylighting system. Figure 6 shows the importance of VLT for maximizing total energy savings from skylights. This same relationship holds and is accentuated for the other climate zones.

In conclusion, the changes proposed here would start the IECC onto the path of recognizing that the envelope issues posed by skylights are fundamentally different when skylights are used in conjunction with photocontrols.

My recommendation is to Approve this proposal As Modified.

Jonathan R. McHugh, PE, LC

Acknowledgements:
This work was funded by Wal-Mart. Project manager: Ralph Williams, Wal-Mart.
Contract management: Architectural Energy Corporation. Project manager, Vern Smith
Report development: Heschong Mahone Group, Inc. Jonathan McHugh and Mudit Saxena
Building simulations: Partnership for Resource Conservation, Paul Reeves

Public Comment 2:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association requests Approval as Modified by this Public Comment.

Modify proposal as follows:

~~**DAYLIT AREA UNDER SKYLIGHTS**. The area underneath the skylight that retains at least 70% of the daylight luminance directly under the skylight. The daylit area shall be taken as the sum of the following:~~

1. ~~The horizontal projection of the outline of the skylight glazed opening onto the floor directly beneath the skylight,~~
2. ~~Additional areas around the perimeter of the area defined in Item 1 above. The width of these areas shall be the lesser of the following:~~
   - ~~2.1. 70% of the height between the floor directly beneath the skylight and the underside of the skylight,~~
   - ~~2.2. 50% of the horizontal distance from the skylight to the edge of glazing in the nearest adjacent skylight, or~~
   - ~~2.3. The distance to the nearest vertical surface of any permanent partition that is farther away from the horizontal projection of the outline of the skylight upon the floor below than 70% of the distance between the top of the partition and the ceiling. If a ceiling is not provided, the distance shall be measured from the top of the partition to the underside of the roof slab above.~~

DAYLIGHT ZONE:

UNDER SKYLIGHTS: The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension in that direction plus either the floor to ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent skylights or vertical fenestration, whichever is least.

AMBIENT LIGHTING. Luminaires that produce general illumination throughout an area. ~~provide ambient diffuse lighting in a space.~~ Ambient lighting includes, but is not limited to, lighting by linear fluorescent luminaires (direct, indirect or direct/indirect), high bay or low bay luminaires. Lighting not considered ambient lighting includes: emergency lighting, electric signs, display lighting, decorative lighting (such as chandeliers), theatrical lighting, or wall sconces less than 150 W.

502.3.1.1 Buildings with daylighting controls: In Use Group M, S-1 and S-2 buildings the percentage of gross roof assembly area that is permitted to be skylights shall be limited to 6%, when the following criteria are met:

1. The haze value of the combined skylight glazing materials or diffuser in the skylight assembly shall be 90% or greater when tested according to ASTM D1003~~, without consideration of the scope of maximum haze~~.
2. All ambient lighting in daylit areas under skylights is controlled by multi-level daylighting controls that comply with Section 505.2.5,
3. The area weighted average U-factor and SHGC of the skylight does not exceed the values given in Table 502.3.1.

505.2.5 Automatic daylighting controls. When automatic daylighting controls are required by this code, the level of ambient lighting in the daylit areas shall be separately controlled by at least one multi-level daylighting control. The multi-level daylighting control shall reduce electric lighting in response to available daylight in steps or uniformly as described in Section 505.2.2.1 and shall automatically reduce ambient lighting output ~~power~~ in the daylit area in direct proportion to the amount of lighting provided by daylighting to 50% ~~of rated power~~ or less. The multi-level daylighting control shall be located so that calibration and set point adjustment controls are readily accessible. The calibration adjustment controls shall also be located in such a manner as to not receive direct lighting from the skylights.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: The original EC 90 proposal addressed an important area that is currently overlooked in the IECC. That is the benefit of daylighting in conserving the consumption of electrical energy for lighting in a building. At the present time the IECC considers fenestration openings only in terms of the potential heat energy gain/loss that can occur through the fenestration. Focusing only on this aspect of the fenestration product without considering the potential benefit in terms of natural daylighting presents a skewed and inaccurate view of the value of fenestration in the overall energy consumption picture for a building.

The original proposal permitted the percentage of roof area in Use Group M, S-1 and S-2 occupancies that is permitted to be skylights to be increased from 3% to 6% when the area provided with daylighting under the skylights was equipped with automatic lighting controls and the skylights met certain performance characteristics. Studies conducted by Carli, Inc, found that this combination of skylights with lighting controls provided energy and cost savings as great as 40 percent when compared to the energy use of the same building, with skylights as permitted by the prescriptive provisions of the 2006 IECC. The study looked at 24 types of skylights in all three occupancies, in 21 U.S. cities distributed over the 8 U.S. climate zones, and found energy and cost savings in every instance except one.

Although use of skylights in this fashion could be achieved using the whole building design method, including these provisions within the prescriptive provisions of the IECC would make them available for those who do not have the resources to conduct a whole building analysis. This in turn would encourage the design and construction of retail and storage buildings that have significant energy and cost savings over those currently provided for in the IECC.

The original proposal was disapproved by the IECC committee due to two concerns. This public comment addresses these concerns in the following manner.

1. Concern that the original proposal would reduce the U-factor stringency in some climate zones.

EC 90 did not reduce the U-factor stringency from those values currently given in the 2006 IECC for glass and plastic skylights. The table below shows the U-factors originally proposed in EC 90 in comparison to those currently given in the 2006 IECC. The U-factors from the 2006 IECC are not more stringent in any climate zone. In fact, in climate zones 1 and 2 the 2006 IECC values are less stringent than those proposed in EC 90. In climate zone 3 – 5 the values of the 2006 IECC for plastic skylights are less stringent than those proposed in EC 90, and in climate zones 7 & 8 the 2006 IECC values for plastic skylights are the same as those proposed in EC 90.

Climate Zone	1	2	3	4 except Marine	5 & Marine 4	6	7	8
2006 IECC – Glass	1.60	1.05	0.90	0.60	0.60	0.60	0.60	0.60
2006 IECC – Plastic	1.90	1.90	1.30	1.30	1.30	0.90	0.90	0.90
EC 90 – As Submitted	1.35	0.95	0.90	0.90	0.90	0.90	0.90	0.60

2. Concern that changes to the location of partitions on the interior would affect the area defined as daylighted.

The public comment replaces the originally proposed definition of daylighting, which included consideration of the location of interior partitions, with the definition approved by the IECC committee in EC 122. This later definition does not include consideration of partial height interior partitions. Since partial height interior partitions are more likely to be relocated within an interior space then full height partitions, removing consideration of them from the definition of daylighting should significantly simplify application of the definition.

Other items addressed in this revision include changes to the definition of ambient lighting, and the criteria for skylight haze and automatic lighting controls.

The ASHRAE subcommittee on lighting requested the changes to the definition of ambient lighting and automatic lighting controls. The definition for ambient lighting given in this public comment is consistent with that given in the International Engineering Society of North America (IESNA) *Illumination Standards Handbook*.

The changes to Section 505.2.5 are proposed for consistency of units within the section. With the proposed change to the langauge lighting output (lumens) is directly related to the amount of daylighting provided (also lumens).

Finally, the criteria for haze is revised in response to concerns expressed at the Public Hearings that the scope of maximum haze should be retained when the haze of the skylighting material is determined in accordance with ASTM D1003.

We encourage the ICC membership to support this type of energy efficient construction and approve this proposal as modified.

Public Comment 3:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association requests Approval as Modified by this Public Comment.

Modify proposal as follows:

~~**DAYLIT AREA UNDER SKYLIGHTS**. The area underneath the skylight that retains at least 70% of the daylight luminance directly under the skylight. The daylit area shall be taken as the sum of the following:~~

1. ~~The horizontal projection of the outline of the skylight glazed opening onto the floor directly beneath the skylight,~~
2. ~~Additional areas around the perimeter of the area defined in Item 1 above. The width of these areas shall be the lesser of the following:~~
   - ~~2.1. 70% of the height between the floor directly beneath the skylight and the underside of the skylight,~~
   - ~~2.2. 50% of the horizontal distance from the skylight to the edge of glazing in the nearest adjacent skylight, or~~
   - ~~2.3. The distance to the nearest vertical surface of any permanent partition that is farther away from the horizontal projection of the outline of the skylight upon the floor below than 70% of the distance between the top of the partition and the ceiling. If a ceiling is not provided, the distance shall be measured from the top of the partition to the underside of the roof slab above.~~

DAYLIGHT ZONE:

UNDER SKYLIGHTS: The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension in that direction plus either the floor to ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent skylights or vertical fenestration, whichever is least.

AMBIENT LIGHTING. Luminaires that produce general illumination throughout an area. ~~provide ambient diffuse lighting in a space.~~ Ambient lighting includes, but is not limited to, lighting by linear fluorescent luminaires (direct, indirect or direct/indirect), high bay or low bay luminaires. Lighting not considered ambient lighting includes: emergency lighting, electric signs, display lighting, decorative lighting (such as chandeliers), theatrical lighting, or wall sconces less than 150 W.

502.3.1.1 Buildings with daylighting controls: In Use Group M, S-1 and S-2 buildings the percentage of gross roof assembly area that is permitted to be skylights shall be limited to 6%, when the following criteria are met:

1. The haze value of the combined skylight glazing materials or diffuser in the skylight assembly shall be 90% or greater when tested according to ASTM D1003~~, without consideration of the scope of maximum haze~~.
2. All ambient lighting in daylit areas under skylights is controlled by multi-level daylighting controls that comply with Section 505.2.5,
3. The area weighted average U-factor and SHGC of the skylight does not exceed the values given in Table 502.3.1.

TABLE 502.3.1
MAXIMUM U-FACTOR AND SHGC FOR SKYLIGHTS IN BUILDINGS WITH DAYLIGHTING CONTROLS

Climate Zone	1	2	3	4 except Marine	5 & Marine 4	6	7	8
U-factor	~~1.35~~ 0.75	~~0.95~~ 0.75	~~0.90~~ 0.75	~~0.90~~ 0.75	~~0.90~~ 0.75	~~0.90~~ 0.75	~~0.90~~ 0.60	0.60
SHGC	0.35	0.50	0.55	0.55	0.55	0.60	NR	NR

505.2.5 Automatic daylighting controls. When automatic daylighting controls are required by this code, the level of ambient lighting in the daylit areas shall be separately controlled by at least one multi-level daylighting control. The multi-level daylighting control shall reduce electric lighting in response to available daylight in steps or uniformly as described in Section 505.2.2.1 and shall automatically reduce ambient lighting output ~~power~~ in the daylit area in direct proportion to the amount of lighting provided by daylighting to 50% ~~of rated power~~ or less. The multi-level daylighting control shall be located so that calibration and set point adjustment controls are readily accessible. The calibration adjustment controls shall also be located in such a manner as to not receive direct lighting from the skylights.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: The original proposal addressed an important area that is currently overlooked in the IECC. That is the benefit of daylighting in conserving the consumption of electrical energy for lighting in a building. At the present time the IECC considers fenestration openings only in terms of the potential heat energy gain/loss that can occur through the fenestration. Focusing only on this aspect of the fenestration product without considering the potential benefit in terms of natural daylighting presents a skewed and inaccurate view of the value of fenestration in the overall energy consumption picture for a building.

The original proposal permitted the percentage of roof area in Use Group M, S-1 and S-2 occupancies that is permitted to be skylights to be increased from 3% to 6% when the area provided with daylighting under the skylights was equipped with automatic lighting controls and the skylights met certain performance characteristics. Studies conducted by Carli, Inc, found that this combination of skylights with lighting controls provided energy and cost savings as great as 40 percent when compared to the energy use of the same building, with skylights as permitted by the prescriptive provisions of the 2006 IECC. The study looked at 24 types of skylights in all three occupancies, in 21 U.S. cities distributed over the 8 U.S. climate zones, compared the energy use of such buildings to those provided with skylights that met the criteria of the 2006 IECC for glass skylights and for plastic skylights, and found energy and cost savings in those buildings that met the criteria of EC 90 in every instance except one.

Although use of skylights in this fashion could be achieved using the whole building design method, including these provisions within the prescriptive provisions of the IECC would make them available for those who do not have the resources to conduct a whole building analysis. This in turn would encourage the design and construction of retail and storage buildings that have significant energy and cost savings over those currently provided for in the IECC.

Although the original proposal was disapproved, some members of the IECC committee and other interested parties encouraged AAMA to revise the proposal to address the committee's concerns, and bring it back. This Public Comment is one of two attempts to do that.

This Public Comment addresses the concerns of the committee in the following manner:

1. Concern that the original proposal would reduce the U-factor stringency in some climate zones.

EC 90 did not reduce the U-factor stringency from those values currently given in the 2006 IECC for glass and plastic skylights, and although it did reduce the U-factor stringency in most climate zones from those approved in EC 95, the data generated in the Carli study clearly demonstrated that buildings built with skylights and lighting controls that complied with the criteria of EC 90 were more energy efficient than buildings built with skylights that comply with the criteria of EC 95 in climate zones 4 to 8. This public comment further reduces the proposed U-factor in climate zones 1-6 to more closely match those given in EC 95, while still permitting the use of products that are readily available and whose use can most easily be justified by the energy cost savings they will contribute to the building.

The table below shows the U-factors originally proposed in EC 90 in comparison to those currently given in the 2006 IECC. The U-factors from the 2006 IECC are not more stringent in any climate zone. In fact, in climate zones 1 and 2 the 2006 IECC values are less stringent than those proposed in EC 90. In climate zone 3 – 5 the values of the 2006 IECC for plastic skylights are less stringent than those proposed in EC 90, and in climate zones 7 & 8 the 2006 IECC values for plastic skylights are the same as those proposed in EC 90.

Climate Zone	1	2	3	4 except Marine	5 & Marine 4	6	7	8
2006 IECC – Glass	1.60	1.05	0.90	0.60	0.60	0.60	0.60	0.60
2006 IECC – Plastic	1.90	1.90	1.30	1.30	1.30	0.90	0.90	0.90
EC 90 – As Submitted	1.35	0.95	0.90	0.90	0.90	0.90	0.90	0.60
EC 95 – As Approved	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
EC 90 – As proposed in this public comment	0.75	0.75	0.75	0.75	0.75	0.75	0.60	0.60

The U-factors in EC 95, which was approved by the IECC committee just prior to consideration of EC 90, were more stringent than those of EC 90 in every climate zone except climate zone 8. Upon first glance this would seem to indicate that the Carli study was not relevant to the values approved in EC 95. If one considered only U-factor, the reduced stringency would indicate an increase in energy use if EC 90 were approved.

The Carli study is relevant to the U-factors approved in EC 95, however, in climate zones 4 – 8, because skylights with U-factors that met that criteria of EC 95 (U= 0.60) were considered when the comparison of energy use was made to buildings with skylights that met the criteria of the 2006 IECC for glass skylights. When the entire energy use of the building is considered, as was done in the Carli study, the fact is that even with the higher U-factors, in climate zones 4 to 8 buildings constructed with skylights and lighting controls that met the criteria of EC 90 were more energy efficient than buildings constructed with skylights that meet the U-factors given in EC 95.

This meant, for example, that a building with 6% skylight roof area and automatic lighting controls as specified in EC 90, with skylights that had a U-factor of 0.90 and a SHGC of 0.55, was more energy efficient than the same building with 3% skylight roof area, no lighting controls, and skylights with a U-factor of 0.60 and an SHGC of 0.40. The energy and cost savings due to reduced lighting power more than offset the energy gain due to increased heating load. Therefore, the study showed that the proposal as originally written provided energy and cost savings over the U-factors approved in EC 95 in climate zones 4 through 8.

This public comment revises the U-factors in climate zones 1 and 2 to 0.75, consistent with EC95. For consistency, the U-factors in climate zones 3 to 6 are also reduced from the values originally proposed in EC 90 to 0.75. It should be noted that these are more stringent than the skylights with U-factor of 0.90 that were originally considered in the Carli study and which give even greater energy and cost savings when combined with the lighting controls required by EC 90 than the skylights approved in EC 95.

2. Concern that changes to the location of partitions on the interior would affect the area defined as daylighted.

The public comment replaces the originally proposed definition of daylighting, which included consideration of the location of interior partitions, with the definition approved by the IECC committee in EC 122. This later definition does not include consideration of partial height interior partitions.

Other items addressed in this revision include changes to the definition of ambient lighting, and the criteria for skylight haze and automatic lighting controls.

The ASHRAE subcommittee on lighting requested the changes to the definition of ambient lighting and automatic lighting controls. The definition for ambient lighting given in this public comment is consistent with that given in the International Engineering Society of North America (IESNA) *Illumination Standards Handbook*.

The changes to Section 505.2.5 are proposed for consistency of units within the section. With the proposed change to the langauge lighting output (lumens) is directly related to the amount of daylighting provided (also lumens).

Finally, the criteria for haze is revised in response to concerns expressed at the Public Hearings that the scope of maximum haze should be retained when the haze of the skylighting material is determined in accordance with ASTM D1003.

Public Comment 4:

Julie Ruth, JRuth Code Consulting, representing American Architectural Manufacturers Association requests Approval as Modified by this Public Comment.

Modify proposal as follows:

~~**DAYLIT AREA UNDER SKYLIGHTS**. The area underneath the skylight that retains at least 70% of the daylight luminance directly under the skylight. The daylit area shall be taken as the sum of the following:~~

1. ~~The horizontal projection of the outline of the skylight glazed opening onto the floor directly beneath the skylight,~~
2. ~~Additional areas around the perimeter of the area defined in Item 1 above. The width of these areas shall be the lesser of the following:~~
   - ~~2.1. 70% of the height between the floor directly beneath the skylight and the underside of the skylight,~~
   - ~~2.2. 50% of the horizontal distance from the skylight to the edge of glazing in the nearest adjacent skylight, or~~
   - ~~2.3. The distance to the nearest vertical surface of any permanent partition that is farther away from the horizontal projection of the outline of the skylight upon the floor below than 70% of the distance between the top of the partition and the ceiling. If a ceiling is not provided, the distance shall be measured from the top of the partition to the underside of the roof slab above.~~

DAYLIGHT ZONE:

UNDER SKYLIGHTS: The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension in that direction plus either the floor to ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent skylights or vertical fenestration, whichever is least.

AMBIENT LIGHTING. Luminaires that produce general illumination throughout an area. ~~provide ambient diffuse lighting in a space.~~ Ambient lighting includes, but is not limited to, lighting by linear fluorescent luminaires (direct, indirect or direct/indirect), high bay or low bay luminaires. Lighting not considered ambient lighting includes: emergency lighting, electric signs, display lighting, decorative lighting (such as chandeliers), theatrical lighting, or wall sconces less than 150 W.

502.3.1.1 Buildings with daylighting controls: In Use Group M, S-1 and S-2 buildings the percentage of gross roof assembly area that is permitted to be skylights shall be limited to 6%, when the following criteria are met:

1. The haze value of the combined skylight glazing materials or diffuser in the skylight assembly shall be 90% or greater when tested according to ASTM D1003~~, without consideration of the scope of maximum haze~~.
2. All ambient lighting in daylit areas under skylights is controlled by multi-level daylighting controls that comply with Section 505.2.5,
3. The area weighted average U-factor and SHGC of the skylight does not exceed the values given in Table 502.3.~~1.~~

~~**TABLE 502.3.1**~~
~~MAXIMUM U-FACTOR AND SHGC FOR SKYLIGHTS IN BUILDINGS WITH DAYLIGHTING CONTROLS~~

~~Climate Zone~~	~~1~~	~~2~~	~~3~~	~~4 except Marine~~	~~5 & Marine 4~~	~~6~~	~~7~~	~~8~~
~~U-factor~~	~~1.35~~	~~0.95~~	~~0.90~~	~~0.90~~	~~0.90~~	~~0.90~~	~~0.90~~	~~0.60~~
~~SHGC~~	~~0.35~~	~~0.50~~	~~0.55~~	~~0.55~~	~~0.55~~	~~0.60~~	~~NR~~	~~NR~~

502.3.2 Maximum *U*-factor and SHGC. For vertical fenestration, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3, based on the window projection factor. For skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3.

The window projection factor shall be determined in accordance with Equation 5-1.

$PF = A/B$ **(Equation 5-1)**

where:

PF = Projection factor (decimal).
A = Distance measured horizontally from the furthest continuous extremity of any overhang, eave, or permanently attached shading device to the vertical surface of the glazing.
B = Distance measured vertically from the bottom of the glazing to the underside of the overhang, eave, or permanently attached shading device.

Where different windows or glass doors have different *PF* values, they shall each be evaluated separately, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.

> ~~**Exception:** The maximum U-factor and solar heat gain coefficient (SHGC) of skylights in buildings that meet the criteria of Section 502.3.1.1 shall be as specified in Table 502.3.1.~~

505.2.5 Automatic daylighting controls. When automatic daylighting controls are required by this code, the level of ambient lighting in the daylit areas shall be separately controlled by at least one multi-level daylighting control. The multi-level daylighting control shall reduce electric lighting in response to available daylight in steps or uniformly as described in Section 505.2.2.1 and shall automatically reduce ambient lighting output ~~power~~ in the daylit area in direct proportion to the amount of lighting provided by daylighting to 50% ~~of rated power~~ or less. The multi-level daylighting control shall be located so that calibration and set point adjustment controls are readily accessible. The calibration adjustment controls shall also be located in such a manner as to not receive direct lighting from the skylights.

(Portions of proposal not shown remain unchanged)

Commenter's Reason: The original proposal addressed an important area that is currently overlooked in the IECC. That is the benefit of daylighting in conserving the consumption of electrical energy for lighting in a building. At the present time the IECC considers fenestration openings only in terms of the potential heat energy gain/loss that can occur through the fenestration. Focusing only on this aspect of the fenestration product without considering the potential benefit in terms of natural daylighting presents a skewed and inaccurate view of the value of fenestration in the overall energy consumption picture for a building.

The original proposal permitted the percentage of roof area in Use Group M, S-1 and S-2 occupancies that is permitted to be skylights to be increased from 3% to 6% when the area provided with daylighting under the skylights was equipped with automatic lighting controls and the skylights met certain performance characteristics. Studies conducted by Carli, Inc, found that this combination of skylights with lighting controls provided energy and cost savings as great as 40 percent when compared to the energy use of the same building, with skylights as permitted by the prescriptive provisions of the 2006 IECC. The study looked at 24 types of skylights in all three occupancies, in 21 U.S. cities distributed over the 8 U.S. climate zones, compared the energy use of such buildings to those provided with skylights that met the criteria of the 2006 IECC for glass skylights and for plastic skylights, and found energy and cost savings in those buildings that met the criteria of EC 90 in every instance except one.

Although use of skylights in this fashion could be achieved using the whole building design method, including these provisions within the prescriptive provisions of the IECC would make them available for those who do not have the resources to conduct a whole building analysis. This in turn would encourage the design and construction of retail and storage buildings that have significant energy and cost savings over those currently provided for in the IECC.

Although the original proposal was disapproved, some members of the IECC committee and other interested parties encouraged AAMA to revise the proposal to address the committee's concerns, and bring it back. This Public Comment is one of two attempts to do that.
This Public Comment addresses the concerns of the committee in the following manner:

1. Concern that the original proposal would reduce the U-factor stringency in some climate zones.
   The alternate table for U-factors and SHGC (Table 502.3.1) given in the original proposal is removed in this public comment. All skylights would need to comply with the U-factor and SHGC of Table 502.3, so there would be no variation of U-factor in any climate zones.
2. Concern that changes to the location of partitions on the interior would affect the area defined as daylighted.
   The public comment replaces the originally proposed definition of daylighting, which included consideration of the location of interior partitions, with the definition approved by the IECC committee in EC 122. This later definition does not include consideration of partial height interior partitions.

Other items addressed in this revision include changes to the definition of ambient lighting, and the criteria for skylight haze and automatic lighting controls.

The ASHRAE subcommittee on lighting requested the changes to the definition of ambient lighting and automatic lighting controls. The definition for ambient lighting given in this public comment is consistent with that given in the International Engineering Society of North America (IESNA) *Illumination Standards Handbook*.

The changes to Section 505.2.5 are proposed for consistency of units within the section. With the proposed change to the langauge lighting output (lumens) is directly related to the amount of daylighting provided (also lumens).

Finally, the criteria for haze is revised in response to concerns expressed at the Public Hearings that the scope of maximum haze should be retained when the haze of the skylighting material is determined in accordance with ASTM D1003.

Final Action: AS AM AMPC____ D

EC91-06/07
Table 502.3

Proposed Change as Submitted:

Proponent: Michael D. Fischer, The Kellen Company, representing The Window and Door Manufacturers Association

Revise table as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
***U*- Factor**								
~~**Framing materials other than metal with or without metal reinforcement or cladding**~~								
Entrance Door *U*- Factor	1.2	1.1	0.9	0.85	0.8	0.8	0.8	0.8
Vertical fenestration (other than entrance doors) [a]								
~~*U* -Factor~~ 40% Glazing	1.05 ~~1.20~~	0.60 ~~0.75~~	0.55 ~~0.65~~	0.4	0.35	0.35	0.35	0.35
~~**Metal framing with or without thermal break**~~								
~~Curtain Wall/Storefront~~ ~~*U* -Factor~~ 35% Glazing	1.2	0.7	0.6	0.5	0.45	0.45	0.45	0.45
~~Entrance Door *U*- Factor~~	~~1.2~~	~~1.1~~	~~0.9~~	~~0.85~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~
~~All Other *U*- Factor~~ 30% Glazing	1.40 ~~1.20~~	0.80 ~~0.75~~	0.70 ~~0.65~~	0.55	~~0.55~~ 0.5	~~0.55~~ 0.5	0.5	0.5
SHGC Vertical Fenestration ~~**All Frame Types**~~								
SHGC: PF < 0.25	0.25	0.25	0.25	0.4	0.4	0.4	NR	NR
SHGC: 0.25 ~ PF <0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ~ 0.5	0.4	0.4	0.4	NR	NR	NR	NR	NR
Skylights (3% maximum)								
Glass								
U -Factor	1.6	1.05	0.9	0.6	0.6	0.6	0.6	0.6
SHGC	0.4	0.4	0.4	0.4	0.4	0.4	NR	NR
Plastic								
U -Factor	1.9	1.9	1.3	1.3	1.3	0.9	0.9	0.6
SHGC	0.35	0.35	0.35	0.62	0.62	0.62	NR	NR

NR = No requirement.
PF = Projection factor (See Section 502.3.2)
a. ~~All others includes operable windows, fixed windows and non-entrance doors.~~ User shall select the 40% Glazing, 35% Glazing or 30% Glazing requirements based on the overall percentage of vertical fenestration to above-grade wall. These requirements shall apply to all vertical fenestration including fixed and operable windows, curtain wall, storefront glazing and doors other than entrance doors. Entrance door glazing area shall be included in the vertical fenestration area used to determine the appropriate fenestration U-factors.

Reason: The purpose for this change is to convert the vertical fenestration requirements of this table from material specific requirements to material neutral requirements. The current IECC requirements contain a material bias base upon the type of frame selected by the designer. The proponents believe that the energy efficiency requirements for fenestration should be more appropriately based solely upon product performance. In order to achieve the stated goal of material neutrality with basically the same level of stringency of energy efficiency requirements, this proposal recommends a limited reintroduction of window/glazing area into the commercial prescriptive fenestration requirements. It is important to remember that the PNNL and DOE study of window to wall ratio was based upon residential construction. While the proponents believe that some level of simplicity in the prescriptive tables will streamline code interpretation and facilitate compliance, the tremendous variety of glazing features and quantities across the spectrum of commercial construction does merit at least a limited consideration of the amount of glazing within these prescriptive values.

The existing table sets different levels of stringency for different framing material types. As a result, a building constructed with fenestration with non-metal frames would be considerably more efficient than a building constructed with metal frame fenestration. The reason given for this lack of material neutrality, which was adopted in the last code cycle, is that metal frame products could not meet the more stringent requirements established in the 2004 version of the code for all fenestration. Although the committee could have adopted the less stringent requirements for all frame types, the committee elected to adopt this discriminating treatment, with the expressed hope by many that a material neutral solution could be offered in the future. After considerable thought and consideration, WDMA determined that the most reasonable approach to maintain similar stringency, yet move to material neutrality, would be to reintroduce, on a limited basis, U-factor requirements that vary by glazing area.

In order to determine the values proposed above, the present requirements for curtain wall and storefront applications were set as a baseline for the 35% glazing level. Then the 40% and 30% levels were calculated by use of a simple ratio to increase or decrease values appropriately. Then the values were rounded down for conservative results.

This proposal results in eliminating material discrimination while permitting all frame types to be used. While the window area of projects using higher U-factors will be more limited, this is appropriate since such products are less energy efficient. If a designer wished to select such a product, then compliance using the methods in ASHRAE 90.1 remain as a solution to overall building performance.

In summary, the text below is drawn from the preface to the IECC:

> *"This code is founded on principles intended to establish provisions consistent with the scope of an energy conservation code that adequately conserves energy; provisions that do not unnecessarily increase construction costs; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction."*

The current IECC requirements are in direct conflict with this stated intent of the IECC by allowing different levels of energy efficiency for different window frame materials. This proposal solves that conflict while maintaining current levels of efficiency.

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

Committee Action: Disapproved

Committee Reason: While the committee agrees that the more appropriate approach would be for requirements to be "material neutral", this table was the result of a needed compromise in the last code change cycle; therefore, the committee felt that it would be undesirable to make any changes at this time.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Michael D. Fischer, The Kellen Company, representing Window and Door Manufacturers Association, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
***U*-Factor**								
Entrance Door *U*-Factor	1.2	1.1	0.9	0.85	0.8	0.8	0.8	0.8
Curtain Wall/Storefront U-Factor	1.2	0.7	0.6	0.5	0.45	0.45	0.45	0.45
Vertical fenestration U-Factor, (other than entrance doors, curtain wall or storefront.) (a.)								
~~40% Glazing~~ Total glazing area 35% to 40%	1.05	0.6	0.55	0.4	0.35	0.35	0.35	0.35
~~35% Glazing~~ Total glazing area > 30% to < 35%	1.2	0.7	0.6	0.5	0.45	0.45	0.45	0.45
~~30% Glazing~~ Total glazing area ≤ 30%	1.4	0.8	0.7	0.55	0.5	0.5	0.5	0.5
SHGC Vertical Fenestration (all frame types)								

NR = No requirement
PF = Projection factor (See Section 502.3.2)

a. ~~User shall select the 40% Glazing, 35% Glazing or 30% Glazing requirements based on the overall percentage of vertical fenestration to above-grade wall. These requirements shall apply to all vertical fenestration including fixed and operable windows, curtain wall, storefront glazing and doors other than entrance doors. Entrance door glazing area shall be included n the vertical fenestration area used to determine the appropriate fenestration U-factors.~~ Glazing area is based upon the percentage of total vertical fenestration area to total above-grade wall area.

(Portions of table not shown remain unchanged)

Commenter's Reason: This comment provides a compromise for vertical fenestration requirements used in commercial construction, while placing material neutral values into the prescriptive energy requirements of the IECC commercial provisions. The proposal answers issues that have been raised regarding curtain wall and storefront applications by providing separate performance requirements for those specialized systems. By reinstating some level of glazing area variations, the table is able to provide achievable values for all frame types that level the playing field. The vast majority of commercial projects that do not utilize curtain wall systems will likely have glazing areas at less than 30%. At that level, window suppliers using metal-framed products are able to utilize the less restrictive values, while more efficient products will be able to receive appropriate trade-off credit.

This public comment achieves material neutrality without sacrificing energy efficiency. Opponents may say that previous code cycles removed glazing area variables as part of the IECC simplification proposals. WDMA believes that the technical work leading to the elimination of the window to wall ratio in the prescriptive requirements of the IECC were based solely upon residential single-family construction, and that extending that concept to commercial occupancies without appropriate research was not technically justified. Restoring three levels provides a simple trade-off for wall area.

Final Action: AS AM AMPC____ D

EC92-06/07
Table 502.3

Proposed Change as Submitted:

Proponent: Michael D. Fischer, The Kellen Company, representing The Window and Door Manufacturers Association

Revise table as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 And Marine 4	6	7	8
(No changes to vertical fenestration section of the table)								
Skylights (3% maximum)								
Glass								
U-Factor	1.6	1.05	0.9	0.6	0.6	0.6	0.6	0.6
SHGC	0.4	0.4	0.4	0.4	0.4	0.4	NR	NR
Plastic								
U-Factor	1.9	1.9	1.3	1.3	1.3	0.9	0.9	0.6

NR = No requirement
PF = Projection factor (See Section 502.3.2)
a. All others includes operable windows, fixed windows and non-entrance doors.

Reason: The purpose for this change is to convert the skylight fenestration U-Factor and SHGC requirements of this table from material specific requirements to material neutral requirements. The current IECC requirements contain a material bias base upon the type of glazing material selected by the designer. The proponents believe that the energy efficiency requirements for skylights should be more appropriately based solely upon product performance.

This proposal results in eliminating material discrimination while permitting all glazing types to be used. In the previous code cycle, WDMA worked with other stakeholders to remove material biases from the energy code requirements, and did achieve some success. We made no secret of our goal to help develop an energy code that provides for the development of energy efficient products without any discrimination based upon the materials used.

In preparing this proposal, we were left with several choices. One would have been to remove the values currently assigned to plastic skylights, and require all products, regardless of glazing materials, to meet the glass values. That approach, while more energy efficient and certainly acceptable to the glass skylight manufacturers, would no doubt receive substantial opposition from other industry segments. The committee, then, is left with the problem. The ICC is in agreement with WDMA in its stated intentions regarding material neutrality as outlined below. The proponent asks the committee to carefully consider the available options to achieve that common goal, and select the best solution.

In summary, the text below is drawn from the preface to the IECC:

> "This code is founded on principles intended to establish provisions consistent with the scope of an energy conservation code that adequately conserves energy; provisions that do not unnecessarily increase construction costs; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction."

The current IECC requirements are in direct conflict with this stated intent of the IECC by allowing different levels of energy efficiency for different glazing materials. This proposal solves that conflict while maintaining current *minimum* levels of efficiency.

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

Committee Action: **Disapproved**

Committee Reason: The committee voted in favor of the stringency in EC95-06/07; this would reduce that level of stringency.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Michael D. Fischer, The Kellen Company, representing Window and Door Manufactures Association, requests Approval as Modified by this Public Comment.

Modify proposal as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 And Marine 4	6	7	8
(No changes to vertical fenestration section of the table)								
Skylights (3% maximum)								
U-Factor	~~1.9~~ 0.75	~~1.9~~ 0.75	~~1.3~~ 0.75	~~1.3~~ 0.75	~~1.3~~ 0.75	~~0.9~~ 0.75	~~0.9~~ 0.6	0.6
SHGC	0.35	0.4	0.4	0.55	0.55	0.55	NR	NR

NR = No requirement
PF = Projection factor (See Section 502.3.2)
a. All others includes operable windows, fixed windows and non-entrance doors.
(Portions of table not shown remain unchanged)

Commenter's Reason: The values contained in the above table represent the compromise forged between AAMA and WDMA during the IECC committee hearings in Orlando. There were several options to choose from; the IECC committee ignored the compromise and selected the most stringent proposal, and further modified it with added stringency.

This modification results in increased energy efficiency over the existing requirements (as well as the original proposal, which presented the least stringent values between glass and plastic requirements) and also accomplishes the goal of removing material preferences from the skylight prescriptions.

AAMA is submitting companion comments to EC 90 in order to address the daylighting credit issue. WDMA supports the proposal for daylighting and believes that this compromise provides the best solution to balance daylighting credits, material neutrality, and energy efficiency.

Final Action: AS AM AMPC____ D

EC95-06/07
Table 502.3

Proposed Change as Submitted:

Proponent: Garrett Stone, Brickfield Burchette Ritts & Stone, P.C., representing Cardinal Glass Industries

Revise table as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
***U*-Factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-Factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront *U*-Factor	1.20	0.70	0.60	0.50	0.45	0.45	0.45	0.45
Entrance Door *U*-Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other *U*-Factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.50	0.50
SHGC-All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	NR	NR
SHGC: 0.25 ≤ PF <0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
~~Glass~~								
U-Factor	0.75 ~~1.60~~	0.75 ~~1.05~~	0.65 ~~0.90~~	0.60	0.60	0.60	0.60	0.60
SHGC	0.40	0.40	0.40	0.40	0.40	0.40	NR	NR
~~Plastic~~								
~~*U*-Factor~~	~~1.90~~	~~1.90~~	~~1.30~~	~~1.30~~	~~1.30~~	~~0.90~~	~~0.90~~	~~0.60~~
~~SHGC~~	~~0.35~~	~~0.35~~	~~0.35~~	~~0.62~~	~~0.62~~	~~0.62~~	~~NR~~	~~NR~~

NR = No requirement.
PF = Projection factor (See Section 502.3.2).
a. All others includes operable windows, fixed windows and non-entrance doors.

Reason: The purpose of this proposal is to eliminate the plastic and glass categories of skylights in the simplified prescriptive path and establish a single set of prescriptive values, in order to ensure consistent stringency regardless of the type of skylights chosen. This proposal establishes a single set of values by eliminating the less stringent plastic values and modifying the glass U-factors (they are presently different in climate zones 1-3) to reflect the same values as set for residential skylights. As a result, this proposal will ensure more energy efficient buildings.

As discussed in previous code cycles, material-neutral prescriptive requirements are an important objective. This can only be achieved if a single set of skylight values is adopted.

In essence, skylights are holes in what are otherwise highly insulated roofs. While there are certainly legitimate reasons for installing skylights, those reasons do not negate the need for requiring a reasonable level of energy efficiency for such products. There is no legitimate justification for different performance requirements for glass versus plastic skylights. Amazingly, the table presently allows plastic skylights that in some cases have energy losses more than twice the losses of glass skylights, and in some cases have solar heat gains more than 50% greater than glass skylights. This cannot be justified.

If plastic skylights cannot perform to a reasonable level, then the energy lost should be offset by energy gained through some other improved envelope component. This can only be done if more poorly performing skylights (whatever material they are constructed from) are required to use a trade-off path (e.g., ASHRAE 90.1 or COMCHECK) rather than the prescriptive path.

Some might argue for daylighting benefits from skylights. We agree that such benefits can occur. However, nothing in this 3% skylight exception suggests that such benefits can be obtained only by allowing poorer performing skylights from a U-factor and/or SHGC standpoint, particularly without requirements to ensure such daylighting benefits.

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

Committee Action: Approved as Modified

Modify the proposal as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Skylights (3% maximum)								
SHGC	~~0.40~~ <u>0.35</u>	~~0.40~~ <u>0.35</u>	~~0.40~~ <u>0.35</u>	0.40	0.40	0.40	NR	NR

(Portions of proposal not shown remain unchanged)

Committee Reason: The committee agrees that this proposal eliminates an undesirable differential that is based upon different materials. The modification would utilize the more stringent factor of 0.35 for skylights, as presently required for plastic skylights, as the committee believes that the more restrictive factors should be used in consolidating these requirements.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Julie Ruth, P.E., JRuth Code Consulting, representing the American Architectural Manufacturers Association, requests Disapproval.

Commenter's Reason: Approval of EC 95 drastically reduced the U-factor requirements for plastic skylights in climate zones 1 – 7 and the SHGC requirements for plastic skylights in climate zones 4 – 6, under the prescriptive provisions of the IECC. The table below shows the current values for plastic skylights in the 2006 IECC, and those approved in EC 95.

Climate Zone	1	2	3	4 except Marine	5 and Marine 4	6	7	8
U-factor								
Plastic Skylights (2006 IECC)	1.90	1.90	1.30	1.30	1.30	0.90	0.90	0.90
EC 95 – as approved by the IECC Comm.	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC								
Plastic Skylights (2006 IECC)	0.35	0.35	0.35	0.62	0.62	0.62	NR	NR
EC 95 – as approved by the IECC Comm.	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

The U-factors and SHGC values approved for skylights in EC 95 are unrealistic and cannot be met economically by plastic skylights that are currently in the marketplace. This virtually prevents the use of plastic skylights in buildings designed using the prescriptive provisions of the IECC for commercial buildings.

Furthermore, reducing the maximum SHGC values to below 0.55 also reduces the visible light transmitted through the skylight. This has a detrimental effect on the amount of daylighting provided by skylights in climate zones 4 - 6, which in turn reduces the energy saving benefit of skylights when used to reduce overall lighting load in a building.

AAMA urges the ICC membership to maintain reasonable energy performance values for skylights in the IECC by disapproval of EC 95.

Final Action: AS AM AMPC____ D

EC103-06/07

Tables 503.2.3(7) through (10), Tables 503.2.3(11) through (14) (New)

Proposed Change as Submitted:

Proponent: Harry Misuriello, representing the Alliance to Save Energy, American Council for an Energy-Efficient Economy; Steven Nadel, American Council for an Energy-Efficient Economy, representing the Alliance to Save Energy, American Council for an Energy-Efficient Economy; Mark Frankel, new Buildings Institute, representing the Alliance to Save Energy, American Council for an Energy-Efficient Economy

1. Delete tables and substitute as follows:

~~TABLE 503.2.3(7)~~
~~WATER CHILLING PACKAGES, MINIMUM EFFICIENCY REQUIREMENTS~~

~~TABLE 503.2.3(8)~~
~~COPs AND IPLVs FOR NONSTANDARD CENTRIFUGAL CHILLERS < 150 TONS~~

~~TABLE 503.2.3(9)~~
~~COPs AND IPLVs FOR NONSTANDARD CENTRIFUGAL CHILLERS ≥ 150 TONS, ≤ 300 TONS~~

~~TABLE 503.2.3(10)~~
~~COPs AND IPLVs FOR NONSTANDARD CENTRIFUGAL CHILLERS > 300 TONS~~

TABLE 503.2.3(7)
WATER CHILLING PACKAGES, MINIMUM EFFICIENCY REQUIREMENTS
(UNDERLINING OMITTED FOR CLARITY)

Equipment Type Electrically-Operated Chillers	**Size Category**	**PATH A Required Efficiency- chillers with ASDs or without ASDs (See note g.)**		**PATH B Required Efficiency- Chillers with ASDs optional compliance path (See note g.)**	
		Full Load (kW/ton)	IPLV (kW/ton)	Full Load (kW/ton)	IPLV (kW/ton)
Air cooled w/ condenser	All	1.2	1.0	N/A	N/A
Air cooled w/o condenser	All	1.08	1.08	N/A	N/A
Water cooled, reciprocating	All	0.840	0.630	N/A	N/A
Water cooled, rotary screw and scroll (positive displacement)	< 100 tons	0.780	0.600	N/A	N/A
	≥100 tons and < 150 tons	0.730	0.550	N/A	N/A
	≥150 tons and ≤ 300 tons	0.610	0.510	N/A	N/A
	> 300 tons	0.600	0.490	N/A	N/A
Water cooled, centrifugal	< 150 tons	0.610	0.620	0.630	0.410
	≥150 tons and ≤ 300 tons	0.590	0.560	0.610	0.410
	> 300 tons and ≤ 600 tons	0.570	0.510	0.590	0.400
	> 600 tons	0.550	0.510	0.570	0.400
Equipment Type Absorption Chillers	Size Category	Required Efficiency Full load COP (IPLV) (See note g.)			
Air cooled, single effect	All Capacities	0.60, but only allowed in heat recovery applications			
Water cooled, single effect	All Capacities	0.70, but only allowed in heat recovery applications			
Double effect – direct fired	All Capacities	1.0(1.05)			
Double effect – indirect fired	All Capacities	1.20			

a. Compliance with full load efficiency numbers and IPLV numbers are both required.
b. Systems with single chillers that operate on 460/480V require ASDs. ASDs are optional in multiple chiller systems.
c. Electrically-operated chiller packages shall be tested in accordance with ARI Standard 550/590
d. Absorption chillers shall be tested in accordance with ARI Standard 560
e. Chapter 6 contains a complete specification of the referenced test procedures, including the referenced year version of the test procedure.
f. Water-cooled centrifugal water-chilling packages that are not designed for operation at ARI Standard 550/590 test conditions (and thus cannot be tested to meet the requirements of Table 503.2.3(7)) of 44 degrees F leaving chilled water temperature and 85 degrees F entering condenser water temperature shall meet the applicable full load and IPLV/NPLV requirements in Tables 503.2.3(8) through 503.2.3(15) for "Path A" and in Tables 503.2.3(16 through 503..2.3(21) for "Path B."
g. The chiller equipment requirements do not apply for chillers used in low temperature applications where the design leaving fluid temperature in less than or equal to 40 degrees F.

TABLE 503.2.3(8)
PATH A - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.49	0.47	0.46	0.44	0.42	0.41
45	75	30	0.50	0.48	0.47	0.45	0.43	0.42
44	75	31	0.51	0.49	0.47	0.46	0.44	0.43
43	75	32	0.52	0.50	0.48	0.46	0.45	0.44
42	75	33	0.52	0.50	0.49	0.47	0.46	0.45
41	75	34	0.53	0.51	0.50	0.48	0.47	0.46
46	80	34	0.53	0.51	0.50	0.48	0.47	0.46
40	75	35	0.54	0.52	0.50	0.49	0.48	0.47
45	80	35	0.54	0.52	0.50	0.49	0.48	0.47
44	80	36	0.55	0.53	0.51	0.49	0.48	0.48
43	80	37	0.56	0.53	0.52	0.50	0.49	0.48
42	80	38	0.57	0.54	0.53	0.51	0.50	0.49
41	80	39	0.58	0.55	0.53	0.52	0.51	0.50
46	85	39	0.58	0.55	0.53	0.52	0.51	0.50
40	80	40	0.60	0.56	0.54	0.52	0.51	0.51
45	85	40	0.60	0.56	0.54	0.52	0.51	0.51
44	85	41	0.62	0.57	**0.55**	0.53	0.52	0.51
43	85	42	0.64	0.59	0.56	0.54	0.53	0.52
42	85	43	0.66	0.60	0.57	0.55	0.54	0.53
41	85	44	0.69	0.62	0.59	0.56	0.55	0.54
40	85	45	0.72	0.64	0.60	0.57	0.55	0.55
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

The following applies to the above table and all the following tables :

- LIFT = Entering Condenser Water Temperature - Leaving Chilled Water Temperature
- Cond DT = Leaving Condenser Water Temperature(F) - Entering Condenser Water Temperature(F)
- Kadj = 6.1507 - 0.30244(X) + 0.0062692(X)2 - 0.000045595(X)3 where X = Cond DT + LIFT
- kW/ton adj = kW/tonstd / Kadj

TABLE 503.2.3(9)
PATH A - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 300 Tons < 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.51	0.49	0.47	0.45	0.44	0.43
45	75	30	0.52	0.50	0.48	0.46	0.45	0.44
44	75	31	0.53	0.51	0.49	0.47	0.46	0.45
43	75	32	0.53	0.51	0.50	0.48	0.47	0.46
42	75	33	0.54	0.52	0.51	0.49	0.48	0.47
41	75	34	0.55	0.53	0.52	0.50	0.49	0.48
46	80	34	0.55	0.53	0.52	0.50	0.49	0.48
40	75	35	0.56	0.54	0.52	0.51	0.49	0.49
45	80	35	0.56	0.54	0.52	0.51	0.49	0.49
44	80	36	0.57	0.54	0.53	0.51	0.50	0.49
43	80	37	0.58	0.55	0.54	0.52	0.51	0.50
42	80	38	0.59	0.56	0.55	0.53	0.52	0.51
41	80	39	0.60	0.57	0.55	0.53	0.52	0.52
46	85	39	0.60	0.57	0.55	0.53	0.52	0.52
40	80	40	0.62	0.58	0.56	0.54	0.53	0.52
45	85	40	0.62	0.58	0.56	0.54	0.53	0.52
44	85	41	0.64	0.59	**0.57**	0.55	0.54	0.53
43	85	42	0.66	0.61	0.58	0.56	0.55	0.54
42	85	43	0.68	0.62	0.60	0.57	0.56	0.55
41	85	44	0.71	0.64	0.61	0.58	0.56	0.56
40	85	45	0.75	0.66	0.63	0.59	0.57	0.57
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(10)
PATH A - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 150 Tons < 300 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.53	0.51	0.49	0.47	0.45	0.44
45	75	30	0.54	0.52	0.50	0.48	0.46	0.45
44	75	31	0.55	0.52	0.51	0.49	0.47	0.46
43	75	32	0.55	0.53	0.52	0.50	0.48	0.48
42	75	33	0.56	0.54	0.53	0.51	0.49	0.49
41	75	34	0.57	0.55	0.53	0.51	0.50	0.49
46	80	34	0.57	0.55	0.53	0.51	0.50	0.49
40	75	35	0.58	0.56	0.54	0.52	0.51	0.50
45	80	35	0.58	0.56	0.54	0.52	0.51	0.50
44	80	36	0.59	0.56	0.55	0.53	0.52	0.51
43	80	37	0.60	0.57	0.56	0.54	0.53	0.52
42	80	38	0.61	0.58	0.56	0.55	0.54	0.53
41	80	39	0.63	0.59	0.57	0.55	0.54	0.54
46	85	39	0.63	0.59	0.57	0.55	0.54	0.54
40	80	40	0.64	0.60	0.58	0.56	0.55	0.54
45	85	40	0.64	0.60	0.58	0.56	0.55	0.54
44	85	41	0.66	0.61	0.59	0.57	0.56	0.55
43	85	42	0.68	0.63	0.60	0.58	0.57	0.56
42	85	43	0.71	0.65	0.62	0.59	0.58	0.57
41	85	44	0.74	0.66	0.63	0.60	0.58	0.58
40	85	45	0.77	0.69	0.65	0.61	0.60	0.59
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(11)
PATH A - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS < 150 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.55	0.53	0.51	0.48	0.47	0.46
45	75	30	0.56	0.53	0.52	0.49	0.48	0.47
44	75	31	0.56	0.54	0.53	0.50	0.49	0.48
43	75	32	0.57	0.55	0.53	0.51	0.50	0.49
42	75	33	0.58	0.56	0.54	0.52	0.51	0.50
41	75	34	0.59	0.57	0.55	0.53	0.52	0.51
46	80	34	0.59	0.57	0.55	0.53	0.52	0.51
40	75	35	0.60	0.57	0.56	0.54	0.53	0.52
45	80	35	0.60	0.57	0.56	0.54	0.53	0.52
44	80	36	0.61	0.58	0.57	0.55	0.54	0.53
43	80	37	0.62	0.59	0.58	0.56	0.55	0.54
42	80	38	0.63	0.60	0.58	0.56	0.55	0.55
41	80	39	0.65	0.61	0.59	0.57	0.56	0.55
46	85	39	0.65	0.61	0.59	0.57	0.56	0.55
40	80	40	0.66	0.62	0.60	0.58	0.57	0.56
45	85	40	0.66	0.62	0.60	0.58	0.57	0.56
44	85	41	0.68	0.64	0.61	0.59	0.58	0.57
43	85	42	0.70	0.65	0.62	0.60	0.59	0.58
42	85	43	0.73	0.67	0.64	0.61	0.59	0.59
41	85	44	0.76	0.69	0.65	0.62	0.60	0.60
40	85	45	0.80	0.71	0.67	0.63	0.62	0.61
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

2. Add new tables as follows:

TABLE 503.2.3(12)
PATH A - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.51	0.49	0.47	0.45	0.44	0.43
45	75	30	0.52	0.50	0.48	0.46	0.45	0.44
44	75	31	0.53	0.51	0.49	0.47	0.46	0.45
43	75	32	0.53	0.51	0.50	0.48	0.47	0.46
42	75	33	0.54	0.52	0.51	0.49	0.48	0.47
41	75	34	0.55	0.53	0.52	0.50	0.49	0.48
46	80	34	0.55	0.53	0.52	0.50	0.49	0.48
40	75	35	0.56	0.54	0.52	0.51	0.49	0.49
45	80	35	0.56	0.54	0.52	0.51	0.49	0.49
44	80	36	0.57	0.54	0.53	0.51	0.50	0.49
43	80	37	0.58	0.55	0.54	0.52	0.51	0.50
42	80	38	0.59	0.56	0.55	0.53	0.52	0.51
41	80	39	0.60	0.57	0.55	0.53	0.52	0.52
46	85	39	0.60	0.57	0.55	0.53	0.52	0.52
40	80	40	0.62	0.58	0.56	0.54	0.53	0.52
45	85	40	0.62	0.58	0.56	0.54	0.53	0.52
44	85	41	0.64	0.59	**0.57**	0.55	0.54	0.53
43	85	42	0.66	0.61	0.58	0.56	0.55	0.54
42	85	43	0.68	0.62	0.60	0.57	0.56	0.55
41	85	44	0.71	0.64	0.61	0.58	0.56	0.56
40	85	45	0.75	0.66	0.63	0.59	0.57	0.57
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(13)
PATH A - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 300 TONS AND < 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.46	0.44	0.42	0.40	0.39	0.38
45	75	30	0.47	0.45	0.43	0.41	0.40	0.39
44	75	31	0.47	0.45	0.44	0.42	0.41	0.40
43	75	32	0.48	0.46	0.45	0.43	0.42	0.41
42	75	33	0.49	0.47	0.45	0.44	0.43	0.42
41	75	34	0.49	0.47	0.46	0.44	0.43	0.43
46	80	34	0.49	0.47	0.46	0.44	0.43	0.43
40	75	35	0.50	0.48	0.47	0.45	0.44	0.44
45	80	35	0.50	0.48	0.47	0.45	0.44	0.44
44	80	36	0.51	0.49	0.47	0.46	0.45	0.44
43	80	37	0.52	0.49	0.48	0.47	0.46	0.45
42	80	38	0.53	0.50	0.49	0.47	0.46	0.46
41	80	39	0.54	0.51	0.50	0.48	0.47	0.46
46	85	39	0.54	0.51	0.50	0.48	0.47	0.46
40	80	40	0.55	0.52	0.50	0.49	0.48	0.47
45	85	40	0.55	0.52	0.50	0.49	0.48	0.47
44	85	41	0.57	0.53	**0.51**	0.49	0.48	0.48
43	85	42	0.59	0.54	0.52	0.50	0.49	0.48
42	85	43	0.61	0.56	0.53	0.51	0.50	0.49
41	85	44	0.64	0.57	0.55	0.52	0.51	0.50
40	85	45	0.67	0.59	0.56	0.53	0.51	0.51
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(14)
PATH A - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 150 TONS < 300

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.50	0.48	0.47	0.44	0.43	0.42
45	75	30	0.51	0.49	0.48	0.45	0.44	0.43
44	75	31	0.52	0.50	0.48	0.46	0.45	0.44
43	75	32	0.53	0.51	0.49	0.47	0.46	0.45
42	75	33	0.53	0.51	0.50	0.48	0.47	0.46
41	75	34	0.54	0.52	0.51	0.49	0.48	0.47
46	80	34	0.54	0.52	0.51	0.49	0.48	0.47
40	75	35	0.55	0.53	0.51	0.50	0.49	0.48
45	80	35	0.55	0.53	0.51	0.50	0.49	0.48
44	80	36	0.56	0.53	0.52	0.50	0.49	0.49
43	80	37	0.57	0.54	0.53	0.51	0.50	0.49
42	80	38	0.58	0.55	0.54	0.52	0.51	0.50
41	80	39	0.59	0.56	0.54	0.53	0.52	0.51
46	85	39	0.59	0.56	0.54	0.53	0.52	0.51
40	80	40	0.61	0.57	0.55	0.53	0.52	0.52
45	85	40	0.61	0.57	0.55	0.53	0.52	0.52
44	85	41	0.63	0.58	0.56	0.54	0.53	0.52
43	85	42	0.65	0.60	0.57	0.55	0.54	0.53
42	85	43	0.67	0.61	0.58	0.56	0.55	0.54
41	85	44	0.70	0.63	0.60	0.57	0.56	0.55
40	85	45	0.73	0.65	0.61	0.58	0.56	0.56
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(15)
PATH A - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS < 150 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.56	0.53	0.52	0.49	0.48	0.46
45	75	30	0.57	0.54	0.53	0.50	0.49	0.48
44	75	31	0.57	0.55	0.54	0.51	0.50	0.49
43	75	32	0.58	0.56	0.54	0.52	0.51	0.50
42	75	33	0.59	0.57	0.55	0.53	0.52	0.51
41	75	34	0.60	0.58	0.56	0.54	0.53	0.52
46	80	34	0.60	0.58	0.56	0.54	0.53	0.52
40	75	35	0.61	0.58	0.57	0.55	0.54	0.53
45	80	35	0.61	0.58	0.57	0.55	0.54	0.53
44	80	36	0.62	0.59	0.58	0.56	0.55	0.54
43	80	37	0.63	0.60	0.58	0.57	0.55	0.55
42	80	38	0.64	0.61	0.59	0.57	0.56	0.55
41	80	39	0.66	0.62	0.60	0.58	0.57	0.56
46	85	39	0.66	0.62	0.60	0.58	0.57	0.56
40	80	40	0.67	0.63	0.61	0.59	0.58	0.57
45	85	40	0.67	0.63	0.61	0.59	0.58	0.57
44	85	41	0.69	0.65	0.62	0.60	0.59	0.58
43	85	42	0.72	0.66	0.63	0.61	0.60	0.59
42	85	43	0.74	0.68	0.65	0.62	0.60	0.60
41	85	44	0.77	0.70	0.66	0.63	0.61	0.61
40	85	45	0.81	0.72	0.68	0.64	0.63	0.62
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(16)
PATH B - FULL LOAD-EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.51	0.49	0.47	0.45	0.44	0.43
45	75	30	0.52	0.50	0.48	0.46	0.45	0.44
44	75	31	0.53	0.51	0.49	0.47	0.46	0.45
43	75	32	0.53	0.51	0.50	0.48	0.47	0.46
42	75	33	0.54	0.52	0.51	0.49	0.48	0.47
41	75	34	0.55	0.53	0.52	0.50	0.49	0.48
46	80	34	0.55	0.53	0.52	0.50	0.49	0.48
40	75	35	0.56	0.54	0.52	0.51	0.49	0.49
45	80	35	0.56	0.54	0.52	0.51	0.49	0.49
44	80	36	0.57	0.54	0.53	0.51	0.50	0.49
43	80	37	0.58	0.55	0.54	0.52	0.51	0.50
42	80	38	0.59	0.56	0.55	0.53	0.52	0.51
41	80	39	0.60	0.57	0.55	0.53	0.52	0.52
46	85	39	0.60	0.57	0.55	0.53	0.52	0.52
40	80	40	0.62	0.58	0.56	0.54	0.53	0.52
45	85	40	0.62	0.58	0.56	0.54	0.53	0.52
44	85	41	0.64	0.59	**0.57**	0.55	0.54	0.53
43	85	42	0.66	0.61	0.58	0.56	0.55	0.54
42	85	43	0.68	0.62	0.60	0.57	0.56	0.55
41	85	44	0.71	0.64	0.61	0.58	0.56	0.56
40	85	45	0.75	0.66	0.63	0.59	0.57	0.57
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(17)
PATH B - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 300 TONS < 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.53	0.51	0.49	0.47	0.45	0.44
45	75	30	0.54	0.52	0.50	0.48	0.46	0.45
44	75	31	0.55	0.52	0.51	0.49	0.47	0.46
43	75	32	0.55	0.53	0.52	0.50	0.48	0.48
42	75	33	0.56	0.54	0.53	0.51	0.49	0.49
41	75	34	0.57	0.55	0.53	0.51	0.50	0.49
46	80	34	0.57	0.55	0.53	0.51	0.50	0.49
40	75	35	0.58	0.56	0.54	0.52	0.51	0.50
45	80	35	0.58	0.56	0.54	0.52	0.51	0.50
44	80	36	0.59	0.56	0.55	0.53	0.52	0.51
43	80	37	0.60	0.57	0.56	0.54	0.53	0.52
42	80	38	0.61	0.58	0.56	0.55	0.54	0.53
41	80	39	0.63	0.59	0.57	0.55	0.54	0.54
46	85	39	0.63	0.59	0.57	0.55	0.54	0.54
40	80	40	0.64	0.60	0.58	0.56	0.55	0.54
45	85	40	0.64	0.60	0.58	0.56	0.55	0.54
44	85	41	0.66	0.61	**0.59**	0.57	0.56	0.55
43	85	42	0.68	0.63	0.60	0.58	0.57	0.56
42	85	43	0.71	0.65	0.62	0.59	0.58	0.57
41	85	44	0.74	0.66	0.63	0.60	0.58	0.58
40	85	45	0.77	0.69	0.65	0.61	0.60	0.59
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(18)
PATH B - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 150 TONS < 300 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.55	0.53	0.51	0.48	0.47	0.46
45	75	30	0.56	0.53	0.52	0.49	0.48	0.47
44	75	31	0.56	0.54	0.53	0.50	0.49	0.48
43	75	32	0.57	0.55	0.53	0.51	0.50	0.49
42	75	33	0.58	0.56	0.54	0.52	0.51	0.50
41	75	34	0.59	0.57	0.55	0.53	0.52	0.51
46	80	34	0.59	0.57	0.55	0.53	0.52	0.51
40	75	35	0.60	0.57	0.56	0.54	0.53	0.52
45	80	35	0.60	0.57	0.56	0.54	0.53	0.52
44	80	36	0.61	0.58	0.57	0.55	0.54	0.53
43	80	37	0.62	0.59	0.58	0.56	0.55	0.54
42	80	38	0.63	0.60	0.58	0.56	0.55	0.55
41	80	39	0.65	0.61	0.59	0.57	0.56	0.55
46	85	39	0.65	0.61	0.59	0.57	0.56	0.55
40	80	40	0.66	0.62	0.60	0.58	0.57	0.56
45	85	40	0.66	0.62	0.60	0.58	0.57	0.56
44	85	41	0.68	0.64	0.61	0.59	0.58	0.57
43	85	42	0.70	0.65	0.62	0.60	0.59	0.58
42	85	43	0.73	0.67	0.64	0.61	0.59	0.59
41	85	44	0.76	0.69	0.65	0.62	0.60	0.60
40	85	45	0.80	0.71	0.67	0.63	0.62	0.61
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(19)
PATH B – FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS < 150 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.57	0.54	0.52	0.50	0.48	0.47
45	75	30	0.57	0.55	0.53	0.51	0.50	0.48
44	75	31	0.58	0.56	0.54	0.52	0.51	0.50
43	75	32	0.59	0.57	0.55	0.53	0.52	0.51
42	75	33	0.60	0.58	0.56	0.54	0.53	0.52
41	75	34	0.61	0.58	0.57	0.55	0.54	0.53
46	80	34	0.61	0.58	0.57	0.55	0.54	0.53
40	75	35	0.62	0.59	0.58	0.56	0.55	0.54
45	80	35	0.62	0.59	0.58	0.56	0.55	0.54
44	80	36	0.63	0.60	0.59	0.57	0.55	0.55
43	80	37	0.64	0.61	0.59	0.57	0.56	0.56
42	80	38	0.65	0.62	0.60	0.58	0.57	0.56
41	80	39	0.67	0.63	0.61	0.59	0.58	0.57
46	85	39	0.67	0.63	0.61	0.59	0.58	0.57
40	80	40	0.69	0.64	0.62	0.60	0.59	0.58
45	85	40	0.69	0.64	0.62	0.60	0.59	0.58
44	85	41	0.70	0.66	0.63	0.61	0.60	0.59
43	85	42	0.73	0.67	0.64	0.62	0.60	0.60
42	85	43	0.75	0.69	0.66	0.63	0.61	0.61
41	85	44	0.79	0.71	0.67	0.64	0.62	0.61
40	85	45	0.82	0.73	0.69	0.65	0.64	0.63
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(20)
PATH B - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS > 300 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.36	0.34	0.33	0.32	0.31	0.30
45	75	30	0.36	0.35	0.34	0.32	0.31	0.31
44	75	31	0.37	0.3 6	0.35	0.33	0.32	0.32
43	75	32	0.38	0.36	0.35	0.34	0.33	0.32
42	75	33	0.38	0.37	0.36	0.34	0.33	0.33
41	75	34	0.39	0.37	0.36	0.35	0.34	0.34
46	80	34	0.39	0.37	0.36	0.35	0.34	0.34
40	75	35	0.39	0.38	0.37	0.35	0.35	0.34
45	80	35	0.39	0.38	0.37	0.35	0.35	0.34
44	80	36	0.40	0.38	0.37	0.36	0.35	0.35
43	80	37	0.41	0.39	0.38	0.36	0.36	0.35
42	80	38	0.41	0.39	0.38	0.37	0.36	0.36
41	80	39	0.42	0.40	0.39	0.38	0.37	0.36
46	85	39	0.42	0.40	0.39	0.38	0.37	0.36
40	80	40	0.44	0.41	0.39	0.38	0.37	0.37
45	85	40	0.44	0.41	0.39	0.38	0.37	0.37
44	85	41	0.45	0.42	**0.40**	0.39	0.38	0.37
43	85	42	0.46	0.43	0.41	0.39	0.38	0.38
42	85	43	0.48	0.44	0.42	0.40	0.39	0.38
41	85	44	0.50	0.45	0.43	0.41	0.40	0.39
40	85	45	0.52	0.47	0.44	0.41	0.40	0.40
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(21)
PATH B - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS < 300 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.37	0.35	0.34	0.33	0.31	0.31
45	75	30	0.37	0.36	0.35	0.33	0.32	0.32
44	75	31	0.38	0.36	0.35	0.34	0.33	0.32
43	75	32	0.38	0.37	0.36	0.35	0.34	0.33
42	75	33	0.39	0.38	0.37	0.35	0.34	0.34
41	75	34	0.40	0.38	0.37	0.36	0.35	0.34
46	80	34	0.40	0.38	0.37	0.36	0.35	0.34
40	75	35	0.40	0.39	0.38	0.36	0.36	0.35
45	80	35	0.40	0.39	0.38	0.36	0.36	0.35
44	80	36	0.41	0.39	0.38	0.37	0.36	0.36
43	80	37	0.42	0.40	0.39	0.37	0.37	0.36
42	80	38	0.43	0.40	0.39	0.38	0.37	0.37
41	80	39	0.43	0.41	0.40	0.38	0.38	0.37
46	85	39	0.43	0.41	0.40	0.38	0.38	0.37
40	80	40	0.45	0.42	0.40	0.39	0.38	0.38
45	85	40	0.45	0.42	0.40	0.39	0.38	0.38
44	85	41	0.46	0.43	0.41	0.40	0.39	0.38
43	85	42	0.47	0.44	0.42	0.40	0.39	0.39
42	85	43	0.49	0.45	0.43	0.41	0.40	0.39
41	85	44	0.51	0.46	0.44	0.42	0.41	0.40
40	85	45	0.54	0.48	0.45	0.43	0.41	0.41
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

(Renumber subsequent Table 503.2.3(11) to 503.2.3(22)

Reason: The current minimum efficiency requirements for electrically-operated chillers in Chapter 5 of the 2006 IECC are less stringent than those contained in ASHRAE Standard 90.1-2004 which is referenced in Section 501 of the IECC. The ASHRAE Standard 90.1, in turn, contains minimum chiller efficiency requirements that are essentially unchanged since the 1999 version of the standard. The underlying data used to set the 1999 ASHRAE Standard dates back to 1993. Thus, in late 2007 when the Supplement to the 2006 IECC is issued, the data and analyses underlying the chiller efficiency requirements will be almost 15 years old.

Advances in cost-effective energy-efficient chiller performance since 1993, widespread marketing of chillers with adjustable speed drives (ASDs), and historic and dramatic increases in energy costs in recent years, coupled with equipment lifetimes of more than 20 years, require this code proposal change. According to some manufacturers, the most efficient chiller available in 1993 was rated at 0.52 kW per ton of full-load cooling capacity. Today the most efficient models are rated at about 0.47 kW per ton—about a 10% increase. In addition, some manufacturers believe that the performance of the average chiller sold in the marketplace has increased by the same amount. Yet, the minimum efficiency requirements for chillers have not risen at all. The proponents believe that now is the time to increase the minimum efficiency requirements for electrically-operated chillers.

Purpose: The purpose of this code change proposal is to update the minimum efficiency requirements for electrically-operated water chiller packages in Section 5 of the 2006 IECC. Specifically, we propose to strengthen efficiency requirements, add an explicit path for chillers with adjustable speed drives (ASDs), and change the units of measurement to that which is most widely used in the industry.

Substantiation: The basis for this code change proposal are the chiller performance criteria recommended in the New Buildings Institute publication ***Advanced Buildings Benchmark Version 1.1*** ("Benchmark".) Version 1.0 of the Benchmark was published in October 2003. A national committee consisting of manufacturers, contractors, building owners, designers, property managers, government representatives, efficiency experts and members of the public was involved in Benchmark's rigorous, year-long development and review process. The development process was modeled after the policies and procedures on the American National Standards Institute (ANSI) and included a Criteria Review Committee to serve as a "consensus body". Version 1.1 of the Benchmark was published in January 2005.

The Benchmark document is intended to provide comprehensive "whole building" design guidance for envelope, lighting and mechanical systems as well as commissioning recommendations. The Benchmark is recognized by the US Green Buildings Council for prescriptive use in the LEED process. For this code change proposal we have adapted the chiller performance recommendations of the Benchmark because of the open development process, rigorous technical analysis and its ANSI-based consensus approach. However, while we have largely used the Benchmark values to develop this proposal, in the case of centrifugal chillers with ASDs, we have modestly loosened the full-load performance values in order to make these easier to meet. Specifically, we have made the full load efficiencies 0.02 kW/ton higher for systems with ASDs than without in order to allow for ASD losses. Also, we have increased the IPLV for centrifugal chillers of 300 tons or less from 0.40 to 0.41 in order to allow some additional manufacturers and products to comply.

Adoption of this code change proposal will bring important improvements to the IECC commercial building requirements. To assist reviewers, we have provided a table which compares the current IECC and ASHRAE requirements to the code change proposal. As shown in the table, the 2006 IECC lags ASHRAE 90.1-2004 slightly on full-load performance and also in the important criterion of integrated part-load value (IPLV) ratings. On average, the 2006 IECC is about 9.3% less stringent than the current ASHRAE standard for IPLV. With this code change proposal the IECC can improve full-load chiller performance by about 6.6% and improve IPLV by about 18.3% across all chiller types. If adopted, the IECC will require better chiller performance than the ASHRAE standard.

According to a 2001 study prepared for DOE, chillers account for about 31% of commercial building cooling energy use, or about 42 billion kWh of electricity use each year. An 18.3% average improvement in IPLV means that more than 7 billion kWh will be saved annually once the existing chiller stock turns over, not to mention additional savings from more efficient chillers in new buildings. Based on these electricity savings figures, the average peak load and IPLV improvements discussed above, and the full load equivalent operating hours for chillers assumed by ASHRAE 90.1, once the stock turns over, these chiller standards will reduce peak electric generating requirements by about 1800 MW, equivalent to six power plants of 300 MW each.

The code change proposal also offers more flexibility to manufacturers, design engineers and building owners in selecting the best chiller for a particular application. There are two compliance paths to demonstrate minimum chiller efficiency. The first set of criteria (Path A) applies to chillers with or without adjustable speed drives or ASDs. A second optional compliance path (Path B) includes slightly less stringent full-load requirements for chillers equipped with ASDs. The optional compliance path offers cost flexibility to all parties. In particular, this path was developed by NBI in order to permit all current chiller manufacturers to meet the standard, irregardless of which refrigerant they use. As of 2002 when NBI did its analysis, each of the chiller efficiency values could be met by at least two manufacturers, and at least three manufacturers in most cases. Since then, additional equipment has been introduced to the market. In addition, the modest easing we propose to the NBI full-load efficiencies for chillers with ASDs will also increase the number of existing products that comply. Furthermore, since chillers are generally custom engineered and built for each site, manufacturers will generally have the option of adding additional heat exchange area to a chiller in order to reach an efficiency level that current equipment may just miss.

When NBI developed the Benchmark, the economics of all requirements were examined and each requirement needed to provide positive discounted lifecycle cost savings to building owners. Since then, electricity costs have increased significantly (e.g. commercial average electricity prices are up 15% comparing Dec. 2005 to Dec. 2002), improving the economics of the Benchmark chiller efficiency requirements.

Normally, we would bring a proposal to improve chiller efficiency to ASHRAE first before approaching the ICC. However, the chiller industry has been in a multiyear controversy over chiller refrigerants, with the largest manufacturer preferring one refrigerant and several manufacturers preferring another refrigerant. ASHRAE has attempted to develop a consensus on new chiller efficiency values for more than two years but has been unsuccessful due to this controversy over refrigerants. The Air-Conditioning and Refrigeration Institute (ARI), the chiller industry trade association, has set up a process to try to broker a compromise, but this process is moving very slowly. In the face of inaction by both ASHRAE and ARI, we are making this proposal to the ICC. Our proposal is a compromise that provides efficiency levels that can be met with both refrigerants, provided manufacturers use best practices.

The code change proposal also changes the basic units describing minimum chiller performance in an energy code. Instead of the traditional Coefficient of Performance (COP) metric, we are proposing to use the more industry-standard term of kilowatts per ton of cooling capacity.

Supplemental Information

Chiller Performance Requirements Comparison for IECC Code Change Proposal

Equipment Type and Capacity		**COP Comparisons**				**kW per Ton Comparisons**					
Equipment Type	**Size Category**	**Units**	**ASHRAE Standard 90.1-2004 Table 6.8.1C**	**2006 IECC Table 503.2.3(7)**	**IECC compared to ASHRAE (Percent Below)**	**Units**	**ASHRAE Standard 90.1-2004 Table 6.8.1C**	**2006 IECC Table 503.2.3(7)**	**Code Change Proposal (NBI-based)**	**Code Change Proposal compared to ASHRAE (Percent Better)**	**Code Change Proposal compared to IECC (Percent Better)**
Air cooled w/ condenser	<150 tons	COP	2.80	2.80	0.0%	Full Load	1.256	1.256	**1.200**	4.4%	4.4%
		IPLV	3.05	2.80	-8.2%	IPLV	1.153	1.256	**1.000**	13.3%	20.4%
	>150 tons	COP	2.80	2.50	-10.7%	Full Load	1.256	1.406	**1.200**	4.4%	14.7%
		IPLV	3.05	2.50	-18.0%	IPLV	1.153	1.406	**1.000**	13.3%	28.9%
Air cooled w/o condenser	All	COP	3.10	3.10	0.0%	Full Load	1.134	1.134	**1.080**	4.8%	4.8%
		IPLV	3.45	3.10	-10.1%	IPLV	1.019	1.134	**1.080**	-6.0%	4.8%
Water cooled, reciprocating	All	COP	4.20	4.20	0.0%	Full Load	0.837	0.837	**0.840**	-0.3%	-0.3%
		IPLV	5.05	4.65	-7.9%	IPLV	0.696	0.756	**0.630**	9.5%	16.7%
Water cooled, rotary screw and scroll (positive displacement)	< 100 tons	COP	4.45	4.45	0.0%	Full Load	0.790	0.790	**0.780**	1.3%	1.3%
		IPLV	5.20	4.50	-13.5%	IPLV	0.676	0.781	**0.600**	11.3%	23.2%
	100 tons and <150 tons	COP	4.45	4.45	0.0%	Full Load	0.790	0.790	**0.730**	7.6%	7.6%
		IPLV	5.20	4.50	-13.5%	IPLV	0.676	0.781	**0.550**	18.7%	29.6%
	150 tons and <300 tons	COP	4.90	4.90	0.0%	Full Load	0.718	0.718	**0.610**	15.0%	15.0%
		IPLV	5.60	4.95	-11.6%	IPLV	0.628	0.710	**0.510**	18.8%	28.2%
	> 300 tons	COP	5.50	5.50	10.9%	Full Load	0.639	0.576	**0.600**	6.1%	6.1%
		IPLV	6.15	5.60	-0.8%	IPLV	0.572	0.576	**0.490**	14.3%	22.0%
Water cooled, centrifugal	< 150 tons	COP	5.00	5.00	0.0%	Full Load	0.703	0.703	**0.610**	13.3%	13.3%
		IPLV	5.25	5.00	-4.8%	IPLV	0.670	0.703	**0.620**	7.4%	11.8%
	150 tons and 300 tons	COP	5.55	5.55	0.0%	Full Load	0.634	0.634	**0.590**	6.9%	6.9%
		IPLV	5.90	5.55	-5.9%	IPLV	0.596	0.634	**0.560**	6.0%	11.6%
	>300 tons and <600 tons	COP	6.10	6.10	0.0%	Full Load	0.576	0.576	**0.570**	1.1%	1.1%
		IPLV	6.40	6.10	-4.7%	IPLV	0.549	0.576	**0.510**	7.2%	11.5%
	> 600 tons	COP	6.10	6.10	0.0%	Full Load	0.576	0.576	**0.550**	4.6%	4.6%
		IPLV	6.40	6.10	-4.7%	IPLV	0.549	0.576	**0.510**	7.2%	11.5%
		Average Differences		COP	-0.9%	Average Differences			Full Load	5.8%	6.6%
			IPLV		-9.3%				IPLV	10.1%	18.3%

Bibliography: New Buildings Institute ***Advanced Buildings Benchmark Version 1.1*** is available for viewing at: http://www.poweryourdesign.com/benchmark.htm

More information on the Benchmark is available at: http://www.newbuildings.org

Cost Impact: The code change proposal will increase the cost of construction. Note that the proponents believe that any cost increases will be modest with respect to these changes to minimum efficiency requirements.

Committee Action: Disapproved

Committee Reason: The proponent offered some changes to the tables to correct some of the values. This modification was ruled out of order because of the complexity. While the committee does not necessarily disagree with the proposed concept, the proposal could not be approved using the wrong values.

Assembly Action: None

Individual Consideration Agenda

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

Public Comment:

Steven Nadel, American Council for an Energy-Efficient Economy, representing ACEEE, ARI, and ASHRAE, requests Approval as Modified by this Public Comment.

Replace proposal with the following:

TABLE 503.2.3(7)
WATER CHILLING PACKAGES-MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Minimum Efficiency[a]	Test Procedure[b]
Air Cooled, with Condenser, Electrically Operated	~~< 150 tons~~ all capacities	2.80 COP ~~2.80~~ 3.05 IPLV	ARI 550/590
	~~≥ 150 tons~~	~~2.80 COP~~ ~~2.80 IPLV~~	
Air Cooled, without Condenser, Electrically Operated	All Capacities	3.10 COP ~~3.10~~ 3.45 IPLV	ARI 550/590
Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)	All Capacities	4.20 COP ~~4.65~~ 5.05 IPLV	
Water Cooled, Electrically Operated, Positive Displacement (Rotary Screw and Scroll)	<150 tons	4.45 COP ~~4.50~~ 5.20 IPLV	ARI 550/590
	≥150 tons and <300 tons	4.90 COP ~~4.95~~ 5.60 IPLV	
	≥300 tons	5.50 COP ~~5.60~~ 6.15 IPLV	
Water Cooled, Electrically Operated, Centrifugal	<150 tons	5.00 COP ~~5.00~~ 5.25 IPLV	ARI 550/590
	≥150 tons and <300 tons	5.55 COP ~~5.55~~ 5.90 IPLV	
	≥300 tons	6.10 COP ~~6.10~~ 6.40 IPLV	
Air-Cooled Absorption Single Effect	All Capacities	0.60 COP	ARI 560
Water-Cooled Absorption Single Effect	All Capacities	0.70 COP	
Absorption Double Effect, Indirect-Fired	All Capacities	1.00 COP 1.05 IPLV	
Absorption Double Effect, Direct-Fired	All Capacities	1.00 COP 1.00 IPLV	

[a] The chiller equipment requirements do not apply for chillers used in low-temperature applications where the design leaving fluid temperature is <40°F.
[b] Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

TABLE 503.2.3(8)
COPs AND IPLVs FOR NONSTANDARD CENTRIFUGAL CHILLERS < 150 TONS

CENTRIFUGAL CHILLERS < 150 TONS COPstd = 5.4								
			Condenser flow rate					
Leaving chilled water temperature (F)	Entering condenser water temperature (F)	Lift[a] (F)	2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required COP and IPLV					
46	75	29	6.00	6.27	6.48	6.80	7.03	7.20
45	75	30	5.92	6.17	6.37	6.66	6.87	7.02
44	75	31	5.84	6.08	6.26	6.53	6.71	6.86
43	75	32	5.75	5.99	6.16	6.40	6.58	6.71
42	75	33	5.67	5.90	6.06	6.29	6.45	6.57
41	75	34	5.59	5.82	5.98	6.19	6.34	6.44
46	80	34	5.59	5.82	5.98	6.19	6.34	6.44
40	75	35	5.50	5.74	5.89	6.10	6.23	6.33
45	80	35	5.50	5.74	5.89	6.10	6.23	6.33
44	80	36	5.41	5.66	5.81	6.01	6.13	6.22
43	80	37	5.31	5.57	5.73	5.92	6.04	6.13
42	80	38	5.21	5.48	5.64	5.84	5.95	6.04
41	80	39	5.09	5.39	5.56	5.76	5.87	5.95
46	85	39	5.09	5.39	5.56	5.76	5.87	5.95
40	80	40	4.96	5.29	5.47	5.67	5.79	5.86
45	85	40	4.96	5.29	5.47	5.67	5.79	5.86
44	85	41	4.83	5.18	5.40	5.59	5.71	5.78
43	85	42	4.68	5.07	5.28	5.50	5.62	5.70
42	85	43	4.51	4.94	5.17	5.41	5.54	5.62
41	85	44	4.33	4.80	5.05	5.31	5.45	5.53
40	85	45	4.13	4.65	4.92	5.21	5.35	5.44
Condenser ΔT[b]			14.04	11.23	9.36	7.02	5.62	4.68

For SI: C = [(F)-32]/1.8, 1 gallon per minute = 3.785 L/min., 1 ton = 1,0000 Brtish thermal units per hour = 3.517 kW

a LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
b Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
$Kadj = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
where X = Condenser DT + LIFT
COPadj = Kadj * COPstd

TABLE 503.2.3(8)
Minimum Efficiencies for Centrifugal Chillers <150 tons

Centrifugal Chillers < 150 tons COPstd= 5.00; IPLVstd= 5.25			Condenser Flow Rate											
			2 gpm/ton		**2.5 gpm/ton**		**3 gpm/ton**		**4 gpm/ton**		**5 gpm/ton**		**6 gpm/ton**	
Leaving Chilled Water Temperature (°F)	**Entering Con-denser Water Temperature (°F)**	**LIFT[a]** (°F)	**COP**	**NPLV[c]**	**COP**	**NPLV[c]**	**COP**	**NPLV[c]**	**COP**	**NPLV[c]**	**COP**	**NPLV[c]**	**COP**	**NPLV[c]**
40	75	35	5.11	5.35	5.33	5.58	5.48	5.73	5.67	5.93	5.79	6.06	5.88	6.15
40	80	40	4.62	4.83	4.92	5.14	5.09	5.32	5.27	5.52	5.38	5.63	5.45	5.70
40	85	45	3.84	4.01	4.32	4.52	4.58	4.79	4.84	5.06	4.98	5.20	5.06	5.29
41	75	34	5.19	5.43	5.41	5.66	5.56	5.81	5.75	6.02	5.89	6.16	5.99	6.26
41	80	39	4.73	4.95	5.01	5.24	5.17	5.41	5.35	5.60	5.46	5.71	5.53	5.78
41	85	44	4.02	4.21	4.46	4.67	4.70	4.91	4.94	5.17	5.06	5.30	5.14	5.38
42	75	33	5.27	5.51	5.49	5.74	5.64	5.90	5.85	6.12	6.00	6.27	6.11	6.39
42	80	38	4.84	5.06	5.10	5.33	5.25	5.49	5.43	5.67	5.53	5.79	5.61	5.87
42	85	43	4.19	4.38	4.59	4.80	4.81	5.03	5.03	5.26	5.15	5.38	5.22	5.46
43	75	32	5.35	5.59	5.57	5.82	5.72	5.99	5.95	6.23	6.11	6.39	6.23	6.52
43	80	37	4.94	5.16	5.18	5.42	5.32	5.57	5.50	5.76	5.62	5.87	5.70	5.96
43	85	42	4.35	4.55	4.71	4.93	4.91	5.13	5.12	5.35	5.23	5.47	5.30	5.54
44	75	31	5.42	5.67	5.65	5.91	5.82	6.08	6.07	6.34	6.24	6.53	6.37	6.67
44	80	36	5.03	5.26	5.26	5.50	5.40	5.65	5.58	5.84	5.70	5.96	5.79	6.05
44	85	41	4.49	4.69	4.82	5.04	5.00	5.25	5.20	5.43	5.30	5.55	5.38	5.62
45	75	30	5.50	5.75	5.74	6.00	5.92	6.19	6.19	6.47	6.38	6.68	6.53	6.83
45	80	35	5.11	5.35	5.33	5.58	5.48	5.73	5.67	5.93	5.79	6.06	5.88	6.15
45	85	40	4.62	4.83	4.92	5.14	5.09	5.32	5.27	5.52	5.38	5.63	5.45	5.70
46	75	29	5.58	5.84	5.83	6.10	6.03	6.30	6.32	6.61	6.54	6.84	6.70	7.00
46	80	34	5.19	5.43	5.41	5.66	5.56	5.81	5.75	6.02	5.89	6.16	5.99	6.26
46	85	39	4.73	4.95	5.01	5.24	5.17	5.41	5.35	5.60	5.46	5.71	5.53	5.78
47	75	28	5.66	5.92	5.93	6.20	6.15	6.43	6.47	6.77	6.71	7.02	6.88	7.20
47	80	33	5.27	5.51	5.49	5.74	5.64	5.90	5.85	6.12	6.00	6.27	6.11	6.39
47	85	38	4.84	5.06	5.10	5.33	5.25	5.49	5.43	5.67	5.53	5.79	5.61	5.87
48	75	27	5.75	6.02	6.04	6.32	6.28	6.56	6.64	6.94	6.89	7.21	7.09	7.41
48	80	32	5.35	5.59	5.57	5.82	5.72	5.99	5.95	6.23	6.11	6.39	6.23	6.52
48	85	37	4.94	5.16	5.18	5.42	5.32	5.57	5.50	5.76	5.62	5.87	5.70	5.96
Condenser DT[b]			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: C = [(F)-32]/1.8, 1 gallon per minute = 3.785 L/min., 1 ton = 12,000 Brtish thermal units per hour = 3.517 kW

[a] LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
[b] Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
[c] All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperaturen which is IPLV

$Kadj = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
where X = Condenser DT + LIFT
COPadj = Kadj * COPstd

TABLE 503.2.3(9)
COPs AND IPLVs FOR NONSTANDARD CENTRIFUGAL CHILLERS 150 TONS, 300 TONS

CENTRIFUGAL CHILLERS 150 Tons, 300 Tons COPstd = 5.55								
			Condenser flow rate					
Leaving chilled water temperature (F)	Entering condenser water temperature (F)	Lift[a] (F)	2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required COP and IPLV					
46	75	29	6.17	6.44	6.66	6.99	7.23	7.40
45	75	30	6.08	6.34	6.54	6.84	7.06	7.22
44	75	31	6.00	6.24	6.43	6.71	6.90	7.05
43	75	32	5.91	6.15	6.33	6.58	6.76	6.89
42	75	33	5.83	6.07	6.23	6.47	6.63	6.75
41	75	34	5.74	5.98	6.14	6.36	6.51	6.62
46	80	34	5.74	5.98	6.14	6.36	6.51	6.62
40	75	35	5.65	5.90	6.05	6.26	6.40	6.51
45	80	35	5.65	5.90	6.05	6.26	6.40	6.51
44	80	36	5.56	5.81	5.97	6.17	6.30	6.40
43	80	37	5.46	5.73	5.89	6.08	6.21	6.30
42	80	38	5.35	5.64	5.8	6.00	6.12	6.20
41	80	39	5.23	5.54	5.71	5.91	6.03	6.11
46	85	39	5.23	5.54	5.71	5.91	6.03	6.11
40	80	40	5.10	5.44	5.62	5.83	5.95	6.03
45	85	40	5.10	5.44	5.62	5.83	5.95	6.03
44	85	41	4.96	5.33	5.55	5.74	5.86	5.94
43	85	42	4.81	5.21	5.42	5.66	5.78	5.86
42	85	43	4.63	5.08	5.31	5.56	5.69	5.77
41	85	44	4.45	4.93	5.19	5.46	5.60	5.69
40	85	45	4.24	4.77	5.06	5.35	5.50	5.59
Condenser ΔT[b]			14.04	11.23	9.36	7.02	5.62	4.68

For SI: C = [(F)-32]/1.8, 1 gallon per minute = 3.785 L/min., 1 ton = 1,0000 Brtish thermal units per hour = 3.517 kW

a LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
b Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
$Kadj = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
where X = Condenser DT + LIFT
COPadj = Kadj * COPstd

TABLE503.2.3(9)
Minimum Efficiencies for Centrifugal Chillers ≥150 tons, <300 tons

Centrifugal Chillers ≥150 tons, <300 tons COPstd= 5.55; IPLVstd= 5.90														
			Condenser Flow Rate											
			2 gpm/ton		2.5 gpm/ton		3 gpm/ton		4 gpm/ton		5 gpm/ton		6 gpm/ton	
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Tem-perature (°F)	LIFTa (°F)	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc
40	75	35	5.65	6.03	5.90	6.29	6.05	6.46	6.26	6.68	6.40	6.83	6.51	6.94
40	80	40	5.10	5.44	5.44	5.80	5.62	6.00	5.83	6.22	5.95	6.35	6.03	6.43
40	85	45	4.24	4.52	4.77	5.09	5.06	5.40	5.35	5.71	5.50	5.87	5.59	5.97
41	75	34	5.74	6.13	5.80	6.38	6.14	6.55	6.36	6.79	6.51	6.95	6.62	7.06
41	80	39	5.23	5.58	5.54	5.91	5.71	6.10	5.91	6.31	6.03	6.44	6.11	6.52
41	85	44	4.45	4.74	4.93	5.26	5.19	5.54	5.46	5.82	5.60	5.97	5.69	6.07
42	75	33	5.83	6.22	6.07	6.47	6.23	6.65	6.47	6.90	6.63	7.07	6.75	7.20
42	80	38	5.35	5.71	5.64	6.01	5.80	6.19	6.00	6.40	6.12	6.53	6.20	6.62
42	85	43	4.63	4.94	5.08	5.41	5.31	5.67	5.56	5.93	5.69	6.07	5.77	6.16
43	75	32	5.91	6.31	6.15	6.56	6.33	6.75	6.58	7.02	6.76	7.21	6.89	7.35
43	80	37	5.46	5.82	5.73	6.11	5.89	6.28	6.08	6.49	6.21	6.62	6.30	6.72
43	85	42	4.81	5.13	5.21	5.55	5.42	5.79	5.66	6.03	5.78	6.16	5.86	6.25
44	75	31	6.00	6.40	6.24	6.66	6.43	6.86	6.71	7.15	6.90	7.36	7.05	7.52
44	80	36	5.56	5.93	5.81	6.20	5.97	6.37	6.17	6.58	6.30	6.72	6.40	6.82
44	85	41	4.96	5.29	5.33	5.68	5.55	5.90	5.74	6.13	5.86	6.26	5.94	6.34
45	75	30	6.08	6.49	6.34	6.76	6.54	6.98	6.84	7.30	7.06	7.53	7.22	7.70
45	80	35	5.65	6.03	5.90	6.29	6.05	6.46	6.26	6.68	6.40	6.83	6.51	6.94
45	85	40	5.10	5.44	5.44	5.80	5.62	6.00	5.83	6.22	5.95	6.35	6.03	6.43
46	75	29	6.17	6.58	6.44	6.87	6.66	7.11	6.99	7.46	7.23	7.71	7.40	7.90
46	80	34	5.74	6.13	5.80	6.38	6.14	6.55	6.36	6.79	6.51	6.95	6.62	7.06
46	85	39	5.23	5.58	5.54	5.91	5.71	6.10	5.91	6.31	6.03	6.44	6.11	6.52
47	75	28	6.26	6.68	6.56	6.99	6.79	7.24	7.16	7.63	7.42	7.91	7.61	8.11
47	80	33	5.83	6.21	6.07	6.47	6.23	6.64	6.47	6.90	6.63	7.07	6.75	7.20
47	85	38	5.35	5.70	5.64	6.01	5.80	6.19	6.00	6.40	6.12	6.52	6.20	6.61
48	75	27	6.36	6.78	6.68	7.12	6.94	7.40	7.34	7.82	7.62	8.13	7.83	8.35
48	80	32	5.91	6.30	6.15	6.56	6.33	6.75	6.58	7.02	6.76	7.21	6.89	7.35
48	85	37	5.46	5.82	5.73	6.10	5.89	6.28	6.08	6.49	6.21	6.62	6.30	6.71
Condenser DTb			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: C = [(F)-32]/1.8, 1 gallon per minute = 3.785 L/min., 1 ton = 12,000 Brtish thermal units per hour = 3.517 kW

[a] LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
[b] Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
[c] All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperature which is IPLV

$Kadj = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
where X = Condenser DT + LIFT
COPadj = Kadj * COPstd

TABLE 503.2.3(10)
COPs AND IPLVs FOR NONSTANDARD CENTRIFUGAL CHILLERS >300 TONS

CENTRIFUGAL CHILLERS > 300 Tons COPstd = 6.1								
Leaving chilled water temperature (F)	**Entering condenser water temperature (F)**	**Lift[a] (F)**	**Condenser flow rate**					
			2 gpm/ton	**2.5 gpm/ton**	**3 gpm/ton**	**4 gpm/ton**	**5 gpm/ton**	**6 gpm/ton**
			Required COP and IPLV					
46	75	29	6.80	7.11	7.35	7.71	7.97	8.16
45	75	30	6.71	6.99	7.21	7.55	7.78	7.96
44	75	31	6.61	6.89	7.09	7.40	7.61	7.77
43	75	32	6.52	6.79	6.98	7.26	7.45	7.60
42	75	33	6.43	6.69	6.87	7.13	7.31	7.44
41	75	34	6.33	6.60	6.77	7.02	7.18	7.30
46	80	34	6.33	6.60	6.77	7.02	7.18	7.30
40	75	35	6.23	6.50	6.68	6.91	7.06	7.17
45	80	35	6.23	6.50	6.68	6.91	7.06	7.17
44	80	36	6.13	6.41	6.58	6.81	6.95	7.05
43	80	37	6.02	6.31	6.49	6.71	6.85	6.94
42	80	38	5.90	6.21	6.40	6.61	6.75	6.84
41	80	39	5.77	6.11	6.30	6.52	6.65	6.74
46	85	39	5.77	6.11	6.30	6.52	6.65	6.74
40	80	40	5.63	6.00	6.20	6.43	6.56	6.65
45	85	40	5.63	6.00	6.20	6.43	6.56	6.65
44	85	41	5.47	5.87	6.10	6.33	6.47	6.55
43	85	42	5.30	5.74	5.98	6.24	6.37	6.46
42	85	43	5.11	5.60	5.86	6.13	6.28	6.37
41	85	44	4.90	5.44	5.72	6.02	6.17	6.27
40	85	45	4.68	5.26	5.58	5.90	6.07	6.17
Condenser ΔT[b]			14.04	11.23	9.36	7.02	5.62	4.68

For SI: C = [(F)-32]/1.8, 1 gallon per minute = 3.785 L/min., 1 ton = 1,0000 Brtish thermal units per hour = 3.517 kW

a LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
b Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
$Kadj = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
where X = Condenser DT + LIFT
COPadj = Kadj * COPstd

TABLE 503.2.3(10)
Minimum Efficiencies for Centrifugal Chillers >300 tons

Centrifugal Chillers > 300 Tons COPstd= 6.10; IPLVstd= 6.40														
			Condenser Flow Rate											
			2 gpm/ton		**2.5 gpm/ton**		**3 gpm/ton**		**4 gpm/ton**		**5 gpm/ton**		**6 gpm/ton**	
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Tem-perature (°F)	**LIFTa** (°F)	**COP**	**NPLV c**	**COP**	**NPLV c**	**COP**	**NPLV c**	**COP**	**NPLV c**	**COP**	**NPLV c**	**COP**	**NPLV c**
40	75	35	6.23	6.55	6.50	6.83	6.68	7.01	6.91	7.26	7.06	7.42	7.17	7.54
40	80	40	5.63	5.91	6.00	6.30	6.20	6.52	6.43	6.76	6.56	6.89	6.65	6.98
40	85	45	4.68	4.91	5.26	5.53	5.58	5.86	5.90	6.20	6.07	6.37	6.17	6.48
41	75	34	6.33	6.65	6.60	6.93	6.77	7.12	7.02	7.37	7.18	7.55	7.30	7.67
41	80	39	5.77	6.06	6.11	6.42	6.30	6.62	6.52	6.85	6.65	6.99	6.74	7.08
41	85	44	4.90	5.15	5.44	5.71	5.72	6.01	6.02	6.33	6.17	6.49	6.27	6.59
42	75	33	6.43	6.75	6.69	7.03	6.87	7.22	7.13	7.49	7.31	7.68	7.44	7.82
42	80	38	5.90	6.20	6.21	6.53	6.40	6.72	6.61	6.95	6.75	7.09	6.84	7.19
42	85	43	5.11	5.37	5.60	5.88	5.86	6.16	6.13	6.44	6.28	6.59	6.37	6.69
43	75	32	6.52	6.85	6.79	7.13	6.98	7.33	7.26	7.63	7.45	7.83	7.60	7.98
43	80	37	6.02	6.32	6.31	6.63	6.49	6.82	6.71	7.05	6.85	7.19	6.94	7.30
43	85	42	5.30	5.57	5.74	6.03	5.98	6.28	6.24	6.55	6.37	6.70	6.46	6.79
44	75	31	6.61	6.95	6.89	7.23	7.09	7.45	7.40	7.77	7.61	8.00	7.77	8.16
44	80	36	6.13	6.44	6.41	6.73	6.58	6.92	6.81	7.15	6.95	7.30	7.05	7.41
44	85	41	5.47	5.75	5.87	6.17	6.10	6.40	6.33	6.66	6.47	6.79	6.55	6.89
45	75	30	6.71	7.05	6.99	7.35	7.21	7.58	7.55	7.93	7.78	8.18	7.96	8.36
45	80	35	6.23	6.55	6.50	6.83	6.68	7.01	6.91	7.26	7.06	7.42	7.17	7.54
45	85	40	5.63	5.91	6.00	6.30	6.20	6.52	6.43	6.76	6.56	6.89	6.65	6.98
46	75	29	6.80	7.15	7.11	7.47	7.35	7.72	7.71	8.10	7.97	8.37	8.16	8.58
46	80	34	6.33	6.65	6.60	6.93	6.77	7.12	7.02	7.37	7.18	7.55	7.30	7.67
46	85	39	5.77	6.06	6.11	6.42	6.30	6.62	6.52	6.85	6.65	6.99	6.74	7.08
47	75	28	6.91	7.26	7.23	7.60	7.49	7.87	7.89	8.29	8.18	8.59	8.39	8.82
47	80	33	6.43	6.75	6.69	7.03	6.87	7.22	7.13	7.49	7.31	7.68	7.44	7.82
47	85	38	5.90	6.20	6.21	6.53	6.40	6.72	6.61	6.95	6.75	7.09	6.84	7.19
48	75	27	7.01	7.37	7.36	7.74	7.65	8.04	8.09	8.50	8.41	8.83	8.64	9.08
48	80	32	6.52	6.85	6.79	7.13	6.98	7.33	7.26	7.63	7.45	7.83	7.60	7.98
48	85	37	6.02	6.32	6.31	6.63	6.49	6.82	6.71	7.05	6.85	7.19	6.94	7.30
Condenser DTb			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: C = [(F)-32]/1.8, 1 gallon per minute = 3.785 L/min., 1 ton = 1,0000 Brtish thermal units per hour = 3.517 kW

[a] LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
[b] Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
[c] All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperature
which is IPLV
$K_{adj} = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
where X = Condenser DT + LIFT
$COP_{adj} = K_{adj} * COP_{std}$

503.2.3 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables 503.2.3(1), 503.2.3(2), 503.2.3(3), 503.2.3(4), 503.2.3(5), 503.2.3(6), 503.2.3(7), 503.2.3(8), 503.2.3(9), 503.2.3(10) and 503.2.3(11) when tested and rated in accordance with the applicable test procedure. The efficiency shall be verified through certification under an approved certification program or, if no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the manufacturer.

Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrate that the combined efficiency of the specified components meets the requirements herein.

Exception: Equipment listed in Table 503.2.3(7) not designed for operation at ARI Standard test conditions of 44°F (7°C) leaving chilled water temperature and 85°F (29°C) entering condenser water temperature shall have a minimum full load COP and IPLV rating as shown in Tables 503.2.3(8) through 503.2.3(10) as applicable. The table values are only applicable over the following full load design ranges:

Leaving Chilled Water Temperature:	40 to 48°F (4 to 9°C)
Entering Condenser Water Temperature:	75 to 85°F (24 to 29°C)
Condensing Water Temperature Rise:	5 to 15°F (Δ3 to Δ8°C)

~~Chillers designed to operate outside of these ranges are not covered by this code.~~ Chillers designed to operate outside of these ranges or applications utilizing fluids or solutions with secondary coolants (e.g., glycol solutions or brines) with a freeze point of 27°F or less for freeze protection are not covered by this standard.

Commenter's Reason: The purpose of this code change proposal is to update the minimum efficiency requirements for water chiller packages in Section 5 of the 2006 IECC to agree with the ASHRAE/IESNA 90.1-2004 equivalent tables. This will increase the stringency the IECC code as well as harmonize the required efficiencies with the current version of ASHRAE/IESNA Standard 90.1-2004 which was revised in 2004 to reflect new ARI 550/590 fouling factors and IPLV equations. This change is a substitute for the original EC 103 proposed code change which was submitted in March, 2006. This modification proposes to delete all of EC103 and modify what is currently in the IECC 2006.

Considerable work has been done by the proponents of this change, industry representatives, ASHRAE, and ARI to develop the next level of chiller efficiencies. A consensus change proposal is being developed and is now being analyzed to confirm that it meets the goal of equivalent energy savings to the original EC 103 proposed code change. When this proposal is finalized and has gained consensus using the ANSI consensus process, we plan to submit it to ASHRAE and the IECC for future editions. While this process is going on, the proponents, industry representatives, ASHRAE 90.1 Mechanical Subcommittee and ARI have agreed to this interim proposal as a compromise, which is to align the IECC with ASHRAE/IESNA 90.1-2004.

This change proposal will harmonize the requirements for chillers in the IECC and ASHRAE/IESNA 90.1 Standard. An analysis of the impact of the change by Carrier with input from other manufacturers through ARI is that it will increase the stringency of the IECC 2006 code by 11.8% (however, many units sold exceed the current standard and so average savings will be less).

Final Action: AS AM AMPC____ D

EC106-06/07, Part I
503.2.6

Proposed Change as Submitted:

Proponent: Chuck Murray, Washington State University, representing Northwest Energy Code Group

PART I – IECC

Revise as follows:

503.2.6 Energy recovery ventilation systems. Individual fan systems that have both a design supply air capacity of 5,000 cfm (2.36 m3/s) or greater and a minimum outside air supply of 70 percent or greater of the design supply air quantity shall have an energy recovery system that provides a change in the enthalpy of the outdoor air supply of 50 percent or more of the difference between the outdoor air and return air at design conditions. Provision shall be made to bypass or control the energy recovery system to permit cooling with outdoor air where cooling with outdoor air is required.

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are prohibited by the *International Mechanical Code*.
2. Laboratory fume hood systems with a total exhaust rate of 15,000 cfm (7.08 m^3/s) or less.
3. Laboratory fume hood systems with a total exhaust rate greater than 15,000 cfm (7.08 m^3/s) that include at least one of the following features:
    3.1. Variable-air-volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of design values.

3.2. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2_F (1.1_C) below room set point, cooled to no cooler than 3◦F (1.7◦C) above room set point, no humidification.

4. Hazardous exhaust systems covered in *International Mechanical Code* Section 510.
5. Commercial kitchen exhaust systems serving Type I hoods.
6. Clothes dryer exhaust systems covered in *International Mechanical Code* Section 504.

Reason: (IECC) Application of energy recovery ventilation should not be prohibited outright for applications to hazardous exhaust systems, Type I hoods, or Clothes Dryer Exhaust. Specialty equipment is available for the listed applications and can be safely applied when properly designed and maintained.

This proposal would allow the use of energy recovery ventilation for hazardous exhaust systems, type I and II hoods, and clothes dryers. To allow the utilization of energy recovery ventilation in more cases, without requiring it, changes to both the IECC and IMC are required.

There are many type of specialized equipment designed to deal with issues of subsections 1, 4, and 5. Examples of acceptable systems are runaround loops for laboratories, special filtration and warning lights for clothes dryers, and scrubbers for Type I hood are among equipment that have been successfully installed.

In the state of Oregon prison system, for the past several years, we have installed energy recovery on the clothes dryer exhaust for the prison's laundry. We have spoke with engineers that provided energy recovery for Type II hood with specific scrubbing mechanisms for that purpose with no repercussions.

Prohibiting energy recovery ventilation from Type II hoods does not pass the laugh test from engineers polled. Moisture-laden exhaust air is an ideal opportunity for energy recovery. Recovery ventilation equipment is made to deal with condensation, which occurs within the units.

(IMC) Application of energy recovery ventilation should not be prohibited outright for applications to hazardous exhaust systems, Type I hoods, or Clothes Dryer Exhaust. Specialty equipment is available for the listed applications and can be safely applied when properly designed and maintained.

Current code is overly restrictive. This proposal expands the applications where energy recovery ventilation is allowed, without requiring it. Modifications to both the IMC and IECC are required to make this a viable proposal.

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

Committee Action: **Approved as Submitted**

Committee Reason: The proposed text would exempt hazardous exhaust systems, commercial kitchen exhaust systems and clothes dryer exhaust systems from requirements for an energy recovery ventilation system, but with the accompanying change to the IMC, would not outright prohibit it in these locations. This is a more appropriate code logic, given advances in technology that can be used for energy recovery systems in these locations.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Donald J. Vigneau, Northeast Energy Efficiency Partnership, requests Disapproval.

Commenter's Reason: Proposal adds to a laundry list of prohibitions, where the determination of the safety of these systems should clearly be left to the IMC. The decision of the Mechanical Code Committee for denial is appropriate, given the safety concerns and the lack of substantiating data to support the proposal as set forth in their decision.

This IECC section ideally should be re-written to simply direct the user to the appropriate IMC section, where all hazardous/safety concerns about energy recapture devices should be addressed.

Final Action: AS AM AMPC____ D

EC112-06/07
503.3.1

Proposed Change as Submitted:

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing himself

Revise as follows:

503.3.1 Economizers. Supply air economizers shall be provided on each cooling system as shown in Table 503.3.1(1). Economizers shall be capable of providing 100-percent outdoor air, even if additional mechanical cooling is required to meet the cooling load of the building. Systems shall provide a means to relieve excess outdoor air during economizer operation to prevent over pressurizing the building. The relief air outlet shall be located to avoid recirculation into the building. Where a single room or space is supplied by multiple air systems, the aggregate capacity of those systems shall be used in applying this requirement.

Exceptions:

1. Where the cooling equipment is covered by the minimum efficiency requirements of Table 503.2.3(1) or 503.2.3(2) and meets or exceeds the minimum cooling efficiency requirement (EER) by the percentages shown in Table 503.3.1(2).
2. Systems with air or evaporatively cooled condensors and which serve spaces with open case refrigeration or that require filtration equipment in order to meet the minimum ventilation requirements of Chapter 4 of the I*nternational Mechanical Code*.
3. Systems with air or evaporatively cooled condensers which serve spaces involving humidification or dehumidification such as computer rooms, museums, library stacks, or similar.

Reason: The additional exception to the installation of an economizer is required so as to properly facilitate and coordinate such applications to unique building areas and spaces. Each of the areas addressed in the proposed code change require specific humidification of dehumidification requirements, which renders the installation of an economizer as inappropriate.

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

Committee Action: **Approved as Submitted**

Committee Reason: This is a needed exception for computer rooms and other rooms requiring controls for humidity.

Assembly Action: **None**

Individual Consideration Agenda

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

Public Comment:

Chuck Murray, Washington State University Energy Program, representing The Northwest Energy Code Group, requests Disapproval.

Commenter's Reason: The exception for economizers noted in this rule is simply too broad. It could include most zones with humidification or dehumidification.

It is of particular concern that the proposed exception includes "computer rooms". Elimination of economizers for this application represents a substantial loss in potential energy savings. If the engineer determined that air economizers required excessive amount of humidification or dehumidification, a water side economizer could be selected instead.

Final Action: AS AM AMPC____ D

EC122-06/07

202, 505.2.2.3 (New)

Proposed Change as Submitted:

Proponent: John Neff, Washington State Building Code Council

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

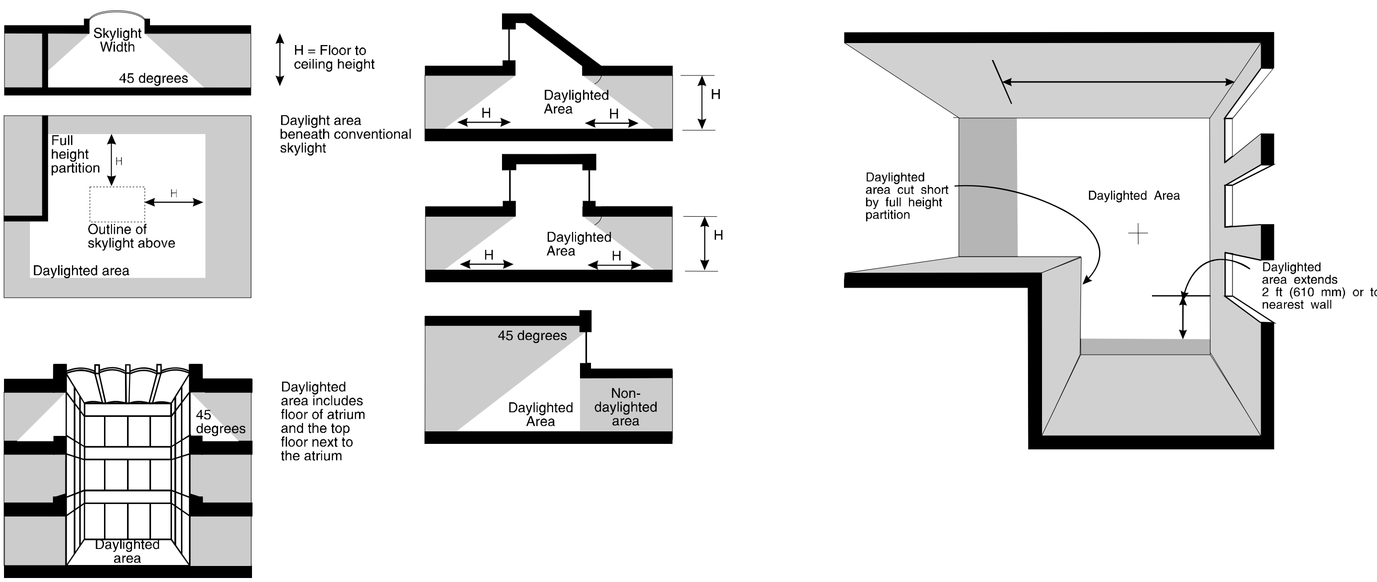
DAYLIGHT ZONE:

1. **Under skylights**: The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension in that direction plus either the floor to ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent skylights or vertical fenestration, whichever is least.
2. **Adjacent to vertical fenestration**: The area adjacent to vertical fenestration which receives daylight through the fenestration. For purposes of this definition and unless more detailed analysis is provided, the daylight zone depth is assumed to extend into the space a distance of 15 feet or to the nearest ceiling height opaque partition, whichever is less. The daylight zone width is assumed to be the width of the window plus two feet on each side, or the window width plus the distance to an opaque partition, or the window width plus one-half the distance to adjacent skylight or vertical fenestration, whichever is least.

505.2.2.3 Daylight zone control. Daylight zones, as defined by this code, shall be provided with individual controls which control the lights independent of general area lighting. Contiguous daylight zones adjacent to vertical fenestration are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e. north, east, south, west). Daylight zones under skylights more than 15 feet from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration.

> **Exception**: Daylight spaces enclosed by walls or ceiling height partitions and containing 2 or fewer light fixtures are not required to have a separate switch for general area lighting.

Reason: Presently there is no provision for allowing occupants to take advantage of being in a daylight zone to use natural light instead of energy consuming electric lighting fixtures. If the circuiting is not done correctly, then the occupants are not able to turn off lighting in the daylight zones without also turning off lights in interior zones that do not receive daylight. Recircuiting after initial construction is an added expense that should not have to be incurred. This proposal would remedy that problem and encourage the use of daylighting. The graphics below provide some illustrations of daylight zones.



Cost Impact: This code change proposal would have a minor impact on costs. It would require that the lighting circuiting be laid out along the lines of interior zones and perimeter zones.

Committee Action: **Approved as Submitted**

Committee Reason: The proposed text will provide for a reasonable control of energy in daylight that will conserve 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 Disapproval.

Commenter's Reason: This new section and its definitions attempt to mandate controls for zones that have daylight. However, the code language is not understandable. For example "daylight zone under skylight" is defined as:

> *"The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension in that direction plus either the floor to ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent skylights or vertical fenestration, whichever is least."*

This code language is too complex to be enforced. The language needs to be rewritten.

Public Comment 2:

Carroll Lee Pruitt, FAIA, NCARB, Pruitt Consulting, Inc., representing the North Texas Chapter of ICC, requests Disapproval.

Commenter's Reason: While this code change has merits on the design side, it will be difficult and costly to enforce. Architects will have to provide detailed sections and plans to show compliance or plans examiners will have to exert an unreasonable amount of time to determine compliance. The amount of interior light received through the skylight will vary at different times of the year and there was no justification to show how much energy might be saved versus what the cost for compliance will be. This proposed code change has very limited practical value. Realistically when one comes into the office in the morning, all the light in a given area are most likely turned on. It is unlikely that anyone will take time to turn on and off selected switches at various times of the day according to where the sun is. Perhaps some type of automatic light meters and switches would be a concept to be credited in a LEEDS type of project, but requiring them in all buildings is impractical. The proponent's cost estimate of minor is speculative. These switches are in addition to all the others already required including duel switching and switches for each room. Remember, in addition to the construction cost of added switches, there is an energy cost in manufacturing, shipping and installing each switch. That should also be considered in contemplating such a code change.

Final Action: AS AM AMPC____ D