IECC - Residential

2019 GROUP B PUBLIC COMMENT AGENDA

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RIO HOTEL AND CONVENTION CENTER
LAS VEGAS, NV

ICC
INTERNATIONAL CODE COUNCIL®

2019 Public Comment Agenda

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RE2-19

IECC: R103.2.2 (IRC N1101.5.2) (New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

R103.2 (IRC N1101.5) Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the *building*, systems and equipment as herein governed. Details shall include the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
3. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
6. Equipment and system controls.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.

R103.2.1 (IRC N1101.5.1) Building thermal envelope depiction. The *building thermal envelope* shall be represented on the construction documents.

Add new text as follows:

R103.2.2 (IRC N1101.5.2) Vapor management declaration. A vapor management strategy shall be documented on the construction documents. The following shall be addressed:

1. Type and class of vapor retarder used throughout the building, or listed per assembly, to manage moisture migration via diffusion as required by Section R402.1.1.
2. Vapor retarder installation scope of work to ensure proper installation.
3. Whole house ventilation strategy to be used in accordance with Section R403.6 and Section M1505.3 of the *International Residential Code* to ensure background ventilation moisture control.
4. Spot/local exhaust ventilation strategy to be used in accordance with Section M1505.4.4 of the *International Residential Code* to manage/remove moisture as it is created
5. Flashing and weather resistant barrier type and installation details.

Reason: Currently the IRC allows one of three vapor retarder strategies to be used in a residential dwelling unit all of which require different levels of installation execution and coordination with the rest of the structure and systems that are built and the energy code features that are required by the IECC. In addition, the three strategies only address diffusion which is one of two means of moisture transport that is occurring in a dwelling unit. Moisture moves in a house by diffusion (which the vapor retarder addresses) but also with air. How we expect to control these two moisture transport mechanisms should be made prominent on the plan set to create more efficient and durable structures. This is especially true since more moisture flows into building assemblies through air transport than by the process of diffusion. This code change proposal promotes a subtle shift in our thinking to understand that moisture management is a combination of components and systems working together to protect the building from moisture related failures.
In the prescriptive section R402.1.1 Vapor retarders are required to be installed and the section refers you to the IRC and the IBC. Vapor Retarders discussed in these sections are an important part of gaining control and predictability of the moisture movement within a dwelling unit, but there is a choice that must be made as to which class of retarder will be installed. The installation of class 1 versus class 3 vapor retarder is significantly different and impacts the efficiency and durability of the structure differently.

This declaration will drive moisture management considerations into the design process resulting in assemblies that will be more moisture resistant and more efficient.

The scope of work requirement will better ensure that especially class 1 vapor retarders are installed to limit the ability of air and moisture from bypassing them and being trapped within assemblies. Is should also create a better understanding of where a class 1 vapor retarder should or should not be installed in different climate zones. For example, in climate zone 5 along the front range in Colorado we often see unsealed class 1 vapor retarders (6 mil poly) installed behind drywall on exterior walls, but no vapor retarder installed in other parts of the exterior wall assembly such as rim joist or exterior walls in bathrooms. This declaration would elevate the inconsistency of placement of vapor retarders as their installation would be more clearly thought out on the plan set than it has ever been in the past.

Whole house and spot/local ventilation are another important part of the moisture management strategy. From a whole house ventilation perspective, the code gives three choices of strategies that can be used, some of which work better in certain climate zones than others. The vapor management declaration, would bring the decision on systems that will be installed to the fore font for review by the plans examiner allowing for conversation prior to building the structure.

Cost Impact: The code change proposal will increase the cost of construction
There would be a small cost increase associated with this proposal as the proposal merely brings existing requirements together to be reported on the plan set. I estimate that this would require no more than 1 hour of time of the designer or architect. Approximately $100 - $200.

RE2-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The committee found that the language of the proposal was unclear. The case for a 'declaration' was not made, it should simply be adequate to put the information on the plans. The declaration would impose additional costs and potential liability on architects. (Vote: 9-2).

Assembly Action: **None**

RE2-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R103.2 (IRC N1101.5), R103.2.1 (IRC N1101.5.1), R103.2.2 (IRC N1101.5.2) (New)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R103.2 (IRC N1101.5) Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the *building*, systems and equipment as herein governed. Details shall include the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
3. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
6. Equipment and system controls.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.

R103.2.1 (IRC N1101.5.1) Building thermal envelope depiction. The *building thermal envelope* shall be represented on the construction documents.

R103.2.2 (IRC N1101.5.2) Vapor management declaration. A vapor management strategy shall be documented on the construction documents. The following shall be addressed:

1. Type and class of vapor retarder used throughout the building, or listed per assembly, to manage moisture migration via diffusion as required by Section R402.1.1.
2. ~~Vapor retarder installation scope of work to ensure proper installation.~~
3. Whole house ventilation strategy to be used in accordance with Section R403.6 and Section M1505.3 of the *International Residential Code* to

ensure background ventilation moisture control.

4. ~~Spot/local exhaust ventilation strategy to be used in accordance with Section M1505.4.4 of the *International Residential Code* to manage/remove moisture as it is created~~
5. ~~Flashing and weather resistant barrier type and installation details.~~

Commenter's Reason: Although it is adequate to put vapor retarder information on the plan set as suggested by the committee, there is no requirement to declare which of the three vapor management strategies will be used or to include them on the plan set in the IRC or the IECC. The interaction of the IECC requirements and the vapor management strategy chosen is critical to coordinate, and this proposal ensures that thought is put into it. The language and the requirements were simplified to address the committee's concerns about clarity. The requirement is not to simply declare which of the three vapor retarders and which of the three ventilation strategies will be used. The requirement ensures the code official knows upfront what to look for, and the design professional considers the interaction of energy and vapor management.
I agree with the committee that this increases the cost to generate the plan set by a small amount and clearly stated that in the original cost statement which I continue to stand by. With regards to liability, this declaration should reduce liability as it specifically declares which strategies must be used, and if they are not carried out, the design professional can clearly point to what was specified.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
There would be a small cost increase associated with this proposal as the proposal merely brings existing requirements together to be reported on the plan set. I estimate that this would require no more than 1 hour of time of the designer or architect. Approximately $100 - $200.

Public Comment# 1767

RE7-19

IECC: R202 (IRC N1101.6), R404.1 (IRC N1104.1)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6)
GENERAL DEFINITIONS

Revise as follows:

HIGH-EFFICACY ~~LAMPS.~~ LIGHT SOURCES. Compact fluorescent lamps, light-emitting diode (LED) lamps, T-8 or smaller diameter linear fluorescent lamps, or other lamps with an efficacy of not less than ~~the following:~~ 65 lumens per watt, or luminaires with an efficacy of not less than 45 lumens per watt.

~~1. 60 lumens per watt for lamps over 40 watts.~~

~~2. 50 lumens per watt for lamps over 15 watts to 40 watts.~~

~~3. 40 lumens per watt for lamps 15 watts or less.~~

R404.1 (IRC N1104.1) Lighting equipment (Mandatory). Not less than 90 percent of the permanently installed lighting fixtures shall contain only *high-efficacy* ~~lamps.~~*lighting sources.*

Reason: The lighting section includes a requirement for a minimum percentage of "high efficiency lamps." However, the definition of "high efficacy lamps" has not been updated to reflect the changes in the market due to increased federal minimums and greater availability/affordability of LED lighting. Because of this, the code is actually becoming less stringent as the baseline for lighting equipment is raised.
The proposal solves this problem by updating the definitions with lighting requirements that reflect what is actually "high-efficacy" in today's market. The proposal also simplifies the definition by reducing the number of wattage categories. The categories in the residential code are an artifact of incandescent and early compact fluorescent lamp wattages. As lamps have gotten more efficient, the higher wattage categories have become less meaningful. As lamps have gotten more efficient, the higher wattage categories have become less meaningful. Even a “100W equivalent” LED lamp and “60W equivalent” CFL lamps generally uses 15W or less, which is the lower category in the existing definition. As a result, the categories have become largely meaningless.

The proposal also accommodates high efficacy luminaires. Many luminaires on the market do not include lamps and include integrated LEDs instead. The way the current code language is written, these efficient lighting products cannot be used to meet the lighting efficiency requirements in the code. The proposal changes the term in the definition to be more inclusive, adds an efficacy requirement for integrated luminaires, and updates the code language to reflect this update.

Cost Impact: The code change proposal will increase the cost of construction
This change could potentially increase the cost of construction because it requires higher efficacy lighting (lamps and/or fixtures), which will likely eliminate some lower-end CFL options and/or push builders to newer LED technologies. However, the cost of LEDs has been steadily declining over the last several years and is expected to continue to decline. Based on an analysis by the U.S. Department of Energy’s Building Energy Codes Program conducted during the 2018 IECC Code Development cycle, the estimated and projected prices for LEDs were $4.84 per lamp compared to CFLs at $3.10 per lamp. However, the rapid expansion of the LED lighting market has changed the economics. A spot check of Home Depot in early 2019 showed that a warm white, 60W equivalent A-lamp is as low as $1.24 for both CFL and LED when purchased in packs. And, LEDs are actually cheaper than CFLs at some sources. At 1000bulbs.com, on online retailer, the same lamps are $1.79/bulb for CFL and $0.99 for LED. Therefore, this code change may actually reduce the cost of construction.

RE7-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Great change that will save energy. Brings the code up the standards of lighting manufacturers. (Vote: 11-0)

Assembly Action: **None**

RE7-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R404.1 (IRC N1104.1)

Proponents:
Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R404.1 (IRC N1104.1) Lighting equipment (Mandatory). Not less than 90 percent of the permanently installed lighting fixtures, excluding kitchen appliance lighting fixtures, shall contain only *high-efficacy lighting sources.*

Commenter's Reason: Because there is no definition for "permanently installed", lamps serving kitchen appliances like range hoods or ovens could be considered "permanently installed" and thereby required to meet the high-efficacy requirements of this section. Achieving high-efficacy in lamps serving appliances like range hoods and ovens is very difficult based on elevated environmental temperatures that diminish useful life. In fact, none of the lamps listed in California's appliance efficiency database are known to be tested or approved for use in range hoods or ovens that can be exposed to air temperature exceeding 100 degrees Celsius, much less the 130-260 degrees Celsius that range hoods and ovens are likely to experience on an occasional basis. The most obvious potential consequence of specifying range hood or oven lamps that are not designed for high temperatures is a severe limitation to lamp life, resulting in large costs for consumers who will need to replace lamps at shorter intervals. Even more importantly, there could be safety concerns with lamp failure in high temperature environments.
Further, the 10% allowance for lamps that are not high-efficacy is not sufficient to exempt kitchen appliance lamps in small dwelling units that have less than 20 lamps (meaning the 2 oven and range hood lamps will account for more than 10% of the total lamps in the dwelling unit). For reasons such as these, California's Title 24 exempts range hood lamps from its high-efficacy lamp requirements (Title 24-2019 Section 150.0(k)1F), and the IECC-C Committee approved two floor modifications to proposals in Albuquerque (CE226-19-Moore7 and CE162-19-Moore3) introducing an exception to high-efficacy lamp requirements in the commercial energy code for kitchen appliance lamps. Approval of RE7 as modified by this public comment will provide reasonable exceptions to the high-efficacy lamp requirement, improve enforcement, and align the IECC-R with action taken in the IECC-C.

For reference, following are floor modifications approved by the IECC-C committee in Albuquerque that provide exceptions to the high-efficacy lamp requirements of the commercial energy code.

CE226-19-Moore7:

C406.3.3 Lamp efficacy. Not less than 95 percent of the interior lighting power (watts) from lamps in permanently installed light fixtures , excluding kitchen appliance light fixtures, in dwelling units and sleeping units shall be provided by lamps with a minimum efficacy of 65 lumens per watt.

CE162-19-Moore3:

C405.1.1 Lighting for dwelling units. No less than 90 percent of the permanently installed lighting , excluding kitchen appliance lighting, serving dwelling units shall be provided by lamps with an efficacy of not less than 65 lm/W or luminaires with an efficacy of not less than 45 lm/W, or shall comply with Sections C405.2.4 and C405.3.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment slightly reduces the original proposal potential for cost increase by removing kitchen appliance lighting from the high efficacy requirements. The prices of high efficacy lamps are falling rapidly and as stated by the proponent, the potential for a cost increase could be substantially diminished or eliminated, especially by the time this code is adopted.

Public Comment# 1780

Public Comment 2:

IECC®: 202, R404.1 (IRC N1104.1)

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

HIGH-EFFICACY LIGHT SOURCES. Compact fluorescent lamps, light-emitting diode (LED) lamps, T-8 or smaller diameter linear fluorescent lamps, or other lamps with an initial efficacy of not less than ~~65~~ 61 lumens per watt, or luminaires with an initial efficacy of not less than ~~45~~ 50 lumens per watt.

R404.1 (IRC N1104.1) Lighting equipment (Mandatory). Not less than 90 percent of the permanently installed lighting fixtures shall contain only *high-efficacy ~~lighting~~ light sources.*

Commenter's Reason: These proposed changes improve the proposal, as they are based on the most recent Energy Star specifications for lamps and luminaires.
-By aligning with the Energy Star values, it will help with compliance and enforcement.

-For the Energy Star ratings, the minimum lamp efficiency (efficacy rating) is based on their initial light output, not their mean output.

-For lamps, to obtain the Energy Star label (Version 2.1), there are different minimum efficiencies based on the type of lamp (omnidirectional, directional, or decorative) and their Color Rendering Index (CRI) values ($\geq$ 90 CRI or < 90 CRI). The minimum required initial values range from 61 lumens/Watt to 80 lumens/Watt. Changing the value from 65 to 61 will help align with the latest Energy Star specifications.

-For luminaires, to obtain the Energy Star label (Version 2.1), there are different minimum efficiencies based on the type of fixture (e.g., cove, downlight, accent, outdoor, etc.). The minimum required initial values range from 50 lumens/Watt to 70 lumens/Watt. Changing the value from 45 to 50 will help align with the latest Energy Star specifications and increase efficiency.

-There is also an editorial change ("lighting" to "light") to match the wording of the revised definition.

Bibliography: ENERGY STAR Lamps Final Specification Version 2.1, June 20, 2017, Table 9.1, available at
https://www.energystar.gov/sites/default/files/ENERGY%20STAR%20Lamps%20V2.1%20Final%20Specification.pdf
ENERGY STAR Luminaires Final Specification Version 2.1, March 15, 2018, Table 9.2, available at
https://www.energystar.gov/sites/default/files/Luminaires%20V2.1%20Spec%20Final%20with%20Partner%20Commitments.pdf

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Lamps and luminaires that have higher efficacies are usually more expensive than standard lamps and luminaires.

Public Comment# 1366

RE10-19

IECC: R202 (IRC N1101.6))(New)

Proposed Change as Submitted

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

SAMPLING. A process where fewer than 100 percent of a builder's dwellings, dwelling units, or sleeping units are randomly inspected and or tested to evaluate compliance with the requirements of this code.

Reason: This definition is to clarify that the practice of sampling includes more than just blower door testing. The approved third party would have the opprtunity to sample any requirement of the code in a developement or building. This is a conept that needs to be made apparent to everyone who uses the code.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
new definition

RE10-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Sampling already is addressed in the code but the term is not defined. This addresses that need. The definition isn't a requirement unto itself and does not authorize sampling in any specific location not already addressed by code language. (Vote: 8-3)

Assembly Action: **None**

RE10-19

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION R202 (IRC N1101.6), 202 (New)

Proponents:
Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

SAMPLING. A process where fewer than 100 percent of ~~a builder's~~ all dwellings or dwelling units~~, or sleeping~~ being constructed ~~units~~ are ~~randomly~~ inspected ~~and~~ or tested to demonstrate ~~evaluate~~ compliance. ~~with the requirements of this code.~~

Commenter's Reason: The committee approved a definition for sampling which is needed but all reverences to sampling were also removed from the IECC at the committee action hearing. Therefore, the importance of the definition becomes even more important. The approved batch sampling definition is problematic because it is defining a process of evaluating compliance in sleeping units instead of dwelling units. In addition, although fewer than 100% of the dwellings or dwelling units are inspected or tested the work is not random. There is a defined and systematic process. Lastly, the definition states that the process is evaluating compliance when in reality the process is demonstrating compliance. The new definition solves these problems.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment is a clarification of a definition, Clarifications of code text do not impact the cost of construction.

Public Comment# 1630

Public Comment 2:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because all homes should be verified as compliant with the code requirements (including tests for air tightness and duct leakage, among others). Sampling a limited number of homes cannot verify compliance with code requirements for homes that are not tested or checked. Although some common voluntary efficiency programs permit sampling for certain specified measures, unlike the code, these programs do not establish the minimum requirements that all homes must meet. For the owner of an untested home that does not comply, it does them no good that the sampled home complied. If the jurisdiction issues a certificate of occupancy, the purchaser of a new home should be entitled to rely on the new home meeting the code.

The proponent claims that with this change, “the approved third party would have the opportunity to sample any requirement of the code in a development or building.” By contrast, the Committee claims that this is only a definition and “the definition isn’t a requirement unto itself and does not authorize sampling in any specific location not already addressed by code language.” We are concerned that some may adopt the proponent’s view instead of the Committee’s view – and we fear that this new definition would spark a broad expansion of the potential use of sampling, which will be detrimental to ensuring that each building meets the minimum code requirements.

Even if some limited sampling were acceptable, another problem with the proposal is the failure to establish any specifics for sampling. Fewer than 100% implies that anywhere between 1 and 99 out of 100 homes could be checked. Further, there is no process established for when a sampled home does not comply in some respect. In short, under this provision and the proponent’s rationale, sampling could be used to check one home for code compliance and give the rest of the homes in the development (or dwelling units in a building) a free pass.

To our knowledge, the only reference to sampling in the residential IECC is a single sentence (with no specifics) that limits any sampling to “stacked multiple family units.” (Section R405.4.2) It should be noted that this is a limiting provision, not an authorization to use sampling for compliance. We do not interpret this language already in the code to permit sampling. Nonetheless, we have also proposed to eliminate this language in another proposed code change – RE157 – to reduce confusion. Moreover, all other proposals during this cycle to allow sampling under the residential provisions of the IECC were all properly rejected by the Committee.

If the definition does not by itself permit sampling, then adding the definition is unnecessary and could be confusing. In addition, we are concerned that including a definition of sampling in the IECC per this code proposal could imply that sampling is acceptable and could put code officials in the position of having to explain why sampling is not allowed by the code for specific requirements.

Based on the above, we recommend that this proposal be disapproved along with any others that permit or imply “sampling” as a means for demonstrating code compliance.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1451

RE14-19

R303.2 (IRC N1101.11)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

R303.2 (IRC N1101.11) Installation. Materials, systems and equipment shall be installed in accordance with the ~~manufacturer's instructions~~ Grade I insulation installation requirements in RESNET/ICC 301 and the International Building Code or the International Residential Code, as applicable.

Reason: The quality of insulation installation has a significant impact on the performance of the building envelope. When insulation is not properly installed, the code does not achieve the energy savings intended by its insulation requirements. Poorly installed insulation can compromise home performance, resulting in higher energy bills for the builder's customers and increased customer call backs due to comfort issues. Based on a report by Energy Star Certified Homes, Version 3 (Rev. 08) there is a 5% savings for heating and cooling system consumption on properly installed insulation (Grade I) vs Grade II insulation that includes more gaps, voids and compressions.
The current IECC language requires that insulation be installed to manufacturer's instructions. This provision is difficult to enforce because installation instructions will vary based on manufacturer and type of installation (e.g. fiberglass batts versus blown fiber glass versus cellulose). Field inspectors normally don't have ready access to manufacturer's installation instructors when conducting an insulation inspection. Manufacturers require that their product be installed with minimal gaps, voids and compression which relates to Grade I Insulation installation but based on the U.S. DOE field study conducted in several states, less than 50% of the homes had insulation installed to Grade I insulation quality.

To address this issue, RESNET has created a new insulation installation standard that includes requirements for Grade I insulation installation for different types of insulation (e.g. fiberglass batts, blown fiber glass and cellulose). The standards language is included in latest version of RESNET/ICC Standard 301. The Grade I installation requirement will help standardize how insulation should be installed and can be used as a reference by both the insulation contractor and the building department reducing potential issues in the field over how products should be installed. This can also be used by the builder focused on quality assurance as they will know how the insulation product is require to be installed.

Grade I insulation allows very small gaps in the insulation. Voids are not allowed to extend from the interior to the exterior (i.e. the full width of a wall cavity). The product is required to be installed according to manufacturer's specification and cut to fit around electrical junction boxes and is split around wires and pipes. Compression or incomplete fill can amount to 2% or less, if the empty spaces are less than 30% of the intended fill thickness.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no cost increase in this code change as the code currently requires insulation to be installed to manufacturers installation instruction which is consistent with Grade I insulation installation requirements.

RE14-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Based on previous action regarding RE57-19. (Vote: 11-0)

Assembly Action: **None**

RE14-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R303.2 (IRC N1101.11)

Proponents:

Eric Makela, representing Northwest Energy Codes Group (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R303.2 (IRC N1101.11) Installation. Materials, systems and equipment shall be installed in accordance with the manufacturer's instructions. ~~Grade I insulation installation requirements in RESNET/ICC 301~~ and the International Building Code or the International Residential Code, as applicable. Insulation shall meet the Grade I insulation installation requirements in RESNET/ICC 301.

Commenter's Reason: The quality of insulation installation has a significant impact on the performance of the building envelope. When insulation is not properly installed, the code does not achieve the energy savings intended by its insulation requirements. Poorly installed insulation can compromise home performance, resulting in higher energy bills for the builder's customers and increased customer call backs due to comfort issues. Based on a report by Energy Star Certified Homes, Version 3 (Rev. 08) there is a 5% savings for heating and cooling system consumption on properly installed insulation (Grade I) vs Grade II insulation that includes more gaps, voids and compressions.

To address this issue, RESNET has created a new insulation installation standard that includes requirements for Grade I insulation installation for different types of insulation (e.g. fiberglass batts, blown fiber glass and cellulose). The standards language is included in latest version of RESNET/ICC Standard 301. The Grade I installation requirement will help standardize how insulation should be installed and can be used as a reference by both the insulation contractor and the building department reducing potential issues in the field over how products should be installed. This can also be used by the builder focused on quality assurance as they will know how the insulation product is require to be installed.

The Northwest Energy Codes Group requested disapproval for this proposal based on opponents testimony for RE57 that would have placed the requirement for Grade I insulation in Chapter 4 while keeping the requirement for insulation installation to manufacturers installation instructions in Chapter 3. If passed RE57 would have created a conflict between the chapters. RE14 places the requirement for Grade I insulation Chapter 3 and eliminates any conflict between Chapter 3 and Chapter 4. The opponents brought up several points that are addressed below:

Creating a Potential Conflict between Designating Grade I and Manufacturers Specification

Chapter 3 of the IECC provides oversight language to Chapter 4 and 5 so referencing Grade I in Chapter 3 will apply to Chapter 4 and 5 insulation installation requirements eliminating potential conflicts.

The requirements in Standard 301 are consistent with the insulation installation requirements in the IECC. For example:

- Section A-1.2 (1) Minimum Specific Application Requirements for floor insulation is consistent with the language in IECC Section R402.2.8 Floors.
- Section A-1.2 (3) requires an effective air barrier for ventilated attic insulation and allows the use of eave baffles to meet this requirement. Eave baffles are required in IECC Section R402.2.3.
- Section A-1.3.1 Insulated sheathing requires that the joints are staggered on the sheathing if multiple layers are used. This is consistent with IECC Section C402.2.1.

Length of Grade I Insulation Requirements in RESNET Standard 301 is to long making it difficult to use

One issue that was presented by an opponent to the Grade I insulation installation requirements is that the standard was too long. Standard 301 currently has requirements for the installation of:

- - Insulated Sheathing
- - Fibrous Batt Insulation
- - Blown of Sprayed Fibrous Loose Fill Insulation
- - Open-Cell Spray Polyurethane Foam Insulation
- - Closed-Cell Spray Polyurethane Foam Insulation
- - Structural Insulated Panels
- - Reflective/Radiant Grading Criteria

The 11 page Standard is necessary to cover the installation requirements for the various options listed above. Each section of the document provides requirements on how to install the insulation and then how to Grade the insulation to ensure that achieves Grade I.

The Grade I Insulation Installation requirements reference Standards within the Standard

One argument against referencing the Grade I installation requirements was that the Standard referenced other Standards which was deemed to make Grade I requirements hard to use. Referencing standards within standards is typically done as it would be duplicative to include the text from an entire reference standard if the referenced standard is available. For example NFRC 100 (referenced for determining fenestration U-factors) includes the reference to six different standards and an additional nine different support documents. Standard E779 – Standard Method for Determining Air Leakage Rate by Fan Pressurization includes the reference to three ASTM Standards. E779 is referenced in the commercial provisions of the IECC for air barrier testing. ANSI/RESNET/ICC Standard 380 – 2016 for testing duct and envelope leakage includes references to three standards.

The Grade I Installation requirements uses the term Recommend

ANSI/RESNET/ICC Standard 380 uses the term recommend in six different sections and this standard was reviewed and passed the ICC Standards review process (need name of the process).

The term Recommends is also used in manufactured installation instructions. For example the CertainTeed CertaWrap Weather Resistant Barrier & Accessories Installation Guidelines uses the terms Recommends and Recommend. Using the term "recommends, recommendation or recommended” in the standard is consistent with the manufacturers installation instructions.

The Grade I Installation requirements is difficult to enforce

The current IECC language requires that insulation be installed to manufacturer’s instructions. This provision is difficult to enforce because installation instructions will vary based on manufacturer and type of installation (e.g. fiberglass batts verses blown fiberglass verses cellulose). Field inspectors normally don’t have readily accessible manufacturer’s installation instructions when conducting an insulation inspection. Manufacturers require that their product be installed with minimal gaps, voids and compression which relates to Grade I Insulation installation but based on the U.S. DOE field study conducted in several states, less than 50% of the homes had insulation installed to Grade I insulation quality.

Enforcement checklists can easily be developed using the Grade I requirements as can industry training programs. Adopting this requirement will provide the necessary standardized instructions on how to install insulation that can be used for the building and enforcement industry resulting in an increase in enforcement. Enforcement agencies will have a standardized set of instructions that can used for inspection that will result in increased quality of installations.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There is no cost increase in this code change as the code currently requires insulation to be installed to manufacturers installation instruction which is consistent with Grade I insulation installation requirements.

Public Comment# 1872

Public Comment 2:

Proponents:
Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests Disapprove

Commenter's Reason: As the committee stated on RE57 and noted again on RE14, RESNET’s new appendix on grade 1 insulation is not ready. Installing insulation correctly is important, but the significantly changed grade 1 insulation requirements will do more harm than good. A partial list of the problems with RESNET's 301 grade 1 appendix follows. In all cases the problems cite examples of specific text from the new RESNET 301 Grade 1. Most of the problems fall into one of these groups:
-eliminates reasonable construction techniques and/or products

-mixes up “recommendations” and “instructions”

-has incomplete or unusable references as requirements

Bold below is added. All section titles and numbers are from RESNET’s new 301 appendix. "Comments" below briefly state the problem.

<u>Eliminates reasonable construction techniques or products:</u>

*A-1.1 Minimum General Installation Requirements … PART 2 - **No air spaces** shall be allowed between different insulation types or systems.* - Comment - Sometimes **air spaces are needed** for drainage and moisture redistribution. For example foil faced insulation over spray foamed wall cavity without an air space would be a problem. Stucco rot and some EIFS problems are partly a result of a lack of air spaces.

A-1.2 Minimum Specific Application Requirements 1. …The combination of both cavity and continuous insulation shall meet or exceed the minimum required floor R value in Table 402.1.2 of the International Energy Conservation Code, (IECC)…. - Comment - RESNET’s criteria says floor insulation cannot be Grade 1 unless the R-value meets or exceeds 2018 IECC Table 402.1.2? Why? Why just the floors? RESNET is mixing up R-value with quality of the installation.

*3. … The effective air barrier shall extend up and beyond the surface of the insulation **or to the ridge vent**.* - Comment - This is a problem for cathedral ceilings. Baffles are not air barriers.

*A-2.2 Structural Insulated Panels (SIPs) Grading Criteria **...** 2. **Use spray foam to seal** penetrations through the SIP panels. … 4. All gaps and penetrations through SIPs including windows, doors, and foundation or roof connections shall be **air-sealed with expanding foam** compatible with the SIP materials.* - Comment - Why only expanding foam for air sealing? What about mastics, tapes and caulking?

*A-2.3.2 Attic Radiant Barriers Minimum Requirements ... 3. Attic and/or roof **ventilation shall be maintained**. Roof, gable and soffit vents shall not be covered.* - Comment - What about unvented attics? Does this eliminate unvented attics in the IRC?

Comment- RESNET exempts fiberglass in basement and crawl spaces from air barriers if there is an interior air barrier (Appendix Section A1.3.2, #2 item “d”). This fiberglass exemption if fine. However, cellulose should also have the exemption as cellulose is denser than fiberglass and cellulose would do an even better job of inhibiting convection within the insulation.

Mixes up "recommendations” and “instructions”:

A-1.1 Minimum General Installation Requirements PART 1 - Insulation shall be installed to manufacturers’ ***recommendations.*** - Comment - code uses “instructions”. “Instructions” and "recommendations" can be very different. Can insulation be grade 1 without following the manufacture's instructions? Manufacturers and the code expect instructions to be followed. The code does not require or even refer to manufacturer’s recommendations. From the IRC: "Section R302. Installation. Materials, systems and equipment shall be installed in accordance with the **manufacturer’s instructions** and the IBC or IRC as applicable."

Has incomplete or unusable references as requirements and does not follow CP-28 guidelines:

A-1.3.4 Open-Cell Spray Polyurethane Foam (SPF) Insulation 1. Installers shall meet the manufacturer’s recommended training requirements and shall complete ***the online health and safety training for SPF provided by the Center for Polyurethanes Industry****.* - Comment - This is an undated reference to an unknown web address and does not name the “document”. Likely the “document” was not subject to ANSI or code compliant development process.

A-1.3.6 Closed-Cell Spray Polyurethane Foam (SPF) Insulation ... Installers shall meet the manufacturer’s recommended training requirements and shall complete the ***online health and safety training for SPF provided by the Center for Polyurethanes Industry****.* - Comment - Again an undated reference to an unknown web address. It does not name the “document”. Likely the “document” was not subject to ANSI or code compliant development process.

A-2.2 Structural Insulated Panels (SIPs) Grading Criteria 1. Sealing of panel joints shall meet the manufacturer's requirements. Where the manufacturer does not have specific joint sealing details SIPA's typical joint sealing details shall be used. SIPA details are available at www.sips.org. -Comment - Another undated reference to an unknown web address. Again it does not name the “documents”. Likely the “documents” were not subject to ANSI or code compliant development process.

A-2.3 Reflective/Radiant Grading Criteria ***...*** *3. Where utilizing R-Values based on testing in accordance with ASTM C1224, the reflective insulation product shall be installed as tested. R-Value claims for the assembly including the airspace shall be based on ASTM C1224 or per the* ***current FTC Rule 460*** *requirements.* - Comment - It is impropriate to reference the “current” version of something. FTC rules are not consensus documents. No section of the FTC rule is refenenced.

RESNET'S new grade 1 insulation requirements are not ready and should not be required by code.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The 11 pages of RESNET 301 Appendix A, plus adding multiple required referenced standards, would increase costs.

Disapproving the proposal would mean no change to code and therefore, no change int he cost of construction.

Public Comment# 2090

RE17-19

IECC: R401.2 (IRC N1101.13), R407 (IRC N1107) (New)

Proposed Change as Submitted

Proponents: Stephen Kanipe, representing Colorado Chapter (stephen.kanipe@cityofaspen.com); Nick Thompson, City of Aspen, representing Colorado Chapter of ICC Energy Code Development Committee (nick.thompson@cityofaspen.com); Mike Suhrbier, representing Self (mikes@sgm-inc.com)

2018 International Energy Conservation Code

Revise as follows:

R401.2 (IRC N1101.13) Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.
4. The simplified equivalent compliance alternative approach in Section R407.

Add new text as follows:

R407 (IRC N1107)
SIMPLIFIED EQUIVALENT COMPLIANCE ALTERNATIVE

R407.1 (IRC N1107.1) Scope. This section establishes criteria for compliance using heating and cooling load analysis.

R407.2 (IRC N1107.2) Requirements. Compliance with this section requires that the provisions identified in Sections R102.3, R403.5, R403.8, R403.9, R403.10, R403.11, and R404.1 be met.

R407.3 (IRC N1107.3) Equivalent HVAC building load. The ratio of the space cooling load and space heating load to *conditioned floor area* shall be less than or equal to the values in Table R407.3.

TABLE R407.3 (IRC N1107.3)
COOLING AND HEATING LOAD PER SQUARE FOOT

CLIMATE ZONE	COOLING LOAD PER SQUARE FOOT	HEATING LOAD PER SQUARE FOOT
0	10.1 Btuh	3.1 Btuh
1	8.9 Btuh	4.6 Btuh
2	11.6 Btuh	7.3 Btuh
3A and 3B	6.5 Btuh	8.5 Btuh
4A and 4B	7.6 Btuh	8.8 Btuh
3C	3.3 Btuh	5.8 Btuh
4C	6.0 Btuh	7.1 Btuh
5	7.0 Btuh	11.4 Btuh
6	5.5 Btuh	11.6 Btuh
7	4.9 Btuh	13.1 Btuh
8	4.0 Btuh	18.1 Btuh

R407.4 (IRC N1107.4) TESTING

R407.4.1 (IRC N1107.4.1) Air leakage. The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding the design infiltration rate in the load calculations. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official.*

Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

R407.4.1 (IRC N1107.4.1) Duct leakage. Ducts shall be tested in accordance with R403.3.3 and R403.3.4.

Reason: This is a refinement of previous code change proposal RE180-16. The committee recommended disapproval for the following reason: “This is a good concept that would be easy to use but the numbers need some refinement.”
This proposal responds to the committee’s comment on RE180-16 by providing specific compliance numbers for each climate zone. Weather data from representative cities of each climate zone as suggested by Pacific Northwest National Laboratory (PNNL) was entered in Wrightsoft Manual J software. Thermal envelope values (insulation, fenestration, air leakage) from the prescriptive 2018 IECC path for each climate zone was entered using the PNNL standard house design. This is consistent with PNNL protocol.

R407.2 includes requirements not addressed by heating and cooling load including service hot water, exterior energy use, and lighting. R102.3 is included to highlight the need for supporting mechanical system design documentation.

R407.4 requires testing to demonstrate the building is built as designed. A blower door test may not exceed the design infiltration rate in the load calculations. Ducts have the same testing requirements as the prescriptive path in R403.3.3 and R403.3.4.

The Simplified Equivalent Compliance Alternative provides the designer, engineer and builder team with another path to comply with climate zone equivalent energy performance targets. The peak heating and cooling loads are already calculated by the design team and drives the HVAC equipment size decision. This option rewards design work value that already exists.

This method is intended as an alternate method for complex residential buildings and HVAC system designs. Energy code compliance documentation at permit application will be greatly reduced as the compliance metric does not require volumes of paperwork.

This compliance path will shorten plan review time and reduce costs in both the public and private sectors.

The targets are fuel neutral.

Note 1- the climate zones are based on this table:

TABLE R301.3(2) INTERNATIONAL CLIMATE ZONE DEFINITIONS

ZONE NUMBER	THERMAL CRITERIA	
	IP Units	SI Units
0	10000 < CDD50°F	
1	9000 < CDD50°F	5000 < CDD10°C
2	6300 < CDD50°F £ 9000	3500 < CDD10°C £ 5000
3A and 3B	4500 < CDD50°F £ 6300 AND HDD65°F £ 5400	2500 < CDD10°C £ 3500 AND HDD18°C £ 3000
4A and 4B	CDD50°F £ 4500 AND HDD65°F £ 5400	CDD10°C £ 2500 AND HDD18°C £ 3000
3C	HDD65°F £ 3600	HDD18°C £ 2000
4C	3600 < HDD65°F £ 5400	2000 < HDD18°C £ 3000
5	5400 < HDD65°F £ 7200	3000 < HDD18°C £ 4000
6	7200 < HDD65°F £ 9000	4000 < HDD18°C £ 5000
7	9000 < HDD65°F £ 12600	5000 < HDD18°C £ 7000
8	12600 < HDD65°F	7000 < HDD18°C

For SI: °C = [(°F) - 32]/1.8.

Note 2 – We provided numbers for Climate Zone 0 using weather data from a CZ0 city (Dubai) but used thermal envelope R and U values and air leakage for CZ1 under the 2018 IECC.

WHAT TO LOOK FOR ON THE COMPLIANCE DOCUMENTS:

Following are example load calculations for climate zone 6 in Helena, MT. The heating load highlighted in the report is 27,725 Btuh; divided by the 2,400sqft conditioned floor area of this house gives a Btuh/sqft of 11.55. This is less than the value in table R407.3 and therefore complies. A similar calculation can be done for the cooling load. This house will need to pass a blower door test of 1080cfm at 50 Pa per the highlighted infiltration value in the report.

Design Information

Weather: Helena Regional, MT, US

Winter Design Conditions

Outside db	-7	°F
Inside db	68	°F
Design TD	75	°F

Heating Summary

Structure	27725	Btuh
Ducts	0	Btuh
Central vent (0 cfm) (none)	0	Btuh
Humidification	0	Btuh
Piping	0	Btuh
Equipment load	27725	Btuh

Infiltration

Method	Blower door
Shielding / stories	3 (partial) / 2
Pressure / AVF	50 Pa / 1080 cfm

	Heating	Cooling
Area (ft²)	2400	2400
Volume (ft³)	21600	21600
Air changes/hour	0.31	0.15
Equiv. AVF (cfm)	113	53

Summer Design Conditions

Outside db	90	°F
Inside db	75	°F
Design TD	15	°F
Daily range	H	
Relative humidity	30	%
Moisture difference	1	gr/lb

Sensible Cooling Equipment Load Sizing

Structure	13980	Btuh
Ducts	0	Btuh
Central vent (0 cfm) (none)	0	Btuh
Blower	0	Btuh
Use manufacturer's data	n	
Rate/swing multiplier	0.95	
Equipment sensible load	13253	Btuh

Latent Cooling Equipment Load Sizing

Structure	19	Btuh
Ducts	0	Btuh
Central vent (0 cfm) (none)	0	Btuh
Equipment latent load	19	Btuh
Equipment Total Load (Sen+Lat)	13272	Btuh
Req. total capacity at 0.70 SHR	1.6	ton

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

This is an option that gives considerable freedom to the design team. Options and flexibility may lower construction cost.

RE17-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
R407.2 (IRC N1107.2) Requirements. Compliance with this section requires that the provisions identified in Sections ~~R102.3~~ R103.2, R401.3, R403.5, R403.8, R403.9, R403.10, R403.11, and R404.1 be met.

R407.3 (IRC N1107.3) Equivalent ~~HVAC building~~ envelope load. The ratio of the ~~space cooling load and space heating load~~ envelope loads to *conditioned floor area* shall be less than or equal to the values in Table R407.3. Heating and cooling envelope loads shall be calculated in accordance with ACCA Manual J or other *approved* heating and cooling calculation methodologies.

Committee Reason: This is a clean simple compliance path, it increases flexibility by adding another option, focuses not on materials but efficiency. The modifications clarified that the language applies to envelope load and it does not impact equipment efficiencies or lighting, corrected the citation, and added as mandatory the certificate (Vote: 6-5).

Assembly Action: **None**

RE17-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R401.2 (IRC N1101.13), R407 (IRC N1107) (New), R407.1 (IRC N1107.1) (New), R407.2 (IRC N1107.2) (New), R407.3 (IRC N1107.3) (New), TABLE R407.3 (IRC N1107.3) (New)

Proponents:
Graham Wright, Passive House Institute U.S., representing self (graham@passivehouse.us)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R401.2 (IRC N1101.13) Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as “Mandatory.”
3. The energy rating index (ERI) approach in Section R406.
4. The simplified equivalent compliance alternative approach in Section R407.

R407 (IRC N1107)
SIMPLIFIED EQUIVALENT COMPLIANCE ALTERNATIVE

R407.1 (IRC N1107.1) Scope. This section establishes criteria for compliance using heating and cooling load analysis.

R407.2 (IRC N1107.2) Requirements. Compliance with this section requires that the provisions identified in Sections R102.3, R403.5, R403.8, R403.9, R403.10, R403.11, and R404.1 be met.

R407.3 (IRC N1107.3) Equivalent HVAC building load. The ratio of the space cooling load and space heating load to *conditioned floor area* shall be less than or equal to the values in Table R407.3. Heating and cooling ~~envelope~~ loads shall be calculated in accordance with the ACCA Manual J Block Load method ~~or other *approved* heating and cooling calculation methodologies~~.

TABLE R407.3 (IRC N1107.3)
COOLING AND HEATING LOAD PER SQUARE FOOT

CLIMATE ZONE	COOLING LOAD PER SQUARE FOOT	HEATING LOAD PER SQUARE FOOT
0	10.1 Btuh	3.1 Btuh
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2	11.6 Btuh	7.3 Btuh
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3C	3.3 Btuh	5.8 Btuh
4C	6.0 Btuh	7.1 Btuh
5	7.0 Btuh	11.4 Btuh
5C	TBD	TBD
6	5.5 Btuh	11.6 Btuh
7	4.9 Btuh	13.1 Btuh
8	4.0 Btuh	18.1 Btuh

Commenter's Reason: The pdf version of RE17-19 that came to me from Michelle Brit has quite a bit of text already in the Reason section, I am not sure why it does not show up in this portal, but part of it explains how the Table R407.3 was generated, as follows, "Weather data from representative cities of each climate zone as suggested by Pacific Northwest National Laboratory (PNNL) was entered in Wrightsoft Manual J software. Thermal envelope values (insulation, fenestration, air leakage) from the prescriptive 2018 IECC path for each climate zone was entered using the PNNL standard house design."
My main comment is that therefore, only the ACCA Manual J method should be accepted for the heating and cooling loads and not any other calculation methodologies, because the Table R407.3 is "calibrated" to that method. In my opinion additional such studies would be needed to generate performance tables pertaining to other methods. Presumably the table was generated with a Block Load (whole-building) type Manual J calculation, thus it is probably best to tie compliance to that specific method as well. I would question whether the language needs to say "envelope loads" as opposed to simply "loads". As I understand it Manual J standard procedure includes ventilation load as well, at least in some cases.

My secondary comment has to do with the granularity of the performance requirements. It is a bit surprising to me that Zone 3-6 are not distinguished as to A or B. I would suggest that at the very least a separate line should be added for Zone 5C as distinct from 5A,B, similar to what is proposed for Zone 3,4. FYI, I noticed that on the energycodes.gov page listing the representative cities, 5C is represented by Port Angeles WA, but the linked climate file is wrong - it points to Fairchild WA which is not the same place at all.

Postscript: The zone-by-zone approach is reminiscent of what we did for our PHIUS+ 2018 pilot phase program. For our final 2018 protocol though, we put a lot of study into making the heating/cooling load performance criteria vary *continuously* with climate factors, and also to be sensitive to building size and occupant density. The annoyance with zone boundaries is that there can be quite different designs required for buildings that are near each other but on different sides of the line. In most places that isn't a problem, but zone boundaries do happen to run through three of the largest metro areas in Canada (Toronto, Vancouver, Montreal) - this is irksome. I have attached screen shots of the PHIUS+ 2018 load criteria formulas just for illustrative purposes - they are not directly applicable to this proposal because they are calibrated to a different calculation method, and are predicated on greater stringency in air-sealing and window performance. The point is that more nuanced criteria might be something to consider as a future improvement. A larger study would need to be done to determine those.

$$
\begin{aligned}
&5.2001065557\\
&+ 1.0910602698 \cdot EnvFlr\\
&+ 294.92913196 \cdot Occ\\
&+ -0.000169585 \cdot HDD65\\
&+ -0.085714432 \cdot THD\\
&+ -0.043301638 \cdot IGHL\\
&+ -3.920896922 \cdot \$elec\\
&+ (EnvFlr - 1.766) \cdot (EnvFlr - 1.766) \cdot 1.0101270679\\
&+ (EnvFlr - 1.766) \cdot (THD - 19.736433333) \cdot -0.023102881\\
&+ (HDD65 - 5860.0833333) \cdot (THD - 19.736433333) \cdot 2.5574756e\text{-}6\\
&+ (EnvFlr - 1.766) \cdot (IGHL - 22.692412967) \cdot -0.021908846\\
&+ (IGHL - 22.692412967) \cdot (IGHL - 22.692412967) \cdot 0.0010214681\\
&+ (HDD65 - 5860.0833333) \cdot (\$elec - 0.2029333333) \cdot -0.00074824
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&-8.894257857\\
&+ 0.4779165041 \cdot EnvFlr\\
&+ 178.12769665 \cdot Occ\\
&+ 1.9044551e\text{-}6 \cdot CDD50\\
&+ 0.1019963231 \cdot TCD\\
&+ 0.0170829233 \cdot IGCL\\
&+ (EnvFlr - 1.766) \cdot (EnvFlr - 1.766) \cdot 1.0406068504\\
&+ (Occ - 0.0027218) \cdot (CDD50 - 4104.8333333) \cdot 0.0235455021\\
&+ (CDD50 - 4104.8333333) \cdot (CDD50 - 4104.8333333) \cdot 2.1816386e\text{-}8\\
&+ (EnvFlr - 1.766) \cdot (TCD - 78.127) \cdot 0.0284904137\\
&+ (TCD - 78.127) \cdot (TCD - 78.127) \cdot 0.0009440729\\
&+ (EnvFlr - 1.766) \cdot (IGCL - 71.844689133) \cdot 0.0083066462
\end{aligned}
$$

Bibliography:

Zone Representative Cities

https://www.energycodes.gov/development/commercial/prototype_models

Building America Guideline: Accurate heating and cooling load calculations

https://www.nrel.gov/docs/fy11osti/51603.pdf

PHIUS+ 2018 Standard-setting documentation

https://www.phius.org/media/W1siZiIsIjIwMTgvMTEvMDIvM2puNXJ3NnV2cV9QSElVU18yMDE4X1N0YW5kYXJkX1NldHRpbmdfRG9jdW1lbnRhdGlvb
sha=1ca3bc8e

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
I concur with the comment in the pdf version, "This is an option that gives considerable freedom to the design team. Options and flexibility may lower construction cost."

Public Comment# 1983

Public Comment 2:

IECC®: R407.2 (IRC N1107.2) (New), R407.4.1 (IRC N1107.4.1) (New)

Proponents:
Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R407.2 (IRC N1107.2) Requirements. Compliance with this section requires that the provisions identified in Sections R103.2, R402.4, R403.5, R403.6, R403.8, R403.9, R403.10, R403.11, and R404.1 be met.

~~**R407.4.1 (IRC N1107.4.1) Air leakage.** The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding the design infiltration rate in the load calculations. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E779 or ASTM E1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.~~

~~Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.~~

~~During testing:~~

1. ~~Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.~~
2. ~~Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.~~
3. ~~Interior doors, where installed at the time of the test, shall be open.~~
4. ~~Exterior or interior terminations for continuous ventilation systems shall be sealed.~~
5. ~~Heating and cooling systems, where installed at the time of the test, shall be turned off.~~
6. ~~Supply and return registers, where installed at the time of the test, shall be fully open.~~

Commenter's Reason: I agree with the committees reason statement that this proposal increases flexibility. I think this new compliance path through the residential section of the IECC should be roughly equivalent to the other paths (Prescriptive, Performance, and ERI) though and as written it is not in two important ways. First by not including the Mandatory section R403.6 Mechanical Ventilation. Having three pathways through Code that do require Mechanical Ventilation and one that does not is very problematic from both a construction and a compliance perspective. Second, by replacing the mandatory Air Leakage section in the IECC (R402.4) with the new R407 Air leakage any cap on the air leakage of the dwelling is removed. This again creates un-equivalent paths and potential confusion in the field.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This code proposal increases the flexibility of the IECC which theoretically will decrease the cost of construction. This public comment better aligns this new IECC-residential pathways with the existing pathways to create equivalency.

Public Comment# 2045

Public Comment 3:

Proponents:
Stephen Kanipe, representing Colorado Chapter (stephen.kanipe@cityofaspen.com)

requests As Modified by Committee

Commenter's Reason: The original proposal was approved as modified by the committee and that decision was upheld during the floor motion online vote (61% to 39%) demonstrating that this is a well received proposal. We recommend that the committee decision be upheld.

The proposal meets the intent of the energy code:

“This code shall regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective.”

The proposal is simple, flexible and offers an additional path for compliance allowing innovative approaches and techniques. It regulates the use and conservation of energy by creating an energy budget of a certain btu/sqft for each climate zone. It is a different way of measuring energy use than the prescriptive path which prescribes specific envelope components. The proposal converges with the prescriptive path for a PNNL standard 2 story slab on grade house. The prescriptive table will produce different energy use per square foot for different residential configurations because the two paths do not correlate. This should not matter from the perspective of using an energy budget as the “standard” as all house types in any one climate zone will use the same amount of energy per square foot.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Designers have a choice, not a requirement, to use this path. This is an option that gives considerable freedom to the design team. Options and flexibility may lower construction cost.

Public Comment# 1788

Public Comment 4:

Proponents:
Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests Disapprove

Commenter's Reason: In concept this proposal has much potential. But, it needs much work to realize that potential. The technical merit of this proposal as currently written is questionable and little meaningful justification has been provided with which to evaluate potential implications or inconsistencies with the other compliance paths. Any new compliance method, with or without the appeal of simplicity, should be shown to be at least equivalent to the current code. This has not been done and should be disapproved for that reason alone.
Some specific technical concerns are as follows:

· The reason statement doesn't provide comparison using whole building energy modeling to ensure equivalency with existing provisions of the code.

· It doesn't provide a means to ensure the load calculation method used or software meet criteria to ensure consistency with the whole building modeling basis of current provisions in the code.

· It allows “other *approved* heating and cooling calculations” without specifying any requirements for evaluating the acceptability or consistency of those calculations. This will create an approval burden on code officials without a basis for supporting approval or disapproval of any given calculation approach.

· There is also a disconnect between energy efficiency based on annual energy savings (as the bases for all existing compliance paths) vs. sizing of equipment based on peak load criteria which may only occur a small percentage of a year or season (e.g., a few days in the winter and a few days in the summer). The example load calculation doesn't provide enough information to make any reasonable comparison of the example building to prescriptive or performance requirements of the current compliance paths in the various climate zones.

· The proposal doesn't specify how to do the design load calculation in recognition that widely varying answers may occur depending on the user and assumptions that are undefined. Because of this. widely varying answers could occur within even a single climate zone and this is compounded by the expected variation in climate effects on peak loads, even within a given climate zone. This will leave this new compliance path unreliable without knowing whether the source of variability in solutions is caused by user assumptions or climate variations within a climate zone.

· It doesn't capture all mandatory provisions in Section R407.2 (thus, is not equivalent to code).

· Proposed Section R407.4.1 places no limit on the amount of air leakage that can be assumed for design and the proposal doesn't address what to do when the unspecified design ACH target for load calculation is not met when later tested. This will create enforcement and compliance problems.

· A similar proposal failed in the previous code development cycle as proposal RE180-16 and this proposal has not addressed or disclosed how it has addressed the relevant concerns resulting in the prior disapproval.

For the above reasons, the code development process, if robust, should not accept a new method of compliance without substantive and transparent justification to address and resolve the above concerns. We request your disapproval to allow this proposal to be further developed and return the next code cycle.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1618

Public Comment 5:

Proponents:
Ben Edwards, representing Mathis Consulting Co. (ben@mathisconsulting.com)

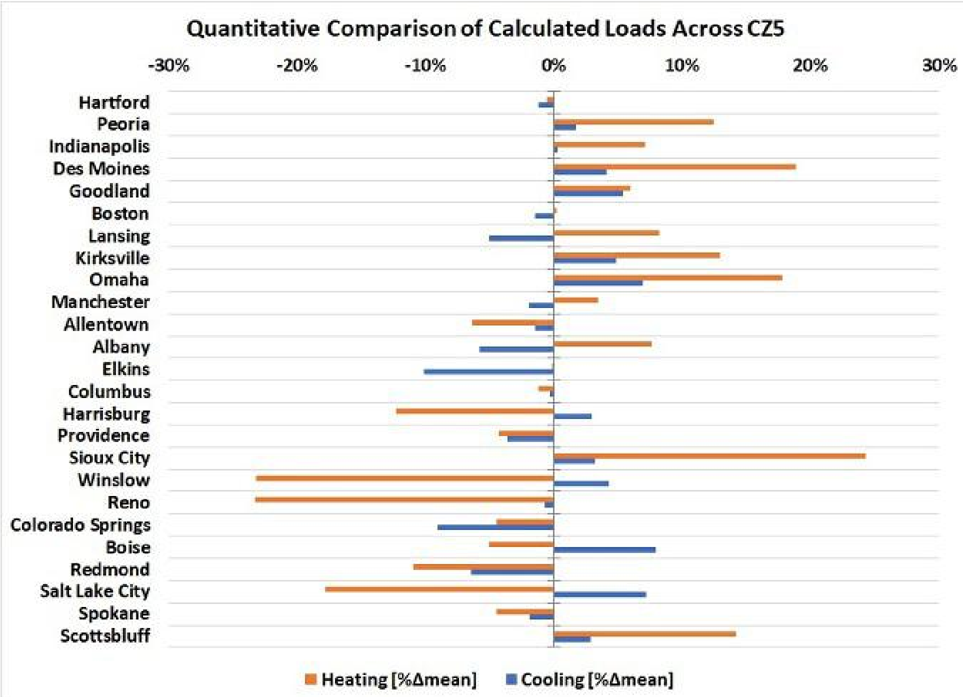
requests Disapprove

Commenter's Reason: Please disapprove RE 17. The reasons can be summarized as "FFF":

- Fascinating future concept.
- Fatally flawed (for now - from a technical standpoint in its current form).
- Fixable (potentially, in a future code cycle).

The idea behind RE 17 – tie IECC efficiency requirements to the loads – is worthy of careful consideration. Everything about a building's energy performance starts with an accurate assessment of loads. Load calculations for equipment sizing have been required by the code for decades now (though often not properly prepared and submitted – another problem). So, from a code official's viewpoint, I have (should have) a useful code compliance tool already in my hand.

Unfortunately, while this loads-based concept has real potential, the graph below demonstrates just one of several "fatal" technical flaws in its current structure. This graph shows heating and cooling load variations for the same home (the same PNNL model that was supposedly used to generate the values in RE 17) for various locations within the SAME climate zone – in this case, Climate Zone 5. If one number for a climate zone was sufficient (as is proposed by RE 17) then all of these heating and cooling loads should be identical. Of course, they are not.



Big Problem #1. Not all locations in each climate zone are the same. In fact, NONE of them are. In CZ 5, for example, the Heating Degree Days ranges from 5400 to 7200. A simple look at the climate zone map suggests how much the individual locations in a climate zone may vary. So, we would expect the heating and cooling loads to vary significantly. A similar variance exists across all CZ 4 locations. And CZ 6 locations, etc. In fact, ALL climate zones defined by the code exhibit broad variation in loads. Therefore, ONE number for a loads-based code compliance option will not work at the climate zone level. This problem should be "fixable" in a future code proposal (after lots of effort) and may suggest improved utility for the code in the future – easier to comply and easier to verify. But not in its current form.

Loads calculators, like all such "tools", suffer from a common problem – GIGO - garbage in, garbage out. Unfortunately, RE 17 provides no guidelines on how these proposed loads were calculated to determine the maximum loads in the proposal or how these loads are to be calculated for each individual home for compliance purposes.

"Following ACCA Manual J procedures" alone is far from enough. How was the proposed maximum load value determined? What diversity factor was used? What building orientation? Were the mandatory measures in code included in the calculations? What were the values used for maximum allowable envelope leakage? Duct Leakage? What other important modeling assumptions were used in the "Manual J" calculation to reach that value? Many assumptions and inputs have a significant impact on "loads".

If we had the actual models and assumptions used, then we might be able to replicate the values proposed and compare them to the loads in the proposed 2021 (or current 2018) prescriptive table requirements. We could make sure that multiple compliance paths yielded similar results too.

Big Problem #2. We have to be able to replicate the values proposed. The proposal as written does not provide enough data to verify the accuracy of the proposed maximum loads values or specify the necessary "rule set" that all users must follow in doing compliance analysis. There is no published technical paper nor sufficient information in the reason statement to verify the numbers and their potential utility in the code. These problems may also be "fixable" – but the current proposal lacks these critical details.

One positive aspect of this "loads-based code compliance" idea is that it partially addresses the building economics "life cycle" question. Building envelope decisions – those that critically define the loads – are often the longest-lived elements in a building, lasting 40, 50, even 100 years. NAHB even notes that the life expectancy of insulation in buildings often lasts over 100 years. By comparison, equipment, appliances and other contributors to loads and meeting them, often last 10, 12, 15 or 20 years. So, a loads-based code begins to properly value life expectancy of durable envelope measures. (Do we know how long PV systems will last?)

Big Problem #3. What are the other necessary requirements applicable to this new compliance method to ensure reasonable results? For example, what sort of reports, compliance process, quality assurance and reviewer independence are required? There is no specification in the proposed new code section as to these critical items. Why aren't the standard mandatory requirements applicable? What other requirements are necessary? These problems may also be "fixable" – but are not addressed in the current proposal.

Again, the concept behind RE 17 has potential. I believe it also may be fixable. But not with the current "just add yet another compliance path" approach. The "fix" would be to use this approach to define the "energy budget" or a "loads budget" for a given location that can be used to demonstrate compliance. We could actually determine what the maximum load should be for every location, potentially for every zip code with a weather file.

This concept has the potential to truly simplify the code as well as simplify code compliance. “Are you under the load budget? If so, good to go!”

While this concept may ultimately provide some benefits, in its current form there are serious technical flaws. As another example, the values proposed are in terms of “per square feet”. So, if I don’t meet the code with my current design, why not just make the house bigger until I do? This “size bias” was discussed in detail last code cycle and the Section R406 ERI path now has provisions for addressing the larger-then-average home situation. Where does RE 17 address that?

I have listed a few of the technical flaws here, but this topic requires considerable additional analytics, which will likely reveal other challenges and issues to work through.

FFF. The loads-based concept is a fascinating, and potentially transformational concept. It has several fatal technical flaws in its current form. And, with some real effort, potentially fixable for future code cycles.

This last part – “fixable” – is important. The “fix” will involve rethinking this concept, providing transparency on where the numbers came from and the variables used to generate them, the assumptions and safety factors, etc. With a bit of effort, we could do a robust assessment of loads that are made much more locally relevant and avoid the inherent problems that come from using one value to cover the huge variations in heating degree days and cooling degree days within a given climate zone.

In addition, the “fix” could expand the impact and reach of the IECC and include other “locally relevant” inputs – such as utility impacts (fuel mix, time-of-use, time-dependent costs, etc.), microclimate impacts (orientation, size adjustments, etc.), and perhaps tie all of the other code compliance structures together under a common umbrella that actually delivers on the energy performance promise implied by the code. Easier for builders. Easier for code officials.

I’m confident if we focus on this last “f” we will set the IECC on a much more impactful course for its future. Please reject RE 17 and let’s get to work on the fix.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1950

Public Comment 6:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it will roll back energy efficiency by creating an entirely new and unnecessary compliance option that could result in substantial negative unintended consequences and would have a substantial negative impact on energy conservation, cost and occupant comfort in many cases. We are also very concerned that this new path could allow code users to completely bypass important minimum code requirements and safeguards, with no guarantee that these homes will perform as well as homes built to the established IECC compliance options. It would also provide a less stringent alternative for some buildings that could not pass the other compliance options, essentially creating a loophole that would allow homes to be built that otherwise would not comply with the current code.

While this proposal was recommended for approval as modified by the Committee by a 6-5 vote, the favorable vote included all four builder representatives (the vote was 5-2 against RE17 without the builder votes). In our view, while the underlying concept may have some potential if it is properly developed and thoroughly studied and fleshed out, this option needs far more analysis and study before being seriously considered as yet another compliance option in the code.

- **RE17 lacks sufficient technical analysis and justification.** The reason offered by the proponents does not provide sufficient information as to how the heating and cooling load compliance targets were derived for each climate zone (the proposal simply shows one example of a complying building in one location, which does not address the validity of the proposed load targets). These targets are crucial as they govern code compliance for all homes using this proposed path, yet we do not know what assumptions were made as to the many variables that would affect the ultimate proposed target.

  Moreover, there is no sensitivity or other analysis by proponents to show that the load values are robust, will consistently produce at least equivalent energy efficiency to other code compliance paths, will correlate reasonably with energy usage and cost, and can be relied upon as reasonable energy efficiency targets. As a result, the proponent has not shown that the methodology is reasonable and the resulting targets can be relied upon for nationwide code compliance. Moreover, no other independent analysis has been provided. By comparison, before the ERI compliance path was added to the 2015 IECC, a number of stakeholders (including US DOE) completed in-depth analyses as to the ERI approach.

- **RE17 as written simply cannot produce comparable/equivalent energy efficiency to the current IECC because the proposal does not reflect the variations in cooling load and heating load based on the specific weather for each location in the climate zone.** The IECC prescriptive path establishes certain specific efficiency measures for each climate zone. The other current IECC compliance paths allow trade-offs of these measures with "equivalent" measures (subject to certain limitations) based on simulations reflecting the applicable weather data for each location in each climate zone. For example, performance path compliance software such as DOE's REScheck, compares the annual energy use of the standard reference design against the proposed design <u>based on the weather data for the specific location.</u> Unlike RE17, REScheck does not use average or "representative" weather data for the entire climate zone. The simulated performance path approach incorporated into REScheck properly recognizes that whether the proposed design is equivalent to the standard design depends hugely on the specific weather data for the specific location – for example, REScheck uses "280 TMY weather data files covering about 22,000 locations…. Both the proposed and standard designs use the same TMY weather data." (RW Schultz, R Bartlett and ZT Taylor, *REScheck Technical Support Document* at 4.2 (March 2019)) By comparison, RE17 uses only 11 climates – effectively 11 sets of weather data. (By contrast, when a similar approach was used to develop the PHIUS+ 2015 program requirements, performance targets were developed for over 1,000 locations.)

  To achieve equivalent energy efficiency to the current IECC, RE17 would need to establish much more granular heating and cooling maximum load values – different targets for each location based on the weather data for each location – and not just reflect average or representative data for the entire climate zone. By setting only a single maximum heating and cooling load value for each climate zone, RE17 vastly oversimplifies the analysis, resulting in maximum loads that are wrong for most or all locations in the climate zone. Since each different weather location in the climate zone would produce a different load value for the same home configuration, by definition, this approach will require either too much or too little efficiency depending on the location. The variation in loads between different locations in a single climate zone can be very large; this reason alone demonstrates that the proposal is simply not ready for code adoption.

  To illustrate this problem, we chose two locations in CZ 2 (Houston and Phoenix) and two in CZ 5 (Chicago and Boise). We calculated the cooling and heating load in Btu/sq. ft. using Wrightsoft Manual J software and using the 2018 IECC requirements and PNNL standard house design (consistent with the approach outlined by the proponents). The results for each location are illustrated in the tables below:

<u>Climate Zone 2 Weather Data Illustration</u>

Heating or Cooling Load (Btu/Sq. Ft.)	RE17 CZ2 Proposed Target	Houston Load	Houston Variation from Target	Phoenix Load	Phoenix Variation from Target	Increase from Houston to Phoenix
Cooling	11.6	7.1	-39%	9.7	-16%	37%
Heating	7.3	7.1	-3%	5.6	-23%	-21%

<u>Climate Zone 5 Weather Data Illustration</u>

Heating or Cooling	RE17 CZ5 Proposed Target	Chicago Load	Chicago Variation from Target	Boise Load	Boise Variation from Target	Increase from Chicago to Boise
Cooling	7.0	6.5	-7%	7.1	1%	9%
Heating	11.4	13.1	15%	11.3	-1%	-14%

(Note: our analysis results may not exactly match what the proponents would produce since, as noted above, we do not know the other assumptions they made in their analysis. This is another one of the fundamental concerns with this proposed approach.)

- As is apparent, the results for each home vary substantially depending on the location even where both are in same climate zone. **<u>Using the same targets for Houston and Phoenix, as proposed in RE17, makes no sense when the Phoenix cooling load is 37% higher than the Houston cooling load, while the Phoenix heating load is 21% lower. While the difference is not as great for Chicago versus Boise, a 9% increase in cooling load and 14% reduction in heating load are still very large.</u>** Moreover, when comparing these loads to the compliance target, it is readily apparent that in many cases, the target is far too high, allowing a substantial reduction in energy efficiency as compared with the current IECC (where the target is too high, the efficiency in the home can be reduced until the load meets the target). On the other hand, in some cases, like Chicago, the heating target will be much too low. As a result, establishing a single heating and single cooling load target for each climate zone is simply not reasonable and, as a result, in many locations will permit homes to be constructed that are clearly not equivalent in efficiency to homes built to other compliance paths of the IECC.

- **RE17 appears to create an exception from otherwise mandatory code requirements.** The IECC establishes mandatory provisions that apply to all current compliance paths. As an extension of these provisions, a great deal of work went into SEHPCAC's reorganization of the mandatory provisions of the IECC, and the resulting proposals (including CE42) have organized mandatory provisions into two tables that apply to the performance and ERI paths. By contrast, RE17 appears to bypass many of the mandatory provisions of the code, creating a huge loophole that can negatively affect homes built to this new compliance path. For example, homes built to the new path will not be required to meet maximum air leakage requirements required for all other homes. Similarly, there are no specific minimum requirements for duct insulation (including building cavities as ducts) or testing, mechanical ventilation, or thermostats, since the applicable sections of the IECC are not required to be met. If RE17 goes forward in some form, at a minimum, it must require compliance with the same mandatory provisions, just like the IECC requires for all other compliance paths (and above-code programs).

- **RE17 does not have adequate and balanced thermal envelope requirements.** The Energy Rating Index was the most recently added compliance option, but when it was adopted into the 2015 IECC, it came with specific language requiring compliance with mandatory requirements and the 2009 IECC prescriptive requirements for the thermal envelope. RE17 could be used to carry out substantial trade-offs among building component efficiencies that are not currently allowed in the IECC, but there are no safeguards like the ERI's thermal envelope backstop and the fenestration trade-off caps that would help ensure minimum efficiency of the building envelope. When a similar approach was followed for the Passive House Institute US 2018 requirements, mandatory requirements were incorporated, including compliance with the U.S. DOE Zero Energy Ready Home and ENERGY STAR Certified Homes, which include minimum thermal envelope efficiencies.

- **RE17 lacks sufficient accreditation, certification, software specifications and/or reporting requirements and is subject to substantially varying results depending on user assumptions.** The IECC lists a number of specific requirements for software and compliance reports under both the performance path and the ERI, and the ERI goes a step further in requiring the services of a trained professional (verification by an approved third party) to determine compliance under the ERI path. US DOE and other organizations have also provided substantial support and there exists a well-defined infrastructure for the compliance process embodied in these paths. By contrast, RE17 does not set any software or reporting requirements (other than simply requiring calculations in accordance with Manual J or other approved calculation methodologies), has no verification, certification or quality control process, and leaves code compliance wide open for mistakes in compliance and even gaming.

  Some examples where the compliance analysis under RE17 may be conducted improperly (or may be subject to different assumptions and interpretations) include inputs related to home orientation, number of occupants, thermostat set point temperature, mechanical ventilation rate, outdoor design temperature, window shading, etc. The range of specifications for these items will produce substantial swings in the building loads, yet none of these items is even mentioned in the proposed code language, much less guaranteed to be utilized properly in the software and compliance process.

  As an example of the potential impact of these specifications, we examined the impact of one variable -- building orientation -- on the values for the two cities in CZ 2. We used the same approach as described above as to location/weather data with the exception of distributing the window area on a real-world basis (30% of the fenestration on each of two opposing walls and 20% on each of the remaining two walls) to test the effect of varying the orientation. The impact of this approach is huge. Orienting the home east/west instead of north/south increases the cooling load in Houston by 15% and in Phoenix by 13%. While it would take a full-blown study to determine the model's sensitivity to various inputs across the various climate zones, as a further illustration we did look briefly at the effects of some of the other items on cooling loads in climate zone 5 between Chicago and Boise (we would expect significant impacts from these types of assumptions on heating load as well):
  - The software user can specify the number of expected occupants – the addition of each occupant increased the cooling load by about 3%.
  - The software user can specify the indoor temperature setpoint – simply changing the cooling temperature from 75 to 78 degrees reduces the cooling load by 6%.

- **RE17 lacks a cushion (unlike the ERI compliance path) to ensure that most homes complying under this optional path will be more efficient than under the IECC prescriptive path.** When the last new compliance path was added to the code (the ERI), target requirements were established at a level intended to provide a cushion so that there was a reasonable assurance that most homes complying with the new path were at least equivalent and ideally more efficient than one simply in compliance with existing paths. A reasonable cushion should be established in RE17 (by lowering the load values) in an effort to maintain and ideally increase energy efficiency, particularly given the other uncertainties related to the proposal.

- **RE17 leaves too many other important questions unanswered.** Far more analysis of this approach and potential requirements needs to be done before such a radical new compliance method is approved and implemented. For example, some of the additional questions that should be answered include: (a) do the results vary by the brand of software used and if so, how much? (b) to what degree do size, occupancy, ventilation, or other assumptions introduce bias into this approach (in other words, can larger homes or homes configured in a certain manner reduce their efficiency requirements relative to the same home complying with the prescriptive path)? (c) does a reduction in glazing area permit a reduction/trade-off of insulation, a practice that has been rejected for several code update cycles? and (d) are there other actual or potential assumptions in the load calculations that may negatively impact the targets and/or compliance calculations?

- **RE17 sets a static efficiency requirement and will not necessarily reflect the efficiency of the 2021 IECC, much less future code improvements.** The standard reference design in the performance path incorporates improvements in prescriptive requirements as they are included in the code and thereby automatically keeps the compliance paths relatively consistent. RE17 sets a static target (purportedly reflecting the 2018 IECC) by locking in a set of numbers that – even if equivalent now – would need to be updated with each new edition of the code to maintain an equivalent level of efficiency with the other compliance options. In fact, if the improvements to the prescriptive path approved by the Committee during this cycle are ultimately approved, RE17 will already be starting behind, since the prescriptive path will already be more efficient in 2021 than the prescriptive values that are purportedly reflected in RE17.

RE17 is currently technically flawed, needs far more analysis and is missing key safeguards. Moreover, there has been no demonstration of need for yet another new compliance path. We strongly recommend that RE17 be disapproved.

Bibliography: RW Schultz, R Bartlett and ZT Taylor, *REScheck Technical Support Document* at 4.2 (March 2019).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1452

Public Comment 7:

Proponents:
Ryan Meres, representing RESNET (ryan.meres@gmail.com)

requests Disapprove

Commenter's Reason: RESNET encourages disapproval of RE17-19 for the following reasons:

1. This proposal will be the first to take the unprecedented step of allowing a compliance path in the IECC that does not require compliance with all the mandatory requirements.

2. This compliance path would make it much easier for larger homes to comply with the IECC than smaller homes (see attached analysis)

3. This compliance path provides no guidance to code officials as to what to look for to verify compliance, nor what is required by the permit applicant to demonstrate compliance

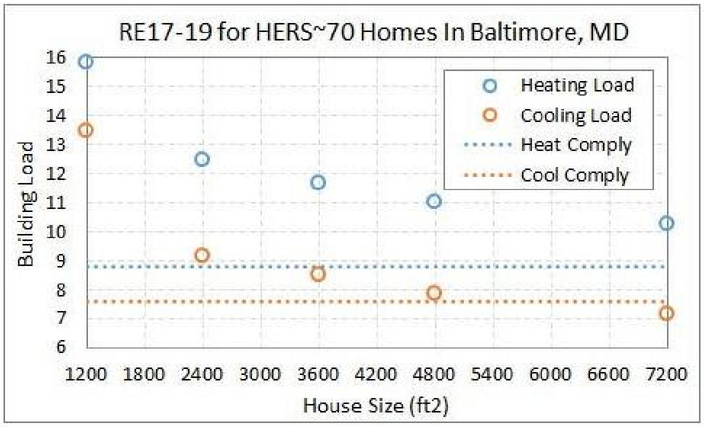
4. This proposal provides no criteria for an “approved” third party or other qualifications for who conducts the calculations to determine compliance

5. With no requirement for what needs to be included on a report to the code official, this proposal provides a significant opportunity for “gaming” compliance.

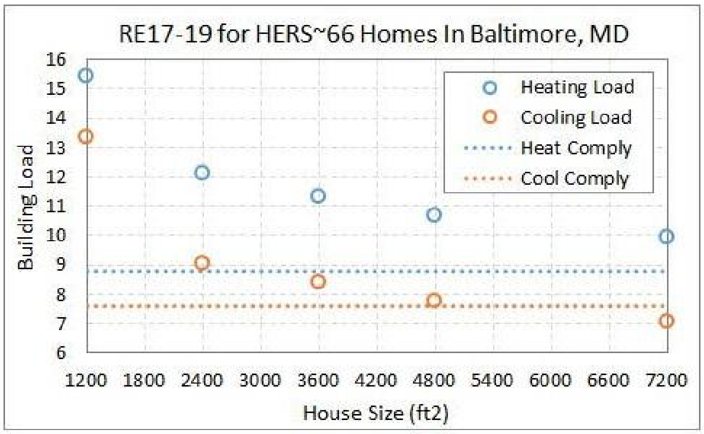
6. In the reason statement for RE-17, the proponents state: “This method is intended as an alternative method for complex residential buildings and HVAC system designs”. However, this is not reflected in the technical content of the proposal.

Overall, this proposal provides a significant loophole in compliance with a pathway that has little accountability for meaningful compliance.

Analysis of RE17-19 using Manual J8 Load Calculations in Energy Gauge Software



Notes: Insulation values approximately equal to 2012 IECC. HERS Index score of 70 based on RESNET/ICC 301. None of these homes fully comply with RE17-19, but it's clear that larger homes will have an easier time complying than smaller homes.



Notes: Insulation and air leakage values in compliance with 2018 IECC. Standard efficiency equipment. HERS Index in accordance with RESNET/ICC 301. No homes fully comply, but it's clear that larger homes will have an easier time complying than smaller ones.

Baltimore 2-story, 3-bedroom Homes minimally compliant with 2018 IECC							
2018 IECC		ManJ8 Loads		EUI (Btu/h-ft2)		Compliance EUI	
CFA	$HERS_{IAF}$	heating	cooling	heating	cooling	heating	cooling
1200	66.2	18,541	16,037	15.45	13.36	8.8	7.6
2400	66.2	29,097	21,790	12.12	9.08	8.8	7.6
3600	66.7	40,892	30,358	11.36	8.43	8.8	7.6
4800	67.1	51,320	37,262	10.69	7.76	8.8	7.6
7200	67.8	71,529	50,860	9.93	7.06	8.8	7.6

Notes: Breakdown of results from the above chart.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1841

RE18-19

IECC: R401.3 (IRC N1101.14)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration, and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters. <u>Where onsite renewable systems have been installed, the array capacity kilowatt size, inverter efficacy, panel tilt and orientation shall be noted on the certificate.</u>

Reason: Four reasons why this proposal should be supported:
1. The Code requires that the efficiency rating of every energy-related building component of the home be observable or documented. Insulation R-values, furnace AFUE and water heater EF ratings, Window U-value and SHGC, as well as blower door and duct leakage testing results to name a few. Onsite renewables systems are the one exception which this proposal is striving to address.

2. The homebuyer must have access to knowledge of the energy comments of their home. The label required in Section R401.3 provides it with the notable exception of onsite renewables.

3. Green appraisal addendums and energy efficient mortgages are becoming more common in the market and the ability to easily gather the energy component information from a home is especially needed after the first sale. The certificate is to be a permanent feature of the home to allow the value of the efficiency features of the home to be recognized and assessed as an impact on the cost of ownership.

4. Lastly, third-party Inspection agencies, especially those working within section R405 and R406, need this information in order to develop compliance and marketing documents. The inclusion of onsite renewables on this certificate will change the renewable industry by ensuring that the information is passed on to all owners in a timely manner that does not impact receiving the certificate of occupancy or the closing of the home.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal would not impact the cost of construction. It does not require the inclusion of onsite renewables only the reporting of it when it is installed.

RE18-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The information is needed. Keeping records with the house makes sense, it is helpful to homeowners. Adds useful information for the future. (Vote 7-4).

Assembly Action: **None**

RE18-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R401.3 (IRC N1101.14)

Proponents:
Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration, and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters. Where onsite ~~renewable~~<u>*photovoltaic panel*</u> *systems* have been installed, the array capacity~~ kilowatt size~~, inverter ~~efficacy~~ <u>efficiency</u>, panel tilt and orientation shall be noted on the certificate.

Commenter's Reason: RE18-19 was successful at the Committee Action Hearings.
This Public Comment includes editorial changes only.

As the language was targeted to photovoltaic panel systems, rather than any other form of renewable energy system, the defined term is used in this public comment.

Inverters have an efficiency associated with them, rather than efficacy. This might have been a typographical error in the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal and public comment only add a requirement for reporting parameters of onsite photovoltaic panel systems, and do not change the cost of construction.

Public Comment# 2174

Public Comment 2:

Proponents:
Craig Conner, representing self (craig.conner@mac.com)

requests Disapprove

Commenter's Reason: RE18 requires inappropriate information on the panel label. The panel label is to help the consumer "comparison shop" homes. The panel label may sometimes help with upgrades or replacements, but the construction documents will often have more and better information.
Why is the inverter efficiency on the panel? The average consumer doesn't even know what an inverter is and certainly doesn't know what "inverter efficiency" is.

If there is a replacement system is that same inverter efficiency somehow a minimum requirement for the new inverter?

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1938

RE20-19

IECC: R401.3 (IRC N1101.14)

Proposed Change as Submitted

Proponents: Jason Vandever, representing Self (jvandever@eepartnership.org)

2018 International Energy Conservation Code

Revise as follows:

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration, and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for each component, the certificate shall indicate the value covering the largest area. The certificate shall indicate the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters. <u>The certificate shall indicate the name of the builder who applied for the building permit, the code edition under which the structure was permitted and the compliance path used.</u>

Reason: This is potentially valuable information to the homeowner or future contractor working on the home

Bibliography: N/A

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Adding a few items to a certification sheet doesn't cost anything. It is only documentation.

RE20-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Do not need builder's name on a certificate (Vote: 8-3).

Assembly Action: **None**

RE20-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R401.3 (IRC N1101.14)

Proponents:
Robert Schwarz, Colorado Chapter of the ICC, representing Colorado Chapter of the ICC (robby@nrglogic.com); Gil Rossmiller, Colorado Code Consulting, LLC., representing Colorado Chapter, ICC (gilrossmiller@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the following:

1. The predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces.*
2. The *U-factors of fenestration and the solar heat gain coefficient (SHGC) of fenestration.* Where there is more than one value for each component, the certificate shall indicate the value covering the largest area.
3. The results from any required duct system and *building* envelope air leakage testing performed on the *building.*
4. The certificate shall indicate the types and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters.
5. The ~~certificate shall indicate the name of the builder who applied for the building permit, the~~ code edition under which the structure was permitted and the compliance path used.

Commenter's Reason: The committee stated that the builder's name is not needed on the certificate. Therefore that has been removed. The Colorado Chapter of the ICC believes that including the code under which the structure was permitted and the compliance path used on the label is valuable information that should be included on the certificate. In addition, the formatting of this section was borrowed from the disapproved proposal RE19 and was carried over here to more clearly highlight what needs to be included on the certificate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Adding a few items to a certification sheet doesn't cost anything. It is only documentation.

Public Comment# 1706

RE21-19

IECC: R401.3 (IRC N1101.14)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org)

2018 International Energy Conservation Code

Revise as follows:

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of fenestration, and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for ~~each~~ any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area-weighted average value if available. The certificate shall indicate the types , sizes and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate "gas-fired unvented room heater," "electric furnace" or "baseboard electric heater," as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters. For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, both with and without any on-site generation, shall be listed on the certificate.

Reason: The purpose of this code change proposal is to make minor but important updates to the certificate that will reflect changes made to the IECC in recent code cycles and include other information that will be beneficial for compliance purposes and for future homeowners. Most importantly, for homes with an Energy Rating Index score, the certificate will be required to provide the actual ERI score achieved with and without on-site generation (since the compliance requirements are different under each option). This proposal would also require the certificate to provide additional detail on thermal envelope efficiency (where available) and HVAC equipment size. This information should all be readily available at construction, and it will take very little effort to transfer it onto the permanent certificate. However, this information may be difficult or impossible to recreate down the road and will be useful for maintenance and future replacement. These are all reasonable improvements to the certificate that will benefit all future owners of the home.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The information required by this proposal will already be available at construction. The only change is to require the information to be recorded on the permanent certificate. Over the useful life of the home, we expect that putting this information in one place could save a homeowner significant money and effort.

RE21-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Confusing language related to area weighted average, and it would require an ERI score both with and without onsite generation (Vote: 10-1)

Assembly Action: **None**

RE21-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R401.3 (IRC N1101.14)

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R401.3 (IRC N1101.14) Certificate (Mandatory). A permanent certificate shall be completed by the builder or other *approved* party and posted on a wall in the space where the furnace is located, a utility room or an *approved* location inside the *building*. Where located on an electrical panel, the certificate shall not cover or obstruct the visibility of the circuit directory label, service disconnect label or other required labels. The certificate shall indicate the predominant *R*-values of insulation installed in or on ceilings, roofs, walls, foundation components such as slabs, *basement walls*, crawl space walls and floors and ducts outside *conditioned spaces*; *U*-factors of fenestration and the *solar heat gain coefficient* (SHGC) of <u>glazed</u> fenestration, and the results from any required duct system and *building* envelope air leakage testing performed on the *building*. Where there is more than one value for any component of the building envelope, the certificate shall indicate both the value covering the largest area and the area-weighted average value <u>of the component</u> if available. The certificate shall indicate the types, sizes and efficiencies of heating, cooling and service water heating equipment. Where a gas-fired unvented room heater, electric furnace or baseboard electric heater is installed in the residence, the certificate shall indicate “gas-fired unvented room heater,” “electric furnace” or “baseboard electric heater,” as appropriate. An efficiency shall not be indicated for gas-fired unvented room heaters, electric furnaces and electric baseboard heaters. <u>The certificate shall provide a summary of information related to compliance with this code, including listing the applicable code and the compliance path used.</u> For buildings where an Energy Rating Index score is determined in accordance with Section R406, the Energy Rating Index score, ~~both with and without~~ <u>and whether it includes</u> any on-site generation, shall be listed on the certificate.

Commenter's Reason: This proposal should be approved as submitted or as modified because it improves the certificate to include important additional information related to the building envelope and the use of on-site generation. Since the 2006 IECC, the permanent certificate has provided homeowners with straightforward, critical information about the energy-saving features of their homes. Consumer demand for information about the home has only increased since then, and RE21 provides important updates to the certificate.

The proposed modification addresses the two issues raised at the Committee Action Hearing:

- First, the Committee found the language related to area-weighted averaging “confusing.” The modification above clarifies that where the area-weighted average value for that component is available, it should be listed. Builders who use trade-off methods like the Total UA or who use REScheck for compliance will already have the area-weighted average fenestration U-factors and/or SHGC values, and it would make sense to include these instead of the U-factor or SHGC that covers “the largest area.” In any case, the revision above would only require including the weighted average if it is available.

- Second, the Committee was also concerned about builders having to provide an ERI score for the building both with and without the inclusion of on-site renewable energy (if any). This modification clarifies that only one ERI score is required to be listed on the certificate, but that the builder must indicate whether the ERI score includes on-site renewable energy or not. Because a different set of thermal envelope requirements apply depending on whether on-site renewable energy is included in the ERI score, we think it is crucial information for the code official to have. Without an acknowledgement by the builder as to whether on-site generation was used as part of the ERI calculation, it will be unclear which thermal envelope backstop applies.

These changes will not increase costs or create any real burden for the builder, but the changes will help facilitate compliance and enforcement as well as provide information for future owners when making future additions, alterations, repairs or replacements.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The changes will not increase costs or create any real burden for the builder.

Public Comment# 1472

RE26-19

IECC: R402.1.4 (IRC N1102.1.4), TABLE R402.1.4 (IRC N1102.1.4), R402.1.5 (IRC N1102.1.5), R402.2.10 (IRC N1102.2.10)

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com)

2018 International Energy Conservation Code

Revise as follows:

R402.1.4 (IRC N1102.1.4) ***U*-factor** **~~alternative.~~ or *F-* factor alternative** An assembly with a *U*-factor or *F-* factor equal to or less than that specified in Table R402.1.4 shall be an alternative to the *R*-value in Table R402.1.2.

TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT *U*-FACTORS-FACTORSAND *F*- FACTORS[a]

CLIMATEZONE	FENESTRATIONU-FACTOR	SKYLIGHTU-FACTOR	CEILINGU-FACTOR	FRAMEWALLU-FACTOR	MASS WALLU-FACTOR[b]	FLOORU-FACTOR	BASEMENTWALLU-FACTOR	UNHEATED SLAB F-FACTOR	HEATED SLAB[d] F-FACTOR	CRAWLSPACE WALLU-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.73	1.03	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.73	1.03	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091[c]	0.73	1.03	0.136
4 except Marine	0.32	0.55	0.026	0.060	0.098	0.047	0.059	0.54	0.68	0.065
5 and Marine 4	0.30	0.55	0.026	0.060	0.082	0.033	0.050	0.54	0.68	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.48	0.68	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.48	0.68	0.055

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.
d. *F*- factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.2

R402.1.5 (IRC N1102.1.5) ~~Total UA~~ Component performance alternative. Where the proposed total building thermal envelope ~~UA, the sum of *U*-factor times assembly area,~~ thermal conductance, is less than or equal to the ~~total UA resulting from multiplying the *U*-factors~~ required total building thermal envelope thermal conductance using factors in Table R402.1.4 ~~by the same assembly area as in the proposed *building*~~, the building shall be considered to be in compliance with Table R402.1.2. The ~~UA calculation shall be performed~~ total thermal conductance shall be shall be determined in accordance with Equation 4-1. Proposed *U*- factors and slab-on-grade *F*- factors shall be determined using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials. In addition to ~~UA~~ total thermal conductance compliance, the SHGC requirements shall be met.

$(U_p A + F_p P) < (U_r A + F_r P)$ (Equation 4-1)

where:

$U_p A$ = the sum of proposed U- factors times the assembly areas in the proposed building

$F_p P$ = the sum of proposed F- factors times the slab-on-grade perimeter lengths in the proposed building

$U_r A$ = the sum of U- factors in Table R402.1.4 times the same assembly areas as in the proposed building

$F_r P$ = the sum of F- factors in Table R402.1.4 times the slab-on-grade perimeter lengths as in the proposed building

R402.2.10 (IRC N1102.2.10) Slab-on-grade floors. Slab-on-grade floors in contact with the ground with a floor surface ~~less than 12~~ within 24 inches (~~305~~ 600 mm) above or below grade shall be insulated in accordance with Table R402.1.2. The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the ~~*building.*~~ building. Insulation extending away from the building shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall. Slab-edge insulation is not required in jurisdictions designated by the code official as having a very heavy termite infestation.

Reason: to clarify how slab-on-grade UA calculations are to be done and provide an approved source for *F*- factor data. Although standard calculation procedures (such as ASHRAE's) cover the incorporation of slab conductances, and existing tools (such as RES*check*) support slab perimeter insulation tradeoffs in the UA alternative, the code currently gives little direction on slab-on-grade component performance calculations. This clarifies the slab calculation.
This is clarification only; there is no direct impact on energy use.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no cost impact since there is no change in requirements. This just clarifies how insulation for slab on grade can be treated in the UA tradeoff calculation.

RE26-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The clarification on slab on grade insulation levels is needed, but the numbers must be correct. They should be fixed in public comment (Vote: 10-1)

Assembly Action: **None**

RE26-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.1.4 (IRC N1102.1.4)

Proponents:
Craig Conner, representing self (craig.conner@mac.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT *U*-FACTORSAND *F*- FACTORS[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAMEWALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOOR U-FACTOR	BASEMENTWALLU-FACTOR	UNHEATED SLAB *F*-FACTOR	HEATED SLAB[d] *F*-FACTOR	CRAWLSPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.73	~~1.03~~ 0.74	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.73	~~1.03~~ 0.74	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091[c]	0.73	~~1.03~~ 0.74	0.136
4 except Marine	0.32	0.55	0.026	0.060	0.098	0.047	0.059	0.54	~~0.68~~ 0.66	0.065
5 and Marine 4	0.30	0.55	0.026	0.060	0.082	0.033	0.050	0.54	~~0.68~~ 0.66	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.48	~~0.68~~ 0.66	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.48	~~0.68~~ 0.66	0.055

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

b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

d. *F*- factors for heated slabs correspond to the configuration described by footnote (d) of Table R402.1.2

Commenter's Reason: This is the public comment correction requested by the committee.
This updates the proposed F-factors for heated slabs (and uninsulated unheated slabs) that were slightly off from the final addendum in the 90.1 BX update of Appendix A.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This change provides a way of doing trade offs including the slab. As such it is not an increase or decrease, rather it is a tradeoff option.

Public Comment# 2143

RE27-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proposed Change as Submitted

Proponents: Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATEZONE	FENESTRATIONU-FACTOR[b]	SKYLIGHT[b]U-FACTOR	GLAZEDFENESTRATION SHGC[b, e]	CEILINGR-VALUE	WOODFRAME WALLR-VALUE	MASSWALLR-VALUE[i]	FLOORR-VALUE	BASEMENT[c]WALLR-VALUE	SLAB[d]R-VALUE& DEPTH	CRAWLSPACE[c]WALLR-VALUE
1	NR	0.75	0.25	30	13 or 0+10[h]	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13 or 0+10[h]	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h] or 0+15[h]	8/13	19	5/13[f]	0	5/13
4 exceptMarine	0.32	0.55	0.40	49	20 or 13+5[h] or 0+15[h]	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30	0.55	NR	49	20 or 13+5[h] or 0+15[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	30 or 20+5[h] or 13+10[h] or 0+20[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	30 or 20+5[h] or 13+10[h] or 0+20[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

Reason: This proposal does not change the stringency of insulation requirements for wood frame walls. The intent of this proposal is to: (1) include an additional equivalent insulation option for cavity insulation (currently an equivalent cavity insulation only option is missing in Climate Zones 6-8) and (2) provide for equivalent continuous insulation only options which are also are missing. With the addition of these options, the table provides a simple yet complete set of insulation options for location of insulation on wood frame wall assemblies for each climate zone. This is intended to improve the usefulness of prescriptive options and show the full range of equivalent insulation options (e.g., cavity only, hybrid cavity + continuous, and continuous only). It is also intended to address concerns that the prescriptive table favors certain options over others by excluding viable options in some climate zones. This approach also provides more flexibility to coordinate insulation options with vapor retarder provisions in the building code which vary by climate as well as insulation strategy. With this flexibility, users can more readily choose between insulation options that provide equivalent assembly U-factor (as a minimum requirement of the energy code) yet have different capabilities and functions with respect to comfort, air-tightness, moisture control, thermal bridging mitigation, and other factors that are important to an overall code-compliant wall assembly. The thermal equivalency of the proposed options is demonstrated in the assembly U-factor analysis tables that follow.

R0+10 option:

Climate Zone 1 and 2 U-Factor Calculation Spreadsheet

Wall Thermal Resistance by Component	**2 x 4 Wall** **R-0 + R8.5ci**	
	R-value Cavity Path	**R-value Stud Path**
Wall - Outside Winter Air Film[A]	0.17	
Siding - Vinyl [A]	0.62	
Continuous Insulation	8.5	

OSB - 7/16" A	0.62	
SPF Stud/Cavity Insulation	0	4.375
1/2 Drywall A	0.45	
Inside Air Film A	0.68	
16" o.c. Framing Factor A	75%	25%
Total Wall R-Values	11.04	15.42
Assembly U-Factor	**0.084**	
A 2009 ASHRAE Handbook of Fundamentals		

NOTE: R-0 + R8.5ci is rounded to R-0 + R10ci to align with current convention for continuous insulation R-values in Table R402.1.1

R0+15 option:

Climate Zone 3, 4 and 5 U-Factor Calculation Spreadsheet

Wall Thermal Resistance by Component	**2 x 4 Wall** **R-0 + R13.2ci**	
	R-value Cavity Path	**R-value Stud Path**
Wall - Outside Winter Air Film A	0.17	
Siding - Vinyl A	0.62	
Continuous Insulation	13.2	
OSB - 7/16" A	0.62	
SPF Stud/Cavity Insulation	0	4.375
1/2 Drywall A	0.45	
Inside Air Film A	0.68	
16" o.c. Framing Factor A	75%	25%
Total Wall R-Values	15.74	20.12
Assembly U-Factor	**0.060**	
A 2009 ASHRAE Handbook of Fundamentals		

NOTE: R-0 + R13.2ci is rounded to R-0 + R15ci to align with current convention for continuous insulation R-values in Table R402.1.1.

R30 option (cavity only):

Climate Zone 6, 7 and 8 U-Factor Calculation Spreadsheet

Wall Thermal Resistance by Component	**2 x 8 Wall** **R-30 + R0ci**	
	R-value Cavity Path	**R-value Stud Path**
Wall - Outside Winter Air Film A	0.17	
Siding - Vinyl A	0.62	
Continuous Insulation	0	
OSB - 7/16" A	0.62	
SPF Stud/Cavity Insulation	30	9.0625
1/2 Drywall A	0.45	
Inside Air Film A	0.68	
16" o.c. Framing Factor A	75%	25%
Total Wall R-Values	32.54	11.60
Assembly U-Factor	**0.045**	

[A] 2009 ASHRAE Handbook of Fundamentals		

NOTE: As shown in the calculation above, the R-30 cavity insulation only wall is dependent on thickness of framing (2x8) to satisfy the required maximum U-factor of 0.045. This is because the R-value of the studs (framing path) has an important effect on the overall effective R-value or U-factor of the assemblies with cavity insulation only. Where a 2x6 wall is used, R-38 insulation would be required because a 2x6 stud has a lower R-value than a 2x8 stud and, consequently, more cavity insulation R-value is needed to make up the difference (even though the cavity depth of a 2x6 wall is smaller). This is demonstrated in the table below. While R-38 insulation in a 2x6 wall cavity is possible, it can only be done with a limited selection of cavity insulation material with a 6.9 R/in or greater (i.e., closed cell spray foam). For this reason the proposal uses the R-30 (2x8) option which is more inclusive of various cavity insulation materials having an R-4.1/in or greater. Other options include combinations of cavity insulation materials that add up to R30 (e.g., flash and batt) or double-stud walls that can comply through the U-factor approach.

Climate Zone 6, 7 and 8 U-Factor Calculation Spreadsheet

Wall Thermal Resistance by Component	**2 x 6 Wall R-38+0ci**	
	R-value Cavity Path	**R-value Stud Path**
Wall - Outside Winter Air Film[A]	0.17	
Siding - Vinyl [A]	0.62	
Continuous Insulation	0	
OSB - 7/16" [A]	0.62	
SPF Stud/Cavity Insulation	38	6.875
1/2 Drywall [A]	0.45	
Inside Air Film [A]	0.68	
16" o.c. Framing Factor [A]	75%	25%
Total Wall R-Values	40.54	9.42
Assembly U-Factor	**0.045**	
[A] 2009 ASHRAE Handbook of Fundamentals		

R0 + 20 option:

Climate Zone 6, 7 and 8 U-Factor Calculation Spreadsheet

Wall Thermal Resistance by Component	**2 x 4 Wall** **R-0 + R18.7ci**	
	R-value Cavity Path	**R-value Stud Path**
Wall - Outside Winter Air Film[A]	0.17	
Siding - Vinyl [A]	0.62	
Continuous Insulation	18.7	
OSB - 7/16" [A]	0.62	
SPF Stud/Cavity Insulation	0	4.375
1/2 Drywall [A]	0.45	
Inside Air Film [A]	0.68	
16" o.c. Framing Factor [A]	75%	25%
Total Wall R-Values	21.24	25.62
Assembly U-Factor	**0.045**	
[A] 2009 ASHRAE Handbook of Fundamentals		

NOTE: R-0 + R18.7ci is rounded to R-0 + R20ci to align with current convention for continuous insulation R-values in Table R402.1.1.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal merely provides additional equivalent options for compliance to ensure no one approach or insulation material or its location on or in an assembly is preferentially treated over another in any of the climate zones.

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This provides additional options for compliance. It simplifies code language and encourages users to look at all the associated issues (Vote: 8-3).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: While having options is a good thing the concern with this option is when all the insulation is located on the exterior this is easier to be removed without replacing it. Having all the insulation on the exterior is less permanent than insulation found in the cavity.
Exterior cladding is replaced all the time due to weather events or because the home owners are wanting a change. Chapter 5 states the alterations shall comply with the requirements for new construction. Section503.1.1 states for the building envelope of alterations comply with requirements for new construction except for a list of 6 situations. As long as the energy use of the building is not increased. Number 3 of the exceptions states the thermal envelope requirements do not apply when construction of a wall cavity is not exposed. This exception would allow for the insulation to not be reinstalled, or at a minimum cause more confusion on how to enforce chapter 5's exceptions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1753

RE28-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proposed Change as Submitted

Proponents: John Woestman, representing Extruded Polystyrene Foam Association (jwoestman@kellencompany.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2 (IRC N1102.1.2) INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATEZONE	FENESTRATIONU-FACTOR[b]	SKYLIGHT[b]U-FACTOR	GLAZEDFENESTRATION SHGC[b, e]	CEILINGR-VALUE	WOODFRAME WALLR-VALUE	MASSWALLR-VALUE[i]	FLOORR-VALUE	BASEMENT[c]WALLR-VALUE	SLAB[d]R-VALUE& DEPTH	CRAWLSPACE[c]WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or ~~13+5~~[h] 13&5ci[h]	8/13	19	~~5/13~~[f] 5ci or 13[f]	0	~~5/13~~ 5ci or 13[f]
4 exceptMarine	0.32	0.55	0.40	49	20 or ~~13+5~~[h] 13&5ci	8/13	19	~~10/13~~ 10ci or 13	10ci[j], 2 ft	~~10/13~~ 10ci or 13
5 andMarine 4	0.30	0.55	NR	49	20 or ~~13+5~~[h] 13&5ci	13/17	30[g]	~~15/19~~ 15ci or 19	10ci, 2 ft	~~15/19~~ 15ci or 19
6	0.30	0.55	NR	49	~~20+5~~[h] ~~or 13+10~~[h] 20&5ci or 13&10ci	15/20	30[g]	~~15/19~~ 15ci or 19	10ci, 4 ft	~~15/19~~ 15ci or 19
7 and 8	0.30	0.55	NR	49	~~20+5~~[h] ~~or 13+10~~[h] 20&5ci or 13&10ci	19/21	38[g]	~~15/19~~ 15ci or 19	10ci, 4 ft	~~15/19~~ 15ci or 19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

> **Exception:** In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "~~10/~~5ci or 13" means ~~R-10~~ R-5 continuous insulation (ci) on the interior or exterior of the ~~home~~ wall or R-13 cavity insulation on the interior of the ~~basement wall~~ ~~/19"~~ wall "15ci or 19" means R-15 continuous insulation (ci) on the interior or exterior surface of the ~~home~~ wall or R-19 cavity insulation at the interior of the ~~basement~~ wall. Alternatively, compliance with ~~"15/19"~~ "15ci or 19" shall be R-13 cavity insulation on the interior of the ~~basement~~ wall ~~plus~~ in addition to R-5 continuous insulation on the interior or exterior of the ~~home.~~wall.

d. R-5 continuous insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation and crawl space wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.
h. The first value is cavity insulation, the second value is continuous ~~insulation. Therefore, as an example, "13+5"~~ insulation (ci), so "13&5ci" means R-13 cavity insulation ~~plus R-5 continuous insulation.~~ in addition to R-5 continuous insulation (ci) and "13&10ci" means R-13 cavity insulation in addition to R-10 continuous insulation (ci).
i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.
j. "10ci" means R-10 continuous insulation (ci).

Reason: This proposal is a clarification of insulation requirements in relation to cavity and continuous insulation applications. This proposal is intended to clarify compliance with Section R402.1.3.
In Table R402.1.2, "ci" is inserted wherever continuous insulation is a prescriptive requirement and / or option. Also, the "+" in several cells is replaced with "&" to more appropriately indicate the continuous insulation (ci), along with the cavity insulation, are both required where the CZ requires both. In footnote "c" replacing "and" with "in addition to" to clearly communicate in these situations both cavity insulation and continuous insulation are required.

In the basement and crawl space wall columns, the "/" is replace with "or" to clearly communicate either is acceptable (ci or cavity insulation).

Also, suggesting a bit of cleanup in footnote "c". Footnote "c" is used for Basement Wall R-value and for Crawl Space Wall R-value. Use of "basement" in the footnote is not quite accurate since this footnote applies equally to basement or crawlspace walls. And, use of "home" is too broad. It seems the use of "wall" is better than the current text. And, in footnote "c" replacing "and" with "in addition to" to clearly communicate in these situations both cavity insulation and continuous insulation are required.

In the crawl space wall column, inserting footnote "f" similar to where footnote "f" is placed in the basement wall column, and modifying footnote "f" to include crawl space walls. It seems logical that crawl space wall insulation would be required – or not required – per the same criteria as basement walls.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There should be no cost implications as no technical changes are intended.

However, if adding footnote "f" to the crawl space wall column is a technical change, this proposal would decrease the cost of construction.

RE28-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This gives clarity to users of the code (Vote: 11-0).

Assembly Action: **None**

RE28-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.1.2, TABLE R402.2.6, TABLE C402.1.3

Proponents:
John Woestman, Kellen Company, representing Extruded Polystyrene Foam Association (jwoestman@kellencompany.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

TABLE R402.2.6
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION *R*-VALUES

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

Commenter's Reason: This proposal is for consistency in IECC-R and IECC-C with the formatting revisions of proposal RE28-19.

IECC-R

In the tables identified, replace the “+” with “&”. Also, append “ci” to the R-value numerical value for continuous insulation.

Table R402.1.2 and footnotes (and IRC Table N1102.1.2 and footnotes)

Table R402.2.6 and footnotes (and IRC Table N1102.2.6 and footnotes)

IECC-C

In the table identified, replace the “+” with “&”.

Table C402.1.3

RE28-19, approved As Submitted during the CAH, proposes to modify the formatting of the requirements in IECC-R Table R402.1.2 (and footnote). The Committee agreed 11/0: “This gives clarity to users of the code.”

This public comment proposes to revise other occurrences of “+” to “&” in IECC-R Table R402.1.2 for consistency of formatting, and to insert “ci” in several cells of this table should RE27-19 be approved. And, this public comment proposes to revise two tables which were outside the scope of the original proposal for consistency within IECC-R. Further, this public comment proposes to revise one table in IECC-C and consistency of IECC-C with IECC-R. Note that proposals RE23-19 and RE27-19 add text to several cells in Table R402.1.2 where the formatting should be consistent with RE28-19.

The proponent of this public comment suggests this public comment should not be needed as these purely editorial revisions (changing the “+” to “&” in the identified tables) could and should be addressed by the Code Correlating Committee. In addition, IF this public comment is allowed to be debated on the floor during the PCH, the entire proposal RE28-19 is exposed to the risk of disapproval during the PCH and subsequent OGCV. Conversely, assuming no other public comment is submitted on RE28-19; or if this public comment is the only public comment for RE28 and is withdrawn prior to the consent agenda action at the PCH, RE28-19 will be on the consent agenda for “As Submitted” at the PCH.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment is only editorial in nature and as such not affect the technical requirements of the code. The proposal does not add any technical requirements and therefore, the net effect of this public comment and proposal is no increase or decrease in the cost of construction.

Public Comment# 1969

RE29-19

IECC: TABLE R402.1.2 (IRC N1102.1.2), TABLE R402.1.4 (IRC N1102.1.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATEZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b]U-FACTOR	GLAZEDFENESTRATION SHGC[b, e]	CEILINGR-VALUE	WOODFRAME WALL R-VALUE	MASSWALL R-VALUE[i]	FLOORR-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE& DEPTH	CRAWLSPACE[c]WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 exceptMarine	0.32	0.55	0.40	49	~~20 or 13+5~~ 20+5 or 13+10[h]	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30	0.55	NR	49	~~20 or 13+5~~ 20+5 or 13+10[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT *U*-FACTORS[a]

CLIMATEZONE	FENESTRATIONU-FACTOR	SKYLIGHTU-FACTOR	CEILINGU-FACTOR	FRAMEWALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOORU-FACTOR	BASEMENTWALL U-FACTOR	CRAWLSPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.32	0.55	0.026	~~0.060~~ 0.045	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	~~0.060~~ 0.045	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

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

b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

Reason: The purpose of this code change proposal is to upgrade and strengthen the requirements for wall insulation in climate zones 4 and 5 by making the requirements equal to the current requirements in climate zone 6. This will make homes more comfortable for occupants and reduce energy costs over the life of the building.
Because wall insulation is most cost-effectively installed during construction, walls should be insulated to the maximum cost-effective levels at that time, rather than expecting homeowners to upgrade them at some later date. This approach is consistent with the intent of the IECC (R101.3) to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building."

The proposed improvements represent the next step in commonly-available products and construction practices. Using DOE's cost-effectiveness methodology, we found these R-values to offer substantial net life cycle savings and be clearly cost-effective for the homeowner/consumer in both climate zones:

Climate Zone	Annual Energy Cost Savings	Present Value Life Cycle Benefit
4	5.7%	$1,605
5	4.3%	$1,152

Bibliography: U.S. Dep't of Energy, Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes (Aug. 2015), *available at* https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology.

Cost Impact: The code change proposal will increase the cost of construction
Requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

RE29-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Removing cavity only insulation option is a mistake, the net savings are not adequate. We need to comply with current code before we increase efficiency (Vote: 8-3).

Assembly Action: **None**

RE29-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.1.2 (IRC N1102.1.2)

Proponents:
Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOODFRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13 or 0+10ci[h]	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13 or 0+10ci[h]	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5ci[h] or 0+15ci[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	30 or 20+5ci[h] or 13+10ci[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	30 or 20+5ci[h] or 13+10ci[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	30 or 20+5ci[h] or 13+10ci[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	30 or 20+5ci[h] or 13+10ci[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5ci" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

Commenter's Reason: The intent of this PC is to request approval of RE29 (as modified) for two purposes: (1) to align the proposed wall insulation changes in Climate Zones 4 and 5 with the changes already recommended for approval in RE27 and (2) to include all relevant and equivalent insulation options: cavity insulation only, cavity + continuous insulation, and continuous insulation only. Should RE29 be approved in public hearing to improve wall insulation requirements in Climate Zones 4 and 5, it is important to coordinate with RE27 by providing flexibility in the means of compliance. The changes in the other climate zones are no different than already recommended for approval in RE27(AM) at the committee action hearings and they do not represent any change in stringency in those climate zones. Also, the 'ci' designation is included to better differentiate the different insulation materials and locations on the assembly (consistent with the committee's approval of RE28). RE28 also replaced the "+" symbol with an "&" symbol with corresponding changes to footnote 'h' and, while not shown here for clarity, these correlations also are intended based on the final outcome of RE28.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The public comment merely aligns RE29 with RE27 which provided additional equivalent options for compliance to ensure no one approach or insulation material or its location on or in an assembly is preferentially treated over another in any of the climate zones. Therefore, net cost impact is limited to only Climate Zones 4 and 5 where economic pay-back justification was provided in the original RE29 proposal's reason statement (thus, resulting in a decrease in overall cost of ownership). There is no cost impact in the other climate zones for reasons given in RE27 which was recommended for approval as submitted by committee.

Public Comment# 1619

Public Comment 2:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it would improve energy efficiency and reduce energy costs by improving wall insulation requirements. Today's homes are being constructed to last 100 years or more, and some components (such as wall insulation) are likely to remain unchanged over the full lifetime of the building. As such, the efficiency requirements for these components should be carefully reviewed in each code cycle and tightened where reasonable to better ensure optimum efficiency and cost-effectiveness levels.

The Committee's stated concern about "removing cavity only insulation option" is off the mark because the IECC provides several alternatives for trade-offs, including the Total UA, the Simulated Performance Alternative, and the Energy Rating Index. Any one of these paths could be used to build an equivalent home with cavity-only insulation, as long as the reduced efficiency is accounted for elsewhere in the calculation.

As demonstrated in the original reason for the proposal, RE29-19 is one of the largest single improvements in residential energy efficiency for climate zones 4 and 5 and would result in substantial energy and cost savings and life cycle benefits for homeowners.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As stated in the original proposal, requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

Public Comment# 1473

RE32-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWLSPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	~~0~~ 10, 2 ft	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, ~~2~~ 4 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, ~~2~~ 4 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

Reason: The purpose of this code change proposal is to increase energy savings and improve comfort by upgrading and improving slab insulation requirements for climate zones 3-5. Although most other components of the building thermal envelope have improved in recent years, the slab R-value requirements have not improved in any climate zone since at least 2006.

The improved values would produce substantial energy cost savings and life cycle cost benefits in all three climate zones:

Climate Zone	Annual Energy Cost Savings	Present Value Life Cycle Benefit
3	6.8%	$3,132
4	2.5%	$1,000
5	2.2%	$1,076

Insulation can last for many decades and possibly the full useful life of the building, providing consistent comfort and energy saving benefits over that period, so it is particularly important to capture as much cost-effective energy efficiency as possible at construction. This is consistent with the intent of the IECC (R101.3), which is to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building."

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

The additional insulation required will add to construction costs. However, our analysis shows that the improved efficiency will produce a clear life cycle benefit to the homeowner.

RE32-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The cost impact does not justify the savings. The analysis was questioned and concerns expressed about constructability (Vote: 7-4).

Assembly Action: **None**

RE32-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it increases the energy efficiency of the building and reduces energy costs through improvements in slab insulation, which is a part of the thermal envelope that has not been improved since at least the 2006 IECC. The measures are clearly cost-effective, particularly in climate zone 3, where homeowners stand to benefit from $3,132 in life-cycle cost savings. Today's homes are being constructed to last 100 years or more, and some components (such as slab insulation) are likely to remain unchanged over the full lifetime of the building. As such, the efficiency requirements for these components should be carefully examined and tightened where reasonable to better ensure optimum efficiency and cost-effectiveness levels for each measure. The improvements in this proposal are straightforward and are already adopted in adjacent climate zones, suggesting that these improvements can be readily implemented in these climate zones as well.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As stated in the original proposal, the additional insulation required will add to construction costs. However, our analysis shows that the improved efficiency will produce a clear life cycle benefit to the homeowner

Public Comment# 1474

RE33-19

IECC: TABLE R402.1.2 (IRC N1102.1.2), TABLE R402.1.4 (IRC N1102.1.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2 (IRC N1102.1.2) INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATEZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b]U-FACTOR	GLAZEDFENESTRATION SHGC[b, e]	CEILINGR-VALUE	WOODFRAME WALL R-VALUE	MASSWALL R-VALUE[i]	FLOORR-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE& DEPTH	CRAWLSPACE[c]WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	~~38~~ 49	13	4/6	13	0	0	0
3	0.32	0.55	0.25	~~38~~ 49	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 exceptMarine	0.32	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT *U*-FACTORS[a]

CLIMATEZONE	FENESTRATIONU-FACTOR	SKYLIGHTU-FACTOR	CEILINGU-FACTOR	FRAMEWALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOORU-FACTOR	BASEMENTWALL U-FACTOR	CRAWLSPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	~~0.030~~ 0.026	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	~~0.030~~ 0.026	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.32	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

Reason: The purpose of this code change proposal is to upgrade and strengthen ceiling insulation requirements in climate zones 2 and 3 by making the prescriptive values equal to current insulation requirements in climate zone 4 and higher. The proposal will make homes more comfortable and reduce costs for homeowners over the life of the building consistent with the objective of the IECC.
Small improvements to the thermal envelope have a significant impact, particularly in light of the long expected useful life of the home and the thermal envelope improvements. Insulation in particular may be undisturbed for many decades and possibly the full useful life of the building, providing consistent comfort and energy saving benefits over that period, so it is particularly important to capture as much cost-effective energy efficiency as possible at construction. After all, the intent of the IECC (R101.3) is to “regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.”

Using DOE’s cost-effectiveness methodology, we found these R-value improvements to be cost-effective to the homeowner/consumer with a positive present value life cycle benefit:

Climate Zone	Annual Energy Cost Savings	Present Value Life Cycle Benefit
2	0.7%	$42
3	0.9%	$126

These proposed changes are also well within the range specified by the U.S. DOE’s insulation guidelines for climate zones 2 and 3 of R30 to R60.
https://www.energy.gov/energysaver/weatherize/insulation

Bibliography: *Insulation*, Dep’t of Energy, https://www.energy.gov/energysaver/weatherize/insulation (last accessed Dec. 30, 2018).
U.S. Dep’t of Energy, Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes (Aug. 2015), *available at* https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology.

Cost Impact: The code change proposal will increase the cost of construction
Requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

RE33-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Insufficient cost justification (Vote: 9-2).

Assembly Action: **None**

RE33-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it will conserve energy and reduce energy costs and bring added comfort to homeowners over the useful life of the building. An incremental improvement in attic insulation (essentially an additional 3.5 inches of blown insulation) will help maintain occupant comfort in all seasons. These insulation levels are sensible, cost-effective, and well within the levels recommended by U.S. DOE. Although the impact of this single improvement may seem relatively small in isolation (.7% to .9%), this is one of several EECC proposals aimed at optimizing the energy savings and cost-effectiveness of residential buildings. Together, these improvements to the thermal envelope will produce substantial energy and cost savings for homeowners.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As stated in the original proposal, requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

Public Comment# 1475

RE34-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

<u>Proposed Change as Submitted</u>

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATEZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b]U-FACTOR	GLAZEDFENESTRATION SHGC[b, e]	CEILINGR-VALUE	WOODFRAME WALL R-VALUE	MASSWALL R-VALUE[i] [h]	FLOORR-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE& DEPTH	CRAWLSPACE[c]WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h] [g]	8/13	19	5/13[f]	0	5/13
4 exceptMarine	0.32	0.55	0.40	49	20 or 13+5[h] [g]	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30	0.55	NR	49	20 or 13+5[h] [g]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h] [g] or 13+10[h] [g]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] [g] or 13+10[h] [g]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

~~g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.~~

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

Reason: The purpose of this code change proposal is to improve the efficiency of homes in the coldest climate zones by removing an exception that allows weaker floor insulation R-values with no corresponding improvements elsewhere in the building. The current footnote "g" to Table R402.1.2 is a loophole that permits builders to reduce floor insulation (which will lead to a less comfortable home and increased energy costs), simply because of design choices made by the builder. Indeed, this exception allows builders in climate zones 7 and 8 to install *half* the insulation required by code.

The proposal above does not prohibit a builder from continuing to build floors with any specific floor joist thickness. However, if adequate insulation cannot be installed in the floor cavity, the energy efficiency losses must be accounted for elsewhere in the thermal envelope through a trade-off.

Cost Impact: The code change proposal will increase the cost of construction
However, the proposal will only increase construction costs for homes that might have taken advantage of this exception in the prescriptive path because it will require the installation of insulation sufficient to meet the R-value requirement in Table R402.1.2. However, this change will not increase costs for homes built to all other compliance paths in the IECC, since the footnote exception already does not apply to those homes. We believe the elimination of this exception will provide homeowners with the superior comfort and energy and cost-savings they expect from a code-compliant home.

RE34-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

TABLE R402.1.2
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWLSPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5[h]	13/17	30~~g~~	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30~~g~~	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38~~g~~	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

~~g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.~~

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R 402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

Committee Reason: There are other options for trading off insulation and the footnote doesn't belong in prescriptive path. Additional insulation also contributes to fire barrier. The modification is necessary to correct unintended deletion of footnote. (Vote: 10-1).

Assembly Action: **None**

Staff Analysis: The modification does not indicate the re-numbering (re-lettering) of footnotes that will occur if the proposal is approved.

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.1.2 (IRC N1102.1.2)

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)
requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Portions of table not shown remain unchanged.

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT bU-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILINGR-VALUE	WOODFRAME WALL R-VALUE	MASS WALL R-VALUEi	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWLSPACE[c] WALL R-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5h	8/13	19	5/13f	0	5/13
4 except Marine	0.32	0.55	0.40	49	20 or 13+5h	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30	0.55	NR	49	20 or 13+5h	13/17	30[j]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5h or 13+10h	15/20	30[j]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5h or 13+10h	19/21	38[j]	15/19	10, 4 ft	15/19

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

g. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

h. insulation *R*-value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. alls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

j. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an R-value of R-19 for existing homes utilizing Chapter 5 that are not sufficiently deep to install the required R-value or when obstructions in the cavity won't allow the full application of the required R-value.

Commenter's Reason: This footnote provides flexibility for the builders when dealing with these obstacles in real world applications, but still provides minimum guidelines for maintaining the integrity of the thermal envelope. The second portion of the footnote recognizes that during construction obstacles may impede the full R-value required in the floor cavity, and would allow for it to be reduced at the obstacle to an R-19. In a real world application obstacle are often found in the floor cavities especially floors over garages where duct work is often located. This table is utilized for compliance in Chapter 5 with alterations of existing buildings for the building envelope. While the list of exceptions to Section R503.1.1 allows for the existing floor cavities to remain as the existing conditions if the exposed cavities are filled with insulation. This exception would not address the floor systems that would be required to demonstrate compliance with Section R503.1.1 because the alteration is required to insulation the floors since they were not insulated previously. This sections refers you to utilize Table R402.1.2 for the required minimum values. Existing conditions may not allow for the full floor insulation value of an R-30 or R-38 as stated in table R402.1.2 due to the existing size of floor joist that was utilized, so the footnote allows for the minimum of an R-19 under these conditions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This is returning the footnote to what it was originally.

Public Comment# 1757

Public Comment 2:

Proponents: Hope Medina, representing Self (hmedina@coloradocode.net)
requests Disapprove

Commenter's Reason: This footnote is needed when this table is utilized for projects that fall into the existing building portion of this code, Chapter 5. Existing projects may not have the floor joist size to install a full R-30 or R-38 into the cavity. This footnote gives options for these projects to comply with the intent of this code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1756

RE35-19

IECC: TABLE R402.1.2 (IRC N1102.1.2), TABLE R402.1.4 (IRC N1102.1.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2 (IRC N1102.1.2) INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATEZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b]U-FACTOR	GLAZEDFENESTRATION SHGC[b, e]	CEILINGR-VALUE	WOODFRAME WALL R-VALUE	MASSWALL R-VALUE[i]	FLOORR-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE& DEPTH	CRAWLSPACE[c]WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	~~0.40~~ 0.35	0.65	0.25	38	13	4/6	13	0	0	0
3	~~0.32~~ 0.30[j]	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 exceptMarine	~~0.32~~ 0.30[j]	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30[j]	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30[j]	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30[j]	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

j. A maximum U-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4000 feet in elevation above sea level, or
2. In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the International Residential Code.

TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT *U*-FACTORS[a]

CLIMATEZONE	FENESTRATIONU-FACTOR	SKYLIGHTU-FACTOR	CEILINGU-FACTOR	FRAMEWALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOORU-FACTOR	BASEMENTWALL U-FACTOR	CRAWLSPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	~~0.40~~ 0.35	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	~~0.32~~ 0.30	0.55	0.030	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	~~0.32~~ 0.30	0.55	0.026	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	0.026	0.060	0.082	0.033	0.050	0.055
6	0.30	0.55	0.026	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	0.026	0.045	0.057	0.028	0.050	0.055

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

Reason: The purpose of this code change proposal is to improve occupant comfort and save energy by upgrading and strengthening fenestration U-factors in climate zones 2 – 4 (by lowering them consistent with modest step improvements in previous code cycles). Fenestration that meets these requirements is cost-effective and will return substantial life cycle savings to homeowners, is already widely available, and is routinely installed in new and existing residential buildings in these climate zones. This proposal also adds a footnote to establish an exception to prescriptive U-factors for fenestration installed at high altitudes (above 4000 feet in elevation) and in regions that require fenestration to be resistant to windborne debris in climate zones 3 - 8. A similar footnote exception was proposed in the last code development cycle and was widely supported by building code officials in these specific regions. Overall, this proposal will improve energy efficiency across much of the nation while allowing reasonable options for fenestration in high-altitude and wind-borne debris regions.
<u>Energy Savings and Cost-Effectiveness</u> - Our analysis, based on the DOE cost-effectiveness methodology, shows the improvements in U-factor to be cost-effective to the consumer with a substantial life cycle benefit:

Climate Zone	Annual Energy Cost Savings	Present Value Life Cycle Benefit
2	0.9%	$275
3	1.0%	$312
4	1.1%	$523

Although we believe that the upgrade in the standards will result in no cost increase in most cases, because the new specification is consistent with the standard product already used in the marketplace (as discussed below), for purposes of the life cycle cost analysis above, we used a marginal upgrade cost to be conservative. Even with this approach, the life cycle benefit is robust.

<u>Availability of Compliant Products and Adoption</u> – A 0.30 U-factor requirement is a natural technology level/breakpoint representing a reasonably efficient, double pane, low-e with argon wood or vinyl window. As a result, a number of national and state programs have promoted fenestration U-factors in the range of 0.30 for several years, making these products widely available and already being installed throughout most of the country:

- For example, the American Recovery and Reinvestment Act of 2009 (ARRA) provided a federal income tax credit for fenestration with a U-factor of 0.30 or lower.
- Energy Star has required 0.30 U-factors (or less) for fenestration installed in all but the southernmost climate zones since January 1, 2015. *See* https://www.energystar.gov/sites/default/files/ES_Final_V6_Residential_WDS_Spec.pdf
- A recent EnergyStar market penetration report estimated that the share of total window products in the market already meeting the EnergyStar standard in 2016 was about 83%. (https://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2016_USD_Summary_Report.pdf?8fd5-1967).
- These findings were reinforced through the U.S. DOE Residential Field Studies, which found that even in states in climate zones 2 – 4, with weaker code U-factor requirements, builders were routinely installing fenestration with U-factors around 0.30.*See* https://www.energycodes.gov/sites/default/files/documents/Field_Study_120715_Final.pdf.
- The state of California has recently upgraded its U-factor requirements for vertical fenestration statewide from 0.32 to 0.30, finding the lower U-factor cost-effective in all of its climate zones (California contains climate zones 2 – 6). *See* Codes and Standards Enhancement (CASE) Initiative, 2019 California Building Energy Efficiency Standards, *Residential High Performance Windows and Doors – Final Report* (Aug. 2017).

Because of these national trends toward 0.30 U-factor or better fenestration, compliance will not be an issue and in most cases will not even result in an increase in construction costs.

Proposed Exception for Special Circumstances - We believe that the proposed exception is warranted due to the special measures that are taken by glass and/or fenestration manufacturers to address higher altitudes and windborne debris due to high winds.

For example, high altitude products may incorporate breather or capillary tubes in the insulating glass unit to allow pressure equalization for products that will be transported to higher elevations for installation. The pressure equalization can help avoid IG unit failures. However, the capillary tubes eliminate the ability to use certain gas fills commonly used to achieve higher levels of thermal performance. The limited exception proposed above recognizes that circumstance and provides some flexibility for builders in these regions.

Likewise, fenestration designed to withstand windborne debris usually requires special glass which (because of its increased thickness) reduces the gap width in the insulating glass unit. This will affect the thermal performance of the window. To provide some additional flexibility in zones where such fenestration is required, this proposal permits a fenestration U-factor of 0.32 for climate zones 3-8.

In sum, we believe this proposal will implement meaningful energy and cost savings and improved occupant comfort through improved fenestration U-factors that are already available and are routinely being installed by homebuilders.

Bibliography: ENERGY STAR® Product Specification Residential Windows, Doors, and Skylights Eligibility Criteria Version 6.0, Energy Star, *available at* https://www.energystar.gov/sites/default/files/ES_Final_V6_Residential_WDS_Spec.pdf.
ENERGY STAR® Unit Shipment and Market Penetration Report Calendar Year 2016 Summary, Energy Star, *available at https://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2016_USD_Summary_Report.pdf?8fd5-1967.*

Single Family Residential Energy Code Field Study, Building Energy Codes Program, available at https://www.energycodes.gov/sites/default/files/documents/Field_Study_120715_Final.pdf.

Codes and Standards Enhancement (CASE) Initiative, 2019 California Building Energy Efficiency Standards, *Residential High Performance Windows and Doors – Final Report* (Aug. 2017).

U.S. Dep't of Energy, Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes (Aug. 2015), *available at* https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology.

Cost Impact: The code change proposal will increase the cost of construction
It is possible that requiring more efficient fenestration may, in some cases, increase the cost of construction (and, as a result, we used an upgrade cost in our life cycle cost/benefit analysis), but in any event, the resulting energy and cost savings will overwhelmingly recoup the initial costs and will continue to benefit consumers over the useful life of the home. Moreover, it should also be noted that we would expect that the U-factor reduction will not increase costs in most cases, since the standard market products, with very high market penetration, already typically hit the proposed improved U-factor levels. We also note that for builders in high-altitude or wind-borne debris regions, the new footnote will provide additional flexibility and will likely serve to reduce costs.

RE35-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: It is an incremental improvement in efficiency, the windows are readily available and it is cost effective (Vote: 6-5).

Assembly Action: **None**

RE35-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.1.2 (IRC N1102.1.2), TABLE R402.1.4 (IRC N1102.1.4)

Proponents:

Thomas Culp, representing the Glazing Industry Code Committee (culp@birchpointconsulting.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Portions of table not shown remain unchanged.

CLIMATEZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b]U-FACTOR	GLAZEDFENESTRATION SHGC[b, e]
1	NR	0.75	0.25
2	~~0.35~~ 0.40	0.65	0.25
3	0.30[j]	0.55	0.25
4 exceptMarine	0.30[j]	0.55	0.40
5 andMarine 4	0.30[j]	0.55	NR
6	0.30[j]	0.55	NR
7 and 8	0.30[j]	0.55	NR

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

j. A maximum U-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4000 feet in elevation above sea level, or

2, In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the International Residential Code..

TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT *U*-FACTORS[a]

Portions of table not shown remain unchanged.

CLIMATEZONE	FENESTRATIONU-FACTOR	SKYLIGHTU-FACTOR
1	0.50	0.75
2	~~0.35~~ 0.40	0.65
3	0.30	0.55
4 except Marine	0.30	0.55
5 and Marine 4	0.30	0.55
6	0.30	0.55
7 and 8	0.30	0.55

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

b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.

c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

Commenter's Reason: This public comment would accept the changes made to fenestration U-factor requirements in zones 3-4, but restore the current 0.40 value in zone 2 in order to avoid a conflict with the ENERGY STAR® program for Residential Windows, Doors, and Skylights. It is a widely agreed upon principle that Energy Star should be a notch beyond the base energy code. In some cases, code matches Energy Star such as in zones 3-4 in this proposal and with some other product types, but the value in zone 2 directly exceeds the Energy Star requirement (0.35 vs. 0.40). This creates a direct conflict. Even if rare, ***this creates a scenario where an Energy Star labeled window could be sold to a consumer that does not meet code.*** This is misleading to the homeowner, harmful to the Energy Star brand, and also creates potential problems for code officials who use the Energy Star label to check code compliance (in addition to the NFRC label). This issue was part of the debate when the code development committee disapproved RE24, RE30, and RE37, but the committee narrowly passed RE35 by only a 6-5 vote. If RE35 is going to go forward to make the changes in zones 3-4, this conflict in zone 2 must be removed.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As noted by the proponent, this proposal will marginally increase the cost of construction. However, this public comment will improve the cost effectiveness of the overall proposal by ensuring the code requirements do not exceed Energy Star in any zone.

Public Comment# 1559

Public Comment 2:

IECC®: TABLE R402.1.2 (IRC N1102.1.2)

Proponents:
Jeff Inks, representing Window and Door Manufacturers Association (jinks@wdma.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING R-VALUE	WOODFRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWLSPACE[c] WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	~~0.35~~ 0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.30[j]	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.30[j]	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.30[j]	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30[j]	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30[j]	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

j. A maximum U-factor of 0.32 shall apply in Climate Zones 3 through 8 to vertical fenestration products installed in buildings located either:

1. Above 4000 feet in elevation above sea level, or

2, In windborne debris regions where protection of openings is required by Section R301.2.1.2 of the International Residential Code.

Commenter's Reason: WDMA is urging approval of this public comment to restore the current IECC U-factor requirement of 0.40 for vertical fenestration in climate zone 2. We are opposed to the proposed reduction to 0.35 in climate zone 2 because doing so exceeds and conflicts with the ENERGY STAR U-factor requirement applicable to windows in climate zone 2. Historically, the ENERGY STAR Windows, Doors and Skylights program has been an above code program which has helped fortify and promote the ENERGY STAR brand and use of above code ENERGY STAR qualified fenestration products. The ENERGY STAR qualified window label has also served as convenient and reliable means for verifying code compliance with the understanding that the ENERGY STAR criteria is equal to or more stringent than the energy code requirement in that climate zone. Those significant benefits will be undermined if the requirements of the IECC exceed those of ENERGY STAR and could also result in the inadvertent approval of non-compliant windows. Regarding the reductions in U-factors to 0.30 for Climate Zones 3&4 as proposed in RE-35, while they will be the same as the ENERGY STAR U-factor requirements applicable to windows in those zones, they do not exceed them. This public comment only intends for the IECC U-factor in Climate Zone 2 to be consistent in that regard and we urge approval of it for the reasons noted above.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
While this public comment may not increase or decrease the cost of construction, there is a greater benefit with respect to preserving the recognition of ENERGY STAR as an above code program for the reasons stated.

Public Comment# 1826

Public Comment 3:

Proponents:
Jennifer Hatfield, representing American Architectural Manufacturers Association (jen@jhatfieldandassociates.com)

requests Disapprove

Commenter's Reason: Although we support the footnotes being added in this proposal to address impact resistant products and those for high altitudes, we must oppose this proposal based on the longstanding principal that Energy Star is supposed to be a notch above the code. The proposal would change the fenestration U-factor for Zones 3 & 4 to match Energy Star and for Climate Zone 2, the proposal goes beyond Energy

Star 6.0 requirements. This is a bad precedent to set and diminishes the Energy Star Program.

Proposal RE41-19, a joint proposal by the Window & Door Manufacturers Association and AAMA, was approved at the committee action hearings As Submitted. This proposal also addressed the impact resistant and high altitude products footnote that we support in RE35-19, but without changing the Table. Therefore, based on the changes to the fenestration U-factor requirements taking the code to Energy Star and above for Climate Zone 2, we believe this proposal should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
If the code proposal is disapproved by this public comment, the net effect is no change to the U-factors; therefore, no increase in the cost of construction.

Public Comment# 1402

RE36-19

IECC: TABLE R402.1.2 (IRC N1102.1.2), TABLE R402.1.4 (IRC N1102.1.4), R402.2.1 (IRC N1102.2.1)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATEZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b]U-FACTOR	GLAZEDFENESTRATION SHGC[b, e]	CEILINGR-VALUE	WOODFRAME WALL R-VALUE	MASSWALL R-VALUE[i]	FLOORR-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE& DEPTH	CRAWLSPACE[c]WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 exceptMarine	0.32	0.55	0.40	~~49~~ 60	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30	0.55	NR	~~49~~ 60	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	~~49~~ 60	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	~~49~~ 60	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

TABLE R402.1.4 (IRC N1102.1.4)
EQUIVALENT *U*-FACTORS[a]

CLIMATEZONE	FENESTRATIONU-FACTOR	SKYLIGHTU-FACTOR	CEILINGU-FACTOR	FRAMEWALL U-FACTOR	MASS WALL U-FACTOR[b]	FLOORU-FACTOR	BASEMENTWALL U-FACTOR	CRAWLSPACE WALL U-FACTOR
1	0.50	0.75	0.035	0.084	0.197	0.064	0.360	0.477
2	0.40	0.65	0.030	0.084	0.165	0.064	0.360	0.477
3	0.32	0.55	0.030	0.060	0.098	0.047	0.091[c]	0.136
4 except Marine	0.32	0.55	~~0.026~~ 0.024	0.060	0.098	0.047	0.059	0.065
5 and Marine 4	0.30	0.55	~~0.026~~ 0.024	0.060	0.082	0.033	0.050	0.055
6	0.30	0.55	~~0.026~~ 0.024	0.045	0.060	0.033	0.050	0.055
7 and 8	0.30	0.55	~~0.026~~ 0.024	0.045	0.057	0.028	0.050	0.055

a. Nonfenestration *U*-factors shall be obtained from measurement, calculation or an approved source.
b. Mass walls shall be in accordance with Section R402.2.5. Where more than half the insulation is on the interior, the mass wall *U*-factors shall not exceed 0.17 in Climate Zone 1, 0.14 in Climate Zone 2, 0.12 in Climate Zone 3, 0.087 in Climate Zone 4 except Marine, 0.065 in Climate Zone 5 and Marine 4, and 0.057 in Climate Zones 6 through 8.
c. In warm-humid locations as defined by Figure R301.1 and Table R301.1, the basement wall *U*-factor shall not exceed 0.360.

R402.2.1 (IRC N1102.2.1) Ceilings with attic spaces. Where Section R402.1.2 requires R-38 insulation in the ceiling, installing R-30 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Where Section R402.1.2 requires R-49 insulation in the ceiling, installing R-38 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-49 insulation wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. Where Section R402.1.2 requires R-60 insulation in the ceiling, installing R-49 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-60 insulation wherever the full height of uncompressed R-49 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

Reason: The purpose of this code change proposal is to improve comfort and save energy for homeowners in climate zones 4 - 8 by upgrading and increasing ceiling insulation requirements from R-49 to R-60. Small improvements to the thermal envelope can have a significant beneficial impact, particularly in light of a home's long expected useful life. Insulation in particular may not be changed for many decades and may last for the full useful life of the building, providing consistent comfort and energy saving benefits over that period.
Making long-lived, life cycle cost beneficial improvements is consistent with the intent of the IECC (R101.3), which is to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building." Using DOE's cost-effectiveness methodology, we found these R-value improvements would provide substantial life cycle cost benefits:

Climate Zone	Annual Energy Cost Savings
4	0.6%
5	0.7%
6	0.6%
7	0.5%
8	0.4%

These proposed changes are also within the range specified by the U.S. DOE's insulation guidelines for these climate zones. https://www.energy.gov/energysaver/weatherize/insulation A home with adequate insulation will maintain more consistent interior temperatures during both heating and cooling seasons and will be more resilient and livable in the event of extreme weather events and power outages.

Bibliography: *Insulation*, U.S. Dep't of Energy, https://www.energy.gov/energysaver/weatherize/insulation (last accessed Dec. 30, 2018).
U.S. Dep't of Energy, Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes (Aug. 2015), *available at* https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology.

Cost Impact: The code change proposal will increase the cost of construction
Requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will

continue to benefit consumers over the useful life of the home.

RE36-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: It impacts buried ducts, raised trusses and air barriers. The energy savings is within the margin of error (Vote: 11-0).

Assembly Action: **None**

RE36-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it will improve efficiency, reduce energy costs and bring added comfort to homeowners over the useful life of the building. An incremental improvement in attic insulation (essentially an additional 3.5 inches of blown insulation) will yield consistent benefits to homeowners in all seasons. These insulation levels are sensible, cost-effective, and well within the levels recommended by U.S. DOE. Although the impact of this single improvement may seem relatively small in isolation (.4% to .7%), this is one of several EECC proposals aimed at optimizing the energy savings and cost-effectiveness of residential buildings. Together, these improvements to the thermal envelope will produce substantial energy and cost savings for homeowners.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As stated in the original proposal, requiring more insulation will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

Public Comment# 1477

RE37-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATEZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b]U-FACTOR	GLAZEDFENESTRATION SHGC[b, e]	CEILINGR-VALUE	WOODFRAME WALL R-VALUE	MASSWALL R-VALUE[i]	FLOORR-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE& DEPTH	CRAWLSPACE[c]WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 exceptMarine	0.32	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30	0.55	~~NR~~ 0.40	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.

Reason: The purpose of this code change proposal is to improve occupant comfort, reduce peak demand and HVAC sizing, and reduce costs for homeowners by establishing a moderate SHGC requirement for fenestration in climate zone 5. While we believe that the vast majority of fenestration installed in climate zone 5 already meets or exceeds this level of efficiency, and the performance path already assumes this same level (a 0.40 SHGC) for climate zone 5, this proposal will encourage the use of fenestration with proven efficiency and comfort benefits.
Comfort – A window that combines both a low U-factor (which is already required for climate zone 5) with a low SHGC will help reduce the volatility of interior temperature swings and better maintain reasonable occupant comfort. According to the Efficient Windows Collaborative, based on an analysis completed by Lawrence Berkeley National Laboratory, windows with lower SHGCs reduce the amount of solar radiation passing through the glass, which will reduce the likelihood of discomfort of occupants. *See* https://www.efficientwindows.org/comfort.php. An uncomfortable occupant due to excessive solar gain through windows is more likely to adjust the thermostat to a cooler temperature over the course of the day in response, thereby increasing peak demand and energy use.

Although energy modeling software does not typically capture the likelihood of occupant response to discomfort, anyone who has lived or worked in a building with excessive solar gain through fenestration, knows that this can lead occupants to adjust the thermostat. The energy impact of adjusting the thermostat is substantial. The following table shows the increased energy use that results from adjusting the thermostat down a single degree in a code-compliant house in each climate zone:

Increased Energy Use Resulting from Downward Thermostat Adjustment									
Measure	**Weighted**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
-1 Degree Cooling	3.0%	7.8%	5.3%	3.9%	2.6%	1.8%	1.4%	0.7%	0.4%

Obviously, if an uncomfortable occupant adjusts the thermostat 2 or 3 degrees, the impact will be far higher.

Peak Demand and HVAC Sizing Savings – Low-SHGC fenestration helps reduce both the home and utility peak electric demand, providing a range of benefits for homeowners and communities. Low-SHGC fenestration helps reduce the need for air conditioning during peak hours when electricity is more scarce and more expensive. Reduced cooling needs can allow for the installation of smaller cooling equipment, benefitting the homeowner by lowering costs at construction and every time the air conditioning unit is replaced. Reduced peak electric demand for each home will also help curb the overall increases in utility peak electric demand, reducing costs and negative environmental impacts associated with installing and operating peak electric generation. *See* U.S. Department of Energy, *Measure Guideline: Energy Efficient Window Performance and Selection*, at 49, *available at* https://www.nrel.gov/docs/fy13osti/55444.pdf.

Market Availability - Given the U-factor requirement in climate zone 5 (currently 0.30), the overwhelming majority of products being installed in this climate are already well under a 0.40 SHGC. Indeed, according to a 2015 U.S. DOE field study of homes in Pennsylvania (which had no SHGC requirement), 100% of the observed fenestration SHGC was below 0.40. In fact, the highest SHGC observed was 0.32. *See* https://www.energycodes.gov/compliance/energy-code-field-studies. While this study was limited to one state and a limited sample, we have seen no evidence that the circumstances are different in other climate zone 5 states. Given the ubiquity of low-SHGC fenestration in climate zone 5, we believe that this proposal will not significantly change, but merely recognize practices already implemented by homebuilders.

Bibliography: U.S. Department of Energy, *Measure Guideline: Energy Efficient Window Performance and Selection*, *available at* https://www.nrel.gov/docs/fy13osti/55444.pdf.
Energy Code Field Studies, U.S. Dep't of Energy, *available at* https://www.energycodes.gov/compliance/energy-code-field-studies.

Efficient Windows Collaborative, *Benefits: Improved Comfort*, *available at* https://www.efficientwindows.org/comfort.php.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
We believe that the vast majority of windows being installed in climate zone 5 already meet this SHGC level, and for any that do not, there are many standard products in the market that will meet it for no additional cost (the vast majority of windows that meet the U-factors specified for climate zone 5 already have a lower SHGC than 0.40; the lower SHGC typically comes with the lower U-factor). A lower SHGC may also provide the opportunity to reduce the size of the HVAC system, thereby reducing construction cost. As a result, any increased or decreased cost impact is dependent on specific circumstances and is uncertain.

RE37-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: No technical data was provided, the cost savings were not justified, there is no energy savings (Vote: 8-3)

Assembly Action: **None**

RE37-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it will improve occupant comfort and help reduce air conditioner sizing, both of which will result in cost savings for homeowners. As explained below, we believe the Committee misunderstood the potential cost savings and other benefits for homeowners (see also the original reason for more details):

- First, the vast majority of windows available in climate zone 5 will already have SHGCs well below 0.40, since lower SHGCs typically accompany the lower U-factors required in this climate zone. This means no incremental cost increase. Even for those few windows that do not have a compliant SHGC, a simple change in low-e coating will achieve the SHGC requirement, at little or no additional cost.

- Second, new homes in climate zone 5 will almost certainly contain air conditioning equipment, which must be sized based on the characteristics of the building thermal envelope. Lower SHGCs reduce the size of the AC equipment needed, which will save money for builders and homeowners.

- Third, lower SHGCs improve comfort for the occupants of homes, making it less likely that they will adjust the AC thermostat. Improved comfort is not a trivial matter – as we noted in the original reason, even a one degree change in the cooling thermostat setpoint would increase total energy use by 1.8%.

- Given the low-to-zero marginal cost of this improvement, and the high likelihood that homeowners will be more comfortable and save far more costs on HVAC equipment, this proposal is a very sensible improvement to the IECC.

In addition to the consumer benefits, this proposal will help to reduce summer electrical system peak demands, which are largely driven by air conditioning loads.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
As stated in the original proposal, we believe that the vast majority of windows being installed in climate zone 5 already meet this SHGC level, and for any that do not, there are many standard products in the market that will meet it for no additional cost (the vast majority of windows that meet the U-factors specified for climate zone 5 already have a lower SHGC than 0.40; the lower SHGC typically comes with the lower U-factor). A lower SHGC may also provide the opportunity to reduce the size of the HVAC system, thereby reducing construction cost. As a result, any increased or decreased cost impact is dependent on specific circumstances and is uncertain.

Public Comment# 1481

RE39-19

IECC: TABLE R402.1.2 (IRC N1102.1.2), R402.2.1 (IRC N1102.2.1), R402.2.2 (IRC N1102.2.2)

Proposed Change as Submitted

Proponents: Greg Johnson, Johnson & Associates Consulting Services, representing Coalition for Fair Energy Codes (gjohnsonconsulting@gmail.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATEZONE	FENESTRATIONU-FACTOR[b]	SKYLIGHT[b]U-FACTOR	GLAZEDFENESTRATION SHGC[b, e]	CEILINGR-VALUE	WOODFRAME WALLR-VALUE	MASSWALLR-VALUE[i]	FLOORR-VALUE	BASEMENT[c]WALLR-VALUE	SLAB[d]R-VALUE& DEPTH	CRAWLSPACE[c]WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 exceptMarine	0.32	0.55	0.40	49	20 or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6 Option 1	0.30	0.55	NR	49	20+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
6 Option 2	0.28	0.55	NR	60	23[j]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8 Option 1	0.30	0.55	NR	49	20+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19
7 and 8 Option 2	0.28	0.55	NR	60	23[j]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. “10/13” means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. “15/19” means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the

interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.
d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.
e. There are no SHGC requirements in the Marine Zone.
f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.
g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.
h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.
i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.
j. Permitted only where the fenestration U-factor is 0.28 and the ceiling R-value is 60.

R402.2.1 (IRC N1102.2.1) Ceilings with attic spaces. Where Section R402.1.2 requires R-38 insulation in the ceiling, installing R-30 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Where Section R402.1.2 requires R-49 insulation in the ceiling, installing R-38 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-49 insulation wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. Where Section R402.1.2 requires R-60 insulation in the ceiling, installing R-49 over 100 percent of the ceiling area requiring insulation shall satisfy the requirement for R-60 insulation wherever the full height of uncompressed R-49 insulation extends over the top plate at the eaves. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

R402.2.2 (IRC N1102.2.2) Ceilings without attic spaces. Where Section R402.1.2 requires insulation *R*-values greater than R-30 in the ceiling and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation *R*-value for such roof/ceiling assemblies shall be R-30. Where Section R402.1.2 requires insulation greater than R49 in the ceiling and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the required insulation R-value for such roof/ceiling assemblies shall be R38. Insulation shall extend over the top of the wall plate to the outer edge of such plate and shall not be compressed. This reduction of insulation from the requirements of Section R402.1.2 shall be limited to 500 square feet (46 m2) or 20 percent of the total insulated ceiling area, whichever is less. This reduction shall not apply to the *U*-factor alternative approach in Section R402.1.4 and the Total UA alternative in Section R402.1.5.

Reason: This proposal will save energy by providing a critically needed prescriptive cavity-only wall insulation option for Climate Zones 6-8 for the many builders and building officials that rely on the prescriptive table.
This new option provides equivalent energy performance by combining a minimum R23 wood frame wall R-value with better performing windows (U=0.28) and increased ceiling insulation (R60), such that equivalent energy performance is achieved.

The proposed R23 wall cavity insulation level is compatible with 2x6 framing using a variety of cavity insulation types, including several types of batt insulation products and blown-in insulation systems.

Verifying compliance in the field is easily done by checking the fenestration labels and insulation certificates and markers required by Sec. R303.

Note that this proposal does not modify the two existing continuous insulation assemblies already listed in Table R402.1.2, nor does it affect the U-factors in Table R402.1.4.

The proposed formatting of Table R402.1.2 in this proposal is identical to that of RE28-16 PC1 which was passed overwhelmingly by the assembly at the public comment hearings in Kansas City in 2016 before failing to achieve the supermajority by a single vote in online voting https://www.iccsafe.org/wp-content/uploads/2016-GroupB-Final-Action-Results-OGCV.pdf .

The energy efficiency of the proposed change was shown to provide better performance than the 2018 IECC using both an energy simulation analysis and a Total UA, REScheck analysis. Both analyses demonstrated better performance than the 2018 IECC. Both analyses used the U.S. Department of Energy Single Family Prototype for Determining the Cost Effectiveness of the 2018 IECC for house characteristics and square footage, in addition the simulated performance analysis uses U-factors and modeling guidelines in Sections R405.5.2(1) and R405.5.2(2) of the 2018 IECC for modeling the base or reference home.

1. Table R402.1.2 - Simulated Energy Performance Analysis:

Option:	Description:	MMBTU/YR[1]	Energy Cost YR[2]	% Better
Base	Base 2018 IECC[3]	87.4	$1309.00	0.0%
Option 2[4]	R-23 wood frame wall, U-.28 vertical fenestration, R-60 attic	85.9	$1292.00	0.3%

1. Whole Home MMBTU/YR

2. Whole Home Energy Cost/YR

3. Square footages and attributes taken from the US DOE Single Family Prototype for Determining the Cost Effectiveness of the 2018 IECC and modeling guidelines in R405.5.2(1) and R405.5.2(2) of the 2018 IECC.

4. Component U-factors calculated in accordance with the 2015 ASHRAE Handbook of Fundamentals.

2. Table R402.1.2 -Total Building UA Analysis (REScheck):

Option:	Description:	Overall U-Factor	% Better
Base	Base 2018 IECC[1]	313	0.0%
Option 2[2]	R-23 wood frame wall, U-0.28 vertical fenestration, R-60 attic	309	1.3%

1. Square footages and attributes taken from the US DOE Single Family Prototype for Determining the Cost Effectiveness of the 2018 IECC.

2. Component U-factors calculated in accordance with the 2015 ASHRAE Handbook of Fundamentals.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal offers an optional path for prescriptive envelope compliance. Because it is optional it cannot raise the cost of construction; a builder will choose whatever option they believe provides the greatest benefit for the cost.

RE39-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: A home with a lot of windows could perform worse, it presents a loophole and alternatives should be restricted to the UA alternative (Vote: 8-3).

Assembly Action: **None**

RE39-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Greg Johnson, representing Coalition for Fair Energy Codes (gjohnsonconsulting@gmail.com)

requests As Submitted

Commenter's Reason: A majority of the committee voted against the proposal, having been influenced by inaccurate testimony, which claimed that proposed Option 2 might be less energy efficient in houses with a lot of window area. However, since Option 2 requires all windows to be 7% *more* energy efficient than the base prescriptive window U-factor requirement, a house with a lot of higher-performance windows actually improves energy performance compared to the same house with just as many lower-performance windows as permitted by the prescriptive table.

RE39 Saves Energy

Two analyses in the original proposal's reason statement, (R402.2.1 - Total Building UA Analysis (REScheck) and; R402.2.1 - Simulated Energy Performance Analysis), both demonstrate that RE39 reduces energy use. Both of these analyses used as a basis the U.S. Department of Energy's Single-Family Prototype for Determining the Cost Effectiveness of the 2018 IECC.

Two additional analyses also demonstrate that RE39 saves energy, as well as showing the impact of the improved Option 2 windows on energy efficiency.

1) REScheck modeling of a single 1800 sq. ft. house in Climate Zone 6 confirmed that increasing the area of higher performance windows from 15% to 18% to 20% saves more energy when a house is insulated according to proposed Option 2, resulting in a building envelope that is 5%, 5.2% and 5.5%, respectively, better than current base prescriptive code (Option 1).

2) A random sample of 10 house designs, supplied by the northern New York code jurisdictions where they were permitted, were analyzed in REScheck using the proposed Option 2 values. The ten house designs, with window areas varying from 8 to 19 percent, demonstrate that the Total UA of **Option 2 averaged 3.8% better** than the current base prescriptive code (see Table 1).

Table 1. REScheck Analyses of 10 Climate Zone 6 Houses Using Option 2[1]

Square Footage	Glazing Area	Max UA	Proposed UA	Percent Above Code
1456	9%	176	171	2.8%
1586	14%	228	219	3.9%
1650	8%	260	254	2.3%
1652	10%	271	263	3.0%
1716	18%	293	282	3.8%
1814	14%	301	284	5.6%
1827	18%	252	239	5.2%
2100	16%	310	291	6.1%
2660	11%	348	349	(.03%)
3110	19%	329	298	5.6%
Average Percent Above Code				**3.8%**
[1]REScheck analysis using the 2018 IECC as the basis				

Approving RE 39 as submitted **will save energy** in two ways:

1) It will provide a more energy-efficient, easily constructed and easily verified Climate Zone 6-8 prescriptive option.

2) It will make the energy code more adoptable in cold climate states, where the current high prescriptive wall insulation levels, which require continuous insulation, are often amended to cavity only R19, R20 or R21 insulation *without* requiring prescriptive improvements in the envelope in some other way. This proposal corrects that problem.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction

The proposal provides for more flexibility in design which inherently reduces costs of construction. Builders can always choose the most cost-effective compliance option.

Public Comment# 2101

RE40-19

IECC: TABLE R402.1.2 (IRC N1102.1.2)

Proposed Change as Submitted

Proponents: Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.1.2 (IRC N1102.1.2)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATEZONE	FENESTRATIONU-FACTOR[b]	SKYLIGHT[b]U-FACTOR	GLAZEDFENESTRATION SHGC[b, e]	CEILINGR-VALUE	WOODFRAME WALLR-VALUE	MASSWALLR-VALUE[i]	FLOORR-VALUE	BASEMENT[c]WALLR-VALUE	SLAB[d]R-VALUE& DEPTH	CRAWLSPACE[c]WALLR-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.32	0.55	0.25	38	20[j]or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 exceptMarine	0.32	0.55	0.40	49	20[j] or 13+5[h]	8/13	19	10/13	10, 2 ft	10/13
5 andMarine 4	0.30	0.55	NR	49	20[j] or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.30	0.55	NR	49	20[j]+5[h] or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.30	0.55	NR	49	20[j]+5[h] or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

NR = Not Required. For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. U-factors and SHGC are maximums. Where insulation is installed in a cavity that is less than the label or design thickness of the insulation, the installed *R*-value of the insulation shall be not less than the *R*-value specified in the table.

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

Exception: In Climate Zones 1 through 3, skylights shall be permitted to be excluded from glazed fenestration SHGC requirements provided that the SHGC for such skylights does not exceed 0.30.

c. "10/13" means R-10 continuous insulation on the interior or exterior of the home or R-13 cavity insulation on the interior of the basement wall. "15/19" means R-15 continuous insulation on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. Alternatively, compliance with "15/19" shall be R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulation on the interior or exterior of the home.

d. R-5 insulation shall be provided under the full slab area of a heated slab in addition to the required slab edge insulation *R*-value for slabs. as indicated in the table. The slab edge insulation for heated slabs shall not be required to extend below the slab.

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

f. Basement wall insulation is not required in warm-humid locations as defined by Figure R301.1 and Table R301.1.

g. Alternatively, insulation sufficient to fill the framing cavity and providing not less than an *R*-value of R-19.

h. The first value is cavity insulation, the second value is continuous insulation. Therefore, as an example, "13+5" means R-13 cavity insulation plus R-5 continuous insulation.

i. Mass walls shall be in accordance with Section R402.2.5. The second *R*-value applies where more than half of the insulation is on the interior of the mass wall.
j. R-18 insulation shall be permitted in place of the R-20 requirement provided that the wall framing factor is 20% or less of exterior walls having 24 inch on center nominal vertical stud spacing.

Reason: This proposal is an energy neutral change based on calculations from ASHRAE. Insulation that is R-19 that is compressed in a 2 x 6 wall with stud spacing at 24 o.c. performs like R-18. The ASHRAE Handbook of Fundamentals and ASHRAE Transaction 1995 Volume 101, Part 2 assumes that wood framed walls have a framing factor of 25%. Meaning 25 percent of the wall area consists of structural framing members and the remainder of the wall is a cavity suitable for installing insulation. When calculating the U-factor for a w all assembly, a high framing factor increases the overall assembly U-Factor. Reducing the framing factor will also provide an increase in the thermal performance of the w all.
This proposal provides an option for a thermally equivalent tradeoff for 2x6 w all assemblies which have reduced framing factors and insulation performing like a R-18 insulator.

Below are the calculations showing equal U-Factors for both assemblies (0.060).

	2x6 Wall R-20 25%FF (16" o.c.)			2x6 Wall R-18 20% FF		
Wall Thermal Resistance by Component	R-Value Studs	R-Value Cavity	Assembly U-Factor	R-Value Studs	R-Value Cavity	Assembly U-Factor
Wall - Outside Winter Air Film^A	0.17			0.17		
Siding - Vinyl^A	0.62			0.62		
Continuous Insulation	0			0		
OSB - 7/16"^A	0.62			0.62		
SPF Stud/Cavity Insulation	6.875	20		6.875	18	
1/2" Drywall ^A	0.45			0.45		
Inside Air Film^A	0.68			0.68		
Studs at 16" o.c. ^A	25%	75%		20%	80%	
Total Wall R-Values	9.42	22.54		9.42	20.54	
Total Wall U-Factor	0.106	0.044	0.060	0.106	0.049	0.060
^A2009 ASHRAE Handbook of Fundamentals						

Enermodal, 2001. Characterization of Framing Factors for Low -Rise Residential Building Envelopes (904-RP). Final Report prepared for ASHRAE, Atlanta, GA (USA)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will offer an optional way for compliance, by allowing a framing and insulation alternative to what is currently in the code without reducing the overall efficiency.

RE40-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The change supports advanced framing techniques which saves energy (Vote: 6-5).

Assembly Action: **None**

RE40-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests Disapprove

Commenter's Reason: The committee reason statement in support of a narrow 6-5 vote recommending approval appears to have misunderstood the intent of this proposal. The proposal will not and is not intended to save energy. In fact, it may not even provide equivalent energy savings because it lacks sufficient guidance to ensure compliance and enforcement. This alternative is already capable of being addressed and is better addressed through the prescriptive U-factor equivalency approach. Adding this alternative as a footnote to the R-value table is not necessary and is an incomplete specification of advanced framing techniques which will result in unintended consequences.

For example, simply specifying 24”oc framing for layout of studs doesn’t guarantee compliance with the intended 20% framing factor. Depending on structural conditions (e.g., beams, girder truss, etc.) which require stacked stud columns in an exterior wall, much more framing may be present than implied by a 24”oc framing layout. Depending on the amount, size, and placement of fenestration, many more jamb and king studs may be present despite the intention to use a 24”oc stud framing layout. One example of these conditions is shown in the photograph below (there are approximately 15 studs packed into this ~4-foot section of wall resulting in a FF of almost 50% -- not close to 20%).

Finally, if framing layout is to be considered as an explicit basis for energy code compliance (as insulation materials presently are), then the framing must be inspected for compliance with the intended framing factor (percentage of wall surface area). This will create an additional inspection burden for code officials and potential for non-compliance. This could be resolved by requiring framing shop drawings for wall framing to help verify compliance in plan review and field inspections, but the proposal does not require it. This request for disapproval does not deny the benefits of “advanced framing” but the use of this approach requires additional effort to ensure compliance and enforcement for the intended performance. Consequently, this option may be better implemented through an “additional energy efficiency packages” or “flex points” approach as proposed by others whereby it would be used for additional energy savings, not as a means for baseline compliance.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1620

Public Comment 2:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it is an efficiency rollback. Under the current code, R-20 is required prescriptively regardless of the framing factor. By creating a specific prescriptive trade-off between framing factor and insulation in this instance, this proposal reduces energy efficiency in cases where R-20 is currently being installed in walls with improved framing factors. Moreover, limited prescriptive trade-offs of this type are unnecessary, confusing, and should not be permitted in the code. Finally, although the reason references “R-19 that is compressed in a 2 x 6 wall …” and the accompanying calculation appears to use a compressed R-19 batt, the new footnote reads “R-18 insulation shall be permitted in place of the R-20 requirement ….” This creates further confusion regarding this proposal and an even bigger rollback because it does not correctly represent the intent of the proponent that R-19 insulation be used. It should be noted that this proposal (submitted by NAHB) was narrowly approved by the Committee on a 6-5 vote, including all 4 builder votes.

To be clear, framing with a lower percentage of studs can improve energy efficiency, but not if the benefits are simply offset by less insulation. However, it is very difficult to define this circumstance in a way that it can be clearly enforced, particularly as a prescriptive option. Who is responsible for calculating the framing fraction of each wall? This trade-off might be equivalent in some circumstances *at best*, but at worst will result in walls nowhere near as efficient as simply installing the insulation required by the code. Because walls are unlikely to be retroactively insulated after they are finished, it is important to build them right the first time.

This proposal creates an unneeded option that is already covered under alternative compliance approaches included in the IECC. Additionally, it is implemented in a way that reduces the energy efficiency of the home and would be extremely difficult to enforce.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1482

Public Comment 3:

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: This proposal to allow an R-18 cavity insulation value when utilizing 24"oc framing is a roll back on energy efficiency. Please review the information below provided by software.

- R18 – 16"oc = R16.3
- R18 – 24" oc = R16.793
- R20 – 16"oc = R17.234
- R20 – 24" oc = R17.815

If you are wanting to use a framing factor then the table that should be utilized is Table R402.1.4 (u-factor table). I do not believe the requirement of the 20% or less wall framing factor is something that most end users will be able to determine.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1750

RE43-19

IECC: R103.2 (IRC N1101.5), R202 (IRC N1101.6), R401.2.2 (IRC N1101.13.2) (New), R401.2.2.1 (N1101.13.2.2.1) (New), R405.4.2 (IRC N1105.4.2)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R103.2 (IRC N1101.5) Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the *building*, systems and equipment as herein governed. Details shall include the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
3. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
6. Equipment and system controls.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.
9. Batch sampling plan (where applicable)

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

BATCH SAMPLING. Verification of energy code requirements when fewer than 100 percent of every dwelling or dwelling unit, within a sampled project are inspected, tested, or modeled for compliance.

Add new text as follows:

R401.2.2 (IRC N1101.13.2) Batch sampling. Batch sampling to determine energy code compliance shall only be allowed for stacked multiple-family dwelling unit projects within the same subdivision or community.

Exceptions:

1. Where sampling of energy compliance items for other than sections R402.4 and R403.3.3, an approved sampling plan shall be included in the construction documents and approved by the code official.
2. Where sampling is proposed for other than stacked multiple-family dwelling unit projects, an approved sampling plan shall be included in the construction documents and approved by the code official.

R401.2.2.1 (N1101.13.2.2.1) Sampling process. The sampling process shall follow these steps.

1. After five consecutive dwellings or dwelling units demonstrate compliance with the code without an incidence of failure, then only one dwelling or dwelling unit in subsequent batches of five dwelling units is required to demonstrate compliance through testing and inspection.
2. The remaining four units in the sampling batch shall be considered to be in compliance with the code when the one sampled unit in the batch of five dwelling units has demonstrated compliance.
3. Where the one dwelling or dwelling unit tested and inspected in the batch of five fails to demonstrate compliance with the code then that unit and 3 consecutive dwellings or dwelling units shall demonstrate compliance without incidence of failure before batch sampling is allowed to continue.

Exception: An *approved* sampling plan shall be used as an alternative to Section R401.2.2.1.

Revise as follows:

R405.4.2 (IRC N1105.4.2) Compliance report. Compliance software tools shall generate a report that documents that the *proposed design* complies with Section R405.3. A compliance report on the *proposed design* shall be submitted with the application for the building permit. Upon completion of the building, a compliance report based on the as-built condition of the building shall be submitted to the *code official* before a certificate of occupancy is issued. ~~Batch sampling of *buildings* to determine energy code compliance shall only be allowed for stacked multiple-family units.~~

Compliance reports shall include information in accordance with Sections R405.4.2.1 and R405.4.2.2. Where the *proposed design* of a building could be built on different sites where the cardinal orientation of the building on each site is different, compliance of the *proposed design* for the purposes of the application for the building permit shall be based on the worst-case orientation, worst-case configuration, worst-case *building* air leakage and worst- case duct leakage. Such worst-case parameters shall be used as inputs to the compliance software for energy analysis.

Reason: Currently, sampling is only addressed within the Simulated Performance Path section R405 of the IECC. It states, “Batch sampling of *buildings* to determine energy code compliance shall only be allowed for stacked multiple-family units.” Narrowing the allowance for sampling to stacked multi-family units makes a lot of sense but narrowing sampling to only the Simulated Performance path does not. This proposal broadens the ability to sample dwelling units regardless of the pathway used to navigate the IECC.
In researching this proposal, it became evident that sampling means something different to the code compliance community than it does to the verification and builder program community. My discussions with the code compliance community indicated that they believe that sampling is only a tool that is used for lessening the requirement of blower door and duct leakage testing every permitted dwelling unit. The verification and builder program community, on the other hand, uses sampling to verify compliance of any requirement of compliance. Therefore, this proposal states that sampling used for anything other than blower door or duct leakage testing must have a sampling plan submitted at permitting that is approved by the authority having jurisdiction. In this way, it is ultimately up to the jurisdiction to determine their comfort level with the use of sampling for other code compliance feature and building types than diagnostic testing and stacked multi-family dwelling units.

Currently, the code does not define in any way what sampling means. The second half of this proposal defines the minimum requirements for sampling, which not only offers guidance to the jurisdiction for what to expect but also offers a baseline for which to assess the merits of submitted sampling plans which may be submitted to potentially broaden the scope of what could be sampled.

In specific markets, such as Phoenix Arizona, sampling is a common occurrence and in others, it never occurs. This proposal ensures that regardless of where it is used that there is a common understanding of what it is and how it can be used for code compliance in comparison to compliance with programs such as EnergyStar or LEED for homes.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
It is not clear how to assess the cost impact of a proposal like this as it depends completely on the quality of the installation of the code required item. If everything passes inspection the first time it can save money due to requiring fewer inspections, but if something fails it must be tested 3 more times and it could increase cost. The most important aspect of the proposal is not associated with cost it is associated with the ability to use sampling regardless of the compliance path chosen.

RE43-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: In favor for multi-family batch sampling, but not single family. The exceptions demonstrate that the language is too vague and should not be applicable to all compliance paths (Vote 9-2).

Assembly Action: **None**

RE43-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R103.2 (IRC N1101.5), SECTION R202 (IRC N1101.6), (New), R401.2.2 (IRC N1101.13.2) (New), R401.2.2.1 (N1101.13.2.2.1) (New), R402.2.2.2 (N1101.13.2.2.2) (New)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R103.2 (IRC N1101.5) Information on construction documents. Construction documents shall be drawn to scale on suitable material. Electronic media documents are permitted to be submitted where *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the *building*, systems and equipment as herein governed. Details shall include the following as applicable:

1. Insulation materials and their *R*-values.
2. Fenestration *U*-factors and *solar heat gain coefficients* (SHGC).
3. Area-weighted *U*-factor and *solar heat gain coefficients* (SHGC) calculations.
4. Mechanical system design criteria.
5. Mechanical and service water-heating systems and equipment types, sizes and efficiencies.
6. Equipment and system controls.
7. Duct sealing, duct and pipe insulation and location.
8. Air sealing details.
9. Batch sampling plan (where applicable)

SECTION R202 (IRC N1101.6)
GENERAL DEFINITIONS

BATCH SAMPLING. ~~Verification of energy code requirements when~~ A process whereby fewer than 100 percent of all ~~every~~ dwelling s or dwelling unit s, ~~within a sampled project~~ being constructed are inspected or tested, ~~or modeled for~~ to demonstrate compliance.

R401.2.2 (IRC N1101.13.2) Batch sampling. Batch sampling ~~to determine energy code compliance~~ shall ~~only~~ be allowed for Group R2 buildings ~~stacked multiple-family dwelling unit projects~~ within the same ~~subdivision or community.~~ project or community for the purpose of demonstrating compliance with Sections R402.4 Air leakage and R403.3.3 Duct testing.

Exceptions:

1. ~~Where~~ If batch sampling ~~of energy compliance items for other than~~ Sections R402.4 air leakage and R403.3.3, duct leakage for other than Group R2 buildings an approved sampling plan shall be included in the construction documents and approved by the code official.
2. ~~Where sampling is proposed for other than stacked multiple-family dwelling unit projects, an approved sampling plan shall be included in the construction documents and approved by the code official.~~

R401.2.2.1 (N1101.13.2.2.1) Sampling process.

Sampling shall use the following process: ~~The sampling process shall follow these steps.~~

1. After five (5) consecutive ~~dwellings or~~ dwelling units are tested and demonstrate compliance with Sections R402.4 Air leakage or R403.3.3 Duct testing ~~the code~~ without an incidence of failure, then only one (1) ~~dwelling or~~ dwelling unit in subsequent ~~batches~~ groups of five (5) dwelling units is required to demonstrate compliance through testing. ~~and inspection.~~
2. The remaining four (4) units using batch sampling ~~in the sampling batch~~ shall be considered to be in compliance ~~with the code~~ when the one (1) tested ~~sampled~~ unit in the ~~batch~~ group of five (5) dwelling units has demonstrated compliance.
3. ~~Where~~ If the one (1) ~~dwelling or~~ dwelling unit tested ~~and inspected~~ in the ~~batch~~ group of five (5) fails to demonstrate compliance ~~with the code~~ then that unit shall be retested until it demonstrates compliance and three (3) consecutive ~~dwellings or~~ dwelling units ~~shall~~ shall also demonstrate compliance without incidence of failure before Batch Sampling is allowed to continue.

Exception: An *approved* sampling plan shall be used as an alternative to Section R401.2.2 and R401.2.2.1.

R402.2.2.2 (N1101.13.2.2.2) Reporting. Batch Sampling reporting shall include the following:

1. At permitting, identify the number of sample sets that will use Batch Sampling.
2. At a time determined by the code official,
   - 2.1. Report units that demonstrate compliance and all addresses or lot numbers in the batch that create the sample set of five dwellings units.
   - 2.2. Report units that fail, and the date they are brought into compliance. Report the three or more additional units that are tested as a result of a failure, their test results, and the date the three consecutive units demonstrated compliance.
   - 2.3. Submit other compliance documents or reporting as required by the code official.

Commenter's Reason: Public Comment Reason Statement

The committee demonstrated in their comments that they are in favor of multi-family batch sampling, and that it made sense to submit this public comment. The proposal was narrowed to directly address Group R2 buildings. However, there are jurisdictions, such as many in Arizona, that currently allow sampling in other building group classifications. Since the scope of sampling was narrowed to only blower door and duct leakage testing, there is an exception that allows for sampling if a sampling plan is approved by the code official.

RE157 removed sampling from Section R405, "The Simulated Performance Path". Multiple questions were raised in the Reason Statement that point to many concerns that the committee and others have had with sampling. I would like to address these questions and demonstrate how these issues were addressed in this proposal (RE43).

RE157 Reason Statement Questions**: "**The purpose of this code change proposal is to remove confusing and incomplete language from the performance path regarding 'batch sampling' of buildings."

- This revised proposal, RE43, removes confusion regarding batch sampling by moving language to an appropriate section of the code so that it could be applied to any pathway a builder chooses to use to demonstrate compliance.

RE157 Reason Statement Questions**: "**Section R405.4.2 contains orphan language that implies that batch sampling might be acceptable for stacked multiple-family units, but there is no process or criteria for 'batch sampling' defined anywhere in the IECC."

- Unless proposal RE43 is approved, there will continue to be no defined process or criteria for batch sampling in the IECC. At the committee action hearing, a definition of sampling in RE10 was approved. If process and criteria clarification of RE43 is not passed, then sampling may be randomly and haphazardly implemented in jurisdictions that decide to use it.

RE157 Reason Statement Questions**: "**Before any sort of sampling is allowed, a number of very important questions must be addressed, such as which parts of the building may be batch sampled, what sample size must be collected, what happens in the event of a failure, etc."

- Proposal RE43 addresses these concerns head-on. Unless there is an approved sampling plan, only blower door testing and duct leakage testing are allowed.
- Five dwelling units must fully demonstrate compliance and then sample sets of 5 units can be created. The sample size is therefore defined as 1 in 5. If you have 100 units and the first 5 are tested in their entirety, then you have 95 units left--or 19 batch sample sets of 5.
- RE43 clearly defines what happens if there is a failure. First, the unit that fails must be retested until it passes. Then three consecutive units must pass without failure before sampling can continue. All of this work must be reported to the code official.

RE157 Reason Statement Questions**: "**Although some common voluntary programs permit sampling for certain specified measures, the IECC does not currently allow this practice and should not until these important questions are addressed."

- The IECC did allow sampling in Section R405 only for the Simulated Performance Path. RE157 removed that. Now it is more ambiguous because RE10 defines sampling but the IECC does not define how to implement sampling. Some jurisdictions will interpret that sampling is allowed, and others will say that it is not.

RE157 Reason Statement Questions**: "**Moreover, we are concerned that batch sampling would fail to ensure that every home meets the code since presumably only some homes would be included in the sampling."

- After testing five dwellings for compliance, sampling of blower door and duct leakage testing is only required by one home in a batch of 5 when using sampling. This does not mean that sampling is a less robust compliance tool. Mandatory and other code compliance items are required regardless of sampling. In addition, the systematic nature of sampling reveals failures and the failure protocol increases testing rates to ensure there is no systemic failure that is not addressed. Sampling is an optional tool that makes sense for some projects and not for others. With the guidance of the code official sampling and now with a sampling protocol embedded in code, it can be used for projects where it makes sense.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
It is not clear how to assess the cost impact of a proposal like this as it depends completely on the quality of the installation of the code required item. If everything passes inspection the first time it can save money due to requiring fewer inspections, but if something fails it must be tested 3 more times and it could increase cost. The most important aspect of the proposal is not associated with cost it is associated with the ability to use sampling regardless of the compliance path chosen.

Public Comment# 1769

RE47-19

IECC: R402.2.4 (IRC N1102.2.4)

Proposed Change as Submitted

Proponents: Stephen Skalko, representing Marwin Company (svskalko@svskalko-pe.com)

2018 International Energy Conservation Code

Revise as follows:

R402.2.4 (IRC N1102.2.4) Access hatches and doors. Access doors from *conditioned spaces* to *unconditioned spaces* such as attics and crawl spaces shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access that prevents damaging or compressing the insulation shall be provided to all equipment. Where loose-fill insulation is installed, a wood-framed or equivalent baffle or retainer shall be installed to prevent the loose-fill insulation from spilling into the living space when the attic access is opened. The baffle or retainer shall provide a permanent means of maintaining the installed Rvalue of the loose-fill insulation.

~~**Exception**~~ **Exceptions:**

1.Vertical doors providing access from *conditioned spaces* to *unconditioned spaces* that comply with the fenestration requirements of Table R402.1.2 based on the applicable *climate zone* specified in Chapter 3.
2. In Climate Zones 1 through 4 horizontal pull-down stair-type access hatches in ceiling assemblies that provide access from *conditioned* to *unconditioned spaces* shall not be required to comply with the insulation level of the surrounding surfaces provided the hatch meets all of the following:

2.1.The average U-factor of the hatch shall not exceed U-0.10 or have an average insulation R-value less than R-10.
2.2.Not less than 75 percent of the panel area shall have an insulation R-value of at least R-13.
2.3.The net area of the framed opening shall be less than or equal to 13.5 square feet, and
2.4.The perimeter of the hatch edge shall be weatherstripped.

The reduction shall not apply to the U-factor alternative approach in Section R402.1.4 or the total UA alternative in Section R402.1.5.

Reason: A code change similar to this proposal was submitted to the IECC and IRC during the 2016 Group B code cycle (RE50-16). At the Code Action Hearing in Louisville, KY the IECC Code Development Committee (CDC) saw the logic of the proposal and recommended the change for Approval As Submitted. The CDC reason given was:
The practical implications outweigh the minimal loss of insulation R-value. Experience with products that can comply with these requirements is a superior method as compared what has been done in the past and provides for a long-term solution.

Their reason is consistent with our experience that the added insulation requirement in section R402.2.4 (N1102.2.4) is frequently achieved with “field crafted detachable apparatuses”. Unfortunately, over time these are commonly discarded or worse, set aside compressing adjacent ceiling insulation thus defeating the intended benefit. The objective of this proposal is to address this field modification issue and provide for a more permanent installed solution.

During the 2015 ICC code development cycle for the IRC and the IECC an exception was added to the ceiling insulation requirements for vertical doors providing access to attic areas in IECC Section R402.2.4 and IRC Section N1102.2.4. This exception was based on the premise that vertical attic access doors between conditioned and unconditioned spaces can be treated as fenestration. Horizontally positioned attic access hatches are a similar issue. These horizontal hatches are being required to have insulation levels that match the surrounding ceiling which is significantly more stringent than skylight fenestration products located in these same ceiling assemblies.

For example, in Table R402.1.2 (N1102.1.2) Skylights are required to meet a U-factor that ranges from 0.75 in Climate Zone 1 to 0.55 in Climate Zone 8. In addition, Section R402.3.3 (N1102.3.3) allows up to 15 square feet of the fenestration per dwelling unit (which includes skylights) to be exempt from the requirements in Table R402.1.2 N1102.1.2). It does not make sense to require R-30 to R-49 insulation for a pull down stair type access hatch in an insulated ceiling when one can have a skylight up to 15 square feet in area that is exempt from the envelope requirements or that has a *U*-FACTOR of 0.55-0.75 (less than R-2). Insulating pull down stair access hatches to the levels specified in N1102.2.4 (R402.2.4), compared to the skylights insulation requirements is expensive, and in many cases not practical.

Because affordable, pre-manufactured pull-down stair access systems are not readily available to meet the R-30 to R-49 target field customization of access hatches is sometimes employed to achieve these performance levels. Inspection and verification for compliance becomes a challenge. As noted previously, long term system performance of these field customized entry devices may also vary. Commonly these “field crafted detachable apparatuses” are designed to be removed for attic access and placed on the adjacent attic joists. This results in the insulation being compressed thus reducing its effectiveness. Also providing sufficient air sealing around the hatch that remains durable long term is difficult. Finally, removal of the insulated covers for access may present a safety hazard to service personnel, inspectors and building owners having to stand on ladders while removing the hatches.

Quality standardized manufactured pull down stair systems however provide a safer, permanent access with proven performance for the life of the structure. Factory built energy rated access systems provide consistent air sealing performance and ensure consistent energy performance while helping to maintain air quality through reduced air infiltration.

This proposal provides a solution by permitting a reasonable reduction in the insulation values for pull down stair access hatches that are less than or equal to 13.5 square feet (approximately 30” X 64”) in attic ceilings. This maximum size accommodates most manufactured products available. The U-value specified at U-0.10 is less stringent than the U-values specified for the insulated ceilings but is far more stringent than those permitted for skylights in all Climate Zones. Too the size limit is more stringent than that permitted for skylights which can have one unit up to 15 square feet in size exempted from the code requirements while all other skylights are less stringent than the pull down stair assembly proposed. Finally, the proposal also does not allow this reduction to be factored into the U-Factor alternative calculation procedure in R4002.1.4 (N1102.1.4) or the total UA alternative procedure in R402.1.5 (N1102.1.5). This is consistent with the limitations in Section R402.2.1 (N1102.2.1) for ceilings with attic spaces and in Section R402.3.3 (N1102.3.3) for skylights.

Though the previous code change RE50-16 was recommended for approval as submitted a public comment was submitted. At the Public Comment Hearing (PCH) in Kansas City, MO the commenter raised concerns about the impact of such reduced insulation levels in cold climates. The membership overturned the action of the committee and RE50-16 was disapproved.

The intent of this proposal is the same as the original proposal previously approved by the IECC Code Development Committee with two basic improvements.

1. The criteria that horizontal pull-down stair-type access hatches must meet has been formatted in a list format to aid the code user in determining the requirements to be met by this exception.

2. The reduced insulation level for these horizontal pull-down stair-type access hatches is limited to Climate Zones 1-4 in response to previous objections for this exception in cold climates.

Recommend the IECC Code Development Committee again take action to Approve As Submitted.

Cost Impact: The code change proposal will decrease the cost of construction
The reduced cost of field installed apparatuses and insulation will offset the cost of the pull-down stair

RE47-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification: R402.2.4 (IRC N1102.2.4) Access hatches and doors. Access doors from *conditioned spaces* to *unconditioned spaces* such as attics and crawl spaces shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access that prevents damaging or compressing the insulation shall be provided to all equipment. Where loose-fill insulation is installed, a wood-framed or equivalent baffle or retainer shall be installed to prevent the loose-fill insulation from spilling into the living space when the attic access is opened. The baffle or retainer shall provide a permanent means of maintaining the installed Rvalue of the loose-fill insulation.
Exceptions:

1. Vertical doors providing access from conditioned spaces to unconditioned spaces that comply with the fenestration requirements of Table R402.1.2 based on the applicable climate zone specified in Chapter 3.
2. ~~In Climate Zones 1 through 4 h~~ Horizontal pull-down stair-type access hatches in ceiling assemblies that provide access from *conditioned* to *unconditioned spaces* in <u>Climate Zones 1 through 4</u> shall not be required to comply with the insulation level of the surrounding surfaces provided the hatch meets all of the following:

   2.1. The average U-factor of the hatch shall ~~not exceed~~ <u>be less than or equal to</u> U-0.10 or have an average insulation R-value ~~less than~~ <u>of</u> R-10 <u>or greater</u>.

   2.2. ~~Not less than~~ <u>At least</u> 75 percent of the panel area shall have an insulation R-value of ~~at least~~ R-13 <u>or greater</u>.

   2.3. The net area of the framed opening shall be less than or equal to 13.5 square feet, and

   2.4. The perimeter of the hatch edge shall be weatherstripped.

The reduction shall not apply to the U-factor alternative approach in Section R402.1.4 or the total UA alternative in Section R402.1.5.

Committee Reason: This provides the user of the code an option for getting into the attic without the additional insulation. The modification fixed problems with initial proposal. (Vote: 9-2).

Assembly Action: **None**

RE47-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests Disapprove

Commenter's Reason: This option is only available if you are utilizing the prescriptive path in climate zones 1-4. Section 2.1 states for R-13 for a minimum of 75%. While climate zones 1-3 have an insulation of R-30 or R-38 climate zone 4 requires an R-49, so the R-13 is quite the reduction in insulation value required.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1761

RE49-19

IECC: R402.2.4 (IRC N1102.2.4)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R402.2.4 (IRC N1102.2.4) Access ~~hatches~~ hatch doors and ~~doors.~~ insulation retention. ~~Access~~ Vertical or horizontal access doors from *conditioned spaces* to *unconditioned spaces* such as attics and crawl spaces shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access that prevents damaging or compressing the insulation shall be provided to all equipment. Where loose-fill insulation is installed, a wood-framed or equivalent baffle, retainer, or ~~retainer~~ dam shall be installed to prevent ~~the~~ loose-fill insulation from spilling into ~~the~~ living space ~~when the attic access is opened.~~ , from higher to lower sections of the attic, and from attics covering conditioned spaces to unconditioned spaces. The baffle or retainer shall provide a permanent means of maintaining the installed Rvalue of the loose-fill insulation.

> ~~**Exception:** Vertical doors providing access from *conditioned spaces* to *unconditioned spaces* that comply with the fenestration requirements of Table R402.1.2 based on the applicable *climate zone* specified in Chapter 3.~~

Reason: This section of the code is solely about the installation of insulation in the attic and retaining it in its installed location to ensure that it performs as intended by the manufacturer. The use of wooden or equivalent baffle retainer or insulation dam to hold insulation in place at the attic hatch needs to be expanded to include insulation that is installed in raised ceilings or separating conditioned from unconditioned spaces. The inclusion of additional language to this proposal improves how insulation will perform when installed in these locations.

Cost Impact: The code change proposal will increase the cost of construction
Attention to detail in installation dams and baffles will initially take slightly more labor but will be negligible once methods are in place to do it right the first time. The cost of ownership and cost of builder warranty is lowered.

RE49-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This is very good best practice and something builders should be following (Vote: 6-5).

Assembly Action: **None**

RE49-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.2.4 (IRC N1102.2.4)

Proponents:
Jeff Inks, representing Window and Door Manufacturers Association (jinks@wdma.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.4 (IRC N1102.2.4) Access hatch doors and insulation retention. Vertical or horizontal access doors from *conditioned spaces* to *unconditioned spaces* such as attics and crawl spaces shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access that prevents damaging or compressing the insulation shall be provided to all equipment. Where loose-fill insulation is installed, a wood-framed or equivalent baffle, retainer, or dam shall be installed to prevent loose-fill insulation from spilling into living space , from higher to lower sections of the attic, and from attics covering conditioned spaces to unconditioned spaces. The baffle or retainer shall provide a permanent means of maintaining the installed Rvalue of the loose-fill insulation.

Exception: Vertical doors providing access from conditioned spaces to unconditioned spaces that comply with the fenestration requirements of Table R402.1.2 based on the applicable climate zone specified in Chapter 3.

Commenter's Reason: This public comment restores the exception which is necessary in terms of practicality, clear applicability of the requirements, and to ensure the intent of the provisions are met. While the proposed amended language may help ensure that best practices are followed in some cases (though the committee was clearly divided in their decision that this amendment is needed), it creates ambiguity with respect to vertical doors by calling them “access hatch doors” in the title and then only “access doors” in the provision, and more importantly, no longer allows the use of a standard vertical door to open to a stairway leading to, or directly into an unconditioned attic space if it meets the IECC requirements for exterior entry doors. The exception makes clear this is not the intent of the Section R402.2.4 and it needs to be maintained. In addition, as amended, Section R402.2.4 could be interpreted as applying only to “hatch” doors, and that a standard door opening to a stairway or directly into an unconditioned attic space does not need to meet the thermal performance requirement for exterior doors as currently required. Restoration of the exception does not change the intent of the proposal to provide best practices guidance and is absolutely necessary for the reasons stated above.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This will decrease the cost of construction by not requiring standard size entry doors to be insulated to the same level as surrounding surfaces.

Public Comment# 1818

RE50-19

IECC: R202 (IRC N1101.6), R402.2.5 (IRC N1102.2.5)

Proposed Change as Submitted

Proponents: Felix Zemel, representing ICC Region 6 -- North East Regional Coalition (felix@pracademicsolutions.com); Peter Zvingilas, ICC Region 6- North East Regional Coalition, Town of Groton and Voluntown CT, representing ICC Region 6- North East Regional Coalition (pzvingilas@voluntown.gov)

2018 International Energy Conservation Code

Revise as follows:

R402.2.5 (IRC N1102.2.5) Mass walls. Mass walls where used as a component of the *building thermal envelope* shall be one of the following:

1. Above-ground walls of concrete block, concrete, insulated concrete form, masonry cavity, brick but not brick veneer, adobe, compressed earth block, rammed earth, solid timber, mass timber, or solid logs.
2. Any wall having a heat capacity greater than or equal to 6 Btu/ft2 ● °F (123 kJ/m^2 ● K).

Add new definition as follows:

MASS TIMBER Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross-section dimensions of Type IV construction, as defined in the *International Building Code*

Reason: This new term, as approved in the 2018 Group A Code Hearings for the IBC, adds a new type of construction into the residential provisions of the IECC. By adding this definition, the subsequent definitions of mass walls can be updated to include mass walls. Addition of mass timber into the prescriptive list of materials that are considered mass walls will make it possible for any material meeting the IBC definition of mass timber to be used without additional testing for heat capacity.

Cost Impact: The code change proposal will decrease the cost of construction
By adding mass timber into the prescriptive list of materials constituting a mass wall, builders will be able to use mass timber for building envelope features without requiring additional testing for heat capacity of the material. By saving on this testing, the cost of construction is expected to decrease.

RE50-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Although the committee really like concept of the proposal, they would like to see more information on heat capacity of these systems (Vote 11-0).

Assembly Action: **None**

RE50-19

Individual Consideration Agenda

Public Comment 1:

IECC®: 202 (New)

Proponents:
Loren Ross, representing American Wood Council (lross@awc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

~~**MASS TIMBER** Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross-section dimensions of Type IV construction, as defined in the *International Building Code*~~

Commenter's Reason: The modification to the original proposal is to delete the definition of mass timber so that the definition in the IBC will be used. This change prevents duplication and possible confusion.
Committee disapproval was because of lack of information on the heat capacity of mass timber, not for lack of merit of the proposal. This comment provides the information asked for by the committee.

The technical requirements for lightweight mass assemblies are in the commercial provisions of the IECC (C402.2.2) and ASHRAE 90.1. Both state that walls can be considered mass if they "have a heat capacity exceeding 5 Btu/ft^2 F where the material weight is not more than 120 pcf." The following calculations demonstrate that typical mass timber walls and floors meet this requirement.

The heat capacity of mass timber is dominated by the wood. The Wood Handbook[1] states that the heat capacity is "practically independent of density or species," and gives equation 4-17, which calculates the heat capacity based upon moisture content and temperature. Using a temperature of 75 °F and a moisture content of 12%, the heat capacity is calculated as 0.393 Btu/lb °F. This calculated value for wood corresponds well with tested values for CLT (KLH rates its CLT at 0.382 Btu/lb °F). The closeness of these values show that the glue has little effect upon the heat capacity.

The temperature of 75 degrees is given in 16 CFR Part 460, which regulates R-values for home insulation (https://www.ftc.gov/policy/federal-register-notices/16-cfr-part-460-labeling-advertising-home-insulation-trade-0).

A moisture content of 12% is the average given in PRG 320: Standard for Performance-Rated Cross-Laminated Timber. Cross-Laminated Timber (CLT) is a type of mass timber.

Unit conversion is needed for comparison with the requirements in the IECC and ASHRAE 90.1, so a density and wall thickness need to be assumed. PRG 320 says that the minimum specific gravity of wood used shall be 0.35. Typical lumber species used in CLT manufacture range in specific gravity from 0.35-0.55. Denser wood will give a higher heat capacity. Per the Wood Handbook, the density of wood with a specific gravity of 0.35 and a moisture content of 12% is 24.0 lb/ft^3. The density of wood with a specific gravity of 0.55 at 12% moisture content is 38.4 lb/ft^3.

A 5-ply CLT assembly will be assumed with a thickness given in PRG 320 as 6 7/8". A thinner assembly will likely have gypsum wallboard, which is denser and has a higher heat capacity than wood.

By combining the above assumptions with the calculated heat capacity, typical mass timber CLT walls are shown to have a heat capacity of 5.4-8.6 Btu/ft^2 °F, which meet the requirement of the IECC and ASHRAE 90.1.

For floors, ASHRAE 90.1 has the same minimum heat capacity requirement as walls, so no further calculation is necessary, but the commercial IECC also requires a minimum weight of 25 psf where the material weight is 120 pcf or less. This requirement can be easily met by adding a concrete or gypcrete topping to the mass timber floor panel, which is common practice. Using the minimum CLT density and the same thickness as above, and assuming lightweight concrete topping of 90 pcf, 1.5 inches of concrete will meet the minimum weight requirement. Heavier concrete, denser wood species, or a thicker CLT panel will reduce the thickness of concrete topping needed to meet the weight requirement.

Bibliography: [1]Forest Products Laboratory. Wood handbook - Wood as an engineering material. General Technical Report FPL-GTR-190. Madison, WI: U.S. Department of Agriculture, Forest Service, Forest Products Laboratory: 4-12 p.
2010 https://www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr190.pdf

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This public comment only deletes (from the proposal) a definition that is currently available in the IBC. This is a simple clarification and clarifications to code language have no cost impact. However, as stated in the proposal, recognition of mass timber provides another option and more options tend to lower the cost of construction.

Public Comment# 1817

RE51-19

IECC: TABLE R402.2.5 (IRC N1102.2.6)

Proposed Change as Submitted

Proponents: Jonathan Humble, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.2.6 (IRC N1102.2.6)
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION *R*-VALUES

WOOD FRAME R-VALUEREQUIREMENT	COLD-FORMED STEEL-FRAMEEQUIVALENT R-VALUE[a]
Steel Truss Ceilings[b]	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
Steel Joist Ceilings[b]	
R-30	R-38 in 2 × 4 or 2 × 6 or 2 × 8 R-49in any framing
R-38	R-49 in 2 × 4 or 2 × 6 or 2 × 8 or 2 × 10
Steel-Framed Wall, 16 inches on center	
R-13	R-13 + 4.2 or R-21 + 2.8 orR-0 + 9.3 or R-15 + 3.8 or R-21 + 3.1
R-13 + 3	R-0 + 11.2 or R-13 + 6.1 or R-15 + 5.7 orR-19 + 5.0 or R-21 + 4.7
R-13+5	R-0+15 or R-13+9 or R-15+8.5 or R19+8 or R-21+7
R-13+10	R0+20 or R-13+15 or R-15+14 or R19+13 or R-21+13
R-20	R-0 + 14.0 or R-13 + 8.9 or R-15 + 8.5 or R-19 + 7.8 ~~or R-19 + 6.2~~ or R-21 + 7.5
R-20 + 5	R-13 + 12.7 or R-15 + 12.3 or R-19 + 11.6 or R-21 + 11.3 or R-25 + 10.9
R-21	R-0 + 14.6 or R-13 + 9.5 or R-15 + 9.1 orR-19 + 8.4 or R-21 + 8.1 or R-25 + 7.7
Steel Framed Wall, 24 inches on center	
R-13	R-0 + 9.3 or R-13 + 3.0 or R-15 + 2.4
R-13 + 3	R-0 + 11.2 or R-13 + 4.9 or R-15 + 4.3 orR-19 + 3.5 or R-21 + 3.1
R-13+5	R-0+15 or R-13+7.5 or R-15+7 or R-19+6 or R-21+6
R-13+10	R-0+20 or R-13+13 or R-15+12 or R-19+11 or R-21+11
R-20	R-0 + 14.0 or R-13 + 7.7 or R-15 + 7.1 orR-19 + 6.3 or R-21 + 5.9
R-20 + 5	R-13 + 11.5 or R-15 + 10.9 or R-19 + 10.1 orR-21 + 9.7 or R-25 + 9.1
R-21	R-0 + 14.6 or R-13 + 8.3 or R-15 + 7.7 orR-19 + 6.9 or R-21 + 6.5 or R-25 + 5.9
Steel Joist Floor	
R-13	R-19 in 2 × 6, or R-19 + 6 in 2 × 8 or 2 × 10
R-19	R-19 + 6 in 2 × 6, or R-19 + 12 in 2 × 8 or 2 × 10

a. The first value is cavity insulation *R*-value, the second value is continuous insulation *R*-value. Therefore, for example, "R-30+3" means R-30 cavity insulation plus R-3 continuous insulation.
b. Insulation exceeding the height of the framing shall cover the framing.

Reason: Commenter's Reason: This proposal expands the listing for cold-formed steel equivalent R-values in order to coordinate with Tables R402.1.2 and N1102.1.2 entitled "Insulation and Fenestration Requirements by Component".
History and Selection of Methodology: The RESCheck methodology was originally selected for determining equivalency since its methodology for calculating wood and steel framed U-factors has served as the basis for U-factor calculations of these assemblies since the publication of the 2004 IECC Supplement Edition. This approach was again used for consistency in this code change proposal.

Details of Calculations and Assumptions: The U-factors from Tables R402.1.4 (and N1102.1.4) for wood framed walls were used as the benchmark to determine the equivalent insulation (Cavity and continuous) R-values for cold-formed steel framing. The cold-formed steel framed walls at 16" o.c. and 24" o.c. were then calculated where cavity and exterior insulation were added in order to achieve near equivalent U-factors as for wood framed wall assemblies. This resulted in R-values and U-factors for cold-formed steel framed walls that can be considered comparable to wood wall assemblies.

In addition to the above modification, we are also proposing the deletion of the R-19+6.2 assembly configuration for the Wood 16 O/C category R-20. After a re-analysis we found that the U-factor is higher than the wood assembly U-factor comparison sufficient enough to recommend its departure.

Conclusion: Adopting the proposed modifications is intended to provide related prescriptive for cold-formed steel framed assembly options consistent with the options listed for wood framed assemblies in the opaque thermal envelope tables.

Bibliography: Bartlett, R., Connell, L.M., Gowri, K., Lucas, R.G., Schultz, R.W., Taylor, Z.T., Wilberg, J.D., "Methodology for Developing the

REScheck Software through Version 4.4.3", U.S. Department of Energy, Washington, DC, contracted through the Pacific Northwest National Laboratory, Richland, WA, September 2012.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This section provides information that was not previously set forth in the code, and does not change the requirements of current code, thus there is no cost impact when compared with present requirements.

RE51-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: The change provides synchronization with other tables, per the proponents reason statement (Vote: 11-0).

Assembly Action: **None**

RE51-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.2.6 (IRC N1102.2.6) (New)

Proponents:
Jonathan Humble, FAIA, NCARB, LEED BD+C, American Iron and Steel Institute, representing American Iron and Steel Institute (Jhumble@steel.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.2.6 (IRC N1102.2.6)
STEEL-FRAME CEILING, WALL AND FLOOR INSULATION *R*-VALUES

WOOD FRAME R-VALUEREQUIREMENT	COLD-FORMED STEEL-FRAMEEQUIVALENT R-VALUE[a]
Steel Truss Ceilings[b]	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
Steel Joist Ceilings[b]	
R-30	R-38 in 2 × 4 or 2 × 6 or 2 × 8 R-49in any framing
R-38	R-49 in 2 × 4 or 2 × 6 or 2 × 8 or 2 × 10
Steel-Framed Wall, 16 inches on center	
R-13	R-13 + 4.2 or R-21 + 2.8 orR-0 + 9.3 or R-15 + 3.8 or R-21 + 3.1
~~R-13 + 3~~	~~R-0 + 11.2 or R-13 + 6.1 or R-15 + 5.7 orR-19 + 5.0 or R-21 + 4.7~~
R-13+5	R-0+15 or R-13+9 or R-15+8.5 or R19+8 or R-21+7
R-13+10	R0+20 or R-13+15 or R-15+14 or R19+13 or R-21+13
R-20	R-0 + 14.0 or R-13 + 8.9 or R-15 + 8.5 or R-19 + 7.8 or R-21 + 7.5
R-20 + 5	R-13 + 12.7 or R-15 + 12.3 or R-19 + 11.6 or R-21 + 11.3 or R-25 + 10.9
R-21	R-0 + 14.6 or R-13 + 9.5 or R-15 + 9.1 orR-19 + 8.4 or R-21 + 8.1 or R-25 + 7.7
Steel Framed Wall, 24 inches on center	
R-13	R-0 + 9.3 or R-13 + 3.0 or R-15 + 2.4
~~R-13 + 3~~	~~R-0 + 11.2 or R-13 + 4.9 or R-15 + 4.3 orR-19 + 3.5 or R-21 + 3.1~~
R-13+5	R-0+15 or R-13+7.5 or R-15+7 or R-19+6 or R-21+6
R-13+10	R-0+20 or R-13+13 or R-15+12 or R-19+11 or R-21+11
R-20	R-0 + 14.0 or R-13 + 7.7 or R-15 + 7.1 orR-19 + 6.3 or R-21 + 5.9
R-20 + 5	R-13 + 11.5 or R-15 + 10.9 or R-19 + 10.1 orR-21 + 9.7 or R-25 + 9.1
R-21	R-0 + 14.6 or R-13 + 8.3 or R-15 + 7.7 orR-19 + 6.9 or R-21 + 6.5 or R-25 + 5.9
Steel Joist Floor	
R-13	R-19 in 2 × 6, or R-19 + 6 in 2 × 8 or 2 × 10
R-19	R-19 + 6 in 2 × 6, or R-19 + 12 in 2 × 8 or 2 × 10

a. The first value is cavity insulation *R*-value, the second value is continuous insulation *R*-value. Therefore, for example, “R-30+3” means R-30 cavity insulation plus R-3 continuous insulation.

b. Insulation exceeding the height of the framing shall cover the framing.

Commenter's Reason: This public comment further coordinates the steel table with Tables R402.1.2, and related IRC Table N102.1.2, by removing the “R-13+3” requirement since this component option is no longer shown in the residential R-value tables.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Removing a component category will not increase or decrease the cost of construction since the category no longer exists in the primary R-value residential tables.

Public Comment# 1778

RE54-19

IECC: R402.2.9 (IRC N1102.2.9)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R402.2.9 (IRC N1102.2.9) Basement walls. Walls associated with ~~conditioned~~ basements shall ~~be insulated from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Walls associated with unconditioned basements shall comply with this requirement except where the floor overhead is insulated in accordance with Sections R402.1.2 and R402.2.8.~~ comply with the following requirements:

1. Basement walls that define the *building thermal envelope* shall be insulated. The R-value shall be in accordance with the compliance path that is defined at the time of obtaining the building permit. Unconditioned basements shall comply with the floor insulation requirements of Section R402.2.8.
2. Unfinished basement walls that define the *building thermal envelope* shall have insulation that is permanently fastened to the wall. The insulation shall cover the exposed portion of the top of the foundation wall not covered by the sill plate, and extend downward to the finished floor below.
3. Finished basement walls that define the *building thermal envelope* shall be Insulated with material that fully fills the framed stud cavity of the finished wall or material that upon installation fully fills the available space. A 1 in. (25 mm) gap is allowed between the framed cavity and insulation, and the concrete foundation wall. Insulation shall be installed between framed bottom plates and the foundation floor when floating walls are used. Insulation shall be installed at the top of the foundation wall not covered by the sill plate.

Reason: This section of the code defines required installation requirements of the code that are not defined by manufacturer instructions. Since the section does not define R-value requirements requirement #1 defines that the R-value installed needs to be in accordance with the compliance path that is used. Requirement #2 is specific to installation requirements for unfinished basement walls and requirement #3 is specific to installation requirements for finished basement walls. All requirements ensure that if the basement wall defines the *building thermal envelope* it is completely insulated and that there are no thermal bypasses allowed in the installation.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There is no cost impact associated with this code proposal as it only clarifies the existing installation requirements of the code that are not adequately defined in the current section of the code

RE54-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This proposal makes things more complicated (Vote: 10-1).

Assembly Action: **None**

RE54-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.2.9 (IRC N1102.2.9)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.9 (IRC N1102.2.9) Basement walls. Walls associated with conditioned basements shall be insulated ~~from the top of the basement wall down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Walls associated with unconditioned basements shall comply with this requirement except where the floor overhead is insulated in accordance with Sections R402.1.2 and R402.2.8.~~ on the exterior or the interior side and comply with the following: ~~requirement:~~

1. ~~Basement walls that define the building thermal envelope shall be insulated.~~ The installed insulation R-value shall be in accordance with the compliance path that is defined at the time of obtaining the building permit. Unconditioned basements shall comply with the floor insulation requirements of Section R402.2.8.
2. Exterior basement wall insulation shall be permanently fastened to the wall and extend downward from the sill plate to the footing. ~~Unfinished basement walls that define the *building thermal envelope* shall have insulation that is permanently fastened to the wall. The insulation shall cover the exposed portion of the top of the foundation wall not covered by the sill plate, and extend downward to the finished floor below.~~
3. Interior basement wall insulation shall extend downward from the interior edge of the sill plate to the finished floor below. ~~Finished basement walls that define the *building thermal envelope* shall be Insulated with material that fully fills the framed stud cavity of the finished wall or material that upon installation fully fills the available space. A 1 in. (25 mm) gap is allowed between the framed cavity and insulation, and the concrete foundation wall. Insulation shall be installed between framed bottom plates and the foundation floor when floating walls are used. Insulation shall be installed at the top of the foundation wall not covered by the sill plate.~~

Commenter's Reason: The committee felt this proposal made things more complicated. Therefore, it has been significantly simplified. The Public comment ensures that insulation R-value is installed per the compliance path chosen. That insulation is installed properly from either the exterior or the interior side of the foundation wall which addresses and resolves past consistent thermal bypass issues. Lastly, Provisions for ensuring the required R-value of the installed material have been maintained, as well as when an unconditioned basement is built.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
There is no cost impact associated with this code proposal as it only clarifies the existing installation requirements of the code that are not adequately defined in the current section

Public Comment# 1890

RE57-19

IECC: R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Aaron Gary, representing Self (aaron.gary@texenergy.org)

2018 International Energy Conservation Code

Revise as follows:

R402.4.1.1 (IRC N1102.4.1.1) Installation. The components of the *building thermal envelope* as indicated in Table R402.4.1.1 shall be installed in accordance with Grade I as defined by RESNET/ICC 301 Appendix A, the manufacturer's instructions and the criteria indicated in Table R402.4.1.1, as applicable to the method of construction. Where required by the *code official*, an *approved* third party shall inspect all components and verify compliance.

Reason: Unlike the ERI path, the Prescriptive and Performance path assume that envelope insulation is always installed as intended. Pointing only to the manufacturer's instructions however makes this very hard to manage for contractors and code officials as there is no central repository of manufacturer's instructions for them to easily reference nor do they usually have time to read more than what is clearly and simply stated in teh Code. Supplementing the manufacturer's installation instructions with something that is easy for all involved to reference and developed for ICC 700 (an ANSI approved standard that many of the insulation manufacturer's contributed to) would greatly increase the ease of use of the Code. Usable and understandable Code would lead to better installations and enforcement. The end result then would not be predicted savings (as models already assumes a near perfection which is rarely achieved in real life) but actual energy savings to the end user, i.e. the home owner or apartment dweller.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
If the manufacturer's instructions are already being met, then this code proposal will not increase or decrease the cost of construction.

RE57-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The Appendix is not ready, and there is potential conflict between Grade I and manufacturers installation when both are required (Vote 8-3).

Assembly Action: **None**

RE57-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Submitted

Commenter's Reason: The installation of the insulation should be installed to a grade 1 installation. Any other building component of the building would not allow for the other building components to be installed hap hazard as insulation is installed. No one would allow for roofing shingles to be installed with large bumps or upside down or crumbled up, so why do we allow for the insulation to be installed in this fashion.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Actually by installing the insulation correctly it may decrease the cost by additional or replacement materials not required, and the additional manpower for the correction of installation, and time waiting for additional inspections.

Public Comment# 1763

Public Comment 2:

Proponents:
Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

requests Disapprove

Commenter's Reason: As the committee stated on RE57 and noted again on RE14, RESNET's new appendix on grade 1 insulation is not ready. Installing insulation correctly is important, but the significantly changed grade 1 insulation requirements will do more harm than good. A partial list of the problems with RESNET's 301 grade 1 appendix follows. In all cases the problems cite examples of specific text from the new RESNET 301 Grade 1. Most of the problems fall into one of these groups:
-eliminates reasonable construction techniques and/or products

-mixes up "recommendations" and "instructions"

-has incomplete or unusable references as requirements

Bold below is added. All section titles and numbers are from RESNET's new 301 appendix. "Comments" below briefly state the problem.

Eliminates reasonable construction techniques or products:

*A-1.1 Minimum General Installation Requirements … PART 2 - **No air spaces** shall be allowed between different insulation types or systems.* - Comment - Sometimes **air spaces are needed** for drainage and moisture redistribution. For example foil faced insulation over spray foamed wall cavity without an air space would be a problem. Stucco rot and some EIFS problems are partly a result of a lack of air spaces.

A-1.2 Minimum Specific Application Requirements 1. …The combination of both cavity and continuous insulation shall meet or exceed the minimum required floor R value in Table 402.1.2 of the International Energy Conservation Code, (IECC)…. - Comment - RESNET's criteria says floor insulation cannot be Grade 1 unless the R-value meets or exceeds 2018 IECC Table 402.1.2? Why? Why just the floors? RESNET is mixing up R-value with quality of the installation.

*3. … The effective air barrier shall extend up and beyond the surface of the insulation **or to the ridge vent**.* - Comment - This is a problem for cathedral ceilings. Baffles are not air barriers.

*A-2.2 Structural Insulated Panels (SIPs) Grading Criteria **...** 2. **Use spray foam to seal** penetrations through the SIP panels. … 4. All gaps and penetrations through SIPs including windows, doors, and foundation or roof connections shall be **air-sealed with expanding foam** compatible with the SIP materials.* - Comment - Why only expanding foam for air sealing? What about mastics, tapes and caulking?

*A-2.3.2 Attic Radiant Barriers Minimum Requirements ... 3. Attic and/or roof **ventilation shall be maintained**. Roof, gable and soffit vents shall not be covered.* - Comment - What about unvented attics? Does this eliminate unvented attics in the IRC?

Comment- RESNET exempts fiberglass in basement and crawl spaces from air barriers if there is an interior air barrier (Appendix Section A1.3.2, #2 item "d"). This fiberglass exemption if fine. However, cellulose should also have the exemption as cellulose is denser than fiberglass and cellulose would do an even better job of inhibiting convection within the insulation.

Mixes up "recommendations" and "instructions":

*A-1.1 Minimum General Installation Requirements PART 1 - Insulation shall be installed to manufacturers' **recommendations.*** - Comment - code uses "instructions". "Instructions" and "recommendations" can be very different. Can insulation be grade 1 without following the manufacture's instructions? Manufacturers and the code expect instructions to be followed. The code does not require or even refer to manufacturer's recommendations. From the IRC: "Section R302. Installation. Materials, systems and equipment shall be installed in accordance with the **manufacturer's instructions** and the IBC or IRC as applicable."

Has incomplete or unusable references as requirements and does not follow CP-28 guidelines:

*A-1.3.4 Open-Cell Spray Polyurethane Foam (SPF) Insulation 1. Installers shall meet the manufacturer's recommended training requirements and shall complete **the online health and safety training for SPF provided by the Center for Polyurethanes Industry**.* - Comment - This is an undated reference to an unknown web address and does not name the "document". Likely the "document" was not subject to ANSI or code compliant development process.

*A-1.3.6 Closed-Cell Spray Polyurethane Foam (SPF) Insulation ... Installers shall meet the manufacturer's recommended training requirements and shall complete the **online health and safety training for SPF provided by the Center for Polyurethanes Industry**.* - Comment - Again an undated reference to an unknown web address. It does not name the “document”. Likely the “document” was not subject to ANSI or code compliant development process.

A-2.2 Structural Insulated Panels (SIPs) Grading Criteria 1. Sealing of panel joints shall meet the manufacturer's requirements. Where the manufacturer does not have specific joint sealing details SIPA's typical joint sealing details shall be used. SIPA details are available at www.sips.org. -Comment - Another undated reference to an unknown web address. Again it does not name the “documents”. Likely the “documents” were not subject to ANSI or code compliant development process.

A-2.3 Reflective/Radiant Grading Criteria **...** *3. Where utilizing R-Values based on testing in accordance with ASTM C1224, the reflective insulation product shall be installed as tested. R-Value claims for the assembly including the airspace shall be based on ASTM C1224 or per the* ***current FTC Rule 460*** *requirements.* - Comment - It is impropriate to reference the “current” version of something. FTC rules are not consensus documents. No section of the FTC rule is refenenced.

RESNET'S new grade 1 insulation requirements are not ready and should not be required by code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code if this disapproval stands.

Public Comment# 2094

RE59-19

IECC: R402.2.9 (IRC N1102.2.9) (New), R402.2.9 (IRC N1102.2.9)

Proposed Change as Submitted

Proponents: David Collins, SEHPCAC, representing SEHPCAC (SEHPCAC@iccsafe.org); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Add new text as follows:

R402.2.9 (IRC N1102.2.9) Basement Walls Basement walls shall be insulated in accordance with Table R402.1.2.

> **Exception:** Basement walls associated with unconditioned basements where the floor overhead is insulated in accordance with Sections R402.1.2 and R402.2.8.

Revise as follows:

~~R402.2.9 (IRC N1102.2.9)~~ R402.2.9.1 (IRC N1102.2.9.1) Basement walls insulation installation (Mandatory). ~~Walls associated with conditioned basements~~ Where basement walls are insulated, the insulation shall be ~~insulated~~ installed from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. ~~Walls associated with unconditioned basements shall comply with this requirement except where the floor overhead is insulated in accordance with Sections R402.1.2 and R402.2.8.~~

Reason: R402.2.9 includes both prescriptive provisions (required insulation levels) and non-tradeable (mandatory) installation specifications. This proposal does not add new requirements; rather, it separates the prescriptive and mandatory provisions into separate sections.

The insulation installation requirements of new Sec. R402.2.9.1 have no value or metric that can be used for modeling purposes; they are non-tradeable (mandatory).

Note that the SEHPCAC has a proposal to eliminate the use of the labels "prescriptive “and "mandatory" in favor of a tabular method of identifying non-tradeable requirements. If that proposal is successful, ICC staff have stated that sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new C407.2 table of requirements that are non-tradeable in the performance path.

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

Cost Impact: The code change proposal will increase the cost of construction
The code change may increase construction costs for a subset of buildings that may have been designed using the Total Building Performance or EIR compliance methods that did not follow the basement wall insulation installations provisions contained in this section.

RE59-19

Public Hearing Results

Committee Action: As Modified

Committee Modification:
R402.2.9.1 (IRC N1102.2.9.1) Basement walls insulation installation ~~(Mandatory)~~. Where basement walls are insulated, the insulation shall be installed from the top of the *basement wall* down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less.

Committee Reason: It adds clarity and allows for adjustments in installation. The modification added clarity (Vote: 9-2).

Assembly Action: None

Staff Analysis: If CE42-19 Part ll is successful, sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE59-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.2.9 (IRC N1102.2.9) (New), R402.2.9.1 (IRC N1102.2.9.1)

Proponents:
Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R402.2.9 (IRC N1102.2.9) Basement Walls <u>[Prescriptive]</u>. Basement walls shall be insulated in accordance with Table R402.1.2. <u>The insulation shall extend the distance from the top of the basement wall down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less.</u>

> **Exception:** Basement walls associated with unconditioned basements where the floor overhead is insulated in accordance with Sections R402.1.2 and R402.2.8.

R402.2.9.1 (IRC N1102.2.9.1) Basement walls insulation installation <u>[Mandatory]</u>. Where basement walls are insulated, the insulation shall be installed from the top of the *basement wall* down <u>in accordance with Section R402.2.9 or the distance of the proposed design as applicable</u> ~~to 10 feet (3048 mm) below grade or to the basement floor, whichever is less~~. <u>Continuous insulation shall be installed on the interior or exterior side of the basement wall. Cavity insulation shall be installed on the interior side of the basement wall.</u>

Commenter's Reason: RE 59-19 was recommended for approval as modified by the committee. The modification made at the committee action hearing removed the “mandatory” designation from the installation requirements in proposed Section R402.2.9.1 due to concern with some of the content being prescriptive (such as the 10ft distance downward from top of basement wall). That modification, however, did not resolve the fact that some of the installation requirements are mandatory such as starting the basement wall insulation at the top of the wall, even if the distance downward is modified by an alternative solution (i.e., proposed design). This public comment maintains the intent of the original proposal and improves it by revising and cleaning-up the text such that the prescriptive and mandatory requirements are clearly differentiated while also allowing alternative installation solutions. It also includes basic installation requirements for continuous and cavity insulation that are otherwise buried in footnote ‘c’ of Table R402.1.2. For these reasons, we request your support for approval as further modified by this PC.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
With this public comment, the issues with the original proposal not allowing alternative installation through the total building performance or ERI path is resolved such that there should be no cost impact as the PC makes it clear that alternative installation practices can still be used based on performance via a proposed design. Thus, the installation practices (whether by performance or by compliance with the R-value method) can be considered mandatory as they should be to ensure the intended performance is achieved.

Public Comment# 1752

RE60-19

IECC®: R402.2.10 (IRC N1102.2.10), R402.2.10.1 (IRC N1102.2.10.1) (New)

Proposed Change as Submitted

Proponents: David Collins, SEHPCAC, representing SEHPCAC (SEHPCAC@iccsafe.org); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Revise as follows:

R402.2.10 (IRC N1102.2.10) Slab-on-grade floors. Slab-on-grade floors with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table R402.1.2. ~~The insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the *building*. Insulation extending away from the *building* shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the *exterior wall* and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the *exterior wall*.~~

Exception: Slab-edge insulation is not required in jurisdictions designated by the *code official* as having a very heavy termite infestation.

Add new text as follows:

R402.2.10.1 (IRC N1102.2.10.1) Slab-on-grade floor insulation installation (Mandatory) Where installed, the insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the *building*. Insulation extending away from the *building* shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the *exterior wall* and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the *exterior wall*.

Reason: R402.2.10 includes both prescriptive provisions (insulation levels) and non-tradeable (mandatory) installation specifications, plus an embedded exception for termite infestations.
This proposal does not add new requirements; rather, it separates the prescriptive and mandatory provisions into separate sections and clarifies the exception to required insulation in jurisdictions designated by the code official as having a very heavy termite infestation.

The insulation installation requirements of new Sec. R402.2.10.1 have no value or metric that can be used for modeling purposes; they are non-tradeable (mandatory).

Note that the SEHPCAC has a proposal to eliminate the use of the labels "prescriptive “and "mandatory" in favor of a tabular method of identifying non-tradeable requirements. If that proposal is successful, ICC staff have stated that sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new C407.2 table of requirements that are non-tradeable in the performance path.

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

Cost Impact: The code change proposal will increase the cost of construction
The code change may increase construction costs for a subset of buildings that may have been designed using the Total Building Performance or EIR compliance methods that included slab on grade with insulation installed not in accordance with the provisions of this section.

RE60-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There are some complications in how the proposal is written and confusion about what is mandatory (Vote: 6-5).

Assembly Action: **None**

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE60-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.2.10.1 (IRC N1102.2.10.1) (New)

Proponents:
David Collins, representing SEHPCAC (sehpcac@iccsafe.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.10.1 (IRC N1102.2.10.1) Slab-on-grade floor insulation installation ~~(Mandatory)~~ Where installed, the insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2 by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the *building*. Insulation extending away from the *building* shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the *exterior wall* and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the *exterior wall.*

Commenter's Reason: Testimony at the committee action hearings revealed that some builders model different insulation installation details which affect prescriptive requirements, making this section 'tradeable.'
In keeping with SEHPCAC's goal of clarifying the distinction between tradeable (prescriptive) and non-tradeable (mandatory) sections, and because these provisions are being 'traded,' this proposal should not be labeled 'mandatory.'

Note that the commercial energy hearing committee acted on the parallel section in the commercial code to also make these provisions 'prescriptive,' for the following reason: *"The proposal provides needed clean up, it is tradable, the modification gives needed flexibility (Vote: 15-0)."*

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Eliminating the "mandatory" language in this code section, as proposed in this public comment, nullifies the potential to increase construction costs for a subset of buildings that may have been designed using the Total Building Performance or EIR compliance methods that included slab on grade with insulation installed not in accordance with the provisions of this section

Public Comment# 1718

Public Comment 2:

IECC®: R402.2.10 (IRC N1102.2.10), R402.2.10.1 (IRC N1102.2.10.1) (New)

Proponents:
Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.10 (IRC N1102.2.10) Slab-on-grade floors <u>[Prescriptive]</u>. Slab-on-grade floors with a floor surface less than 12 inches (305 mm) below grade shall be insulated in accordance with Table R402.1.2.

Exception: Slab-edge insulation is not required in jurisdictions designated by the *code official* as having a very heavy termite infestation.

R402.2.10.1 (IRC N1102.2.10.1) Slab-on-grade floor insulation installation (Mandatory) Where installed, the insulation shall extend downward from the top of the slab on the outside or inside of the foundation wall. Insulation located below grade shall be extended the distance provided in Table R402.1.2, or the distance of the proposed design as applicable, by any combination of vertical insulation, insulation extending under the slab or insulation extending out from the *building*. Insulation extending away from the *building* shall be protected by pavement or by not less than 10 inches (254 mm) of soil. The top edge of the insulation installed between the *exterior wall* and the edge of the interior slab shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the *exterior wall.*

Commenter's Reason: This public comment addresses the committee's reasons for narrowly (6-5) recommending disapproval by clarifying the complications and confusion related to mandatory aspects of slab-on-grade floor insulation installation requirements. The key concern is that different insulation distances from the top of slab are possible if properly addressed by a proposed design. Otherwise, basic installation practices should be considered mandatory to ensure the intended performance, whether by way of the prescriptive R-value method or by way of one of the performance paths for compliance. This PC makes this distinction clear. Your approval as modified is requested.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
With this public comment, the issues with the original proposal not allowing alternative installation through the total building performance or ERI path is resolved such that there should be no cost impact as the PC makes it clear that alternative installation practices can still be used based on performance via a proposed design. Thus, the installation practices (whether by performance or by compliance with the R-value method) can be considered mandatory as they should be to ensure the intended performance is achieved.

Public Comment# 1754

RE61-19

IECC: R402.2.11 (IRC N1102.2.11)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R402.2.11 (IRC N1102.2.11) Crawl space walls. As an alternative to insulating floors over crawl spaces, crawl space walls shall be insulated provided that the crawl space is not vented to the outdoors. Crawl space wall insulation shall be permanently fastened to the wall and shall extend downward from the ~~floor to the finished grade elevation and then vertically or horizontally for not less than an additional 24 inches (610 mm).~~ sill plate on top of the crawlspace wall to the floor of the crawlspace. Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder in accordance with the International Building Code or International Residential Code , as applicable. Joints of the vapor retarder shall overlap by 6 inches (153 mm) and be sealed or taped. The edges of the vapor retarder shall extend not less than 6 inches (153 mm) up stem walls and shall be attached and sealed to the stem walls.

Reason: The foundation of an unvented conditioned crawlspace must be insulated to have a continuous building thermal envelope. It is less clear if the floor of the crawlspace needs to be insulated. However, what is known is that the extension of the wall insulation 24” horizontally over the dirt or vapor retarder on the dirt floor inside the crawlspace is not being enforced with any regularity. When using the Ekotrope or REMRate modeling software to demonstrate compliance with the cost compliance report used in Section R405 it is easy to demonstrate no value associated with the 24” of extended insulation. The crawlspace dirt floor is 3-5 feet below grade and it is not required to be insulated fully. Similarly, there is no requirement to insulate the concrete floor in a basement that is eight feet below grade. If there were a requirement there would be countless arguments regarding the cost-effectiveness of the insulation. This proposal aims to take the 24” extension of insulation out of the code in order to fully focus on insulating the portion of the foundation that is associated with the majority of the heat loss or gain.
On the other side of the equation, when portions of concrete foundation walls are not insulated such as the top of the foundation adjacent to the sill plate it is easy to demonstrate value for the installation of insulation. IR camera imaging, as well as Ekotrope and REMRate modeling, can demonstrate the impact of small portions of uninsulated building thermal envelope.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Would be cost saving associated with this proposal as the 24” extension of insulation over the floor of the crawlspace would be removed as a requirement from the code while asking for a small portion of insulation to be installed at the top of the foundation wall.

RE61-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The new language does not add clarity and may result in unintended thermal bridging consequences (Vote: 7-4).

Assembly Action: **None**

RE61-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.2.11 (IRC N1102.2.11)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.11 (IRC N1102.2.11) Crawl spaces ~~walls~~. As an alternative to insulating floors over crawl spaces, crawl space walls shall be insulated on the exterior or interior side. ~~provided that the crawl space is not vented to the outdoors, in which case the insulation shall follow Section R402.2.8.~~

1. Exterior crawl space wall insulation shall be permanently fastened to the wall and extend downward from the sill plate to the footing.
2. Interior crawl space wall insulation shall be permanently fastened to the wall and extend downward from the sill plate on top of the crawl space wall to the interior floor of the crawl space.

~~Crawl space wall insulation shall be permanently fastened to the wall and shall extend downward from the sill plate on top of the crawlspace wall to the floor of the crawlspace.~~

Crawl spaces vented to the outdoors shall comply with Section R402.2.8.

Exposed earth in unvented crawl space foundations shall be covered with a continuous Class I vapor retarder in accordance with the International Building Code or International Residential Code , as applicable. Joints of the vapor retarder shall overlap by 6 inches (153 mm) and be sealed or taped. The edges of the vapor retarder shall extend not less than 6 inches (153 mm) up stem walls and shall be attached and sealed to the stem walls.

Commenter's Reason: Public Comment Reason Statement
When the committee stated that the language in my original proposal did not add clarity and may result in unintended thermal bridging consequences, I realized that the existing installation instructions only work when insulation is installed on the exterior, as the installation describes a frost-protected foundation insulation installation. When you install insulation on the inside of the foundation wall, it is important to remember to insulate the top of the foundation wall that is not covered by the sill plate, but it does not make sense to extend the insulation in 2 feet. In fact, I have only seen it installed that way once, and most jurisdictions do not enforce the installation. It does make sense to extend the insulation out from the foundation to get frost protection and protect the footing. This appears to be the rationale of the current language. Therefore, I have broken up the installation into exterior and interior installation instructions to address the committee's comments.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
I don't think that there would be added cost in the construction of a crawl space foundation as the current insulation installation options are still allowed. However, there could be a cost-saving associated with this proposal as the 24” extension of insulation over the floor of the crawlspace has been removed as a requirement from the code in exchange for asking for a small portion of insulation to be installed at the top of the foundation wall.

Public Comment# 1880

RE63-19

IECC®: R402.2.14 (IRC N1102.2.14) (New)

Proposed Change as Submitted

Proponents: John Woestman, representing Extruded Polystyrene Foam Association (jwoestman@kellencompany.com)

2018 International Energy Conservation Code

Add new text as follows:

R402.2.14 (IRC N1102.2.14) Airspaces. Where the thermal properties of airspaces are used to comply with this code in accordance with Section R401.2, such airspaces shall be enclosed in an unventilated cavity constructed to minimize air-flow into and out of the enclosed air space. Airflow shall be deemed minimized when the enclosed airspace is located on the interior side of the continuous air-barrier and is bounded on all sides by building components.

> **Exception:** The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

Reason: This proposal is identical to requirements for airspaces added to the 2018 IECC-C (Section 402.2.7). It also is consistent with ASHRAE 90.1-2016 (Section A9.4.2) which was the basis for IECC-C Section 402.2.7. These provisions will ensure that the R-value of airspaces are properly accounted for when used as an optional means of energy code compliance.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal provides needed requirements for the additional and optional use of airspaces as a supplemental means of energy code compliance. This proposal may add an option that's currently not in the code.

RE63-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There are questions about the cost statement and enforcability of air flow and air rate (Vote: 11-0).

Assembly Action: **None**

RE63-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.2.14 (IRC N1102.2.14) (New)

Proponents:
Jay Crandell, P.E., ARES Consulting, representing Foam Sheathing Committee of the American Chemistry Council (jcrandell@aresconsulting.biz)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.14 (IRC N1102.2.14) Airspaces. Where the thermal properties of airspaces are used to comply with this code in accordance with Section R401.2, such airspaces shall be enclosed in an unventilated cavity constructed to minimize air-flow into and out of the enclosed air space. Airflow shall be deemed minimized when the enclosed airspace is located on the interior side of the continuous air-barrier and is bounded on all sides by building components.

~~**Exception:** The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.~~

Commenter's Reason: The committee reason for recommending disapproval was (1) "questions about the cost statement" and (2) "enforceability of air flow and air rate". This public comment addresses both concerns by clarifying the cost impact and deleting the exception statement.

First, the cost statement is accurate in that the existing code does not provide guidance for proper application of air spaces in building envelopes for purpose of meeting R-value or U-factor requirements. Thus, by adding this proposed provision, it will provide greater assurance that air spaces, when properly constructed or tested, can be used to contribute to an assembly's thermal performance. Consequently, this will not increase construction cost and in some cases may actually reduce it. Hence, the proponent appropriately indicated that the proposal "will not increase or decrease construction cost" and provided a rational explanation.

The second part of the committee statement was dealing with "enforceability" of the exception statement. The exception statement, although deleted in this PC, is currently in the IECC-C and was included in the original proposal to make the IECC-R exactly consistent with the IECC-C. This exception is enforceable and is not different from similar provisions already in the I-codes that reference a test method and then test criteria which a qualified test lab complies with in forming a test report for code compliance purposes. However, this public comment removes the originally proposed exception statement because it is a non-mandatory optional means of compliance and is not necessary in the IECC-R prescriptive provisions. This removes any concern with enforceability of the exception statement and its referenced performance test method and air-flow rate.

With the changes made in this PC to address the committee comments, your approval as modified is requested.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The application of air spaces for compliance with the thermal performance requirements of the code is not currently addressed in the code. Thus, the proposal provides an additional means of compliance or supplementing compliance with properly constructed air spaces. Without the exception statement, however, non-compliant airspaces can still be considered (as they currently are) through IECC-R Section R102. Thus, the proposal as modified by this PC may at worst have no cost impact and at best provide a means to slightly reduce cost.

Public Comment# 1624

Public Comment 2:

IECC®: R402.2.14 (IRC N1102.2.14) (New)

Proponents:
Amanda Hickman, representing Reflective Insulation Manufacturers Association International (amanda@thehickmangroup.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.14 (IRC N1102.2.14) Airspaces. Where the thermal properties of airspaces are used to comply with this code in accordance with Section R401.2, such airspaces shall be enclosed in an unventilated cavity constructed to minimize air-flow into and out of the enclosed air space. Airflow shall be deemed minimized when the enclosed airspace ~~is located on the interior side of the continuous air barrier and~~ is bounded on all sides by building components.

Exception: The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material <u>that are ventilated and permit air flow into and out of the enclosed air space</u> shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

Commenter's Reason: This original language does not clearly differentiate between a “ventilated and enclosed airspace” and an “unventilated and enclosed air space”. ASTM C1363 explicitly prohibits the introduction of air flow into a C1363 testing apparatus:
Paragraph 1.14 “This test method does not permit intentional mass transfer of air or moisture through the specimen during measurements”.

It is the intention of this public comment to clarify what the exception pertains to – whether it is ventilated or unventilated.

Additionally – if the air space is “enclosed”, “unventilated” and “bounded on all sides by building components” it can be tested for thermal performance with ASTM C1363 regardless of which side of the air barrier it is located.

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

Because the use of airspaces is optional and not required by code there is no cost impact associated with the proposal.
And because this comment only modifies the proposed language it inherently does not have a cost impact.

Public Comment# 1657

Public Comment 3:

IECC®: R402.2.14 (IRC N1102.2.14) (New)

Proponents:
Dr. David Yarbrough, representing Self (davidyarbrough86@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.14 (IRC N1102.2.14) Airspaces. Where the thermal properties of airspaces are used to comply with this code in accordance with Section R401.2, such airspaces shall be enclosed in an unventilated cavity constructed to minimize air-flow into and out of the enclosed air space. Airflow shall be deemed minimized when the enclosed airspace is located on the interior side of the continuous air-barrier and is bounded on all sides by building components.

> ~~**Exception:** The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.~~

Commenter's Reason: The use of ASTM Test C1363 with airflow through the test specimen is outside the scope of C1363. This type of test is not permitted. The following is a quotation from ASTM C1363.
Paragraph 1.14 "This test method does not permit intentional mass transfer of air or moisture through the specimen during measurements".

Note: "mass transfer" means air moving through the test specimen.

Further, the specification of a minimum rate of 70 mm/second is arbitrary and not supported by technical literature.

This subject, "the impact of air flow on thermal performance" is the subject of a current ASHRAE research project. ASHRAE 1759-TRP: "Impact of Air Flow on Thermal Performance of Airspaces Behind Cladding" (phase 1).

One of the objectives of the ASHRAE Research project is to establish the procedure for use of a C1363 type apparatus to perform thermal measurements with air flow.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The original proposal will increase the cost of construction. However, there is no cost impact with this public comment, as it deletes an exception.

Public Comment# 1663

Public Comment 4:

Proponents:
John Woestman, Kellen Company, representing Extruded Polystyrene Foam Association (jwoestman@kellencompany.com)

requests As Submitted

Commenter's Reason: This proposal is consistent with requirements for airspaces already in the IECC-C provisions and is justified for reasons given in the original proposal. Those same IECC-C requirements are also relevant to and no less important to appropriate treatment of airspaces in the IECC-R. These provisions only apply to airspaces that are used for the purpose of determining compliance with the energy code (e.g., an R-value is attributed to the airspace). Thus, where used for this purpose, the code should provide guidance as it has done in the IECC-C provisions.

The committee reasons for disapproval contradict the reason the provisions in the exception were included in the IECC-C last code development cycle. The concern, in the exception, was with “enforceability of air flow rates” in the test methodology – but, that test methodology applies only to airspaces that are not compliant with the proposed charging language of R402.2.14 (IRC N1102.2.14), with a likely result of a significant reduction of actual R-value.

The test methodology specified in the exception can be conducted and has been conducted. The test methodology and the means of achieving the required airflow rate during testing is not “enforced” by the code official as is the case for many other testing requirements in the code. Instead, the test, following the prescribed methodology with the required airflow, is executed by a qualified laboratory for product evaluation and reporting purposes. This typically results in a product evaluation report which is presented to and used by the code official to confirm compliance with the code as a common means of enforcement.

Remember, the exception in this proposal is a non-mandatory option for considering airspaces, for energy code compliance purposes, which do not provide an R-value consistent with the basic requirement of being enclosed in an unvented cavity which is constructed to minimize air-flow into and out of the enclosed air space.

This proposal should be approved to ensure that the IECC-R is consistent with the IECC-C in enabling the proper use of air spaces to support energy code compliance.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal provides needed requirements for the additional and optional use of airspaces as a supplemental means of energy code compliance. This proposal adds a non-mandatory option that’s currently not in the code.

Public Comment# 1966

Public Comment 5:

Proponents:
Wesley Hall, representing Reflectix, Inc. (wes.hall@reflectixinc.com)

requests Disapprove

Commenter's Reason: The “Cost Impact” for this proposal is in error. It specifies a “new” test method for air spaces outside the air barrier. The ASTM C1363 test method is expensive and would certainly impact material costs for the system.
Additionally, it only specifies one “air movement rate”, but does not indicate the assembly or supporting test data that pertains to this air movement rate. Different ventilated assemblies outside the air barrier will have different flow rates and the exception should include a test method to determine the flow rate for that specific assembly. Additionally, the cost of a second test method to determine air movement flow rate would have associated costs that would increase the material costs, for the assembly even more.

Currently, ASTM C1363 does not permit the introduction of air flow for thermal evaluation of an assembly. This is an additional issue of importance that justifies disapproval.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The original proposal will increase the cost of construction as described above. However, there is no cost impact with this public comment, as we are requesting disapproval of the proposed language.

Public Comment# 1658

RE64-19

IECC: R402.2.14 (IRC N1102.2.14) (New)

Proposed Change as Submitted

Proponents: Jay Crandell, P.E., ARES Consulting / ABTG, representing Foam Sheathing Committee of the American Chemistry Council

2018 International Energy Conservation Code

Add new text as follows:

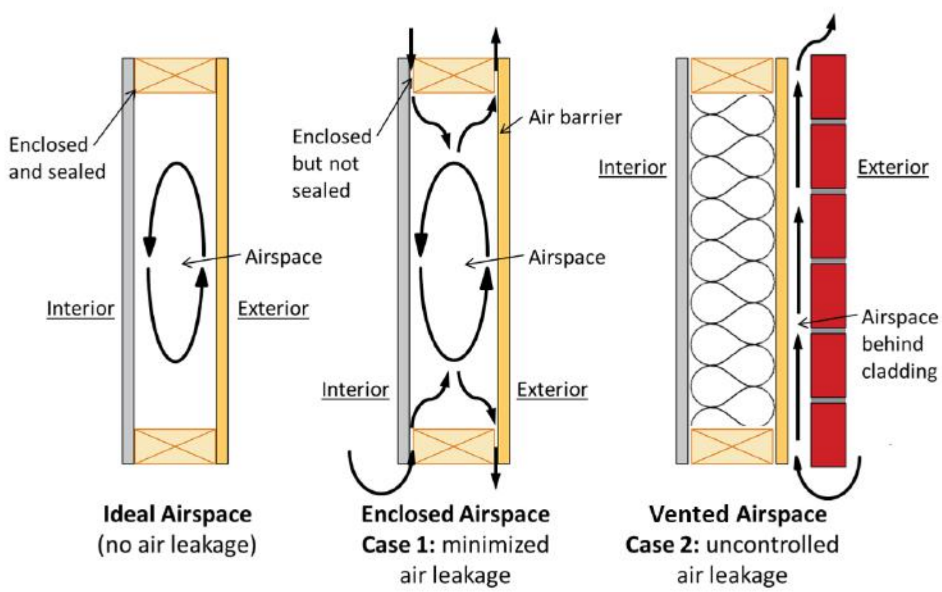
R402.2.14 (IRC N1102.2.14) Airspaces Where the R-value of an airspace is used for compliance in accordance with Section R401.2, the airspace shall be located on the interior side of the continuous air barrier and bounded on all sides by building components.

Exception: Alternative airspace conditions and means of determining R-value shall be permitted in accordance with Section C402.2.7.

Reason: This proposal coordinates the residential provisions with the prescriptive “deemed-to-comply” requirements for airspaces added to the 2018 IECC-C (Section 402.2.7). These requirements also are consistent with and based on ASHRAE 90.1-2016 (Section A9.4.2). They are applicable to both commercial and residential buildings because the thermal behavior of airspaces in assemblies doesn’t depend on building occupancy or use. Therefore, it is appropriate to consistently address airspace requirements in the IECC-R when their thermal resistance (R-value) is used as a means for compliance through the prescriptive, performance, or ERI approach of Section R401.2. An exception is provided to give flexibility for alternative airspace configurations or solutions based on the provisions (and exception) in Section C402.2.7 of the IECC-Commercial provisions.

For background on why these provisions were added to the 2018 IECC-C and also are needed in the IECC-R, the following explanation is provided. The R-values of airspaces are based on an assumption of “no air leakage” (see 2013 ASHRAE Handbook of Fundamentals, Chapter 26, Table 3, footnote b). This is illustrated in the figure below as an “ideal airspace”. As a practical matter, however, fully enclosed airspaces located to the interior of an air barrier are permitted to be considered ideal (see Case 1 in figure below). But, many airspace applications are far from “ideal” and are not fully enclosed; see Case 2 in the figure below. Air leakage into and out of an air-space due to ventilation airflow (especially if an intentionally vented airspace as common behind cladding systems) can significantly degrade its R-value, yet there is currently no standard calculation method or test method to account for this impact on an airspace R-value that otherwise is assumed to be “ideal”. This concern has been appropriately addressed in the IECC-C and, therefore, should be consistently applied to the IECC-R.

For additional information regarding performance of different air-space applications and conditions that affect R-value performance, refer to the figure below, a powerpoint at http://www.appliedbuildingtech.com/content/air-space-r-value, and the research report referenced in the bibliography.



Bibliography: Evaluation of Reflective and Non-Reflective Airspaces for Energy Code and FTC R-value Rule Compliance, ABTG Research Report No. 1601-02, Applied Building Technology Group, LLC, http://www.appliedbuildingtech.com/rr/1601-02

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

The use of airspaces for compliance is not a requirement in the code and is therefore optional. This proposal provides for the option to appropriately include the R-value of airspaces which may reduce the cost of construction. For current applications that are using the R-value of airspaces that are not appropriately quantified or constructed, the cost of construction may increase. Thus, the appropriate conclusion is that the proposal may reduce cost, increase cost, or have no impact on cost depending on the specific case.

RE64-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There are question cost statement and enforceability of air flow and air rate. Additionally there is technical disagreement among experts (Vote: 11-0).

Assembly Action: **None**

RE64-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.2.14 (IRC N1102.2.14) (New)

Proponents:
Amanda Hickman, representing Reflective Insulation Manufacturers Association International (amanda@thehickmangroup.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.2.14 (IRC N1102.2.14) Airspaces Where the R-value of an airspace is used for compliance in accordance with Section R401.2, the airspace shall be in an unventilated cavity constructed to minimize airflow into and out of the enclosed air space. Airflow shall be deemed minimized where the enclosed air space is ~~located on the interior side of the continuous air barrier and~~ bounded on all sides by building components.

~~**Exception:** Alternative airspace conditions and means of determining R-value shall be permitted in accordance with Section C402.2.7.~~

Commenter's Reason:
The originally proposed language is lacking in some of the important characteristics of an "enclosed air space" – the addition of "unventilated cavity" and "bounded on all sides by building components" incorporates important characteristics, which this system should include.

The primary problem with the intent of this language is that it mixes two distinctly different systems and attempts to incorporate them into a single subsection, specifically "unventilated" and "ventilated" enclosed air spaces (the "Exception" includes a reference to Section C402.2.7 which includes an exception that addresses "ventilated" systems).

Section C402.2.7 Airspacesis very efficient in identifying the attributes of an enclosed air space – "enclosed in an unventilated cavity…and is bounded on all sides by building components". These systems are routinely tested with ASTM test method C1363. The stipulation that the enclosed air space must be inside the air barrier is unnecessary – enclosed air spaces meeting the above criteria can exist inside or outside the air barrier. The key element to this discussion is "unventilated" – if the system is unventilated it can be tested, and a thermal performance value assigned.

This text refers to the "C402.2.7" which includes an "Exception" that addresses "ventilated systems" which is unsubstantiated code language and premature:

The Exception from Section C402.2.7 is included below, for this discussion:

Exception: the thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

Ø There is no ASTM test method available for the stated requirements

Ø What is the basis for the stated flow rate requirement?

Ø Should not a flow rate be assigned to specific assemblies?

Ø What supportive data and what test procedure are utilized in determining these flow rates?

There are significant gray areas included within the exception – the Public Comment remedy is to eliminate the “Exception” and remove the restrictive language that specifies where an enclosed air space is located.

Once the additional work has been completed and testing requirements for a ventilated system are identified, it will be appropriate to develop code language specific to the assemblies being discussed.

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

Because the use of airspaces is optional and not required by code there is no cost impact associated with the proposal. And because this comment only modifies the proposed language it inherently does not have a cost impact.

Public Comment# 1654

Public Comment 2:

Proponents:
Doug Kinninger, Fi-Foil Company, representing Fi-Foil Company; Amanda Hickman, representing Reflective Insulation Manufacturers Association International (amanda@thehickmangroup.com)

requests Disapprove

Commenter's Reason: The “Exception”, for reference, from Section C402.2.7:
Exception: The thermal resistance of airspaces located on the exterior side of the continuous air barrier and adjacent to and behind the exterior wall-covering material shall be determined in accordance with ASTM C1363 modified with an airflow entering the bottom and exiting the top of the airspace at an air movement rate of not less than 70 mm/second.

The “Cost Impact” for this proposal is in error. It specifies a “new” test method for air spaces outside the air barrier. The ASTM C1363 test method is expensive and would certainly impact material costs for the system.

Additionally, it only specifies one “air movement rate”, but does not indicate the assembly or supporting test data that pertains to this air movement rate. Different ventilated assemblies outside the air barrier will have different flow rates and the exception should include a test method to determine the flow rate for that specific assembly. Additionally, the cost of a second test method to determine air movement flow rate would have associated costs that would increase the material costs, for the assembly even more.

Currently, ASTM C1363 does not permit the introduction of air flow for thermal evaluation of an assembly. This is an additional issue of importance that justifies disapproval.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1665

RE66-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuousair barrier.Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as asealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall be aligned with the insulation and any gaps in the airbarrier shall be air sealed. Access openings, drop down stairs or knee wall doorsto unconditioned attic spaces shall be air sealed in a manner that does not interfere with its accessibility.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. All access hatches and doors shall be installed in accordance with Section R402.2.4 Raised vertical or diagonal surfaces that are greater than 1' foot in height into the ventilated attic shall be insulated in accordance with the knee wall provisions. Raised vertical or diagonal surfaces that are 1 foot or less in height into a ventilated attic shall be buried with insulation to maintain the ceilings R-value. Eave Baffles shall be installed in accordance with Section R402.2.3
Walls	The junction of the foundation and sill plate shall besealed.The junction of the top plate and the top of exteriorwalls shall be sealed.Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling thecavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framedwalls shall be installed in substantial contact andcontinuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge ofinsulation.	Floor framing cavity insulation shall be installed tomaintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extend from the bottom to the top of all perimeter floorframing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall becovered with a Class I vapor retarder withoverlapping joints taped.	Crawl space insulation, where provided instead offloor insulation, shall be permanently attached tothe walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the	Exterior walls adjacent to showers and tubs shallbe insulated.

	shower or tub.	
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical andcommunication boxes. Alternatively, air-sealed boxesshall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Air barrier and air sealing criteria section:

- Air sealing measures are called out so the table column should incorporate air sealing in its name as it is different than air barrier.
- We are seeing attic access hatches caulked shut so the included language change is to ensure that access to the attic space is maintained.

Insulation installation criteria section:

- Section references have been incorporated in the proposed language change as code required installation issues have been defined in those sections of the code. The problem from an implementation perspective is that the defined installation is in the prescriptive section of the code. So, does the code intend for attic eave baffles to be traded off or not installed if a home uses R405 or R406 compliance paths? I don't believe so. Therefore, the inclusion of section references ensures enforcement language and that the section becomes mandatory for all pathways in the code as it should be.
- Raised ceiling that penetrate into the attic space are particularly difficult to insulate. The guidance given by the proposed language helps those in the field identify particularly difficult areas to insulate, as well as, guidance on how to successful meet the code requirement.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE66-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposed language is guidance, not code language (Vote 8-3).

Assembly Action: **None**

RE66-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:
Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuousair barrier.Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as asealing material.
Ceiling/attic	~~The~~ A sealed air barrier shall be installed in any dropped ceiling or soffit to separate it from unconditioned space. ~~shall be aligned with the insulation and any gaps in the airbarrier shall be air sealed.~~ Access openings, drop down stairs or knee wall doors to unconditioned attic spaces shall be air sealed in a manner that does not interfere with its access ~~accessibility~~.	The insulation in any dropped ceiling/soffit shall be aligned with the air barrier. ~~Raised~~ Vertical or diagonal surfaces that are greater than 1' foot in height into the ventilated attic shall be considered an above grade wall. ~~insulated in accordance with the knee wall provisions.~~ ~~Raised~~ Vertical or diagonal surfaces that are 1 foot or less in height into a ventilated attic shall be buried with insulation to ~~maintain~~ the ceilings required R-value. ~~All~~ Access hatches and doors shall be installed in accordance with Section R402.2.4 Eave Baffles shall be installed in accordance with Section R402.2.3
Walls	The junction of the foundation and sill plate shall besealed.The junction of the top plate and the top of exteriorwalls shall be sealed.Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling thecavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framedwalls shall be installed in substantial contact andcontinuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge ofinsulation.	Floor framing cavity insulation shall be installed tomaintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extend from the bottom to the top of all perimeter floorframing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall becovered with a Class I vapor retarder withoverlapping joints taped.	Crawl space insulation, where provided instead offloor insulation, shall be permanently attached tothe walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the	Exterior walls adjacent to showers and tubs shallbe insulated.

	shower or tub.	
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical andcommunication boxes. Alternatively, air-sealed boxesshall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: The committee stated, “The proposed language is guidance, not code language.” I believe that this comment is primarily focused on the insulation installation section as the air barrier section further clarifies requirements that are already part of the code table. However, redundancy in the existing language was discovered and corrected. Alignment of the insulation with the air barrier was discussed on both sides of the table and this has been fixed in the public comment. The committee comments were taken to heart, and additional significant changes were made to enhance the code language.
On the insulation installation side of the table, raised ceilings that penetrate into the attic space are a common construction detail that is particularly difficult to insulate and needs to be addressed by the code. Redundancy in the proposed language has been fixed which helps those in the field identify this difficult area to insulate, as well as provide language on how to successfully meet the new code requirement.

The committee questioned two code references added to the Insulation side of the table are Section R402.2.3 Eave Baffles and R402.2.4 Attic Hatches. There is a lot of precedence in code language to point to sections for additional clarification, especially for installation guidance that is already in the code. These specific reference sections describe the installation of these measures in the prescriptive section of the code. Installation criteria in the prescriptive section of the code cannot be traded in performance paths. The installation of attic eave baffles, for example, is not discretionary and cannot be traded off when building an attic ventilated with soffit vents. Pointing to reference language makes this clear.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed language changes do not increase the cost of construction but rather removes redundancy and offers greater clarity of existing requirements.

Public Comment# 1714

RE67-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	~~A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuous air barrier.~~ The building's thermal envelope shall contain a continuous air barrier that is in alignment with the insulation on the conditioned and unconditioned side of the assembly.[b] All penetrations breaks or joints in the air barrier assembly shall be air sealed.	Air-permeable insulation shall not be used as an air asealing material. Air- permeable insulation shall be enclosed inside the air barrier assembly [b]. Verification or certification of insulation installation shall be in accordance with Section R303
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall bealigned with the insulation and any gaps in the airbarrier shall be sealed.Access openings, drop down stairs or knee wall doorsto unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shallbe aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall besealed.The junction of the top plate and the top of exteriorwalls shall be sealed.Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling thecavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framedwalls shall be installed in substantial contact andcontinuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge ofinsulation.	Floor framing cavity insulation shall be installed tomaintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extend from the bottom to the top of all perimeter floorframing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall becovered with a Class I vapor retarder withoverlapping joints taped.	Crawl space insulation, where provided instead offloor insulation, shall be permanently attached tothe walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shallbe insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical andcommunication boxes. Alternatively, air-sealed boxesshall be installed.	—

HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.
b. Air barrier and Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.

Reason: Air barrier and air sealing criteria section:

- This code change proposal is intended to offer clarification to this section of Table R402.4.1.1 for those in the field that use it to build homes that are compliant with the air testing requirements of the IECC. In the 2018 IECC definitions section, air barriers and building thermal envelope where changed to recognize that the air barrier and building thermal envelope are an assembly of things not necessarily one component of the building. See definitions below. By removing poor language regarding continuous air barriers this section has been focused to better define the alignment of the air barrier and thermal barrier. In addition, it offers definition for other requirements in the table for installing an interior air barrier in location like behind a tub.
    - **AIR BARRIER.** One or more materials joined together in a continuous manner to restrict or prevent the passage of air through the *building thermal envelope* and its assemblies.
    - **BUILDING THERMAL ENVELOPE.** The *basement walls, exterior walls*, floors, ceiling, roofs and any other *building* element assemblies that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space.
- Air sealing measures are called out so the table column should incorporate air sealing in its name as it is different than air barrier.

Insulation Installation Criteria:

- Manufacturers of air permeable insulation have begun to recognize that their installation literature must incorporate language and pictures showing that air permeable insulation must be enclosed inside of air barrier assemblies. This table promotes this installation instruction in location such as behind tubs, on attic knee walls, etc. Therefore, the general section should begin with an overarching statement that states how air permeable insulation shall be installed.
- See insulation installation instructions from NAIMA (*North American Insulation Manufacturers Association)* at this weblink: http://insulationinstitute.org/wp-content/uploads/2016/03/NAIMA-Tech-Tips-and-Critical-Details-FINAL.pdf

A footnote has been added to ensure a common understanding that insulation installed in a ventilated attic and at the rim joist is not required to be enclosed within an air barrier assembly. The new footnote is necessary as the item it is associated with defines the installed alignment between air barriers and air permeable insulation within building cavity installation, i.e. walls and floor cavities.

Using references to other sections of the code enables reinforcement of what is required. In this case, the reference is to certificates that document the R-values of the material installed which must be created and posted.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE67-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: The proposal is very confusing, there is no need to reference existing section of code (Vote: 8-3).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier that is in alignment with the insulation shall be installed in the *building thermal envelope* assembly . ~~The building's thermal envelope shall contain a continuous air barrier that is in alignment with the insulation on the conditioned and unconditioned side of the assembly.[b]~~ ~~All~~ Penetrations, breaks, or joints in the air barrier ~~assembly~~ shall be air sealed.	Air-permeable insulation shall not be used as an air asealing material. Air- permeable insulation installed in wall or floor cavities, shall be enclosed on all sides with air impermeable materials.[b] ~~inside the air barrier assembly .~~ Verification or certification of insulation installation shall be in accordance with Section R303

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

b. ~~Air barrier and Insulation full enclosure is not required in unconditioned/ventilated attic spaces and at rim joists.~~ Full enclosure of insulation with an air-impermeable material is not required in unconditioned/ventilated attic spaces and at rim joists.

Commenter's Reason: Public Comment Reason Statement:
This comment is being put forth to address committee concerns regarding confusion in the proposed language and the use of a reference section for insulation installation R303. The current published language in the air barrier section of table R402.4.1.1 of the 2018 IECC states, “A continuous air barrier shall be installed in the building envelope. The exterior thermal envelope shall contain a continuous air barrier.” This is completely confusing for those charged with implementation and enforcement in the field. In an effort to create even better code language, as suggested by the committee, this section has been significantly simplified and made to align with RE58 that passed, for better clarity and understanding. However, RE58 did not address the insulation installation side of the table which this proposal does.

Section R303 regarding insulation installation is often overlooked. However, it offers additional installation criteria that goes beyond manufacture instruction -- for example, additional information regarding blow or sprayed roof or ceiling insulation. The committee also approved CE 40 parts I &II, a new section numbered R303.3.1 Insulation Mark Installation, which will require obtaining a certificate of installation for an insulation material that does not have an R-value mark at the time of installation. These are examples of the importance of using references to other sections of the code. In addition, there are multiple precedents for citing sections of the code that need to be referenced. This includes other parts of this table that were approved at the CAH -- for example, RE70 recessed lighting and RE 71 garage separation.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers better clarity of existing requirements.

Public Comment# 1731

RE68-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

<u>Proposed Change as Submitted</u>

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1 (IRC N1102.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuousair barrier.Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as asealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall bealigned with the insulation and any gaps in the airbarrier shall be sealed.Access openings, drop down stairs or knee wall doorsto unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shallbe aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall besealed.The junction of the top plate and the top of exteriorwalls shall be sealed.Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling thecavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framedwalls shall be installed in substantial contact andcontinuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge ofinsulation.	Floor framing cavity insulation shall be installed tomaintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extend from the bottom to the top of all perimeter floorframing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall becovered with a Class I vapor retarder withoverlapping joints taped.	Crawl space insulation, where provided instead offloor insulation, shall be permanently attached tothe walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing ~~and~~ , wiring, or other obstructions	All holes created by wiring, plumbing or other obstructions in the air barrier assembly shall be air sealed.	~~In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.~~ Insulation shall be installed to fill the available space and surround wiring, plumbing, or other obstructions, unless the required R-value can be met by installing insulation and air barrier systems completely to the exterior side of the obstructions.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shallbe insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical andcommunication boxes. Alternatively, air-sealed boxesshall be installed.	—
	HVAC supply and return register boots that	

HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Component:

- The component section of this table item has been amended to include other obstructions as there are a number of obstructions that end up in insulated building cavities that insulation must be split around so that it fully encloses the obstruction. In this revised section plumbing and wiring become examples of obstructions, but things like gas or HVAC duct works amongst other things now can be included.

Air barrier and air sealing criteria section:

- Although it seems obvious it does need to be stated that holes in the continuous air barrier need to be sealed. This is a specific reminder regarding holes that are created by wiring, plumbing, or other obstruction in cavities need to be air sealed.

Insulation Installation Criteria:

- Insulating around obstructions in building cavities can and may happen with material other than fiberglass batts. This code change proposal opens up the possibility of insulating plumbing in exterior walls, for example, so that the plumbing is not surrounded by insulation but rather completely exposed to the warm side of the cavity.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction, but rather offers guidance and clarity of existing requirements.

RE68-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: It is not necessary it brings guidance into the table (Vote: 6-5).

Assembly Action: **None**

RE68-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.4.1.1 (IRC N1102.1.1)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.4.1.1 (IRC N1102.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Plumbing, wiring, or other obstructions	~~All~~ Holes created by ~~wiring,~~ plumbing, wiring, or other obstructions in the air barrier assembly shall be air sealed.	Insulation shall be installed to fill the available space and surround ~~wiring,~~ plumbing, wiring or other obstructions, ~~unless the required R-value can be met by installing insulation and air barrier systems completely to the exterior side of the obstructions.~~ Where the required cavity insulation cannot be achieved due to an installed obstruction, the required R-value shall be installed to the exterior side of the obstruction and t he remainder of the cavity shall be fully insulated to the drywall side, or an air barrier shall separate the two.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment Reason Statement:
The committee's vote of 6 to 5 indicates that there was not agreement on whether this proposal is only offering guidance of true code requirements in the best available code language. That being said, their comment has been taken to heart and changes have been made to address concerns in the following ways:

- Currently, there are no clear and direct air barrier requirements for this section of the table. Therefore, a clear air sealing requirement in the air barrier section has been added to clarify the importance of a continuous air barrier system.
- There was no understanding that the same principles of installation apply for other obstructions such as gas lines, ducts, low voltage, or other things we find inside building cavities that obstruct the direct installation of the air barrier and insulation. In other words, insulation must be split to fit around not only wiring but also any obstruction that is installed within an insulated cavity.
- Lastly, the public comment addresses the committee concern that cavity insulation R-value is maintained when large obstructions, such as ducts, are installed in an insulated cavity. To address this a section of the language was broken out into its own statement requiring that insulation and air barrier systems be held outside the obstruction. This exception offers alternative insulation installation allowances which are often used when plumbing, for example, must be installed in an exterior wall.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction, but rather offers clarity of existing requirements.

Public Comment# 1733

RE71-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuousair barrier.Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as asealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall bealigned with the insulation and any gaps in the airbarrier shall be sealed.Access openings, drop down stairs or knee wall doorsto unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shallbe aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall besealed.The junction of the top plate and the top of exteriorwalls shall be sealed.Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling thecavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framedwalls shall be installed in substantial contact andcontinuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge ofinsulation.	Floor framing cavity insulation shall be installed tomaintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extend from the bottom to the top of all perimeter floorframing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall becovered with a Class I vapor retarder withoverlapping joints taped.	Crawl space insulation, where provided instead offloor insulation, shall be permanently attached tothe walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	Insulated portions of the garage separation assembly shall be installed in accordance with Section R303 and R402.2.8
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shallbe insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical andcommunication boxes. Alternatively, air-sealed boxesshall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is	

Concealed sprinklers	recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Insulation Installation Criteria:

- Many in the field that use table R402.4.1.1 us it as a guide to how to meet the requirements of the codes insulaiton and air leakage sections. Currently the component section for garage separation is blank on the insulation installation column. Unfortunately, many feel that because the section is blank that there is not a requirment to install insulation in the same manner as any other wall or floor component that separated conditioned and unconditioned space. Therefore, there is need to ensure that the installation criteria is used when assessing R402, R405 and R406 compliance. The addition of this language does that.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE71-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Adds clarity by providing more specificity (Vote: 6-5).

Assembly Action: **None**

RE71-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Craig Conner, representing self (craig.conner@mac.com)

requests Disapprove

Commenter's Reason: RE71 brings a reference to R303 into the table as part of the row on "garage separation".
None of R303 is specific to "garage separation", why should R303 fall under that row? The sections in R303 are:

- R303 Materials, Systems and Equipment.
- R303.1 Identification.
- R303.1.1 Building thermal envelop insulation.
- R303.1.1.1 Blown-in and sprayed roof and ceiling insulation.
- R303.1.2 Insulation mark installation.
- R303.1.3 Fenestration product rating.
- R303.1.4 Insulation product rating.
- R303.1.4.1 Insulated siding.
- R303.2 Installation.
- R303.2.1 Protection of exposed foundation insulation.
- R303.3 Maintenance information.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1937

RE73-19

IECC: R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shafts, penetrations	Duct shafts, utility penetrations, ~~and~~ , flue ~~shafts opening~~ shaft openings, and other similar penetrations to the exterior or unconditioned space shall be air sealed.	Penetrations through the building thermal envelope and what is passed through the penetration, shall not damage or compress the insulation surrounding the penetration.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Air barrier and air sealing criteria section:

- There are a number of penetrations that occur through the continuous air barrier assemblies of a home. They are too numerous to list yet some examples are given to create context and additional language was added to ensure that the examples were not thought to be the only penetrations that needs to be sealed.

Insulation Installation Criteria:

- Insulating properly around a penetration and the object that is placed through the penetration in the buildings continuous air barrier assembly and thermal envelop is relatively easy to accomplish when insulation is installed after the penetration has been sealed, but when insulation has been installed first and then a penetration is created damaged insulation often occurs. In either instance this new language points out that insulation still must be installed well regardless.

See the following:

Table R402.4.1.1

AIR BARRIER, AIR SEALING AND INSULATION INSTALATION [a,b,c]

COMPONENT	AIR BARRIER AND AIR SEALING CRITERIA	INSULATION INSTALLATION CRITERIA
Shafts, penetrations	Duct shafts, utility penetrations, ~~and~~ flue shaft openings, or other similar penetration to the exterior or unconditioned space shall be air sealed.	Penetrations through the building thermal envelope and what is passed through the penetration, shall not damage or compress the insulation surrounding the penetration.

Reason Statement:

Air barrier and air sealing criteria section:

- There are a number of penetrations that occur through the continuous air barrier assemblies of a home. They are too numerous to list yet some examples are given to create context and additional language was added to ensure that the examples were not thought to be the only penetrations that needs to be sealed.

Insulation Installation Criteria:

- Insulating properly around a penetration and the object that is placed through the penetration in the buildings continuous air barrier assembly and thermal envelop is relatively easy to accomplish when insulation is installed after the penetration has been sealed, but when insulation has been installed first and then a penetration is created damaged insulation often occurs. In either instance this new language points out that insulation still must be installed well regardless.


Cost Statement:

- The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE73-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: Disapproved

Committee Reason: The is to provide guidance and as such it does not belong in the code. It is poor code language and not enforceable (Vote: 7-4).

Assembly Action: None

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shafts, penetrations	Duct <u>and flue</u> shafts, utility penetrations, , ~~flue shaft openings,~~ and other similar penetrations to the exterior or unconditioned space shall be ~~air~~ sealed <u>to allow for expansion, contraction, and mechnical vibration.</u>	<u>Insulation shall be fitted tightly around utilities passing through shafts and penetrations in the *building thermal envelope* to maintain required R-value.</u> ~~Penetrations through the building thermal envelope and what is passed through the penetration, shall not damage or compress the insulation surrounding the penetration.~~

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment Reason Statement
The committee’s vote was 7-4, and I disagree with committee members who thought this code change proposal only provides guidance and voted to disapprove. That being said, the committee reason statement and the passage of RE86 demonstrates that additional work was needed. The air barrier side of the table has been updated to create better language and incorporate RE86 language.

The insulation installation side of the table clearly provides a new code requirement that ensures that what passed through shaft and other penetrations is insulated properly to maintain its required R-value.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
§ The proposed language does not increase the cost of construction but rather offers clarity of existing requirements.

Public Comment# 1738

RE74-19

IECC: R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuousair barrier.Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as asealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall bealigned with the insulation and any gaps in the airbarrier shall be sealed.Access openings, drop down stairs or knee wall doorsto unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shallbe aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall besealed.The junction of the top plate and the top of exteriorwalls shall be sealed.Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling thecavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framedwalls shall be installed in substantial contact andcontinuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge ofinsulation.	Floor framing cavity insulation shall be installed tomaintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extend from the bottom to the top of all perimeter floorframing members.
Crawl space walls, basement walls, and slabs	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder/air barrier in accordance with Section R402.2.11 ~~with overlapping joints taped~~. A class 1 vapor retarder shall not be installed on the interior side of air permeable insulation in exterior below-grade walls. All penetrations through concrete foundation walls and slabs shall be air sealed.	Crawl space wall insulation installation, where provided instead of floor insulation, shall be ~~permaently attached to the walls~~ installed in accordance with Section R402.2.11. Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.9. Slab on grade floor insulation shall be installed in accordance with Section R402.2.10.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shallbe insulated.
Electrical/phone box on exterior	The air barrier shall be installed behind electrical andcommunication boxes. Alternatively, air-sealed	—

walls	boxesshall be installed.	
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Component:

- Currently only crawl space walls are being addressed by this table. Other foundation types such as basement and slabs have components that need to be addressed, thus the proposal to change the title of this component section.

Air barrier and air sealing criteria section:

- The vapor retarder criteria outlined in the prescriptive section R402.2.11 clearly describes how vapor retarders must be installed over the dirt floor of a conditioned crawl space. There is no need to further explain it in this table, but there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.
- Barrowing from language used in the EnergyStar checklist, I have used this section to ensure that below grade walls are insulated, but do not contain a class 1 vapor retarder that can trap moisture behind them. More vapor permeable materials such as class 2 Kraft faced batts or perforated vinyl or FSK (foil scrim kraft) blankets, as well as, class 3 vapor retarders are allowed. In Colorado we do see class 1 vapor retarders installed in this location and efficiency a building durability issue occur.
- Many feel that concrete foundation walls and slabs are air tight, but we forget that these building assemblies are often penetrated with sump pits, plumbing lines, and the like. These locations must be addressed in order to meet the air leakage requirements of the code.

Insulation Installation Criteria:

- Crawl space insulation installation as outlined in the prescriptive section R402.2.11 clearly describes how insulation must be installed on this component. There is no need to further explain it in this table, but there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.
- Basement wall insulation installation is outlined in the prescriptive section R402.2.9 and clearly describes how insulation must be installed on this component. However, basement walls were never included as a component of this table. Therefore, there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.
- Likewise slab insulation is outlined in the prescriptive section R402.2.10 and clearly describes how insulation must be installed on this component. However, slab insulation was never included as a component of this table. Therefore, there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE74-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Walls and floors should be separated as should slab-on-grade and basements. They should not be together (Vote: 8-3).

Assembly Action: **None**

RE74-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Basement, crawl space ~~walls, basement wall~~s, and slab foundations	Exposed earth in unvented crawl spaces shall be covered with a Class I vapor retarder/air barrier in accordance with Section R402.2.11. ~~All~~ Penetrations through concrete foundation walls and slabs shall be air sealed. Class 1 Vapor retarders shall not be used as an air barrier on below-grade walls and shall be installed in accordance with the International Residential Code Section R702..7. ~~A class 1 vapor retarder shall not be installed on the interior side of air permeable insulation in exterior below-grade walls.~~	Crawl space wall insulation installation, where provided instead of floor insulation, shall be installed in accordance with Section R402.2.11. Conditioned basement foundation wall insulation shall be installed in accordance with Section R402.2.9. Slab on grade floor insulation shall be installed in accordance with Section R402.2.10.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment Reason Statement
The committee's concern with this proposal was that it mixed wall and floor details. In reality, it is all about foundation air sealing and insulation installation. Therefore, to remove the committee's concern, the section has been renamed "Basement, crawl space, and slab foundations." Now all foundation air sealing, air barrier, and insulation installation issues that need to be addressed are in one place. They include references to the prescriptive installation requirements that cannot be traded as they are not associated with R-values that can be traded in the performance paths.

There is a lot of precedence in code language to point to sections for additional clarification, especially for installation guidance. The specific reference sections used in this proposal describe the installation of measures in the prescriptive section of the code. Installation criteria in the prescriptive section of the code cannot be traded in performance paths. Although the R-value of crawlspace wall insulation can be traded off, the installation of crawlspace wall insulation is not discretionary and cannot be traded off when building a conditioned crawlspace. Pointing to reference language makes it all clear.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers clarity of existing requirements.

Public Comment# 1740

RE75-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuousair barrier.Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as asealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall bealigned with the insulation and any gaps in the airbarrier shall be sealed.Access openings, drop down stairs or knee wall doorsto unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shallbe aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall besealed.The junction of the top plate and the top of exteriorwalls shall be sealed.Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling thecavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framedwalls shall be installed in substantial contact andcontinuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, separating conditioned from unconditioned space, including cantilevered floors and floors above garages	~~The air barrier shall be installed at any exposed edge of insulation.~~ Floor cavity air permeable insulation shall be enclosed inside an air barrier assembly Floor systems shall be fully air sealed including continuously air sealed at all edge and perimeter rim joist framing members.	Floor framing cavity insulation shall be installed ~~to maintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extendfrom the bottom to the top of all perimeter floorframing members~~ in accordance with the requirements of Section R402.2.8.
Crawl space walls	Exposed earth in unvented crawl spaces shall becovered with a Class I vapor retarder withoverlapping joints taped.	Crawl space insulation, where provided instead offloor insulation, shall be permanently attached tothe walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shallbe insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical andcommunication boxes. Alternatively, air-sealed boxesshall be	—

	installed.	
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Component:

- It needs to be clear that the floor cavities that are being addressed by this table are only floors that separate conditioned from unconditioned space. It is surprising how not all understand this.

Air barrier and air sealing criteria section:

- Floor cavities are wall cavities laid down, therefore, air permeable insulation installed inside the cavity also needs to be enclosed by the air barrier assembly. As the IECC allows alternative insulation techniques for insulating floors as seen in the exceptions detailed in Section R402.2.8 it become more important to ensure that the rim joist of the insulated floor not only get insulated, but is air tight, because the insulation no longer must be installed adjacent to the subfloor decking. The proposed language change brings this to light for builders and trades that are executing the code requirements.

Insulation Installation Criteria:

- The insulation installation criteria outlined in the prescriptive section R402.2.8 clearly describes how insulation in floor systems must be installed. There is no need to further explain it in this table, but there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE75-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This is to provide guidance and as such it does not belong in the code. It is poor code language and not enforceable (Vote: 6-5).

Assembly Action: **None**

RE75-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Floors, separating conditioned from unconditioned space, including cantilevered floors and floors above garages	The air barrier shall be installed and air sealed at any exposed edge of the insulated cavity adjacent to unconditioned space. ~~Floor cavity air permeable insulation shall be enclosed inside an air barrier assembly~~ ~~Floor systems shall be fully air sealed including continuously air sealed at all edge and perimeter rim joist framing members.~~	Floor framing cavity insulation shall be installed in accordance with the requirements of Section R402.2.8.

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment Reason Statement:
The committee's vote of 6 to 5 tells us there was not agreement on whether this proposal offered only guidance or true code requirements in the best available code language. Their comment has been taken to heart, however, and changes have been made to make this proposal better. The proposal has been simplified since RE53 passed at the CAH (R402.2.8 Floor Insulation Installation) and continues to ensure that the floor insulation installation requirements of the prescriptive section R402.2.8 will be followed regardless of the pathway that is chosen.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers clarity of existing requirements.

Public Comment# 1743

RE79-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

<u>Proposed Change as Submitted</u>

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuousair barrier.Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as asealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall bealigned with the insulation and any gaps in the airbarrier shall be sealed.Access openings, drop down stairs or knee wall doorsto unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shallbe aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall besealed.The junction of the top plate and the top of exteriorwalls shall be sealed.Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling thecavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framedwalls shall be installed in substantial contact andcontinuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge ofinsulation.	Floor framing cavity insulation shall be installed tomaintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extend from the bottom to the top of all perimeter floorframing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall becovered with a Class I vapor retarder withoverlapping joints taped.	Crawl space insulation, where provided instead offloor insulation, shall be permanently attached tothe walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shallbe insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical andcommunication boxes. Alternatively, air-sealed boxesshall be installed.	—
HVAC register boots	HVAC supply and return register boots ~~that penetrate building thermal envelope~~ shall be air sealed to the subfloor, wall covering or ceiling penetrated by the boot.	HVAC supply and return register boots located within the *buildings thermal envelope* shall not damage or compress the insulation surrounding them.
	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is	

Concealed sprinklers	recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Air barrier and air sealing criteria section:

- The change to this section of language in the table slightly broadens the scope of sealing to not only include air sealing between inside and outside but to include sealing of all supply and return boots to the surface they penetrate. This helps to gain more control and predictability of air flow in and out of interstitial spaces as well as improves the performance of the HVAC system. This concept was first introduced by the EnergyStar program.

Insulation Installation Criteria:

- Nationally we like open floor plans which means that more and more duct is being installed in exterior walls and attics. The supply and return duct installation and the insulation installation must be coordinated so that the insulation is not damaged or compressed resulting in the reduction of required R-value.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction, but rather offers guidance and clarity of existing requirements.

RE79-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This is a significant change, requiring all boots be sealed, and there is no evidence it is needed (Vote: 9-2).

Assembly Action: **None**

RE79-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
HVAC register boots	HVAC supply and return register boots shall be air sealed to the subfloor, wall covering or ceiling penetrated by the boot.	<u>Insulation shall be fitted tightly around HVAC supply and return register boots located in the *buildings thermal envelope* to maintain required *R-value.*</u> ~~HVAC supply and return register boots located within the *buildings thermal envelope* shall not damage or compress the insulation surrounding them.~~

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment:
As noted in the original reason statement and the committee comment, this proposal is a significant change to this section. It requires that all supply and return registers be sealed to the surface they are penetrating. The origin of this air sealing requirement comes from ENERGY STAR, who has demonstrated that energy loss is associated with duct boot installation in three ways: 1) if the boot directly penetrates the thermal envelope, such as a duct boot coming from a ventilated attic into the house; 2) when air that should be delivered to the conditioned space is redirected into building cavities when it hits the register cover; 3) when Venturi pressure, sometimes called the Coanda effect, is created and pulls air into the building cavity as it is being delivered into the room.

Read more here, **https://www.achrnews.com/articles/128615-why-dirt-streaking-occurs-around-vents**

By not being able to deliver the HVAC designed volume of air to the rooms of the house, the occupant is often left with no other choice than to raise the thermostat in the winter and to lower it in the summer. This causes energy inefficiencies while not correcting their comfort issue. In addition, building cavities are often connected to unconditioned space which increases duct leakage to the outside, as well as other inefficiencies. Therefore, although I agree with the committee that this is a significate change, I also believe that it is an important energy and building durability issue. This needs to be addressed at this time because most builders and contractors have experience implementing this in part, if not in whole.

There have not been insulation requirements associated with duct boots in the past which continues to make this a significant code change proposal. Ensuring that our building cavities are insulated properly is imperative when ducts are placed in them, and this proposal directly addresses that issue at the termination of the duct boot and the substrate it passes through.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As the committee noted this proposal changes the scope of the requirement (additional boots need sealed) and therefore would slightly increase the cost of construction. However, the proposal, in reality, offers better clarity and expansion of existing requirements.

Public Comment# 1745

RE80-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuousair barrier.Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as asealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall bealigned with the insulation and any gaps in the airbarrier shall be sealed.Access openings, drop down stairs or knee wall doorsto unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shallbe aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall besealed.The junction of the top plate and the top of exteriorwalls shall be sealed.Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling thecavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framedwalls shall be installed in substantial contact andcontinuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge ofinsulation.	Floor framing cavity insulation shall be installed tomaintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extend from the bottom to the top of all perimeter floorframing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall becovered with a Class I vapor retarder withoverlapping joints taped.	Crawl space insulation, where provided instead offloor insulation, shall be permanently attached tothe walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shallbe insulated.
Electrical~~/~~, phone, fan or other utility box es on exterior walls /ceilings	~~The air barrier shall be installed behind electrical and communication boxes. Alternatively, air-sealed boxes shall be installed.~~ Electrical, phone, fan or other utility boxes shall be air sealed or air tight boxes shall be installed. Electrical, phone, fan or other utility boxes, that penetrate the building thermal envelope, shall be air	Spaces behind electrical, phone, fan or other utility boxes on exterior walls shall be insulated or filled by insulation that on installation readily conforms to the available cavity space. Electrical, phone, fan or other utility boxes installed in floors, attics or to other insulated spaces shall have insulation cut or blown to fit snuggly around them or upon installation readily conforms to the available space.

	<u>sealed to the subfloor, wall covering or ceiling penetrated by the box.</u>	
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Component column:

- Although technically speaking, low voltage, speaker, or computer wire boxes are a form of electrical box many builders and trade partners only view true 20- or 15-amp power outlet or switch gang boxes as electrical boxes. By simply broadening the definition to utility box we can ensure that any such box that is installed in an exterior wall or ceiling is insulated and sir sealed properly.

Air barrier and air sealing criteria section:

- In this section the two requirements have been broken apart for greater clarity. First an air tight box of some sort must be installed and second the box must be sealed to the surface that it penetrates.

Insulation Installation Criteria:

- Currently there is no guidance in this table regarding insulating behind electrical boxes in any insulated assembly. This added language rectifies this and offers guidance.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction, but rather offers guidance and clarity of existing requirements

RE80-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There are already penetration sealing requirements, snugly is a poor word choice (Vote: 6-5).

Assembly Action: **None**

RE80-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
~~Electrical, phone, fan or other utility boxes on exterior walls/ceilings~~ Utility boxes (fan,electrical, communication, etc.)	The air barrier shall be installed behind utility boxes within the building thermal envelope. Utility boxes shall be sealed or air-sealed boxes shall be installed. Utility boxes, that penetrate the building thermal envelope, shall be air sealed to the subfloor, wall covering or ceiling penetrated by the box. ~~Electrical, phone, fan or other utility boxes shall be air sealed or air tight boxes shall be installed.~~ ~~Electrical, phone, fan or other utility boxes, that penetrate the building thermal envelope, shall be air sealed to the subfloor, wall covering or ceiling penetrated by the box.~~	Insulation shall be fitted tightly around and behind utility boxes installed in the buildings thermal envelope. ~~Spaces behind electrical, phone, fan or other utility boxes on exterior walls shall be insulated or filled by insulation that on installation readily conforms to the available cavity space.~~ ~~Electrical, phone, fan or other utility boxes installed in floors, attics or to other insulated spaces shall have insulation cut or blown to fit snuggly around them or upon installation readily conforms to the available space.~~

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment Reason Statement:
The committee vote of 6 to 5 tells us that there was not unanimous agreement to disapprove this proposal. The committee stated that there are already penetration air sealing requirements is true. But both NEMA and I feel that more specific language for utility boxes is needed for those that implement and enforce these requirements in the field. In the field, it is necessary to point specifically to language that says that the fan housing or utility box needs to be sealed to the surface that it is penetrating. Specific language is better for enforcement than general language, but the reality is that both general and specific language is needed. To address committee concerns, in collaboration with NEMA new air barrier language has been drafted.

The committee also had an issue with the word “snugly” to describe how insulation should be installed around a utility box. That word has been removed, and the language was changed. With the help of NEMA, the reworked language of this proposal should satisfy the concerns of the committee.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction because sealing box penetrations through the thermal envelope is required. However, this proposal does offer clarity of existing requirements.

Public Comment# 1748

RE81-19

IECC: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuousair barrier.Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as asealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall bealigned with the insulation and any gaps in the airbarrier shall be sealed.Access openings, drop down stairs or knee wall doorsto unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shallbe aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall besealed.The junction of the top plate and the top of exteriorwalls shall be sealed.Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling thecavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framedwalls shall be installed in substantial contact andcontinuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge ofinsulation.	Floor framing cavity insulation shall be installed tomaintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extend from the bottom to the top of all perimeter floorframing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall becovered with a Class I vapor retarder withoverlapping joints taped.	Crawl space insulation, where provided instead offloor insulation, shall be permanently attached tothe walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.
Shower/tub <u>and fireplaces</u> on exterior ~~wall~~ <u>walls</u>	~~The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the shower or tub.~~ <u>An air barrier shall be installed to separate the exterior wall insulation from showers, tubs and fireplaces.</u> <u>Tub and shower drain trap penetrations through the subfloor shall be air sealed.</u> <u>Fireplace doors shall comply with the requirements of Section R402.4.2</u>	<u>Exterior walls adjacent to showers,</u> ~~and~~ tubs <u>, and fireplaces</u> shall ~~separate the wall from the shower or tub~~ <u>be insulated and, where insulated with air permeable</u> <u>insulation, shall be enclosed by an air barrier assembly.</u>

Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical andcommunication boxes. Alternatively, air-sealed boxesshall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Component column:

- The 2012 IECC Air barrier and Insulation table was the last table that specifically referenced the void space behind fireplaces that are located on exterior walls. Just like behind tubs and shower pans a supplemental air barrier is needed on the interior side to enclose the insulation as the drywall plain has been moved to the front of the fireplace.

Air barrier and air sealing criteria section:

- This first revision continues to require the installation of a supplemental air barrier in areas were drywall, tile backer, or other air impermeable material will not be installed as the finished surface is not in alignment with the insulation installed in the building's thermal envelope. The only addition, other than clarification, is the addition of the area behind fireplaces on exterior walls.
- Air sealing the tub and shower drain trap penetration eliminates a significant leakage source especially when located in floor systems over unconditioned spaces. This air leakage often creates condensation on the back side of tubs and shower pans which leads to mold and other building durability issues.
- Fireplace door air sealing is outlined in the prescriptive section R402.4.2 and clearly describes that this component shall be air sealed. The instruction should not be limited to fireplaces that are installed using the prescriptive compliance options. Therefore, there is need to ensure that the installation criteria is used when assessing R405 and R406 compliance. The addition of this language does that.

Insulation Installation Criteria:

- Manufactures of air permeable insulation have begun to recognize that their installation literature must incorporate language and pictures showing that air permeable insulation must be enclosed inside of air barrier assemblies. The current language offered no guidance of this fact and therefore was amended.
- See attached PDF example of newer installation instructions

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction, but rather offers guidance and clarity of existing requirements.

RE81-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: Disapproved

Committee Reason: The cost benefit statement does not reflect the proposed change in requirements (Vote: 10-1).

Assembly Action: None

RE81-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:
Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Shower/tub and fireplaces on exterior framed walls	An air barrier shall be installed to separate the exterior framed wall insulation from showers, tubs and fireplaces. Tub and shower drain trap penetrations through the subfloor shall be air sealed. Fireplace doors shall comply with the requirements of Section R402.4.2	Exterior framed walls adjacent to showers, tubs, and fireplaces shall be insulated. ~~and, where insulated with air permeable insulation, shall be enclosed by an air barrier assembly.~~

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: The committee's comment demonstrated concern that the cost statement did not accurately reflect the increased cost associated with sealing tub and shower drain trap penetrations. This has been remedied below. In addition to the committee's concern, a representative of the masonry institute raised issues with reintroducing specific fireplace language requirements and the potential impact on masonry fireplaces. To address these concerns and in collaboration with industry representatives, the language, “framed” has been introduced for clarity.

Bibliography: For additional reason why it is important to seal holes created by plumbing traps go here.

JLC Practical Air-Sealing

https://www.jlconline.com/how-to/insulation/practical-air-sealing_o

This Hole May Be the Biggest Air Leakage Site in Your Home

https://www.energyvanguard.com/blog/52889/This-Hole-May-Be-the-Biggest-Air-Leakage-Site-in-Your-Home

The 3 Rules of Air Sealing

https://www.energyvanguard.com/blog/56102/The-3-Rules-of-Air-Sealing

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The committee's comment demonstrated concern that the cost statement did not accurately reflect the increased cost associated with sealing tub and shower drain trap penetrations. Although the proposed language is designed primarily to clarify the requirements of the code in this section, specifically regarding the area created by framed fireplace boxes, it will increase the cost of construction. The proposal also addresses the need to air seal tub and shower drain trap penetrations which have been demonstrated to largely contribute to air infiltration and building durability through condensation control.

Public Comment# 1749

RE84-19

IECC®: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuousair barrier.Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as asealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall bealigned with the insulation and any gaps in the airbarrier shall be sealed.Access openings, drop down stairs or knee wall doorsto unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shallbe aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall be air sealed. The junction of ~~the~~ all top plate s and drywall adjacent to unconditioned space above shall be gasketed or air sealed. Knee walls shall be air sealed.	Wall and knee wall cavity air permeable insulation shall be enclosed inside the air barrier assembly Corners in exterior frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Headers on exterior walls shall be insulated to a minimum R-3. Building thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier assembly. Knee wall cavities that are defined by roof truss framing shall maintain a minimum 3.5” inch insulated cavity that can accommodate an R-value that is either required in the wall or can be traded off.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge ofinsulation.	Floor framing cavity insulation shall be installed tomaintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extend from the bottom to the top of all perimeter floorframing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall becovered with a Class I vapor retarder withoverlapping joints taped.	Crawl space insulation, where provided instead offloor insulation, shall be permanently attached tothe walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shallbe insulated.

Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical andcommunication boxes. Alternatively, air-sealed boxesshall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
Concealed sprinklers	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Reason: Table title change

- The objective of table R402.4.1.1 is to offer guidance for how to create an air tight home that meets the air leakage requirements of the IECC. Air barrier and insulation installation are part of the equation to be able to accomplish this goal, but air sealing is another part of it that is missing from the title. The tables name should accurately reflect what it is intended to do and that is what the proposal aim is. Currently air sealing measures are discussed to some extent in the table and the hope is that additional air sealing measure will be incorporated this cycle.

Air barrier and air sealing criteria section:

- Clarification of the language requiring drywall to be sealed to the top plate is needed. In the field there is confusion regarding what exterior means. Does it mean four exterior walls or does it mean top plates that are adjacent to unconditioned space. The gained clarity of this air sealing activity addresses one of the largest air leakage sources on the high side of the home.
- The junction of the bottom plate to the subfloor on exterior walls had not been addressed yet is again one of the larges sources of air leakage in homes and therefore was added to the table.

Insulation Installation Criteria:

- Air permeable insulation must be enclosed in an air barrier in order to trap the pockets of air that are required to resist the flow of energy. This new language expresses that so it can be executed properly in the field.
- Corners and headers are significantly different assemblies. Headers, in particulate may not have a true cavity to insulate and may be better suited to insulate with foam board. This proposal breaks the two assemblies into separately addressed assemblies.
- Adding the defined term Building Thermal Envelop ensures clarity in this section of the code.
- Nationally we are seeing more and more knee walls that are defined by the flat edge of a 2x4 truss. The 1.5” dimension does not offer enough space to properly insulate. In such cases the truss will need to be over framed to enable insulation to be installed. The included language defines the minimum insulated space.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE84-19

Public Hearing Results

Errata: This proposal includes unpublished errata
Note: the bolded, stricken portion of existing code text did not show in the original proposal.

AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION[a]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Walls	The junction of the foundation and sill plate shall be air sealed. The junction of ~~the~~ all top plate s and drywall adjacent to unconditioned space above shall be gasketed or air sealed. Knee walls shall be air sealed.	~~**Cavities within corners and headers of frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, *R*-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier**~~. Wall and knee wall cavity air permeable insulation shall be enclosed inside the air barrier assembly Corners in exterior frame walls shall be insulated by completely filling the cavity with a material having a thermal resistance, R-value, of not less than R-3 per inch. Headers on exterior walls shall be insulated to a minimum R-3. Building thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier assembly. Knee wall cavities that are defined by roof truss framing shall maintain a minimum 3.5" inch insulated cavity that can accommodate an R-value that is either required in the wall or can be traded off.

1. a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Committee Action: **Disapproved**

Committee Reason: It added words without clarity and could make the code more confusing (Vote: 10-1).

Assembly Action: **None**

RE84-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R402.4.1.1 (IRC N1102.4.1.1)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R402.4.1.1 (IRC N1102.4.1.1)
AIR BARRIER, AND INSULATION INSTALLATION[a]

Portions of table not shown remain unchanged.

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
Walls	The junction of the foundation and sill plate shall be air sealed. The junction of all top plates and drywall adjacent to unconditioned space above shall be ~~gasketed or~~ air sealed. The junction of the bottom plate to the subfloor on exterior walls shall be air sealed ~~Knee walls shall be air sealed.~~	~~Wall and knee wall cavity~~ Air permeable insulation in wall cavities shall be enclosed on all six sides of the cavity. ~~inside the air barrier assembly~~ Building thermal envelope insulation for framed walls shall be installed in substantial contact and continuous alignment with the air barrier ~~assembly~~. Corners in exterior frame walls shall be insulated ~~by completely filling the cavity with a material having a thermal resistance,~~ with material that has an R-value of not less than R-3 per inch. Headers on exterior walls shall be insulated to a minimum R-3. Knee wall cavities that are defined by roof truss framing shall be insulated in accordance with the above grade wall provisions. ~~maintain a minimum 3.5" inch insulated cavity that can accommodate an R-value that is either required in the wall or can be traded off.~~

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.

Commenter's Reason: Public Comment Reason Statement
NAIMA recently released a paper titled "Five Priority Air Sealing Locations" from an Owens Corning study and listed the junction of the top plate and drywall adjacent to unconditioned spaces above as number one. They estimate that over 300 lineal feet of leakage is present. Multiply 300 feet by an 1/8" gap, and you get an almost 6060 window-size hole to the outside at this location. Our field experience shows that the current language in this section of the code causes confusion because it says, "seal the junction of the top plate and exterior wall." Many incorrectly assume that this means the top plate of the 4 exterior walls and not all top plates connected to the exterior or unconditioned space. So when the committee states that this code change is merely adding words, I need to push back and state that this code change clearly breaks up the many requirements in this section into bite-size bits of understandable code language. For example, insulated corners and headers were jumbled together in one long sentence. Now, they are separated and clarified so the requirement is clear and understandable.

Other Key air sealing areas that are being addressed by this proposal are

1. The junction of the foundation and sill plate shall be air sealed. (which is original language in this section)
2. The junction of the bottom plate to the subfloor on exterior walls shall be air sealed

Other committee comments have been addressed to streamline and search for better, more concise, and meaningful language to ensure clarity and reduce any confusion.

Bibliography:
https://insulationinstitute.org/wp-content/uploads/2018/05/N090-5-Air-Sealing-Locations-for-New-Homes.pdf

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers clarity of existing requirements

Public Comment# 1759

RE85-19

IECC®: TABLE R402.4.1.1

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R402.4.1.1
AIR BARRIER, AIR SEALING, AND INSULATION INSTALLATION[a,b]

COMPONENT	AIR BARRIER CRITERIA	INSULATION INSTALLATION CRITERIA
General requirements	A continuous air barrier shall be installed in thebuilding envelope.The exterior thermal envelope contains a continuousair barrier.Breaks or joints in the air barrier shall be sealed.	Air-permeable insulation shall not be used as asealing material.
Ceiling/attic	The air barrier in any dropped ceiling or soffit shall bealigned with the insulation and any gaps in the airbarrier shall be sealed.Access openings, drop down stairs or knee wall doorsto unconditioned attic spaces shall be sealed.	The insulation in any dropped ceiling/soffit shallbe aligned with the air barrier.
Walls	The junction of the foundation and sill plate shall besealed.The junction of the top plate and the top of exteriorwalls shall be sealed.Knee walls shall be sealed.	Cavities within corners and headers of framewalls shall be insulated by completely filling thecavity with a material having a thermal resistance, R-value, of not less than R-3 per inch.Exterior thermal envelope insulation for framedwalls shall be installed in substantial contact andcontinuous alignment with the air barrier.
Windows, skylights and doors	The space between framing and skylights, and the jambsof windows and doors, shall be sealed.	—
Rim joists	Rim joists shall include the air barrier.	Rim joists shall be insulated.
Floors, including cantilevered floors and floors above garages	The air barrier shall be installed at any exposed edge ofinsulation.	Floor framing cavity insulation shall be installed tomaintain permanent contact with the underside ofsubfloor decking. Alternatively, floor framingcavity insulation shall be in contact with the top sideof sheathing, or continuous insulation installed onthe underside of floor framing; and shall extend from the bottom to the top of all perimeter floorframing members.
Crawl space walls	Exposed earth in unvented crawl spaces shall becovered with a Class I vapor retarder withoverlapping joints taped.	Crawl space insulation, where provided instead offloor insulation, shall be permanently attached tothe walls.
Shafts, penetrations	Duct shafts, utility penetrations, and flue shaftsopening to exterior or unconditioned space shall besealed.	—
Narrow cavities	—	Batts to be installed in narrow cavities shall be cut tofit or narrow cavities shall be filled with insulationthat on installation readily conforms to the availablecavity space.
Garage separation	Air sealing shall be provided between the garage andconditioned spaces.	—
Recessed lighting	Recessed light fixtures installed in the building thermalenvelope shall be sealed to the finished surface.	Recessed light fixtures installed in the buildingthermal envelope shall be air tight and IC rated.
Plumbing and wiring	—	In exterior walls, batt insulation shall be cut neatly tofit around wiring and plumbing, or insulation, thaton installation readily conforms to available space,shall extend behind piping and wiring.
Shower/tub on exterior wall	The air barrier installed at exterior walls adjacent toshowers and tubs shall separate the wall from the shower or tub.	Exterior walls adjacent to showers and tubs shallbe insulated.
Electrical/phone box on exterior walls	The air barrier shall be installed behind electrical andcommunication boxes. Alternatively, air-sealed boxesshall be installed.	—
HVAC register boots	HVAC supply and return register boots that penetrate building thermal envelope shall be sealed to the subfloor, wall covering or ceiling penetrated by the boot.	—
	Where required to be sealed, concealed fire sprinklersshall only be sealed in a manner that is	

Concealed sprinklers	recommendedby the manufacturer. Caulking or other adhesivesealants shall not be used to fill voids between firesprinkler cover plates and walls or ceilings.	—

a. Inspection of log walls shall be in accordance with the provisions of ICC 400.
b.<u>The requirements of this table are mandatory in accordance with Section R402.4 and shall be applied to all components of the *building's thermal envelope.* Building elements not specifically addressed in the table shall be sealed, as appropriate, and consistent with the requirements of this table in order to maintain the continuity of the air barrier.</u>

Reason: The objective of table R402.4.1.1 is to offer guidance for how to create an air tight home that meets the air leakage requirements of the IECC. Air barrier and insulation installation are part of the equation to be able to accomplish this goal, but air sealing is another part of it that is missing from the title. The tables name should accurately reflect what it is intended to do and that is what the proposal aim is.
An additional footnote is being proposed here to first reiterate that the items included in this table are mandatory and second to show that in reality the principals demonstrated in the table are the important mandatory items. The code, and this table in particular cannot address every situation that will arise in the field. Therefore, the principals of installation air barrier, air sealing, and insulation installation demonstrated in the table must be clearly expressed and exemplified in order for builders and trade partners to successfully executed them regardless as unique instances of construction and installation occur.

For example, the table reinforces the need for the continuity of the air barrier assembly and its alignment with the thermal barrier of the home. The components described in the table express many of the situations where this must be executed but it can't explain every unique knee wall, tub, or fire fireplace surround. Therefore, the principals embodies in the table are used to successfully execute the continuity of the air barrier and alignment with insulation throughout the building thermal envelope.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction but rather offers guidance and clarity of existing requirements.

RE85-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: It changes nothing in the code and the language does not make it more clear (Vote: 10-1).

Assembly Action: **None**

RE85-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests As Submitted

Commenter's Reason: While this Code Change Proposal may not make the language of the Code more clear, it does make the Code for enforceable. A prescriptive list of air-sealing measures will never be comprehensive as changes in construction techniques and technology will change the types of penetrations through an envelope. For example, while the existing table calls out shower and tub walls for air-sealing it does not mention fireplace walls. Similarly tv-cable boxes are not mentioned even though electrical and phone are. Common sense says all of these need to be sealed at the exterior walls. A strict reading of the Codes does not however. This additional language gives the code inspector the necessary leeway and backing and the construction team the necessary understanding to achieve the Code objectives in a common sense way.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposed language does not increase the cost of construction because it offers only guidance and clarity of existing requirements.

RE88-19

IECC: R202 (IRC N1101.6), R402.4.1.2 (IRC N1102.4.1.2) , R403.6 (IRC N1103.6)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com); Joseph Lstiburek, representing self (joe@buildingscience.com); Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6)
GENERAL DEFINITIONS

Add new definition as follows:

DWELLING UNIT ENCLOSURE AREA. The sum of the area of ceiling, floors, and walls separating a dwelling unit's conditioned space from the exterior or from adjacent conditioned or unconditioned spaces. Wall height shall be measured from the finished floor of the *dwelling unit* to the underside of the floor above.

R402.4 (IRC N1102.4) Air leakage (Mandatory). The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

Revise as follows:

R402.4.1.2 (IRC N1102.4.1.2) Testing. The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in *Climate Zones* 1 and 2, and three air changes per hour in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

Exception: An air leakage rate not exceeding 0.30 cfm per ft^2 of the dwelling unit enclosure area shall be an accepted alternative in all *climate zones* for:

1.Attached single and multifamily building dwelling units.
2.Buildings or dwelling units that are 1500 square feet or smaller.

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). The *building* *and each dwelling unit* shall be provided with ~~ventilation that complies~~ mechanical ventilation. The mechanical ventilation system shall comply with the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Reason: Air changes per hour (ACH) is a volumetric calculation that is used to express air exchanges in a home when the house is brought to 50 Pascal's pressure with relation to outside. It is calculated using the house volume and the cubic feet per minute airflow rate as measured at the blower door to reflect the number of times each hour the volume of air in the house is exchanged with the outside. Although it can be used to express the air leakage rate of an efficient or inefficient home, it does not have a direct correlation with the holes through which air is passing and, therefore, is not a measurement that is best used to quantify how air tight a dwelling is. This is especially true for small volume and attached dwellings.

This proposal introduces an exception to using ACH to quantify air leakage in attached and small volume dwelling units because ACH is biased against small volume and attached dwellings. Although it is not difficult to get a single-family median size home to pass 3 or 5 ACH as required by the IECC, it is significantly difficult to get a small volume and or an attached home to pass. The alternative metric more accurately reflects leakage through the exterior enclosure area which removes built in volumetric bias while continuing to ensure a tight structure.

The alternative metric uses a cubic foot per minute (CFM) per square foot (ft^2) of dwelling unit enclosure area metric to demonstrate compliance with the IECC. This metric allows the air leakage measured at 50 Pascals divided by the building surface area to be used to assess the air tightness of the building enclosure. Unlike ACH, a CFM/ ft^2 of dwelling unit enclosure area normalizes the building air leakage per unit of building envelope surface area, the actual location where air is infiltrating or exfiltrating the dwelling regardless of where the air is coming from, which removes the volumetric bias that is causing small volume and attached dwellings units to fail the code require blower door test. In addition, it is not possible to only measure air leakage to the ambient outdoors in attached dwellings which is what ACH assumes. The air leakage measurement is actually quantifying the leakage that is coming from attached dwellings, stairs, elevator shafts or other parts of the building that may be connected to the living space of the tested unit. Air leakage from a conditioned space to any other space, as well as, two the ambient outdoors continues to be an energy efficiency issue, but it also is a health issue from an indoor air quality perspective, as well as, a building durability issue from a building science perspective. Reducing air leakage from all surfaces of the building enclosure promotes the IECC's intent while providing a metric that makes better sense for the building type in question.

The use of a more accurate reflection of air leakage that better represents the distribution of holes that are occurring in the building enclosure has begun to be adopted in programs such as EnergyStar, LEED, and Passive House and by standards created by the US Army Corp of Engineers and ASHRAE. Largely this is happening in multifamily construction as looking at the CFM/ft^2 of building enclosure area better represents leakage that is occurring in an attached dwelling unit. However, small volume is also a significant issue which this proposal addresses. The CFM/ft^2 of enclosure area will allow both small volume and attached dwellings to be more successful at meeting the intent and requirements of the code.

The proposal also defines "Dwelling Unit Enclosure Area" as the sum of the area of ceiling, floors, and walls separating a dwelling unit's conditioned space from the exterior or from adjacent conditioned or unconditioned spaces. In addition, the definition offers a small piece of defined guidance in order to further understand the measurement that must take place to calculate the dwelling unit enclosure area. This guidance states that the wall height shall be measured from the finished floor of the dwelling unit to the underside of the floor above. Lastly, the proposal ensures that the intent of the code, to ensure that the structure is built tight and ventilated correctly with mechanical ventilation, is maintained. If this exception is adopted into the code, as proposed, then ventilation must also be ensured regardless of how air tightness of the structure is expressed.

Why the change to R403.6?

It was pointed out in the last code cycle, that this metric could have an unintended loophole since it is not used in the IRC. To avoid that, the section was edited to to ensure whole house mechanical ventilation continues to be required and installed

Why The change to IRC 303.4?

It was pointed out in the last code cycle, that this metric could have an unintended loophole since it is not used in the IRC. To avoid that, the section was edited to ensure whole house mechanical ventilation continues to be required and installed

Cost Impact: The code change proposal will decrease the cost of construction
This proposal would reduce cost for the following reasons.

- Some jurisdictions nationally allow Guarded testing, an alternative blower door testing method that attempts to only quantify air leakage between conditioned space and the outdoors. This testing method requires multiple individuals and blower doors to be run simultaneously. Using a CFM/ft^2 of enclosure area Metric ensures a tight building thermal enclosure in the most cost-effective way by only requiring one tester and piece of equipment per test.
- Air leakage pathways depend on the type of area separation assembly that is used between attached units. Some assemblies such as shaft liner areas separation walls are fairly tight from unit to unit and leak substantially to the outdoors while others promote leakage between units, common spaces, and other defined unconditioned spaces in the building. An enclosure test for attached dwellings allows for identification of the most cost-effective air sealing option per assembly that is chosen.
- Air sealing of exterior walls in mid to large size single family homes has become cost effective, repeatable, and achievable. Small volume homes don't have the same opportunities for sealing as volume is the primary driver not the number or size of holes to the exterior. Therefore, multiple re-inspections are needed and additional application of air sealing measures to chase down very small reductions in air leakage that still don't result in passing 3 and in some cases 5 ACH occur. A more reasonable metric for small volume dwelling would result in more passing units and less re-inspections while still meeting the tightness goals of the code.
- In attached housing there is an additional fire and air separation wall, floor, and or ceiling where often only a limited amount of air sealing is allowed. However, with a reasonable metric such a 0.30 CFM/ft^2 of enclosure area one is looking at the entire surface area. This creates parity with single family homes as they have the opportunity to address all surfaces of the dwelling when seeking to reduce the infiltration rate to pass the requirements of code.
- The value of allowing an exception to use 0.30 CFM/ft^2 of enclosure area is that air-sealing varies directly with the amount of surface area. Two dwellings can have surface area that differs by 15%, but still have the same volume and the current metric offers the same leakage allowance. If the surface area can be addressed in the measurement than the playing field is leveled and attached and small volume dwelling units would not have the problems passing the IECC.

RE88-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
R402.4.1.2 (IRC N1102.4.1.2) Testing. The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in *Climate Zones* 1 and 2, and three air changes per hour in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

Exception: When testing individual dwelling units, an air leakage rate not exceeding 0.30 cfm per ft^2 of the dwelling unit enclosure area, tested in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals), shall be ~~an accepted alternative~~ permitted in all *climate zones* for:

1. Attached single and multifamily building dwelling units.
2. Buildings or dwelling units that are 1500 square feet or smaller.

Mechanical ventilation shall be provided in accordance with Section M1505 of the International Residential Code or Section 403.3.2 of the International Mechanical Code, as applicable, or with other approved means of ventilation.

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). The *building* ~~*and each dwelling unit*~~ shall be provided with ~~mechanical~~ ventilation ~~. The mechanical ventilation system shall~~ that complies with the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Committee Reason: The proposal will help solve a lot problems for testing smaller units, the modification adds a needed standard (Vote: 10-1).

Assembly Action: **None**

RE88-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.4.1.2 (IRC N1102.4.1.2)

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R402.4.1.2 (IRC N1102.4.1.2) Testing. The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in *Climate Zones* 1 and 2, and three air changes per hour in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

   Exception: When testing individual dwelling units, an air leakage rate not exceeding 0.~~30~~ 28 cfm per ~~ft²~~ square foot of the dwelling unit enclosure area shall be an accepted alternative in Climate Zones 1 and 2 and 0.17 cfm per square foot shall be an acceptable alternative in Climate Zones 3 through 8, tested in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals), ~~shall be permitted in all *climate zones*~~ for:

   1. Attached single and multifamily building dwelling units.
   2. Buildings or dwelling units that are 1500 square feet or smaller.

   Mechanical ventilation shall be provided in accordance with Section M1505 of the International Residential Code or Section 403.3.2 of the International Mechanical Code, as applicable, or with other approved means of ventilation.

Commenter's Reason: This proposal should be approved as modified or, if not modified, disapproved. The Committee recommended approval of both RE88 and RE92. The two proposals are inconsistent as to values and application. This modification is intended to reconcile the differences between the two proposals by utilizing the more stringent cfm per square foot requirements of RE92 with the limited applicability of RE88 (applies to smaller homes and attached dwelling units). If RE88 is not modified, then the current code, or at least RE92, with the more stringent values, would be preferable. Our assessment is that the value proposed in RE88 (0.30 cfm) is a significant rollback in climate zones 3-8, where the current requirement for all homes is 3 ACH50. 0.17 cfm per square foot is a more comparable/acceptable value for these climate zones. To the extent that builders need additional flexibility to achieve air tightness requirements for multifamily dwelling units, we note that RE96, which was approved by the Committee and supported by a broad group of stakeholders, will already allow air leakage trade-offs up to 5 ACH50, as long as the efficiency losses are accounted for elsewhere in the unit.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
While the modification in this public comment adopts the more stringent air leakage requirement included in RE92, it still provides new options for testing air tightness in attached dwelling units and small single-family homes. We agree with the proponent that this additional flexibility could result in reduced costs in some cases. Since this is a new option, we assume that builders would only select it when it reduces costs as compared to current code requirements.

Public Comment# 1499

Public Comment 2:

IECC®: (New)

Proponents:
Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David A Eisenberg, DCAT, representing DCAT (strawnet@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

DWELLING UNIT ENCLOSURE AREA. The sum of the areas of ceiling s, floors, and walls that ~~separating~~ separate the conditioned space of a dwelling unit~~'s conditioned space~~ from the exterior , ~~or from~~ its adjacent ~~conditioned or~~ unconditioned spaces , and adjacent dwelling units and common spaces. ~~Wall height shall be measured from the finished floor of the *dwelling unit* to the underside of the floor above.~~

Commenter's Reason: This public comment does the following:

- Changes the definition of the term "dwelling unit enclosure area" to be consistent with the source definition in ASHRAE 62.2-2016 and that definition's intent.
- Removes ambiguous language from the proposal's definition while retaining its intent, as understood through communication with the proposal's team members.
- The word "or" is replaced with the word "and", with input from ICC staff. "And" is clearly the intent, where all of the included adjacency situations are meant to be included in calculating the dwelling unit enclosure area, not only any one of them. "And" is also the word used in the source definition.
- Strikes the last sentence in the proposal's definition because that sentence is not in the source definition and because the vertical dimension used to determine wall area is self evident.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment changes a definition only, and does not affect cost.

Public Comment# 1963

RE92-19

IECC®: SECTION R202 (IRC N1101.6), (New), R402.4 (IRC N1101.6), R402.4.1.2 (IRC N1102.4.1.2), SECTION R403 (IRC N1103), R403.6 (IRC N1103.6)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6)
GENERAL DEFINITIONS

Add new text as follows:

DWELLING UNIT ENCLOSURE AREA. The sum of the area of ceiling, floors, and walls separating a dwelling unit's conditioned space from the exterior or from adjacent conditioned or unconditioned spaces. Wall height shall be measured from the finished floor of the *dwelling unit* to the underside of the floor above.

Revise as follows:

R402.4 (IRC N1101.6) Air leakage (Mandatory). The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

R402.4.1.2 (IRC N1102.4.1.2) Testing. The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour or 0.28 cubic feet per minute (CFM) per square foot (ft^2) of d*welling unit enclosure area* in *Climate Zones* 1 and 2, and three air changes per hour or 0.17 CFM per (ft^2) of d*welling unit enclosure area* in in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

SECTION R403 (IRC N1103)
SYSTEMS

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). ~~The *building*~~ Each dwelling unit shall be provided with mechanical ventilation ~~that complies~~ . The mechanical ventilation system shall comply with the requirements of the International Residential Code or International Mechanical Code , as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Reason: Air changes per hour (ACH) is a volumetric metric that is useful for air quality measurements in buildings but is not the correct expression of air leakage from an energy or building durability perspective. This proposal introduces the ability to use an alternative cubic foot per minute (CFM) per square foot (ft^2) of dwelling unit enclosure area metric for measuring air leakage in a building. In this way, the air leakage measured at 50 Pascals divided by the building surface area is used to assess the airtightness of the construction and building envelope. Unlike ACH, a CFM/ ft^2 of dwelling unit enclosure area metric normalizes the building air leakage per unit of building envelope surface area; the actual location where air is infiltrating or exfiltrating the building. To this end, the proposal also defines "Dwelling Unit Enclosure Area" as the sum of the area of ceiling, floors, and walls separating a dwelling unit's conditioned space from the exterior or from adjacent conditioned or unconditioned spaces. In addition, the definition offers guidance to further understand the measurement that must take place to calculate the dwelling unit enclosure area. This guidance states that the wall height shall be measured from the finished floor of the dwelling unit to the underside of the floor above. Lastly, the proposal ensures that the intent of the code, to ensure that the structure is built tight and ventilated correctly with mechanical ventilation, is maintained. If an additional option is adopted into the code, as proposed, then ventilation must also be ensured regardless of how air tightness of the structure is expressed.
Since 1980, The Energy Conservatory, has not only been a leader in air leakage science, but also one of the prominent manufacturers of the blower door air measurement tool. In their article, "Which Is A Better Metric For Measuring Airtightness: ACH @ 50 Pa Or CFM/ Ft^2 Of Surface Area @ 50

Pa?", which is adapted and added to in this reason statement, we get the basis of the argument for the introduction of a new metric into the International Energy Conservation Code for the measurement of air leakage.

To paraphrase, when measuring the airtightness of a building the objective is to learn how much leakage is occurring across the building's enclosure area. It is analogous to moisture permeability or the measurement of moisture across the building's enclosure area and thermal transmittance, the rate at which heat is transferred across the building enclosure area. The rate of air leakage or tightness does not depend on the volume of the structure as defined by the building's enclosure area but does depend on the holes associated with the surface area of the structure. Air permeability of a material is typically measured as the flow per area at a given pressure difference across the material. U value measurements are similar. If we want a metric to use to measure the airtightness quality of construction of the exterior enclosure of buildings it makes sense to use a metric that equates flow to the size and number of holes in the building's thermal enclosure.

The article continues with an example to help demonstrate how volume is not proportional to surface area:

Comparison between ACH50 and CFM50/ft² for a 2000 ft² home at 3 ACH50

House Is 50 X 40 X 8

Volume = 16,000 ft³

Surface Area = 50 X 40 X 2 + 180 X 8 = 5440 ft²

CFM50 = (3 X 16000)/60 = 800 CFM

CFM50/ft2 = 800/5440 = 0.147 CFM50/ft²

Increase height to 2 story at 3 ACH50

House Is 50 X 40 X 16 Volume = 32,000 ft³

Surface area = 50 X 40 X 2 + 180 X 16 = 6880 ft²

CFM50 = (3 X 32000)/60 = 1600 cfm

CFM50/ft2 = 1600/6880 = 0.233 CFM50/ft²

In this example, when the volume is doubled, the surface area increased by 26%. And when the ACH50 stays the same, the CFM/ ft² of surface area increased by 58%. I have attached an Excel spreadsheet calculator that further defines the disconnect between ACH and CFM/ ft² of surface area to further elaborate the issue. In the attached calculator you can change the ratio of width and length of the building to see the effect on the resulting expressions of air leakage. An independent yet similar calculator can be found at this Residential Energy Dynamic link http://www.residentialenergydynamics.com/REDCalcFree/Tools/AirLeakageMetrics

The primary purpose of this code change proposal is to introduce the CFM/ft² of surface area metric into the code. Deciding on where to set the minimum allowable leakage rate is difficult largely due to the earlier volume and surface area discussion. Both tests are performed at a pressure differential of 0.2 inch water gauge (50 Pa), which is a the traditional residential testing pressure so an attempt was made to align the introduction of a CFM/ft² of surface area metric with the existing ACH50 matric of 3 and 5 air changes per hour. ACH being a volumetric measurement penalized small volume dwelling units so a decision was made to concentrate on a size range of dwellings between 2500 and 5500 square feet. By doing this and using the attached conditioned floor space to shell area calculator we were able to see that little variation occurred between ACH and CFM/ft² of surface area metric when changing the size ratio of the modeled house within this house size range. By rounding up, the proposal is using .17 CFM/ft² of surface area metric to align with 3 ACH and .28 CFM/ft² of surface area metric to align with 5 ACH. By using these numbers, small volume homes, while not having a volumetric penalty, are allowed to be a little more leaky and large volume homes must achieve just about the same level of tightness if not a slight bit more. As the average home size in the United States is approximately just less than 2500 square feet this code change proposals purpose of introducing a better measurement metric without removing the codes traditional measurement methodology, provid additional flexibility while maintaining similar stringency.

The Energy Conservatory suggests that the use of Air Changes per Hour at 50 Pa (ACH50) started approximately 60 years ago by researchers who were interested in ways to predict the natural infiltration rate of buildings, which at the time was most commonly measured in Air Changes per Hour. At the time air quality in buildings was being studied and the metric made sense. If a pollutant is released in a building, the time for the concentration to decay by a certain percentage depends on the infiltration measured in air changes per hour. The analysis of a tracer gas decay test gives a result in air changes per hour. So, when they started measuring airtightness, for use in estimating natural infiltration in air changes per hour, it made sense to use ACH50 as the metric.

However, as discussed earlier, two homes with the same volume can have very different surface areas and holes associated with the building enclosure area.

Value is gained by including a surface area-based metric in that air-sealing varies directly with the amount of surface area not the amount of volume in the dwelling. Two buildings can have surface areas that differs by 15%, but have the same volume and the current metric offers the same leakage allowance. Therefore, if the purpose of measuring air leakage is to determine something about the construction quality, air leakage rate, energy efficiency and building durability the metric should be associated with the flow of air through holes in the enclosure. To quantify these things ACH is the wrong metric. It does not tell you anything about the quantity and air leakage through holes in the building. Conversely, the CFM/ ft² of surface area metric concretely expresses the quantity of air leakage throught the building's exterior enclosure. When an enclosure is tight more energy is conserved as well as allowing better control and predictability of air flow, thermal flow, and moisture flow.

Many standards are now using square foot of enclosure area instead of ACH. Examples include EnergyStar, US Army Corp of Engineers, LEED, US Passive House and ASHRAE 62.2. This proposal is the first step to bring this better expression of air leakage into the code. It has been created in such a way that options are maintained allowing jurisdictions and building professionals flexibility in defining air leakage requirements.

Link to Energy Conservatory article from which portions of this reason statement have been added:

https://support.energyconservatory.com/hc/en-us/articles/204176240-Which-is-a-better-metric-for-measuring-airtightness-ACH-50-Pa-or-CFM-ft-of-surface-area-50-Pa-

Cost Impact: The code change proposal will not increase or decrease the cost of construction
There should be no cost implication associated with the adoption of this proposed language. Dwellings will continue to need to be tested and testing prices will not change due to an additional option for how to express the results of the test.

RE92-19

Public Hearing Results

Committee Action: As Modified

Committee Modification:
R303.4 Mechanical ventilation. Where the air infiltration rate of a *dwelling unit* is 5 air changes per hour or less <u>or equal to 0.28 cubic feet per minute per square foot of dwelling unit enclosure area or less</u> where tested with a blower door at a pressure of 0.2 inch w.c (50 Pa) in accordance with Section N1102.4.1.2, the *dwelling unit* shall be provided with whole-house mechanical ventilation in accordance with Section M1505.4.

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). The Building ~~Each dwelling unit~~ shall be provided with ~~mechanical~~ ventilation <u>that complies</u> ~~. The mechanical ventilation system shall comply~~ with the requirements of the International Residential Code or International Mechanical Code , as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Committee Reason: The proposal as modified adds a better option that opens up opportunity for improved energy efficiency. The modifications bring in the detailed requirements is necessary to make this proposal work, and add another metric that is needed for this code change (Vote: 9-2).

Assembly Action: None

RE92-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.4 (IRC N1102.4), (New)

Proponents:
Martin Hammer, representing Martin Hammer, Architect (mfhammer@pacbell.net); David A Eisenberg, DCAT, representing DCAT

(strawnet@gmail.com)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R402.4 ~~(IRC N1101.6)~~ (IRC N1102.4) Air leakage (Mandatory). The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

DWELLING UNIT ENCLOSURE AREA. The sum of the areas of ceilings, floors, and walls that ~~separating~~ separate the conditioned space of a dwelling unit~~'s conditioned space~~ from the exterior, ~~or from~~ its adjacent ~~conditioned or~~ unconditioned spaces, and adjacent dwelling units and common spaces. ~~Wall height shall be measured from the finished floor of the *dwelling unit* to the underside of the floor above.~~

Commenter's Reason: This public comment does the following:

- Changes the definition of the term "dwelling unit enclosure area" to be consistent with the source definition in ASHRAE 62.2-2016 and that definition's intent.
- Removes ambiguous language from the proposal's definition while retaining its intent, as understood through communication with the proposal's team members.
- The word "or" is replaced with the word "and", with input from ICC staff. "And" is clearly the intent, where all of the included adjacency situations are meant to be included in calculating the dwelling unit enclosure area, not only any one of them. "And" is also the word used in the source definition.
- Strikes the last sentence in the proposal's definition because that sentence is not in the source definition and because the vertical dimension used to determine wall area is self evident.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment only corrects a section number and clarifies a definition. Section number corrections and clarifications do not affect the cost of construction.

Public Comment# 1961

Public Comment 2:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved. The Committee recommended approval of both RE88 and RE92. The two proposals are inconsistent as to values and application. We have proposed a modification to RE88, which is intended to reconcile the differences between the two proposals by utilizing the more stringent cfm per square foot requirements of RE92 with the limited applicability of RE88 (applies to smaller homes and attached dwelling units). If RE88 is modified, then there is no need for RE92, as larger homes can simply meet the ACH50 standard and, as a result, RE92 should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1500

RE94-19

IECC: R402.4.1.3 (IRC N1102.4.1.3) (New)

Proposed Change as Submitted

Proponents: Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

R402.4 Air leakage (Mandatory). The *building thermal envelope* shall be constructed to limit air leakage in accordance with the requirements of Sections R402.4.1 through R402.4.5.

R402.4.1.2 Testing. The *building* or dwelling unit shall be tested and verified as having an air leakage rate not exceeding five air changes per hour in *Climate Zones* 1 and 2, and three air changes per hour in *Climate Zones* 3 through 8. Testing shall be conducted in accordance with RESNET/ICC 380, ASTM E 779 or ASTM E 1827 and reported at a pressure of 0.2 inch w.g. (50 Pascals). Where required by the *code official*, testing shall be conducted by an *approved* third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*. Testing shall be performed at any time after creation of all penetrations of the *building thermal envelope*.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed, beyond the intended weatherstripping or other infiltration control measures.
2. Dampers including exhaust, intake, makeup air, backdraft and flue dampers shall be closed, but not sealed beyond intended infiltration control measures.
3. Interior doors, where installed at the time of the test, shall be open.
4. Exterior or interior terminations for continuous ventilation systems shall be sealed.
5. Heating and cooling systems, where installed at the time of the test, shall be turned off.
6. Supply and return registers, where installed at the time of the test, shall be fully open.

Add new text as follows:

R402.4.1.3 (IRC N1102.4.1.3) Testing Garage Separation. The integrity of the air barrier assembly between dwelling units and attached garages shall pass a two-part test.

1. While conducting the air leakage test as described in Section R402.4.1.2 the air barrier separation between the house and the garage shall be tested to ensure that the house in reference to the garage is ≥ 45 Pascals of pressure when the house is held at 50 Pascals of pressure in relation to outside. All operable garage openings to the outside shall be closed during the test.
2. If test number 1 passes, the test shall be performed a second time with the garage vehicle door open to the ambient outside. The two test results shall not differ by more than 6 percent.

Reason: The energy code, like all code, is about health, safety, comfort, durability, as well as efficiency. The garage is the largest potential source of pollutants and carbon monoxide in the house and it has been codified in table R402.4.1.1 to ensure that the air in the garage is separated from the house. Air from an attached garage can enter the living space of the home if there are bypasses in the air barrier between the two spaces and if the home is at a negative pressure with respect to the garage. Negative pressures may be due to natural forces or to mechanical depressurization of the house with respect to the garage caused by appliances like rangehood fans, clothes dryers, bath fans, crawlspace ventilation or whole house ventilation systems, as well as, unbalanced HVAC systems. Unfortunately, there is no way to be sure that separation has been achieved, in this location, unless the separation is tested. Fortunately testing for separation between the house and garage is simple and is made even more practical due to the requirement to blower door test for every home.
The surest way to keep garage pollutants out of the house is to build a detached garage. Since most houses are designed with attached garages, planning ahead of construction to make sure a continuous air barrier is installed between the house and the garage makes sense. This proposal will promote such planning.

To ensure that there is not a false positive result Building America research has determined that the test requires two steps. First, while the house is at 50 Pascals of pressure with regards to outside during the blower door test a zonal pressure test is performed by installing a tube between the house and the garage. (Usually under the door between the house and the garage) If the garage is clearly outside, the measurement between the house and the garage should also be 50 Pascals of pressure. The closer the measurement is to zero the more connected the garage is to the house. This code proposal requires that the results of the first test be ≥ 45 pascals which is an indication that the air barrier assembly between the house and garage is sound. The first test is performed when all openings between the garage and the outside are closed. Second, this test is repeated with the overhead vehicle door open. If the results of the second test are greater than 6% the connection between the house and the garage tests fails. The rationale for the second test is to guard against false positive results that can occur while performing the first test.

If we continue to require separation between the house and the garage from an energy efficiency perspective, we must also test to ensure it from a health and safety perspective in order to maintain the intent of the IECC. Programs such as the EPA Indoor Air Plus and the DOE Zero Energy Ready Home program have incorporated the protocol described above to test for this separation. In addition, Jurisdictions around the country, such as Fort Collins Colorado have amended the IECC to require this test as they realize the energy and health and safety implications.

People have asked if garage separation is really an issue. Past research, as pointed out in the Building America Program research paper titled “Air Leakage and Air Transfer between Garage and Living Space” says yes. An excerpt of a study done by S.J. Emmerich used in the Building America paper, reports that polluted garage air infiltrated into living quarters was as much as 45% of total house infiltration. See the attached research paper for more evidence of carbon monoxide and other pollutants traveling between attached garages and the house and the bibliography of numerous studies that have documented that pollutants from the garage are capable of migrating into the house.

The problem is that one cannot know for sure if the garage is connected to the house unless one tests. The complexities of the assemblies separating the house and the garage, with dropped ceilings, pipe, ducts, wiring and who knows what else penetrating the buildings thermal envelope and air barrier systems, make it an extremely difficult part of the house to seal. What we do know is that automobiles are the largest source of carbon monoxide in our home and they are parked in attached garages. We also know that other pollutants such as gasoline, pesticides, and paints are stored in attached garages. Therefore, to not test is clearly against the health and safety intent of the code and ultimately places builders and homebuyers at risk.

Resources:

US Department of Energy Building Technologies Office

Building America Program

“Air Leakage and Air Transfer between Garage and Living Space”

Armin Rudd Building Science Corporation

September 2014

Air Sealing and Insulating Garage Walls - Code Compliance Brief

https://basc.pnnl.gov/code-compliance/air-sealing-and-insulating-garage-walls-code-compliance-brief

Overview:

The intent of this brief is to provide code-specific information about air sealing and insulating garage walls to help ensure that the measure will be accepted as being in compliance with the code. Providing notes for code officials on how to plan reviews and conduct field inspections can help builders or remodelers with proposed designs and installations and provide jurisdictional officials with information for acceptance. Providing the same information to all interested parties (e.g., code officials, builders, designers, etc.) is expected to result in increased compliance and fewer innovations being questioned at the time of plan review and/or field inspection.

As in other parts of the home, sealing and insulating the walls and ceiling of your garage can be an effective way to improve energy efficiency in a home. In addition, properly isolating and air sealing attached garages from the living space is critical for preventing the potential infiltration of carbon monoxide and other contaminants into the home. Open joist bays above the garage that extend into living spaces need to be blocked and air sealed at the garage wall. Seams along the rim joist, top plate, sill plate, and foundation wall should be caulked or sealed. If there is living space above the garage, extra care should be taken to seal all seams and any holes in the subfloor, and any doors between the house and the garage should be weather stripped and have a tight-fitting threshold sweep.

Insulation and air-sealing requirements for garage walls shared with conditioned space are found in the International Energy Conservation Code (IECC) and International Residential Code (IRC). Even though each version of the 2009, 2012, and 2015 IECC/IRC codes has included provisions that the *building thermal envelope*[1] should be durably sealed to limit infiltration, the language related to air barriers and insulation in the 2009 version was somewhat vague and did not specify specific components of the *building thermal envelope*. The 2012 IECC/IRC added more specific language regarding areas of the *building thermal envelope* that should be sealed and expanded upon those areas that are now included in the 2015 IECC/IRC as well. This brief provides an overview of the 2009 through 2015 IRC/IECC code requirements related to air sealing and insulating attached garage walls.

Cost Impact: The code change proposal will increase the cost of construction
The cost implication of this proposal is small as this test must be performed at the same time as the blower door test described in section R4052.4.1.2. The garage separation test will add approximately 15 minutes to the testing that is already being performed so may add between $25 and $50. If the test fails it is an indication that already required code air sealing scopes of work are not being performed properly. This should require greater attention to detail rather than additional cost from the air sealing contractor.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Testing the integrity of the wall for separation of garage and living area air is not an energy code issue, it is an IRC issue (Vote: 9-2).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Submitted

Commenter's Reason: Public Comment Reason Statement
I don't agree with the committee that the separation of the house and garage is solely an IRC issue. It is also an IECC issue as the integrity of the air barrier is critical in this location and air barriers are primarily discussed in the IECC, not the IRC. Garage Separation is addressed in the IECC in table R402.4.1.1 and floors over garages are addressed in other areas to ensure that a tight house is built and separation is created. This proposal quantifies what separation means, as it is, in its essence, why the IECC is also a health and safety code that needs to be taken as seriously as any other code and why many proposals at the CAH sought to address life safety in the IECC intent statement of Section R101.3.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost implication of this proposal is small as this test must be performed at the same time as the blower door test described in section R4052.4.1.2. The garage separation test will add approximately 15 minutes to the testing that is already being performed so may add between $25 and $50. If the test fails it is an indication that already required code air sealing scopes of work are not being performed properly. This should require greater attention to detail rather than additional cost from the air sealing contractor.

Public Comment# 1903

RE95-19

IECC: R402.4.1.3 (IRC N1102.4.1.3) (New), R402.4.1.3.1 (IRC N1102.4.1.3.1) (New), R402.4.1.3.2 (IRC N1102.4.1.3.2) (New)

Proposed Change as Submitted

Proponents: Aaron Gary, Tempo Partners, representing Self (aaron.gary@tempopartners.com)

2018 International Energy Conservation Code

Add new text as follows:

R402.4.1.3 (IRC N1102.4.1.3) Sampling options for R2 multifamily dwelling units. For buildings having three or more dwelling units, a minimum of 15% of the dwelling units in each building must be tested as required by Section R402.4.1.2. Prior to beginning sampling for testing, “Initial Testing” is required for each multifamily property. “Initial Testing” shall consist of the 3rd party testing contractor performing the required tests on at least three consecutive dwelling units. Test results from the “Initial Testing” must satisfy minimum code requirements before sampling is permitted. Dwelling units selected for the “Initial Testing” must be within the same building. Dwelling units selected for “Initial Testing” shall not be included in a “sample group” or counted toward the minimum 15% of dwelling units tested. The building official shall randomly select the three dwelling units for “Initial Testing.” The building official may delegate the random selection to the designated 3rd party testing contractor.

R402.4.1.3.1 (IRC N1102.4.1.3.1) Sample group Identification and Sampling. The builder shall identify a "sample group" which may be a building, floor, fire area or portion thereof. All of the dwelling units within the “sample group” must be at the same stage of construction and must be ready for testing. The building official shall randomly select at least 15% of dwelling units from each “sample group” for testing. The building official may delegate the random selection to the designated 3rd party testing contractor.

If each tested dwelling unit within a “sample group” meets the minimum code requirements, then all dwelling units in the “sample group” are considered to meet the minimum code requirements.

Before a building may be deemed compliant with the testing as required, each “sample group” must be deemed compliant with the minimum code requirements. The sum total of all of the tested dwelling units across all “sample groups” shall not be less than a minimum of 15% of the dwelling units in a building.

R402.4.1.3.2 (IRC N1102.4.1.3.2) Failure to Meet Code Requirement(s). If any dwelling units within the identified “sample group” fail to meet a code requirement as determined by testing, the builder will be directed to correct the cause(s) of failure, and 30% of the remaining dwelling units in the “sample group” will be randomly selected for testing by the building official, or third-party testing contractor, regarding the specific cause(s) of failure.

If any failures occur in the additional dwelling units, all remaining dwelling units in the sample group must be individually tested for code compliance.

A multifamily property with three failures within a 90-day period is no longer eligible to use the sampling protocol in that community or project until successfully repeating "Initial Testing." Sampling may be reinstated after at least three consecutive dwelling units are individually verified to meet all code requirements.

A Certificate of Occupancy may not may be issued for any building until testing has been performed and deemed to satisfy the minimum code requirements on the dwelling unit(s) identified for testing.

Reason: For many multifamily (R2 classifications) projects, it is very costly and time consuming to test each dwelling unit for projects where there may be dozens of dwelling units in each building. Considering that the same tradesman generally constructs a building, it is reasonable to deem that construction practices are consistent and that if a reasonable sampling of units tested pass then all units would pass. These amendments (originally drafted by the North Texas Council of Governments Energy and Green Advisory Board) or are very similar ordinances, have been accepted across Texas by the EHJs including the City of Dallas, the City of Austin, and the City of San Antonio.

Cost Impact: The code change proposal will decrease the cost of construction
This code change proposal will streamline the cost and time required to conduct on-site verification of Code which will result in lower testing costs and faster construction timelines.

RE95-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The sampling criteria as it is written is not code-ready (Vote: 7-4).

Assembly Action: **None**

RE95-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.4.1.3 (New)

Proponents:
Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

R402.4.1.3 Sampling for multifamily dwelling and sleeping units. Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit shall be considered an individual testing unit and the building air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's testing unit enclosure area. Units shall be tested separately with an unguarded blower door test as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units the greater of seven units or 20 percent of the testing units in the building shall be tested including a top floor unit, a ground floor unit, and a unit with the largest testing unit enclosure area. For each tested unit that exceeds the maximum air leakage rate, additional units shall be tested, including a mixture of testing unit types and locations.

Commenter's Reason: The reason statement for disapproval given by the Committee was that, "The sampling criteria as it is written is not code-ready." The revised language proposed achieves the same intent of the original proposal but using better code-ready language. This revised sampling language was overwhelmingly approved by the Commercial Energy Committee for the testing of multifamily dwelling units.

Bibliography: 2019 REPORT OF THE COMMITTEE ACTION HEARINGS ON THE 2018 EDITIONS OF THE GROUP B INTERNATIONAL CODES

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This replacement proposal streamlines the time required to conduct on-site testing which will translate to better compliance and faster construction timelines.

Public Comment# 2062

Public Comment 2:

Proponents:
Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests As Submitted

Commenter's Reason: This proposal helps to establish a sampling protocol and gives direction to verifiers and code officials on how sampling is to be done. It is over burdensome to require testing of all units in multifamily dwellings – some jurisdictions around the country are already allowing sampling to be done and this protocol gives directions and guidance on how these measures should take place. This proposal has mechanisms in place for when failures occurs and how to handle those appropriately.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This proposal would help decrease the cost of construction. If a sampling protocol is in place then every unit would not need to be tested which would save builders and developers money and third party inspectors the time that it takes to test every unit.

Public Comment# 1417

RE102-19

IECC: R402.4.1.2.1 (IRC N1102.4.1.2.1) (New)

Proposed Change as Submitted

Proponents: Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

2018 International Energy Conservation Code

Add new text as follows:

R402.4.1.2.1 (IRC N1102.4.1.2.1) Multi-unit buildings and single family attached buildings Multi-unit buildings and single family attached buildings shall be tested as a single zone, multiple zones, or as individual dwelling units in accordance with ASTM E779.

Reason: This proposal is very clear and straight forward, it helps to clarify testing in multi-unit buildings. The ASTM E779 standard is referenced in R402.4.1.2 and this standard allows for single, or multiple zone testing. This proposal is just adding clarification to the code for a method that is already allowed. Currently the IECC treats low -rise multifamily buildings of three stories or less like single-family homes and multifamily buildings of four stories or more like commercial buildings. Regardless of height, all multifamily buildings have the same airtightness testing complications to address. Large multiple dwelling buildings are often tested as isolated test zones due to the nature of the actual testing procedures and available equipment needed to depressurize large volumes of conditioned space and this proposal would recognize this challenge for those conducting the testing. By approving this proposal, low -rise multifamily buildings, two-unit dwellings and town houses will avoid these complications, but still be held to the same level of performance as high-rise (R-2) residential as w ell as commercial buildings

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not change the cost of construction. It is adds clarification to something that is already allowed in the code.

RE102-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This adds more options (Vote: 6-5).

Assembly Action: **None**

RE102-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R402.4.1.2.1 (IRC N1102.4.1.2.1) (New)

Proponents:
Gayathri Vijayakumar, representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R402.4.1.2.1 (IRC N1102.4.1.2.1) ~~Multi-unit buildings and single family attached b~~ Buildings other than detached one-family dwellings Multi-zone~~unit~~ buildings , ~~and~~ two-~~single~~ family dwellings, and townhouses ~~attached buildings~~ shall be tested as a single zone , without inducing equal pressures in adjacent zones~~, multiple zones,~~ or shall be tested as individual dwelling units~~ in accordance with ASTM E779~~.

Commenter's Reason: NAHB seeks to clarify air-leakage testing in multi-unit buildings (ie. low-rise apartment bldg., townhouses, 2-family), which is allowed at the building or dwelling unit level. Section 1.4 of ASTM E779 states that "This test method is intended to be used for measuring the airtightness of building envelopes of single-zone buildings. For the purpose of this test method, many multi-zone buildings can be treated as single-

zone buildings by opening interior doors or by inducing equal pressures in adjacent zones."
There is indeed confusion in the industry about the last option, which is often called a "guarded test", where you can test a single dwelling unit while inducing equal pressures in adjacent spaces, which then effectively ignores leakage to/from those adjacent spaces. In apartment buildings, these adjacent spaces can be conditioned (other apartments, corridor) or unconditioned (stairwell, trash chute, elevator shaft, vacant apartment). Approving this code change proposal (RE102) would explicitly allow a test that ignores air leakage from those spaces, meaning a dwelling unit can be code compliant, yet have significant energy losses due to the air leakage to/from those spaces.

Additionally, the proponent didn't offer a different air leakage rate for units using this test, meaning a single family detached home might be limited to 900 CFM50 of leakage when testing the entire envelope, whereas an attached unit of the same size gets the same exact leakage allowance, but is only counting air leakage through 20-50% of its envelope. They stated that their proposal would hold these buildings "to the same level of performance as high-rise (R-2) residential as well as commercial buildings", but that isn't the case since in commercial, that test is pro-rated based upon the envelope surface area, not volume.

While NAHB indicates that this test option should result in needing less equipment than the single-zone building test and is somehow less complicated, a dwelling unit test only requires one blower door. Simple! It generally requires 6-9 (or more!) simultaneously running blower doors to establish equal pressures in the adjacent zones. That is much more complicated! It's actually not the test procedures that are complicated. What is happening in practice is that when a dwelling unit fails to meet the required ACH50, the expense of this test is incurred rather than fixing the airtightness of the dwelling unit, since this test procedure allows the failure to remain. While ASTM E779 is an approved standard, it is very difficult for code officials to verify that all the procedures of ASTM E779 have actually been followed, let alone this specific test option.

This public comment seeks to provide the clarity that is in fact needed, but without providing a loop-hole around meeting the air leakage test requirement in R402.4.1.2. Other options have been proposed with NAHB's support (RE88, RE92, RE96) that provide builders of attached housing the appropriate flexibility they need to overcome the understandable challenges of meeting the air leakage rates, without sacrificing energy efficiency. Those proposals were met with much more support than RE102, which was barely approved by the Committee with a vote of 6-5. Supporting RE102 As-Submitted explicitly allows multi-zone testing in the code which undermines the purpose of the air leakage test. Supporting RE102 As-Submitted also inadvertently removes the option to test in accordance with the other 2 approved referenced standards (RESNET/ICC 380 and ASTM E1827).

This public comment also improves the original proposal by using defined terms and avoiding the redundant reference to the standards, which is already part of R402.4.1.2

I urge your support of this public comment or my other public comment for Disapproval of RE102. For context, I am a mechanical engineer, not a code official or a builder. I have worked for a building science consulting firm since 2005, primarily in support of energy efficient multifamily housing. My goal here is to help builders build energy efficient buildings.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The net effect of the code change proposal and the public comment is to disallow a more expensive air leakage test option. It will not therefore increase or decrease the cost of construction.

Public Comment# 1866

Public Comment 2:

Proponents:
Gayathri Vijayakumar, Steven Winter Associates, Inc., representing Steven Winter Associates, Inc. (gvijayakumar@swinter.com)

requests Disapprove

Commenter's Reason: While the Proponent had submitted a Floor Mod to add the missing referenced standards (RESNET/ICC 380, ASTM E1827) that are approved for use currently in R402.4.1.2, the Committee's vote was "As Submitted" and not "As Modified". Therefore, the version approved by the Committee, which is the original proposal, must now be Disapproved as it limits multi-unit and single family attached buildings from using these other Standards which are approved for conducting the air leakage test. ANSI/RESNET/ICC 380-2019 actually has procedures specific to this type of attached housing and is a better referenced standard for that reason. As the Committee's rationale for approving 'As Submitted' was that "This adds more options", their approval of the non-modified version actually LIMITS the options available. Additionally, explicitly allowing multi-zone testing in the code undermines the purpose of the air leakage test. If multi-zone testing (ie. guarded testing) is to be permitted, the leakage permitted would need to be adjusted as well. Attached units using multi-zone testing are just measuring leakage through the walls/floors/ceilings exposed to the outdoors. This is an acceptable test, but they cannot have the same leakage allowance as a detached home testing leakage through its entire envelope.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

RE106-19

IECC: R403.1.1 (IRC N1103.1.1)

Proposed Change as Submitted

Proponents: David Collins, SEHPCAC, representing SEHPCAC (SEHPCAC@iccsafe.org); David Collins, representing The American Institute of Architects (dcollins@preview-group.com)

2018 International Energy Conservation Code

Revise as follows:

R403.1.1 (IRC N1103.1.1) Programmable thermostat. The thermostat controlling the primary heating or cooling system of the dwelling unit shall be capable of ~~controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day.~~ providing a 5:2 (weekdays:weekends) programmable schedule, and at least 2 programmable schedules per day. This thermostat shall include the capability to set back or temporarily operate the system to maintain *zone* temperatures of not less than 55°F (13°C) to not greater than 85°F (29°C~~). The thermostat shall be programmed initially by the manufacturer with a heating temperature setpoint of not greater than 70°F (21°C) and a cooling temperature setpoint of not less than 78°F (26°C~~).

Reason: This code change clarifies the intended operational capability of programmable thermostats by distinquishing between weekday and weekend occupancy schedules along with at least 2 programmable schedules per day. The change also accounts for the capabilities of smart thermostatic controls that auto-adjust based on daily and weekly occupancy patterns. Finally, the manufacturer's initial programmed setting requirement is deleted.
This proposal is submitted by the ICC Sustainable, Energy and High Performance Code Action Committee (SEHPCAC). The SEHPCAC was established by the ICC Board of Directors to pursue opportunities to improve and enhance International Codes with regard to sustainability, energy and high performance as it relates to the built environment included, but not limited to, how these criteria relate to the International Green Construction Code (IgCC) and the International Energy Conservation Code (IECC). In 2018-2019, the SEHPCAC has held five two- or three-day open meetings and numerous workgroup calls, to discuss and debate proposed changes and public comments. Attendees at the meetings and calls included members of the SEHPCAC as well as any interested parties. Related documentation and reports are posted on the SEHPCAC website at: http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx (http://www.iccsafe.org/cs/SEHPCAC/Pages/default.aspx)

Cost Impact: The code change proposal will increase the cost of construction
This requirement will increase costs for the subset of buildings not currently constructed with weekday:weekend programmable thermostats.

RE106-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This is not solving anything that is not standard and the language confuses the requirement (Vote: 7-4).

Assembly Action: **None**

RE106-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R403.1.1

Proponents:
Anthony Floyd, representing City of Scottsdale (afloyd@scottsdaleaz.gov)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.1.1 Programmable thermostat. The thermostat controlling the primary heating or cooling system of the dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day and week ~~providing a 5:2 (weekdays:weekends) programmable schedule, and at least 2 programmable schedules per day.~~ This thermostat shall include the capability to set back or temporarily operate the system to maintain *zone* temperatures of not less than 55°F (13°C) to not greater than 85°F (29°C). The thermostat shall be programmed initially by the manufacturer with a heating temperature setpoint of not greater than 70°F (21°C) and a cooling temperature setpoint of not less than 78°F (26°C).

Commenter's Reason: This code change clarifies the intended operational capability of programmable thermostats by accounting for the day(s) of the week that the dwelling occupancy regularly deviates from the typical day such as on weekends. This change accommodates temperature settings based on not just the time of day but also the day of the week.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment only provides clarification to existing operational requirements. Clarifications to the code do not impact the cost of construction.

Public Comment# 1870

RE107-19

IECC: R403.1.3 (N1103.1.3) (New), R403.10.1 (1103.10.1)

Proposed Change as Submitted

Proponents: Nicholas O'Neil, NW Energy Codes Group, representing NW Energy Codes Group (noneil@energy350.com)

2018 International Energy Conservation Code

Add new text as follows:

R403.1.3 (IRC N1103.1.3) Continuously Burning Pilot Lights The natural gas systems and equipment listed below are not permitted to have continuously burning pilot lights:

1. Fan-type central furnaces.
2. Household cooking appliances.

   Exception: Household cooking appliances without electrical supply voltage connections and in which each pilot light consumes less than 150 Btu/hr.

3. Pool heaters.
4. Spa heaters.
5. Fireplaces.

Revise as follows:

R403.10.1 (N1103.10.1) Heaters. The electric power to heaters shall be controlled by a readily *accessible* on-off switch that is an integral part of the heater mounted on the exterior of the heater, or external to and within 3 feet (914 mm) of the heater. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. ~~Gas-fired heaters shall not be equipped with continuously burning ignition pilots.~~

Reason: Standing pilot lights are no longer necessary with many gas-fired appliances offering alternative ignition methods. Some models rely completely on intermittent ignition, while others allow standing pilots to operate for a few hours after shutdown and then use electronic ignition to re-start. This proposal saves energy by eliminating the wasted energy of a pilot light during the numerous hours per year when the appliance is non-operational.

Cost Impact: The code change proposal will increase the cost of construction
This prohibition is not expected to add significant cost to any gas-fired appliance listed in the proposal. Past efficiency studies have shown $100 increase in price for fireplaces in particular to move from a standard continuously lit pilot light to an intermittent ignition system.

RE107-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Proponent asked for disapproval to provide time to work with opposition (Vote: 11-0).

Assembly Action: **None**

RE107-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R202 (New), R403.1.3 (IRC N1103.1.3) (New), R403.10.1 (N1103.10.1)

Proponents:
Nicholas O'Neil, representing Energy 350 (noneil@energy350.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R202 **Continuously Burning Pilot Light** A small gas flame used to ignite gas at a larger burner. Once lit, a continuous pilot light remains in operation until manually interrupted.

R403.1.3 (IRC N1103.1.3) Continuously Burning Pilot Lights The natural gas systems and equipment listed below are not permitted to have continuously burning pilot lights:

1. Fan-type central furnaces.
2. Household cooking appliances.

   Exception: Household cooking appliances without electrical supply voltage connections and in which each pilot light consumes less than 150 Btu/hr.

3. Pool heaters.
4. Spa heaters.
5. Fireplaces.

R403.10.1 (N1103.10.1) Heaters. The electric power to heaters shall be controlled by a readily *accessible* on-off switch that is an integral part of the heater mounted on the exterior of the heater, or external to and within 3 feet (914 mm) of the heater. Operation of such switch shall not change the setting of the heater thermostat. Such switches shall be in addition to a circuit breaker for the power to the heater. ~~Gas-fired heaters shall not be equipped with continuously burning ignition pilots.~~

Commenter's Reason: Public comment adds a definition of a continuously burning pilot light to clarify what "continuous" means based on feedback from the industry. In addition, while continuous pilot lights for pool and spa heaters are already banned by the IECC, this new section R403.1.3 will cover all cases where they are banned and therefore we have removed the additional reference to continuously burning pilot lights in section R403.10.1 to avoid duplicate information.
Original reason statement: Standing pilot lights are no longer necessary with many gas-fired appliances offering alternative ignition methods. Some models rely completely on intermittent ignition, while others allow standing pilots to operate for a few hours after shutdown and then use electronic ignition to restart. This proposal saves energy by eliminating the wasted energy of a pilot light during the numerous hours per year when the appliance is nonoperational.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Original cost statement: This prohibition is not expected to add significant cost to any gas-fired appliance listed in the proposal. Past efficiency studies have shown $100 increase in price for fireplaces in particular to move from a standard continuously lit pilot light to an intermittent ignition system. Other gas-fired appliances on the prohibition list have largely moved away from continuous pilots and intermittent ignition systems do not add substantial cost to the final product.

Public Comment# 1409

RE109-19

IECC: R403.3 (IRC N1103.3), R403.3.1 (IRC N1103.3.1) , R403.3.7 (IRC N1103.3.7)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

R403.3 (IRC N1103.3) Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through ~~R403.3.7~~ R403.3.6.

~~**R403.3.1 (IRC N1103.3.1) Insulation (Prescriptive).** Supply and return ducts in attics shall be insulated to an *R*-value of not less than R-8 for ducts 3 inches (76 mm) in diameter and larger and not less than R-6 for ducts smaller than 3 inches (76 mm) in diameter. Supply and return ducts in other portions of the *building* shall be insulated to not less than R-6 for ducts 3 inches (76 mm) in diameter and not less than R-4.2 for ducts smaller than 3 inches (76 mm) in diameter.~~

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

~~**R403.3.7 (IRC N1103.3.7)**~~ **R403.3.6 (IRC N1103.3.6) Ducts located ~~in conditioned space.~~ and insulation.** ~~For ducts~~ Duct work located outside conditioned space, shall be insulated to an *R* -value of not less than R-8. For duct work to be considered ~~as~~ inside ~~a~~ conditioned space, ~~such ducts~~ it shall comply with ~~either~~ one of the following:

1. The duct system shall be located completely within the continuous air barrier and within the building thermal envelope.
2.~~The ducts shall~~ Duct work in ventilated attic spaces.shall be buried within ceiling insulation in accordance with Section R403.3.6 and all of the following conditions shall exist:
2.1. The air handler is located completely within the *continuous air barrier* and within the building thermal envelope..
2.2. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the building thermal envelope in accordance with Section R403.3.4, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of conditioned floor area served by the duct system..
2.3. The ceiling insulation *R*-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the duct.
3.Duct work in floor cavities located over unconditioned space shall have a continuous air barrier on all six sides of the floor cavity and insulation installed in accordance with section R402.2.8 with the addition of insulation fully surrounding the duct and uncompressed R-19 insulation below, or duct work installed in a floor cavity that is insulated per the exception in section R402.2.8..
4.Duct work located within exterior walls shall have a continuous air barrier on all six sides of the wall cavity, a minimum R-10 insulation separating the entire duct from the outside sheathing of the cavity, and the remainder of the cavity insulation fully surrounding the duct to the drywall side.

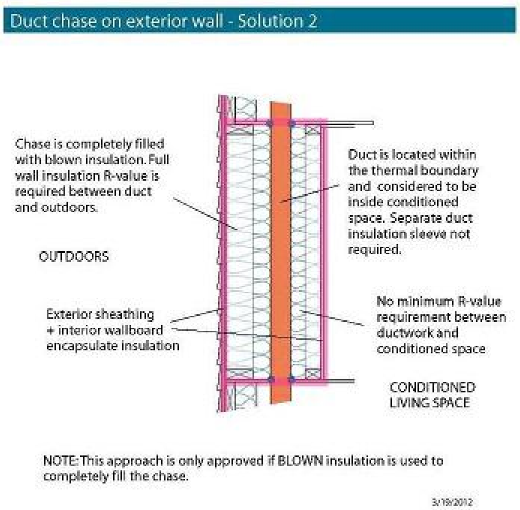
Reason: Ductwork insulation is dependent on its location. This proposal addresses this issue. By removing Section R403.3.1 Insulation, and combining it with section R403.3.7 duct location, the code becomes more understandable and useable for field practitioners. This newly edited section requires that all duct work located outside of conditioned space regardless of size be insulated to an R-8. This minimum R-value duct insulation is widely available and important to have on ducts located outside regardless of the climate zone in which it is installed or the size of the duct. In addition, it is already the required R-value for duct work located outside per the existing section R403.3.1 As Allison Bailes points out in his Energy Vanguard blog post titled, “The invisible problem with duct insulation” The delta T across the insulated surface can be huge when ducts are located outside the conditioned space. (https://www.energyvanguard.com/blog/invisible-problem-duct-insulation) In his example ducts located in the attic experienced a delta T of 62°. Although it would be good to raise the minimum required R-value associated with ducts located outside the conditioned envelope this proposal instead incentivizes installation techniques that drive the performance of the duct to be more like that of ducts installed completely inside.
By defining the three possible locations where ductwork can be installed and how to address the insulated assembly so the duct can be considered to be inside conditioned space this proposal increases the energy performance of homes. The three possible locations for duct installation are, one, completely inside the continuous air barrier assemblies, two, completely outside the continuous air barrier assemblies, or three within the continuous air barrier and building thermal envelope assemblies. In the last code cycle, the addition of section R403.3.6 Ducts buried within ceiling insulation addressed the insulation installation issue for ducts located outside of the continuous air barrier assemblies. This code cycle, the hope is that ducts located within the continuous air barrier and building thermal envelope assemblies will be addressed.

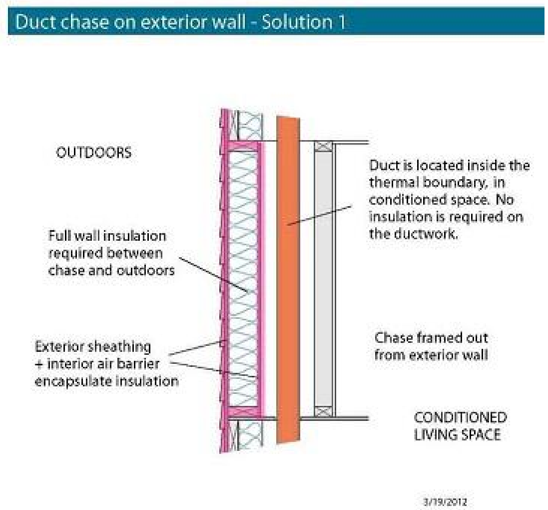
The last detail to point out is an energy code compliance issue when using section R405 Simulated Performance Alternative and section R406 Energy Rating Index compliance paths. These pathways include duct location in the software modeling. It has not been clear until the 2018 IECC how to model buried ductwork and the hope now is that the additional language in this proposal will clarify how to model duct work that is installed within the continuous air barrier and building thermal envelope assemblies. If it is installed per this code change proposal is can be considered to be within conditioned space.

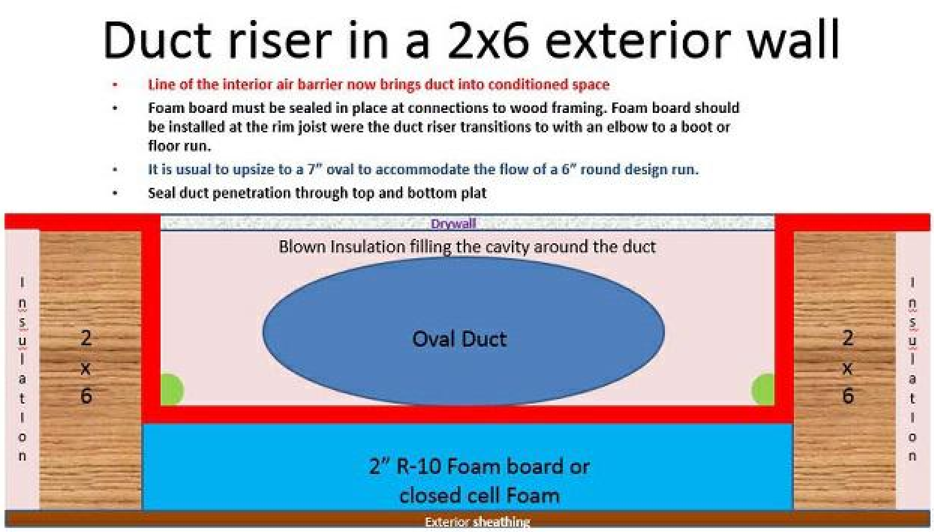
See example diagrams for examples of how insulation of duct work installed within the building thermal envelope assembly could be achieved in order to locate them within the conditioned space.

The following diagrams illustrate example installations of duct work in garage floor systems or in exterior walls that would be considered to be within the conditioned space.

Example of Ducts in Exterior walls that would be considered within the conditioned space

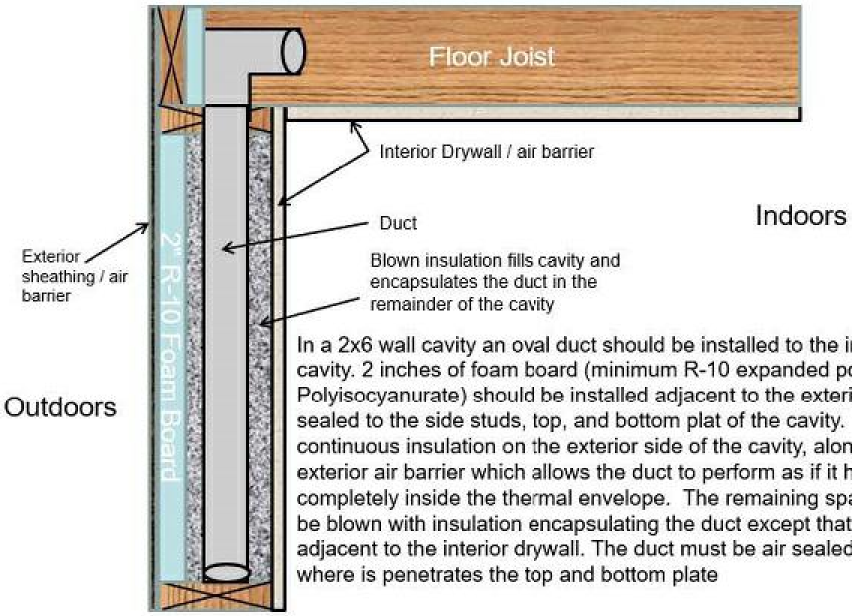






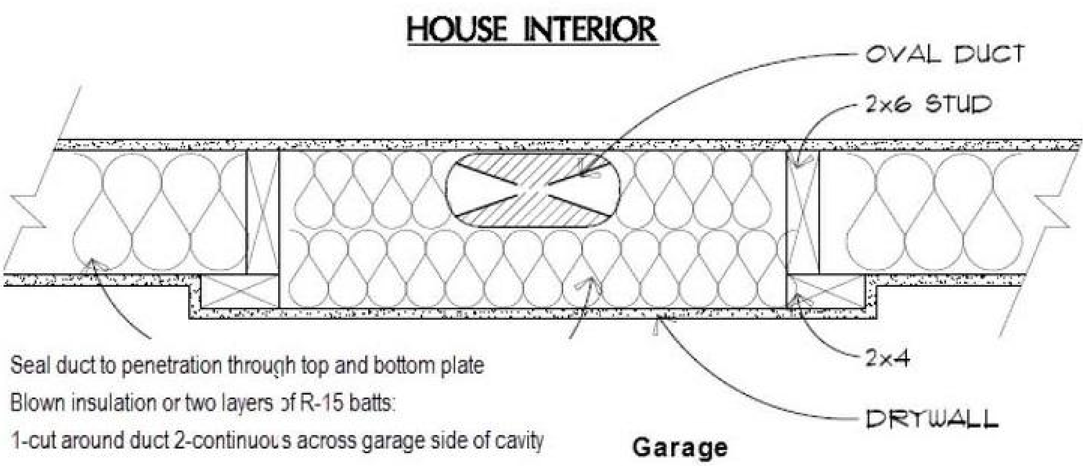
Supply Duct Riser in an Exterior Wall – Solution 3

For situations where a wall cannot be bumped out into the conditioned space of the home:

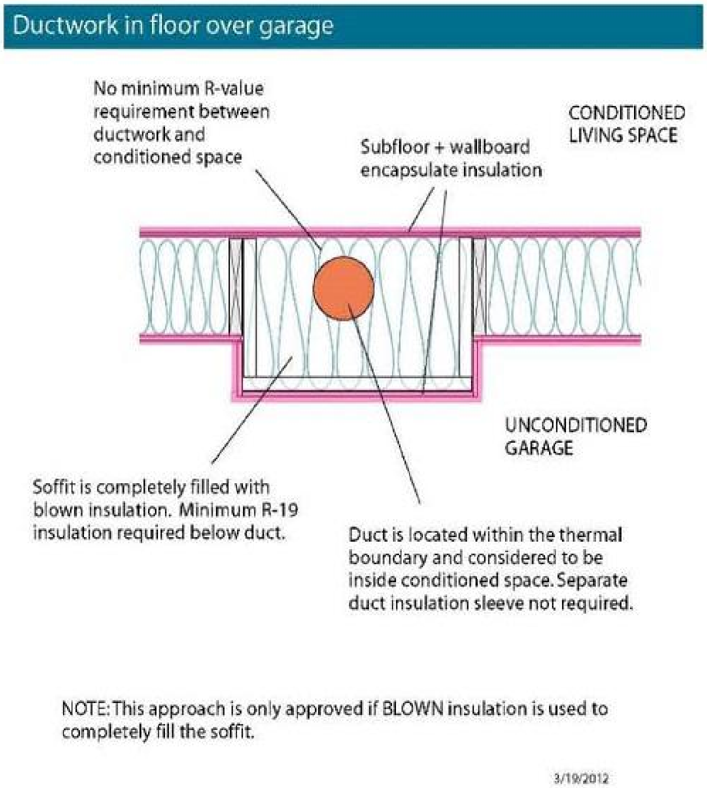


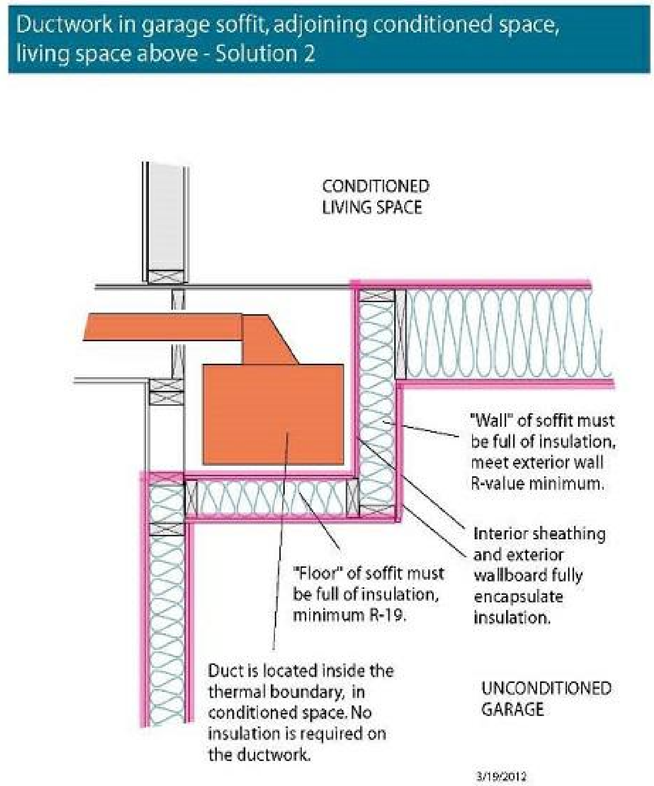
In a 2x6 wall cavity an oval duct should be installed to the inside of the framed cavity. 2 inches of foam board (minimum R-10 expanded polystyrene or R-14 Polyisocyanurate) should be installed adjacent to the exterior sheathing and sealed to the side studs, top, and bottom plat of the cavity. This creates continuous insulation on the exterior side of the cavity, along with an interior and exterior air barrier which allows the duct to perform as if it has been installed completely inside the thermal envelope. The remaining space in the cavity must be blown with insulation encapsulating the duct except that edge that might be adjacent to the interior drywall. The duct must be air sealed with expanding foam where is penetrates the top and bottom plate

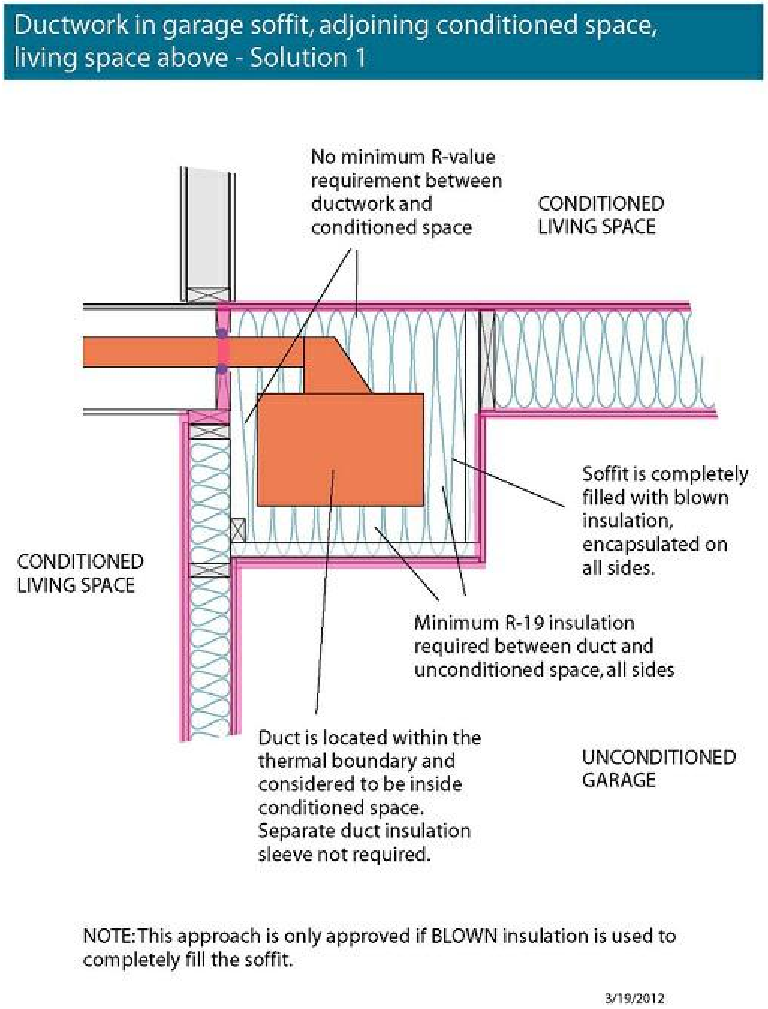
Example of Duct in wall between house and garage

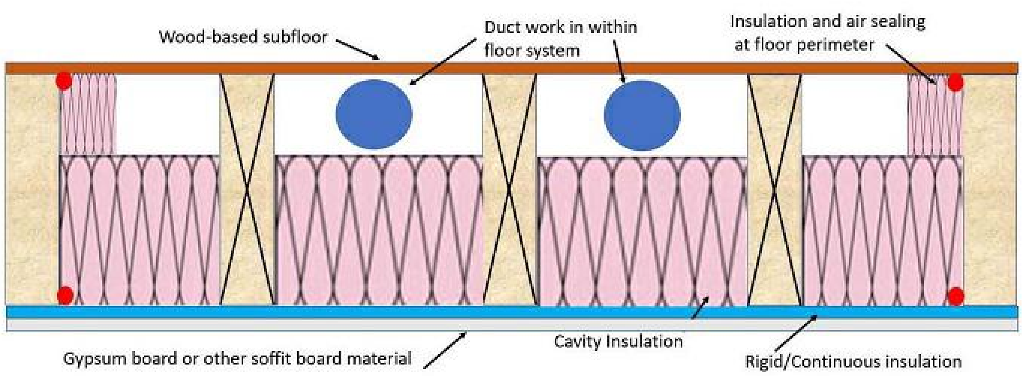


Example of Duct in floor system that would be considered within the condistioned space.









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

This proposal provides new installation guidance and a definition of when a duct is considered to be inside conditioned space that will increase the energy efficiency of a house with better insulated ducts when installed within the continuous air barrier and building thermal envelope assemblies. Ductwork must be insulated and installed per manufacturer instruction. Also, insulation currently must fully surround obstructions like ductwork that is installed in a cavity. So, no additional cost should be expected with the approval of this proposal.

RE109-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The concept is needed but the language is confusing and it could appear that you must bury ducts. Needs to come back with improved language. The change from R6 to R8 is significant and not addressed (Vote: 10-1).

Assembly Action: **None**

RE109-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R403.3 (IRC N1103.3), R403.3.1, R403.3.7 (IRC N1103.3.7)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.3 (IRC N1103.3) Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through ~~R403.3.6.~~ R403.3.7

R403.3.1 **Insulation (Prescriptive).** Supply and return ducts located outside conditioned space shall be insulated to an *R*-value of not less than R-8 for ducts 3 inches (76 mm) in diameter and larger and not less than R-6 for ducts smaller than 3 inches (76 mm) in diameter.

R403.3.7~~6~~ (IRC N1103.3.7) Ducts located in conditioned space. ~~and insulation.~~ ~~Duct work located outside conditioned space, shall be insulated to an *R*-value of not less than R-8~~. For duct work to be considered inside conditioned space, it shall comply with one or more of the following:

1. The duct system shall be located completely within the continuous air barrier and within the building thermal envelope.
2. Duct work in ventilated attic spaces shall be buried within ceiling insulation in accordance with Section R403.3.6 and all of the following conditions shall exist:
   2.1. The air handler is located completely within the *continuous air barrier* and within the building thermal envelope..

   2.2. The duct leakage, as measured either by a rough-in test of the ducts or a post-construction total system leakage test to outside the building thermal envelope in accordance with Section R403.3.4, is less than or equal to 1.5 cubic feet per minute (42.5 L/min) per 100 square feet (9.29 m^2) of conditioned floor area served by the duct system..

   2.3. The ceiling insulation *R*-value installed against and above the insulated duct is greater than or equal to the proposed ceiling insulation *R*-value, less the *R*-value of the insulation on the duct.
3. Duct work in floor cavities located over unconditioned space shall comply with all of the following:

   3.1. A continuous air barrier ~~on all six sides of he floor cavity and insulation~~ installed between unconditioned space and the duct.

   3.2 Insulation installed in accordance with Section R402.2.8 ~~with the addition of insulation fully surrounding the duct and uncompressed R-19 insulation below, or duct work installed in a floor cavity that is insulated per the exception in Section R402.2.8~~

   3.3. A minimum R-19 insulation installed in the cavity width separating the duct from unconditioned space.

4. Duct work located within exterior walls of the building thermal envelope shall comply with the following:

   4.1. ~~shall have~~ A continuous air barrier ~~on all six sides of the wall cavity, a~~ installed between unconditioned space and the duct

   4.2. Minimum R-10 insulation installed in the cavity width separating the ~~entire~~ duct from the outside sheathing ~~of the cavity, and~~

   4.3 The remainder of the cavity insulationshall be fully ~~surrounding the duct~~ insulated to the drywall side .

Commenter's Reason: The committee agreed that the concept of being able to define ducts that are located within wall and floor cavities as either inside or outside the conditioned space of the home, based on how the air barrier and insulation is installed, is needed. They agreed that it is a logical extension of the buried duct concept, but they found some of the language confusing and wanted to clarify that it is not a requirement to burry ducts in ventilated attics, but rather it is a choice. To help clarify, the section language was changed to read, "R403.3.7 Ducts located in conditioned space". I believe that this new title makes clear that specific things need to occur with the installation of the duct to ensure that it will perform as if it is within the building's air barrier and thermal envelope. Other changes have been made to make the language and requirements more understandable. For example, the 2nd sentence was reworked to say, "For ductwork to be considered inside conditioned space, it shall comply with one of the following." This language ensures that all understand that the "following" must occur to determine that the ducts are inside the building. The installation requirements for ducts within floor and wall cavities have been adjusted to be more clear, concise, and ultimately more understandable. To clarify that only ducts installed in ventilated attics and want to be considered inside the building envelope and therefore need to be buried, the following language was added, "Ductwork in ventilated attic spaces…."

The committee also believed that there was a significant change in requiring R8 duct insulation vs. R6. I don't believe this is a significant change as the code currently states that R8 is required for 90% of the duct that is installed in unconditioned space. Section **R403.3.1 Insulation** states**, "**Supply and return ducts in attics shall be insulated to an *R*-value of not less than **R-8** for ducts 3 inches (76 mm) in diameter and **larger** and not less than R-6 for ducts **smaller** than 3 inches (76 mm) in diameter. Supply and return ducts in other portions of the *building* shall be insulated to not less than R-6 for ducts 3 inches (76 mm) in diameter and not less than R-4.2 for ducts smaller than 3 inches (76 mm) in diameter." Therefore, when the duct is located in a ventilated attic and its size is greater than or equal to 3", it is required to be insulated to an R8. This proposal's only change is to require the few ducts that might be smaller than 3" to also be insulated to an R8.

Lastly, Section R403.3.1 regarding duct insulation has been added back in and changed to say, "Supply and return ducts located outside conditioned space ~~in attics~~ shall be insulated". Now, there should be no confusion regarding the fact that only ducts located outside must be insulated.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
First, it is optional to install the duct work so that it is considered to be in the conditioned space. Next, This proposal provides new installation guidance and a definition of when a duct is considered to be inside conditioned space that will increase the energy efficiency of a house with better-insulated ducts when installed within the continuous air barrier and building thermal envelope assemblies. Ductwork must be insulated and installed per manufacturer instruction. Also, insulation currently must fully surround obstructions like ductwork that is installed in a cavity. So, no additional cost should be expected with the approval of this proposal.

Public Comment# 1909

RE110-19

IECC: R403.3.2 (IRC N1103.3.2)

Proposed Change as Submitted

Proponents: David Bixby, Air Conditioning Contractors of America, representing Air Conditioning Contractors of America

2018 International Energy Conservation Code

R403.3.2 (IRC N1103.3.2) Sealing (Mandatory). Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the International Mechanical Code or International Residential Code , as applicable.

Exception: Ducts or portions thereof located completely inside the *building thermal envelope* .

Reason: When ductwork is located inside a building's thermal envelope, any duct leakage from unsealed ductwork enters an already conditioned space within the building thermal envelope. Therefore, no energy loss occurs that is directly related to the sealed and/or unsealed air leakage through the building envelope and not by an unsealed duct in a conditioned space. Although sealing ductwork located inside the building's thermal envelope provides better comfort for the homeowner, it has no impact on energy efficiency or economic benefits. When discussing building energy efficiency and economic benefits, a homeowner should focus on reducing building leaks, better insulation, windows, and doors, as these are areas where building energy efficiency is lost at the building envelope, not by sealing ductwork in a conditioned space.

Cost Impact: The code change proposal will decrease the cost of construction
The proposal will potentially eliminate the need to seal ducts under the conditions specified in the exception, thus reducing the cost of construction in those situations.

RE110-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This would create excessive duct leakage (Vote: 11-0).

Assembly Action: **None**

RE110-19

Individual Consideration Agenda

Public Comment 1:

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

requests As Submitted

Commenter's Reason: ACCA requests approval of the proposal as submitted. The Committee's reason for rejection is that the proposed exception "would create excessive duct leakage." There is no "credible" scientific study that we are aware of that substantiates this. Such an unsubstantiated assertion is therefore a baseless and false assumption. If the ductwork is properly constructed (i.e., put together) according to IRC requirements, as verified by the code official, there should NOT be "excessive leakage" that requires additional sealing. Currently the IRC requires compliance with SMACNA/ANSI—2016: *HVAC Duct Construction Standards—Metal and Flexible* and SMACNA—10: *Fibrous Glass Duct Construction Standards*. The IRC also requires ducts to be designed to meet ACCA Manual D requirements, with each duct carefully sized to provide the airflow needed to meet room-by-room heat loss and heat gain calculations in accordance with ACCA Manual J. Problems with poor airflow are attributed to (1) improperly following ACCA Manual J so the calculated airflow is wrong, (2) improper ductwork design and installation, and/or (3) lack of commissioning and air balance. Excessive duct leakage is very rarely the cause of low or poor airflow. Commissioning and an air balance would show excessive duct leakage if it existed. When ductwork is inside a building's thermal envelope, any duct leakage from unsealed ductwork enters an already conditioned space within the building thermal envelope. Therefore, no energy loss occurs that is directly related to the sealed and/or unsealed air leakage through the building envelope and not by an unsealed duct in a conditioned space. Although sealing ductwork located inside the building's thermal envelope may provide better comfort for the homeowner, it has no impact on energy efficiency or economic benefits. When discussing building energy efficiency and economic benefits, a homeowner should focus on reducing building leaks, better insulation, windows, and doors, as these are areas where building energy efficiency is lost at the building envelope, not by sealing ductwork in a conditioned space.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
The proposal will potentially eliminate the need to seal ducts under the conditions specified in the exception, thus reducing the cost of construction in those situations.

Public Comment# 1990

RE112-19

IECC: R403.3.3 (IRC N1103.3.3), R403.3.4 (IRC N1103.3.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

R403.3 (IRC N1103.3) Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through R403.3.7.

R403.3.1 (IRC N1103.3.1) Insulation (Prescriptive). Supply and return ducts in attics shall be insulated to an *R*-value of not less than R-8 for ducts 3 inches (76 mm) in diameter and larger and not less than R-6 for ducts smaller than 3 inches (76 mm) in diameter. Supply and return ducts in other portions of the *building* shall be insulated to not less than R-6 for ducts 3 inches (76 mm) in diameter and not less than R-4.2 for ducts smaller than 3 inches (76 mm) in diameter.

Exception: Ducts or portions thereof located completely inside the *building thermal envelope.*

R403.3.2 (IRC N1103.3.2) Sealing (Mandatory). Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the International Mechanical Code or International Residential Code , as applicable.

R403.3.2.1 (IRC N1103.3.2.1) Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of not greater than 2 percent of the design airflow rate when tested in accordance with ASHRAE 193.

Revise as follows:

R403.3.3 (IRC N1103.3.3) Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

~~Exceptions~~ <u>Exception</u>:

~~1.A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the*building thermal envelope.*~~
~~2.~~ A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 (IRC N1103.3.4) Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.
2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.
3. <u>Test for ducts within thermal envelope: Where all ducts and air handlers are located entirely within the building thermal envelope, total leakage shall be less than or equal to 8.0 cubic feet per minute (226.6 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.</u>

Reason: The purpose of this code change proposal is to help ensure occupant comfort, proper heating and cooling system performance, and resulting long-term energy savings by requiring a duct leakage test for all new homes, including homes with all ducts inside conditioned space. This action will also help reduce the likelihood of builder callbacks for poorly-functioning, uncomfortable HVAC systems. The IECC currently exempts homes from duct testing requirements where the air handler and all ducts are located inside conditioned space. Although moving all ducts inside conditioned space may have a positive impact on energy efficiency overall, this practice alone cannot guarantee that the ducts will be tight enough to deliver conditioned air to all occupied areas of the home. Uncomfortable occupants commonly adjust thermostat settings to counteract the effect of poor delivery of conditioned air, leading to huge losses in energy efficiency. And these homes are at far greater risk for builder callback. This proposal will improve building quality and keep occupants more comfortable by requiring a duct test for all new homes, although the allowable leakage rate will be set at twice the prescriptive rate when all ducts are located inside conditioned space.
Duct leakage rates can be extremely high when ducts are not tested. We do not believe that builders intentionally cut corners in duct sealing when

they know that the system will not be tested. However, without an objective test as a means of quality assurance, even careful builders may not be aware of missed connections or poor sealing. In a recent DOE field study of residential homes in Kentucky, homes received duct leakage tests even where all supply and return ducts were located inside conditioned space. The results were striking – **of the 24 homes tested (that would have qualified for the test exemption under the IECC), all 24 homes had higher leakage rates than the 2018 IECC requirement. Tested duct leakage for these homes averaged 18.5 cfm/sq.ft., with individual homes ranging from 6.26 cfm/sq.ft. to as high as 40.36 cfm/sq.ft.** *See* https://www.energycodes.gov/compliance/energy-code-field-studies. We note that 40 other homes in the same study were required to be tested (because at least some ducts were located outside conditioned space), and these homes achieved leakage rates of 9.7 cfm/sq.ft., on average – roughly half the leakage rate of homes that qualified for the exemption. Obviously, this is a small sample size, but the Field Studies found similar results in Pennsylvania, where "exempt" homes (with all ducts inside conditioned space) averaged almost 31 cfm/sq.ft. leakage, while homes required to be tested averaged almost 18 cfm/sq.ft. leakage.

Results of DOE Field Study Data Collection on Duct Tightness				
	Ducts in Conditioned Space (Exempt from Test)		Ducts Outside Conditioned Space (Testing Required)	
Kentucky	# Samples	24	# Samples	40
	Max Test Result	40.36	Max Test Result	18.90
	Min Test Result	6.26	Min Test Result	3.10
	Avg Test Result	18.46	Avg Test Result	9.71
Pennsylvania	# Samples	18	# Samples	52
	Max Test Result	77.10	Max Test Result	69.00
	Min Test Result	12.60	Min Test Result	2.44
	Avg Test Result	30.95	Avg Test Result	17.95

Although the results vary across the states sampled, these results point to a shortcoming in the IECC's "complete exemption" approach to homes with all ducts inside conditioned space.

Although most energy modeling software does not capture the occupant-level impact of poorly-sealed ducts, anyone who has lived or worked in a building with leaky ducts understands that discomfort can lead occupants to adjust the thermostat. The energy impact of adjusting the thermostat is huge. The following table shows the increased energy use that results from adjusting the thermostat up or down a single degree in a code-compliant house in each climate zone.

Increased Energy Use Resulting from Thermostat Adjustment									
Measure	**Weighted**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
+1 Degree Heating	4.1%	0.5%	3.0%	4.2%	4.4%	4.7%	4.5%	4.0%	2.9%
-1 Degree Cooling	3.0%	7.8%	5.3%	3.9%	2.6%	1.8%	1.4%	0.7%	0.4%

Obviously, if an uncomfortable occupant adjusts the thermostat 2 or 3 degrees, the impact will be far higher, and could essentially negate many of the efficiency gains made in the IECC over the last decade.

The concept of requiring a test for all new homes is not new. DOE's Building America Program recommends that "[e]ven in conditioned space, ducts should be insulated to reduce the risk of condensation and mold. They should be tightly sealed and tested for leakage." *See* https://www.energy.gov/sites/prod/files/2014/01/f6/1_1g_ba_innov_ductsconditionedspace_011713.pdf. Likewise, the International Association of Certified Home Inspectors recommends that ducts be located entirely within conditioned space and tested to ensure air tightness. Air leakage rates at air handlers, even when all ducts are located in conditioned space, can lead to significant reduction in comfort, leading homeowners to adjust the thermostat and significantly increase energy use. *See* https://www.nachi.org/inspecting-hvac-cabinet-seams-air-leakage-sealing.htm.

Bibliography: *Insulation*, U.S. Dep't of Energy, https://www.energy.gov/energysaver/weatherize/insulation (last accessed Dec. 30, 2018).
U.S. Dep't of Energy, Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes (Aug. 2015), *available at* https://www.energycodes.gov/residential-energy-and-cost-analysis-methodology.

Cost Impact: The code change proposal will increase the cost of construction
This proposal will require duct testing and meeting a modest duct tightness level in the limited subset of homes that are currently exempt from the test requirement in the IECC. However, we believe the added value in quality control for builders and the likely positive impact on occupant comfort and energy savings will easily outweigh the cost of the test and any remedial efforts to improve duct tightness.

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: It important to test the ducts and make certain the air needed to condition the space is delivered appropriately (Vote: 6-5).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

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

requests Disapprove

Commenter's Reason: ACCA requests disapproval of the proposal in its entirety. The proposal is not cost effective and a duct leakage test will not correct the actual problems that are, in reality, airflow problems. If the ductwork is properly constructed (i.e., put together) according to IRC requirements, as verified by the code official, there should NOT be "excessive leakage" that requires additional sealing **or leak testing**. When ductwork is inside a building's thermal envelope, any duct leakage from unsealed ductwork enters an already conditioned space within the building thermal envelope. Therefore, no energy loss occurs that is directly related to the sealed and/or unsealed air leakage through the building envelope and not by an unsealed duct in a conditioned space. Although sealing ductwork located inside the building's thermal envelope may provide better comfort for the homeowner, it has no impact on energy efficiency or economic benefits. When discussing building energy efficiency and economic benefits, a homeowner should focus on reducing building leaks, better insulation, windows, and doors, as these are areas where building energy efficiency is lost at the building envelope, not by sealing **or leak testing** ductwork in a conditioned space. **See ACCA Public Comment under Item RE110-19.**

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1996

Public Comment 2:

Proponents:
Craig Drumheller, NAHB, representing NAHB (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: This code change is not necessary. There is no need to test a system that is located entirely inside of conditioned space, if there is any leakage it is leaking to conditioned space and dwellings already have to comply with the air sealing requirements. This is an unnecessary code change and would increase the cost of construction by mandating additional testing.
Very few multi-family dwelling units have ducts outside conditioned space, this would require testing of nearly every forced air system in the building. A visual inspection on duct systems entirely within conditioned space is sufficient.

Generally, energy will be saved when bringing ducts into conditioned space, this proposal would discourage builders from doing this.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment 3:

Proponents:
Margo Thompson, representing National Multifamily Housing Council (mthompson@newportventures.net)

requests Disapprove

Commenter's Reason: The proposal, RE-112, removes the exception for testing duct leakage when the ducts and air handler are located entirely within the building's thermal envelope. As a result, it will unnecessarily add cost to multifamily dwelling units without delivering significant energy savings. This is true for multiple reasons.
One rationale for this proposal is that leaky ducts result in poor air delivery and uncomfortable residents who will then adjust the thermostat, thus wasting energy. Multifamily dwellings, in particular, have much smaller floor plans and greatly reduced heating/cooling loads due to adiabatic surfaces compared to most single-family homes. These factors greatly reduce the likelihood that duct leakage will result in an isolated hot or cold spot and trigger thermostat adjustments. While this could happen in a 3500 square foot, two-story single-family detached home, it is much less likely in a 1200 square foot, single floor apartment.

Secondly, the proposal only establishes an actual air leakage *limit* for ducts located in conditioned space if a project is pursuing <u>Prescriptive</u> Compliance with the IECC. If a home is pursuing the Performance Path or the ERI Path for compliance, the proposal makes duct leakage testing Mandatory, but the prescriptive air leakage *limit* of 8 cfm per 100 sf conditioned floor area is something that can be traded off – at least, theoretically. Furthermore, the air leakage test result must still be factored into the energy models which must be developed in order to demonstrate compliance under the Performance or ERI paths. However, the modeling software does not apply any type of penalty for duct leakage that occurs within conditioned space no matter how high it might be. A 1400 sf apartment with all ducts and HVAC equipment entirely within the thermal envelope will show no difference in energy performance or Energy Rating Index (ERI) within the modeling software whether it has 0 cfm total duct leakage or 300 cfm total duct leakage. So, for projects pursuing Performance Path or ERI compliance, RE112 would require a duct leakage test, the result of which will have no bearing on the project's code compliance, the percentage by which it is above or below code, or the Energy Rating Index.

Lastly, field testing requirements like blower door tests or duct blaster tests, when applied to multifamily buildings with dozens or hundreds of very similar units, should include sampling provisions.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval will result in no change in code text.

The proposal will significantly increase the cost of construction, particularly for multifamily buildings and larger developments of single family homes and townhouses. On average, the cost of a DuctBlaster test is $250. Assuming an Energy Consultant or HVAC technician might offer a discounted rate for performing multiple tests during a single visit, added cost for a 100-unit apartment complex would still be in the range of $15,000 -$20,000. As indicated in the Reason Statement above, there is no energy benefit or energy cost savings to offset the additional testing cost.

Public Comment# 1684

RE115-19

IECC: R403.3.3 (IRC N1103.3), R403.3.4 (IRC N1103.3.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

R403.3 Ducts. Ducts and air handlers shall be installed in accordance with Sections R403.3.1 through R403.3.7.

R403.3.1 Insulation (Prescriptive). Supply and return ducts in attics shall be insulated to an *R*-value of not less than R-8 for ducts 3 inches (76 mm) in diameter and larger and not less than R-6 for ducts smaller than 3 inches (76 mm) in diameter. Supply and return ducts in other portions of the *building* shall be insulated to not less than R-6 for ducts 3 inches (76 mm) in diameter and not less than R-4.2 for ducts smaller than 3 inches (76 mm) in diameter.

Exception: Ducts or portions thereof located completely inside the *building thermal envelope.*

R403.3.2 Sealing (Mandatory). Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the International Mechanical Code or International Residential Code , as applicable.

R403.3.2.1 Sealed air handler. Air handlers shall have a manufacturer's designation for an air leakage of not greater than 2 percent of the design airflow rate when tested in accordance with ASHRAE 193.

Revise as follows:

R403.3.3 (IRC N1103.3) Duct testing (Mandatory). ~~Ducts~~ The ductwork in a building or dwelling unit shall be pressure tested ~~to determine~~ for air leakage . The maximum total leakage rate for ducts in any building or dwelling unit under any compliance path shall not exceed 8.0 cfm (226.5 L/min) per 100 square feet (9.29 m^2) of conditioned floor area. Testing shall be conducted at the rough-in stage or post-construction by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.
2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 (IRC N1103.3.4) Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to ~~4~~ 4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to ~~3~~ 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.
2. Postconstruction test: Total leakage shall be less than or equal to ~~4~~ 4.0 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.

Reason: The purpose of this code change proposal is to help ensure long-term energy savings, occupant comfort and promote good building quality by establishing a maximum level of duct leakage permitted as a trade-off backstop for duct tightness. We propose a backstop that would still permit substantial flexibility – double the allowable leakage rate as the prescriptive requirement -- but that would establish a "worst case scenario" for all tested homes in all compliance paths.
There is currently no upper limit on duct leakage in the IECC. In the 2012 IECC, all ducts (except those in conditioned space) were required on a mandatory basis to meet the prescriptive levels. The mandatory nature of the requirement was removed in 2015, allowing duct tightness to be fully traded off for other efficiency measures. We believe some trade-off is acceptable, but that a minimum level of duct tightness is necessary to ensure some reasonable level of duct performance occurs in the home. When ducts are excessively leaky, there is no assurance that conditioned air is provided where it is needed for adequate comfort. The failure to properly distribute conditioned air is likely to result in excess energy usage when the

occupants adjust the thermostat to counter an inadequate distribution of conditioned air. Many of the intended benefits of high-performance homes are negated if occupants are uncomfortable and adjust the thermostat in response.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal is intended to be cost-neutral, since it does not change the prescriptive requirement, but will ensure that at least some reasonable attention has been paid to duct tightness. Because the new backstop will only apply in homes that are already required to have ducts tested, the only potential cost would come in a situation where a builder has traded away the efficiency of the duct system for an improvement elsewhere in the home at a lower cost such that the home would not even meet the weaker duct tightness level proposed here. However, in such cases, we believe owners and occupants of homes will benefit substantially from having an outer limit on duct leakage.

RE115-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This provides additional clarity and a backstop (Vote: 10-1).

Assembly Action: **None**

RE115-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R403.3.2, R403.3.3 (IRC N1103.3)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.3.2 Sealing (Mandatory). Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the International Mechanical Code or International Residential Code , as applicable.

R403.3.3 (IRC N1103.3) Duct testing (Mandatory). The ductwork in a building or dwelling unit shall be pressure tested for air leakage. The maximum total leakage rate for ducts in any building or dwelling unit under any compliance path shall not exceed ~~8.0~~ (6) cfm (~~226.5~~ 169.9 L/min) per 100 square feet (9.29 m^2) of conditioned floor area when the air handler is installed at the time of testing. When the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3.0 CFM (85 L/min) per 100 square feet (9.29 m2) of conditioned floor area. Registers shall be taped or otherwise sealed during the test. Testing shall be conducted at the rough-in stage or post-construction by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer’s air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer’s air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.
2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

Commenter's Reason: Public Comment Reason Statement:
The public comment addresses two issues which were not addressed by the five duct leakage proposals that passed during the CAH.

1. The prescriptive duct leakage requirement rightly describes what to do if the air handler is not installed at the time of the duct leakage test. If this is not added to the mandatory section now that a duct leakage target has been introduced, then the flexibility of when a test can occur during the construction cycle is lost which could increase cycle time and cost of construction.
2. This PC lowers the upper duct leakage target in the mandatory section that passed at the CAH from 8 CFM/sqft of conditioned floor area to 6 CFM/sqft. The rationale for this is two-fold.
    1. First, there are energy savings from tighter ducts, as well as health, safety, and durability benefits.
    2. Second, if the ducts are at 6 CFM of total leakage, then that number works 90+% of the time for the duct leakage to outside input in the code compliance software for the simulated performance and ERI paths to demonstrate compliance. Therefore, additional testing is not needed unless more trade-offs are needed or desired and cost savings can be achieved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Per the cost statement of the original proposal (below) these changes are intended to be cost neutral and changing from 8CFM/100sqft to 6 CFM/100sqft should not change that. additional flexibility of when a system can be tested can actually save money by not interfering with cycle time.

Original Cost Statement:

The proposal is intended to be cost neutral, since it does not change the prescriptive requirement, but will ensure that at least some reasonable attention has been paid to duct tightness. Because the new backstop will only apply in homes that are already required to have ducts tested, the only potential cost would come in a situation where a builder has traded away the efficiency of the duct system for an improvement elsewhere in the home at a lower cost such that the home would not even meet the weaker duct tightness level proposed here. However, in such cases, we believe owners and occupants of homes will benefit substantially from having an outer limit on duct leakage.

Public Comment# 1906

RE116-19

IECC: R403.3.3 (IRC N1103.3.3), R403.3.3.1 (IRC N1103.3.3.1) (New), R403.3.3.2 (IRC N1103.3.3.2) (New), R403.3.4 (IRC N1103.3.4)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

SECTION R403 (IRC N1103) SYSTEMS

R403.3.3 (IRC N1103.3.3) Duct testing (Mandatory). Ducts shall be pressure tested to determine both total duct leakage and leakage to the outdoors. ~~air leakage by one of the following methods:~~

~~1.Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.~~
~~2.Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.~~

~~**Exceptions:**~~

1.~~A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.~~
2.~~A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.~~A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

Add new text as follows:

R403.3.3.1 (IRC N1103.3.3.1) Total duct leakage rough-in test or post construction test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m2) of conditioned floor area served, (4cfm/100sqft), when the air handler is installed at the time of the test. When the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m2) of conditioned floor area; (3cfm/100sqft). Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. If the HVAC duct work system is serving less than 1500 square feet of conditioned floor area, the allowable total duct leakage target shall be 60 cfm regardless of the calculated 4 cfm/100 sqft minimum performance target.
2. A total duct leakage measurement of 80 cfm or less may replace the requirement to test for duct leakage to outside the building's thermal envelope (R403.3.3.2) if compliance can be obtained through the modeling software calculations used to verify compliance with Section R405 or Section R406 for duct leakage to outside penalty or tradeoff.

R403.3.3.2 (IRC N1103.3.3.2) Duct leakage to outside the buildings thermal envelope post construction test. Leakage to outside the building thermal envelope shall be less than or equal to 4 cubic feet minute (113.3 L/min) per 100 square feet (9.29 m2) of conditioned floor area served, (4cfm/100sqft), when tested at a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure, with a blower door and duct leakage testing device. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct leakage to outside test shall not be required where the ducts and air handlers are documented, at a rough stage of construction, to be located entirely within the building's air barrier and thermal envelope. For systems that are not tested, a distribution systems efficiency of (0.96) for leakage to outside shall be permitted to be used when modeling for confirmed compliance with Sections R405 and R406
2. If the HVAC duct work system is serving less than 1500 square feet of conditioned floor area the allowable duct leakage to outside shall be 60 CFM or less.

Revise as follows:

~~**R403.3.4 (IRC N1103.3.4) Duct leakage (Prescriptive).** The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:~~

~~1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.~~

~~2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.~~

Reason:

- Although requiring two duct leakage tests, this proposal actually focuses on total duct leakage. If the total HVAC duct system is tight the built-in exceptions would allow the system not to have to have the second duct leakage to outside test. In addition, if the duct can be verified to be within the Building's Thermal Envelope and continuous air barrier assembly the duct would not have to be tested and could you a default distribution system efficiency. In this way great flexibility has been incorporated into this proposal.
- Currently having both mandatory and prescriptive requirements is confusing. Duct leakage testing is needed and needs to just be required to ensure efficiency, durability, safety, and comfort. Just as it is impossible to visually verify if a home's air barrier system is air tight it is impossible to know if the duct system is tight unless it is tested.
- Both of the current testing paths, prescriptive and mandatory, use the wrong matrix from an energy perspective. In order to ensure the intent of the IECC is maintained regardless of the compliance path, it makes sense to keep the total duct leakage requirement as it deals with the efficiency of the HVAC system from a use perspective. If the master bedroom, for example, is not receiving the quantity of air required by the HVAC design due to leaky ducts, then the thermostat will be adjusted and inefficiencies will be created.
- Adding a Duct leakage to outside (LTO) testing requirement specifically addresses the energy lose component of duct leakage which is also the intent of the IECC. Since duct leakage is associated with two distinct means of inefficiencies, behavior and measured, both tests should be required.
- The 4 cfm/100sqft of floor area target currently penalizes small units, so we have introduced a fix that was first developed by the Energy Star program. Currently the total duct leakage target is based on the amount of conditioned floor area. In this proposal a 'floor' has been added to the duct leakage target for small homes. By 'floor', we mean a lower limit that doesn't decrease as the space gets smaller and smaller.
- Energy Stars target floor is 40 CFM. We have used 80 CFM as it is a more reasonable target for small systems in our current state of installation and sealing expertise. In addition, it is our experience that there is a minimal modeling penalty associated with 80 CFM of duct leakage to outside.

Bibliography: Energy Conservatory

Duct Leakage to Outside Testing Instructions

http://energyconservatory.com

Cost Impact: The code change proposal will increase the cost of construction
Currently Total duct leakage testing is required. Duct leakage to outside is also required for IECC code sections R405 simulated performance and R406 ERI pathways. Duct leakage to outside is a tradeable feature and is an input in the modeling software used to demonstrate compliance with the code when using sections R405 and R406. Therefore, the code in essence is currently requiring both tests when these compliance options are used. **Price would increase for those who are using the prescriptive path** but should remain the same for those using the simulated performance path or the ERI path for compliance.

RE116-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This is not in alignment with previously approved proposals (Vote: 10-0).

Assembly Action: **None**

RE116-19

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION R403, R403.3.3, R403.3.4

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

SECTION R403 SYSTEMS

R403.3.3 Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.
2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.
3. <u>If the HVAC duct system is serving less than 1200 square feet of conditioned floor area the allowable duct leakage to outside shall be 72 CFM or less.</u>

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.
2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.

<u>**Exception:** If the HVAC duct system is serving less than or equal to 1,200 square feet of conditioned floor area, the allowable duct leakage shall be 72 cubic feet per minute or less.</u>

Commenter's Reason: The committee felt that RE116 did not align with other duct leakage proposals that passed prior to hearing RE116 at the CAH. Therefore, this public comment has been drastically narrowed to reintroduced an exception to the quantification of duct leakage when an HVAC system is servicing 1,200 sqft or less. This has support from all proponents of duct leakage proposals that passed at the CAH.
The allowance/exception for small dwelling units that are 1,200 sqft or less in size is being reintroduced here because they will have limited ductwork. It becomes irrational to expect to consistently seal the system below 72 CFM or 6 percent as would be required. If you have a 1,000 sqft unit, then the leakage rate at 6 CFM would be 60 CFM. If you had a 500 sqft unit, then the leakage rate would be 30 CFM. This is not practical, and there should be an exception.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal and the exception it proposes for duct leakage testing does not increase cost because it does not change the code requirement to perform a duct leakage test but rather how the results of the test is applied. Therefore, cost remains constant for the testing that is required.

Public Comment# 1913

RE117-19

IECC: R403.3.3 (IRC N1103.3.3), R403.3.4 (IRC N1103.3.4)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

SECTION R403 (IRC N1103)
SYSTEMS

R403.3.3 (IRC N1103.3.3) Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods ~~:~~ and shall not leak more than 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m2) of conditioned floor area served, (4cfm/100sqft), when the air handler is installed at the time of the test. When the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m2) of conditioned floor area; (3cfm/100sqft). Registers shall be taped or otherwise sealed during the test.

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1.A duct air-leakage test shall not be required ~~where the ducts and air handlers are located entirely within the *building thermal envelope*.~~
~~2.A duct air-leakage test shall not be required~~ for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.
2. If the HVAC duct system is serving less than or equal to 1,500 square feet of conditioned floor area, the allowable duct leakage shall be 60 cubic feet per minute or less.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

Delete without substitution:

~~**R403.3.4 Duct leakage (Prescriptive).** The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:~~

~~1.Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.~~
~~2.Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.~~

Reason: Since the 2006 IECC it has been a mandatory requirment to seal ductwork. The language has changed very little and in Section R403.3.2 of the 2018 IECC it now says, "Ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with either the *International Mechanical Code* or *International Residential Code*, as applicable." A separate section is addressing building cavities by stating that, "*Building* framing cavities shall not be used as ducts or plenums" in order to ensure tight, efficient, and well performing HVAC systems.
This short historical perspective reminds us that duct leakage has been an important energy conservation issue for quite some time; at least since 2006. However, it was not until the 2009 IECC that mandatory duct leakage testing entered the code. From that point forward the importance of duct leakage on the efficiency and performance of the house has not change, but more and more confusion has been introduced into the code. Currently, this confusion shows itself primarily in the relationship between testing organizations, HVAC contractors and builders, because there is a requirement to test, but there is no testing threshold target for the performance paths by which to hold a system to. Therefore, when using the performance paths, one mistakenly believes that yes, a system must be tested test, but no it does not have to be tight. This inconsistency between section R403.3.2 Sealing and R403.3.3 Duct testing is at the hart of this code change.

The 4 CFM/100 square feet of conditioned floor area leakage threshold is currently only a prescriptive threshold target. This makes some sense as duct leakage is a tradable performance metric in the software tools used to demonstrate compliance using sections R405 and R406. However, it also makes **no** sense as the IECC currently requires a total duct leakage test while sections R405 and R406 require a duct leakage to outside test to assess the performance trade off. To add to the confusion, a field testing organization cannot report to the HVAC contractor and builder if a home has passed the duct leakage testing requirements of the code when using performance compliance options because the software tools must be fully populated with data that is observed at both rough and final stages of construction in order to accurately determine tradeoffs.

This code change proposal simplifies the requirement and enforcement of the requirment. Just as whole house air leakage testing has specific blower door threshold targets, creating one minimum and specific threshold target for duct leakage allows for better and more streamline code adoption and enforcement. From a prescriptive compliance perspective, we know that if the home is equal to or better than the air leakage and duct leakage performance thresholds that it is meeting the minimum efficiency requirements of the code. From a performance perspective we also need to know if the home is meeting the minimum threshold requirements and then additional compliance flexibility is achieved when or if the home performs better. The unintended consequence of introducing a mandatory and prescriptive duct leakage test has only led to mass confusion in the field and a miss interpretation of the requirements.

I believe that the intent of the current 2018 IECC is that the duct leakage testing threshold is the 4% target. However, interpretation abounds. If this proposal is adopted, testing organizations would be able to quickly determine if the home is passing or failing with out argument that tighter systems are not required. Field interpretation from the HVAC contractor and builder side has not been that a specific leakage threshold target must be achieved or that the system must be sealed as Section R403.3.2 Sealing (Mandatory) requires. Instead the field interpretation is often that the system must be tested, but can be extremely leaky. This code change proposal fixes this miss interpretation.

This proposal continues by requiring that the HVAC duct system be tested to a specific minimum target threshold regardless of the location of the duct work. There are two reasons for this change. First, a significant amount of energy savings is achieved when the total leakage of the system is reduced. Remember that the code is currently only testing for total leakage, but only on HVAC systems that have a portion of the duct located outside of the building thermal envelope. When HVAC duct systems are located within the buildings thermal envelop, we are seeing significate total duct leakage that far exceed the 4 CFM/100 square feet of conditioned floor area threshold target, yet the system is in compliance with the code.

BTU's being delivered inside the building's thermal envelop does not equate to a home that is comfortable and efficient unless the correct quantity of BTU's that were designed to be delivered to the specific location occurs. Significant total duct leakage within the thermal envelop by definition ensures that the designed BTU's are not being delivered to their design location therefore causing comfort and efficiency issues. The occupant adjusts the thermostat in an attempt to deliver the required BTU's to the location where they are needed thus casing the system to run more often and less efficiently. The popularity of AreoSeal duct sealing in existing homes is a direct indication of this problem as homeowners seek a solution to leaky inefficient duct work that should have been addressed during construction.

https://aeroseal.com/

https://aeroseal.com/residential/how-aeroseal-works/

https://www.youtube.com/watch?v=06DlipDW0GU

The second reason to require duct leakage testing regardless of where the duct is located is due to cost saving that can be achieved. By just requiring the test to be performed, there will be a move to testing systems at a rough stage of construction to ensure that system testing failures do not impact construction cycle time or the closing of the home. This is the correct stage of construction for conducting the test, as if needed, the system can be economically fixed and retested before drywall has been installed.

Lastly, by holding duct systems to a 4 CFM/100 square feet of conditioned floor area threshold target the likely hood of needing a second test for duct leakage to outside when using R405 and R406 compliance options is low. Total duct leakage numbers in the 4% range can most often be used in software modeling to replace the duct leakage to outside number to demonstrate compliance when duct leakage to outside has not been tested. In other words the HVAC duct system will not leak more to outside than represented by the total duct leakage tested number, so if that number is used to represent duct leakage to outside and the home passes the compliance metrics of sections R405 or R406 then all is good and the home meets the intent of the code.

Cost Impact: The code change proposal will increase the cost of construction
There will be a small cost impact because all duct systems will be required to be tested. However, regardless of where the ducts are located the IECC already requires that the system be sealed in section R403.3.2. It is not possible to visually verified if the duct system is tight just as it is not possible to visually see if a house is air tight, so testing should be required. Energy savings beyond the actual loss of BTU's to the outside will be achieve, but this will require builders and or HVAC contractors to pay testing organizations or third party approved agencies to verify the duct leakage of the system.

RE117-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Do not need any more incentives to move mechanical equipment and ducts out of the attic. It is incumbent on building owners to ensure the system functions as intended (Vote: 6-5).

Assembly Action: **None**

RE117-19

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION R403, R403.3.3 (IRC N1103.3.3), R403.3.4

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION R403
SYSTEMS

R403.3.3 (IRC N1103.3.3) Duct testing (Mandatory). ~~Ducts~~ The duct work in a building or dwelling unit shall be pressure tested in accordance with ANSI/RESNET/ICC 380 or ASTM E1554 ~~to determine~~ for air leakage. The maximum total leakage rate for duct in any building or dwelling unit under any compliance path ~~by one of the following methods~~ ~~and~~ shall not exceed ~~leak more than~~ ~~4~~ 6.0 cubic feet per minute (~~113.3~~ 169.9 L/min) per 100 square feet (9.29 m2) of conditioned floor area served, (~~4~~ 6cfm/100sqft), when the air handler is installed at the time of the test. When the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3.0 cubic feet per minute (85 L/min) per 100 square feet (9.29 m2) of conditioned floor area; (3cfm/100sqft). Registers shall be taped or otherwise sealed during the test.

Testing shall be conducted at the rough-in stage or post-construction by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Alternatively, a duct leakage test to outside conditioned space with a pressure differential of 0.1 w.g. (25 Pa) with reference to the outside across the entire system including the manufacturers' air handler. Registers shall be taped or otherwise sealed during the test.

   Exceptions:

   1. A duct air-leakage test shall not be required for ducts serving ~~heat or energy recovery ventilators~~ ventilation systems that are not integrated with ducts serving heating or cooling systems.
   2. If the HVAC duct system is serving less than or equal to ~~1,500~~ 1,200 square feet of conditioned floor area, the allowable duct leakage shall be ~~60~~ 72 cubic feet per minute or less.

   A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.
2. Postconstruction test: Total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.
3. Where all ducts and air handlers are located entirely within the building thermal envelope, total leakage shall be less than or equal to 6.0 CFM (169.9 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.

Exception: If the HVAC duct system is serving less than or equal to 1,200 square feet of conditioned floor area, the allowable duct leakage shall be 72 cubic feet per minute or less.

Commenter's Reason: Public Comment Reason Statement:
The committee was split 6-5 in disapproval of the original RE117 proposal. As 5 CAH proposals dealing with duct leakage did pass many but not all aspects of RE117 have been addressed. Therefore, the public comment and proposal has been structred to incorporate all CAH approved changes to this duct leakage section and address issues which were not addressed by the five duct leakage proposals that passed during the CAH. TheCAH Proposals that were approved are, RE112, RE114, RE115, RE118, RE119. Now, one can comprehend the totality of the changes that will occur in this section if this proposal passes. The following has been added or moved.

1. RE119 alternative testing allowance has been moved to Post construction testing as Duct leakage to Outside testing cannot occur at a rough stage of construction.
2. Allowance for testing without the air handler at a rough stage of construction has been added to Section R403.3.3 in order to provide the same level of flexibility that is offered in Section R403.3.4
3. This proposal lowers RE115's upper duct leakage target from 8 CFM/sqft of conditioned floor area to 6 CFM/sqft in the mandatory requirement. The rationale for this is two-fold. First, there are energy savings from tighter ducts within the building envelope, as well as health, safety, and durability benefits. Second, if the ducts are at 6 CFM of total leakage, then that number works 90+% of the time for the duct leakage to outside input in the code compliance software for the simulated performance and ERI paths to demonstrate compliance. Therefore, additional testing is not needed unless more trade-offs are needed or desired.
4. Next, an allowance/exception for small dwelling units that are 1,200 sqft or less in size has been added. A 1,200 sqft dwelling unit will have limited ductwork, and it becomes irrational to expect to consistently seal the system below 72 CFM or 6 percent as would be required. If you have a 1,000 sqft unit, the leakage rate at 6 CFM would be 60 CFM. If you had a 500 sqft unit, it would be 30 CFM. This is not practical, and there should be an exception. There was agreement from the proponents of duct leakage CAH proposals that this exception was worth adding to the code.

Lastly, although there was not total agreement,collaboration with the proponents of the five proposals that passed at the CAH has occurred.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Per the reason statements of the 5 original proposals that passed at the CAH this proposal will be cost neutral or will not increase cost.

There should be a small cost impact because all duct systems will be required to be tested. However, regardless of where the ducts are located the IECC already requires that the system be sealed in section R403.3.2. It is not possible to visually verified if the duct system is tight just as it is not possible to visually see if a house is air tight, so testing should be required. Energy savings beyond the actual loss of BTU's to the outside will be achieve, but this will require builders and or HVAC contractors to pay testing organizations or third party approved agencies to verify the duct leakage of the system. This proposal tries to ensure that the required testing is performed in the most efficient manner to save cost.

Staff Analysis: ANSI/RESNET/ICC 380 is currently referenced in the 2018 IECC. ASTM E1554 has been proposed as a new standard to this section as part of RE114-19. RE114-19 was recommended for approval by the IECC-R code committee. RE114-19 did not receive any public comments and is therefore on the consent agenda.

Public Comment# 1920

RE119-19

IECC: R403.3.3 (IRC N1103.3.4), R403.3.3 (IRC N1103.3.4)

Proposed Change as Submitted

Proponents: Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

2018 International Energy Conservation Code

Revise as follows:

R403.3.3 (IRC N1103.3.3) Duct testing (Mandatory). Ducts shall be pressure tested to determine air leakage by one of the following methods:

1. Rough-in test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the system, including the manufacturer's air handler enclosure if installed at the time of the test. Registers shall be taped or otherwise sealed during the test.
2. Postconstruction test: Total leakage shall be measured with a pressure differential of 0.1 inch w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Alternatively, a duct leakage test to outside conditioned space with a pressure differential of 0.1 w.g. (25 Pa) with reference to the outside across the entire system including the manufacturers's air handler enclosure. Registers shall be taped or otherwise sealed during the test.

Exceptions:

1. A duct air-leakage test shall not be required where the ducts and air handlers are located entirely within the *building thermal envelope*.
2. A duct air-leakage test shall not be required for ducts serving heat or energy recovery ventilators that are not integrated with ducts serving heating or cooling systems.

A written report of the results of the test shall be signed by the party conducting the test and provided to the *code official*.

R403.3.4 (IRC N1103.3.4) Duct leakage (Prescriptive). The total leakage of the ducts, where measured in accordance with Section R403.3.3, shall be as follows:

1. Rough-in test: The total leakage shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area where the air handler is installed at the time of the test. Where the air handler is not installed at the time of the test, the total leakage shall be less than or equal to 3 cubic feet per minute (85 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.
2. Postconstruction test: Total leakage or leakage to outside conditioned space shall be less than or equal to 4 cubic feet per minute (113.3 L/min) per 100 square feet (9.29 m^2) of conditioned floor area.

Reason: Allowing the option for measurement of duct leakage to the outside will give both HVAC installers and homeowners an accurate measurement of duct leaks to the exterior of the building. This is the only true testing method that measures energy loss as the method is measuring the leakage outside the thermal envelope not from inside conditioned space. Duct leakage to the outdoors is an accepted duct testing method in the industry and was allowed under Section 403.2.2 of the 2009 IECC and approved for the 2015 IECC by the committee, but withdrawn by the proponent. Proposed changes provide clarity as to what distribution system efficiency should be applied to the Standard Reference Design and how the ducts should be modeled in the performance path.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal will not change the cost of construction. It will provide a testing method that measures the true energy loss of ducts.

RE119-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This provides an alternative means to help reduce leakage to the outside (Vote: 6-5).

Assembly Action: **None**

RE119-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it is a rollback that will reduce energy efficiency and will lead in many cases to reduced occupant comfort and increased energy use. A test for leakage to outdoors only determines if air is being leaked outside the home and, unlike total duct leakage, does not reflect whether conditioned air is actually being delivered to the intended spaces of the home. By definition, total duct leakage may equal leakage to the outdoors in some circumstances, but in many cases it can far exceed leakage to the outdoors. As a result, testing for leakage to the outdoors is a far weaker standard and should not be allowed as an option. The two tests are not interchangeable and should not be treated as such in the code. It should be noted that this proposal (submitted by NAHB) was only narrowly approved by the Committee on a 6-5 vote, which included all 4 builder votes in favor.

Proposals similar to RE119 have been rejected several times in recent code development cycles, most recently RE108-16, which was disapproved by over 95% of Governmental Member Voting Representatives. The efficiency of the delivery system for conditioned air is important, no matter where ducts are located and no matter how much conditioned air ultimately escapes the thermal envelope.

For example, when a substantial amount of conditioned air spills out into the furnace room or otherwise does not reach intended locations in the home, energy modeling software may not recognize this as an efficiency loss, but the home's occupants will respond by tweaking the thermostat to offset the failure to deliver this conditioned air to the desired locations in the home. As we noted in the reason for proposal RE112, in addition to the negative direct impacts on occupants from discomfort, the negative energy use impact of uncomfortable occupants can also be significant. Changing the thermostat setting by just one degree can increase total energy use of the home from 0.5% to 4.7% for heating and 0.4% to 7.8% for cooling, depending on climate zone.

Increased Total Energy Use Resulting from Thermostat Adjustment									
Measure	Weighted	1	2	3	4	5	6	7	8
+1 Degree Heating	4.1%	0.5%	3.0%	4.2%	4.4%	4.7%	4.5%	4.0%	2.9%
-1 Degree Cooling	3.0%	7.8%	5.3%	3.9%	2.6%	1.8%	1.4%	0.7%	0.4%

The only way to ensure that duct systems are delivering conditioned air to the intended locations in the building is to require a total duct leakage test, not a test for leakage to the outdoors. Proposal RE119-19 will create a loophole for poorly-constructed duct systems, and it will lead to increased energy use. It should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1483

RE121-19

IECC: R403.3.4.1 (IRC N1103.3.4.1) (New), R403.3.4.1.1 (IRC N1103.3.4.1.1) (New), R403.3.4.1.2 (IRC N1103.3.4.1.2) (New)

Proposed Change as Submitted

Proponents: Aaron Gary, representing Self (aaron.gary@texenergy.org)

2018 International Energy Conservation Code

Add new text as follows:

R403.3.4.1 (IRC N1103.3.4.1) Sampling options for R2 multifamily dwelling units. For buildings having three or more dwelling units, a minimum of 15% of the dwelling units in each building must be tested as required by Section R403.3.3. Prior to beginning sampling for testing, “Initial Testing” is required for each multifamily property. “Initial Testing” shall consist of the 3rd party testing contractor performing the required tests on at least three consecutive dwelling units. Test results from the “Initial Testing” must satisfy minimum code requirements before sampling is permitted. Dwelling units selected for the “Initial Testing” must be within the same building. Dwelling units selected for “Initial Testing” shall not be included in a “sample group” or counted toward the minimum 15% of dwelling units tested. The building official shall randomly select the three dwelling units for “Initial Testing.” The building official may delegate the random selection to the designated 3rd party testing contractor.

R403.3.4.1.1 (IRC N1103.3.4.1.1) Sample group Identification and Sampling The builder shall identify a "sample group" which may be a building, floor, fire area or portion thereof. All of the dwelling units within the “sample group” must be at the same stage of construction and must be ready for testing. The building official shall randomly select at least 15% of dwelling units from each “sample group” for testing. The building official may delegate the random selection to the designated 3rd party testing contractor.

If each tested dwelling unit within a “sample group” meets the minimum code requirements, then all dwelling units in the “sample group” are considered to meet the minimum code requirements.

Before a building may be deemed compliant with the testing as required, each “sample group” must be deemed compliant with the minimum code requirements. The sum total of all of the tested dwelling units across all “sample groups” shall not be less than a minimum of 15% of the dwelling units in a building.

R403.3.4.1.2 (IRC N1103.3.4.1.2) Failure to Meet Code Requirement(s). If any dwelling units within the identified “sample group” fail to meet a code requirement as determined by testing, the builder will be directed to correct the cause(s) of failure, and 30% of the remaining dwelling units in the “sample group” will be randomly selected for testing by the building official, or third-party testing contractor, regarding the specific cause(s) of failure.

If any failures occur in the additional dwelling units, all remaining dwelling units in the sample group must be individually tested for code compliance.

A multifamily property with three failures within a 90-day period is no longer eligible to use the sampling protocol in that community or project until successfully repeating "Initial Testing." Sampling may be reinstated after at least three consecutive dwelling units are individually verified to meet all code requirements.

A Certificate of Occupancy may not may be issued for any building until testing has been performed and deemed to satisfy the minimum code requirements on the dwelling unit(s) identified for testing.

Reason: For many multifamily (R2 classifications) projects, it is very costly and time consuming to test each dwelling unit for projects where there may be dozens of dwelling units in each building. Considering that the same tradesman generally constructs a building, it is reasonable to deem that construction practices are consistent and that if a reasonable sampling of units tested pass then all units would pass. These amendments (originally drafted by the North Texas Council of Governments Energy and Green Advisory Board) or are very similar ordinances, have been accepted across Texas by the EHJs including the City of Dallas, the City of Austin, and the City of San Antonio.

Cost Impact: The code change proposal will decrease the cost of construction
This code change proposal will streamline the cost and time required to conduct on-site verification of Code which will result in lower testing costs and faster construction timelines

RE121-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The language is not appropriate for the code, and 15% is too low of sample size (Vote: 6-5).

Assembly Action: **None**

RE121-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R403.3.5 (New)

Proponents:
Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

R403.3.5 Sampling for multifamily dwelling and sleeping units. Where multiple dwelling units or sleeping units or other occupiable conditioned spaces are contained within one building thermal envelope, each unit shall be considered an individual testing unit and the duct air leakage shall be the weighted average of all testing unit results, weighted by each testing unit's testing unit conditioned area. Units shall be tested separately as follows:

1. Where buildings have fewer than eight testing units, each testing unit shall be tested.
2. For buildings with eight or more testing units the greater of seven units or 20 percent of the testing units in the building shall be tested including a top floor unit, a ground floor unit, and a unit with the largest testing unit conditioned area. For each tested unit that exceeds the maximum duct air leakage rate, 2 additional units shall be tested, including a mixture of testing unit types and locations.

Commenter's Reason: The Committee reason for Disapproval was that," The language is not appropriate for the code, and the 15% is too low of (a) sample size." The revised language I am proposing addresses both of these reasons while maintaining the intent of the original Code Change Proposal. The revised language, which is substantially similar to language approved by the Commercial Energy Committee for a testing requirement for multifamily dwelling units, increases the minimum sampling rate to 20%.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal will neither increase nor decrease the cost of construction. It will streamline the time required to conduct on-site testing which will translate to better compliance and faster construction timelines.

Public Comment# 2078

RE126-19

IECC: R202 (IRC N1101.6), R403.5.1 [IRC N1103.5.1] (New), TABLE R403.5.1 [IRC N1103.5.1] (New)

Proposed Change as Submitted

Proponents: Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org)

2018 International Energy Conservation Code

Add new text as follows:

R403.5.1 (IRC N1103.5.1) Water heating equipment. Service water heating equipment shall be one or more of the following types:

1. Storage gas water heater with a uniform energy factor (UEF) that meets the requirements of Table R403.5.1.
2. Storage electric water heater utilizing not less than 1.0 kW of on-site renewable energy.
3. Heat pump water heater with a UEF not less than of 2.0.
4. Tankless water heater.
5. Grid-enabled water heater.
6. Solar water heating system having a solar fraction of not less than 0.5.

TABLE R403.5.1 (IRC N1103.5.1)
MINIMUM UNIFORM ENERGY FACTOR (UEF) FOR STORAGE GAS WATER HEATERS

FIRST HOUR RATING[a]	MINUMUM UEF
Very Small	0.24
Low	0.50
Medium	0.64
High	0.68

a. The first hour rating of a water heater is determined by the federal test procedure. It is listed on the Energy Guide label affixed to the water heater.

SECTION R202 (N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

GRID-ENABLED WATER HEATER. An electric water heater that includes controls that enable activation for use as part of an electric thermal storage or demand response program.

SOLAR FRACTION. The fraction of total annual water heating energy met by a solar water heater.

Reason: This proposal improves the energy efficiency of the prescriptive path of the code while continuing to offer builders the same level of flexibility they already enjoy. Builders may still install any type of water heater that works for the home and location, including storage gas or electric water heaters. While it is true that not every home may be able to utilize every option listed, there is an option that is appropriate for any home. This proposal also modifies only the prescriptive path, which leaves builders the flexibility of the performance and ERI paths.
This proposal is structured so that it does not trigger provisions of the National Appliance Energy Conservation Act (NAECA). See attached for a legal memorandum.

Residential envelopes have been getting tighter and better over the last few years. As a result, domestic water heating energy is emerging as a significant end-use from the efficiency stand-point. There are multiple ways of improving the efficiency of generating hot water in homes.

The US Department of Energy's analysis for the standard that took effect in 2015 found that high-efficiency gas storage water heaters cost less upfront to install in new construction than standard efficiency models, due to lower venting costs of the high-efficiency equipment[1]. Furthermore, this efficiency level is cost-effective for customers compared to a standard model, saving more than $200 in energy costs. This means that customers will save money on their bills by installing a more efficient gas storage water heater *and* will pay less to purchase the efficient model than the less-efficient model. Gas furnaces that meet the Uniform Energy Factors specified in this proposal are widely available. Uniform Energy Factors are specified, per the DOE federal test procedure, based on the equipment's First Hour Rating, which is clearly labeled on the yellow Energy Guide label affixed to each

Storage electric water heaters may be installed, when coupled with solar energy. The purpose of this requirement is to offset the electricity used to heat the water, saving money for the consumer. In addition, solar energy is a strong selling point for a new home.

DOE analysis found that heat pump water heaters that replace electric storage water heaters are wildly cost-effective in all climate zones, in spite of their higher equipment costs. Homeowners will save more than $500 in energy costs compared to even an efficient electric storage water heater.

Tankless water heaters were cost-effective in the warmer climate zones, but were not as cost-effective in the colder climate zones.

As part of DOE's appliance and equipment standards initiative, stakeholders expressed the importance of electric resistance water heaters to electric thermal storage (ETS) programs, so those grid-enabled water heaters are also incorporated into this proposal. Utilities use ETS programs, sometimes also known as load shifting or demand response programs, to manage peak demand load by limiting the times when certain appliances are operated. In certain water-heater based ETS programs, a utility typically controls a water heater remotely to allow operation only when electricity demand is during off-peak hours. During that off-peak operation, the electricity consumed is stored by the water heater as thermal energy for use during peak hours when the utility prevents the water heater from using electricity.

A solar water heating system can be designed in a variety of different ways. They can directly heat the water using the sun, can indirectly transfer heat from the sun to water in a storage tank, or can use pumps and valves to move water from collectors to a storage tank. They can have either gas or electric backup heating capabilities. This proposal requires at least half of the total energy delivered to the water heater to be generated through solar energy.

[1] U.S. Department of Energy, Energy Efficiency and Renewable Energy Office. Water Heater Technical Support Document Analytical Tools. Retrieved on January 11, 2019 from https://www.regulations.gov/document?D=EERE-2006-STD-0129-0046.

LEGAL MEMORANDUM CONCERNING NRDC's PROPOSED R403.5.1 AND THE NATIONAL APPLIANCE ENERGY CONSERVATION ACT

Introduction

The Natural Resources Defense Council (NRDC) proposes the addition of R403.5.1 to Chapter 4 of the 2018 International Efficiency Conservation Code (IECC).[1] The proposed addition prescribes six types of water heaters which may be installed by builders in order to comply with the prescriptive compliance pathway of IECC Chapter 4. Some commenters on similar past proposals expressed concern that such a provision would be preempted by the National Appliance Energy Conservation Act, which amended the Energy Policy Conservation Act and set up the energy efficiency standards program for appliances, including water heaters. This is not the case. The proposed code addition comports with the federal statutory provision for building codes because it does not require installation of water heaters that exceed the current federal minimum level.

Legal Analysis

As explained in greater detail below, the issue is whether these proposed additions would effectively require builders to use products that are more efficient than required by federal efficiency standards and thus would trigger preemption. Because they do not there is no preemption concern here.

The National Appliance Energy Conservation Act provides that state building codes may include provisions concerning the efficiency of appliances covered by federal efficiency standards if they meet seven specified requirements.[2] Commenters in the past expressed concern that the provision would not meet two of these requirements: Sections 6297(f)(3)(B) and 6297(f)(3)(E). The basic requirement of these two provisions is that the building code not require use of an appliance more efficient than the level set by the Department of Energy under the Act.

The first of these focuses on the code as a whole. It states, in relevant part, that the code may not "require that the covered product have an energy efficiency exceeding the applicable energy conservation standard ... ." The second provision concerns building codes that offer optional combinations of items.[3] Our proposed changes easily satisfy this provision because, as discussed below,

[1] This memorandum is submitted as an attachment to NRDC's July 21, 2016 proposed amendment.
[2] 42 U.S.C. § 6297(f)(3).
[3] It is not clear whether the optional "combinations of items" applies to the prescriptive pathway at all. 42 U.S.C § 6297(f)(3)(E). Assuming that it does, we believe the relevant "combination" would be the combination of each of the different water heater options and the rest of the prescriptive options. The proposed standard avoids preemption because it includes multiple optional combinations that include minimum efficiency water heaters and only two that require higher efficiency appliances.

four of the six options do not involve products that exceed existing federal standards. (A fifth option may not require a standard-exceeding product depending on the first hour rating of the water heater.)

The presence of some more efficient options does not trigger preemption. In interpreting these provisions, the Ninth Circuit Court of Appeals has recognized that "a builder is not 'required' to select a [more efficient] option . . . simply because there is an economic incentive to do so."[4]

The proposed amendment would be not preempted because it allows installation in new residential buildings of minimum-efficiency water heaters. The statutory preemption test focuses on the "covered product," which is defined in this case as water heaters.[5] Thus, a building code is not preempted so long as it does not require installation of a covered product – in this case a water heater – that is above the minimum efficiency level. The proposed amendment plainly does not do so for several reasons. First, the performance path (Section 405) and the Energy Rating Index path (Section 406) focus on overall energy use and include no water heater requirements at all.

Second, even just considering the prescriptive pathway, the proposed amendment still does not require use of a water heater that exceeds minimum federal standards. The proposed amendment allows builders to select any of the six prescribed types of water heaters, at least two of which clearly do not exceed the federal requirements: tankless water heaters (R403.5.1.4) and grid-enabled water heaters (R403.5.1.5). For tankless water heaters, the proposed code amendment contains no minimum efficiency standard and thus the federal standards would apply.[6] For grid-enabled water heaters, the proposed code complies with the federal provision.[7] As such, builders can comply with the standard by using water heaters that meet, but do not exceed, federal efficiency standards. Indeed, even if these minimum efficiency options were not available, the prescriptive path would still not "require" use of higher efficiency water heaters since any type of water heater can be used under the prescriptive approach if combined with other options such as a solar water heater.[8]

The proposed amendment is also similar to existing building code provisions. The prescriptive compliance path in California's 2016 building code, for instance, requires installation of either gas/propane instantaneous water heaters or gas/propane storage type water heaters in new residential dwellings.[9] California's prescriptive compliance path allows use of certain minimum efficiency water heaters but does not allow use of every type of minimum efficiency water heater. Like the proposed

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[4] *Building Industry Ass'n of Wash. v. Wash. State Bldg. Code Council*, 683 F.3d 1144, 1151 (9th Cir. 2012).
[5] 42 U.S.C. § 6292(a)(4).
[6] Energy Conservation Program for Consumer Products: Definitions and Standards for Grid-Enabled Water Heaters, Final Rule, 80 Fed. Reg. 48004-01 (August 11, 2015).
[7] *Id.*
[8] *See Building Industry Ass'n of Wash.*, 683 F.3d at 1151.
[9] 2016 Building Energy Efficiency Standards for Residential and Nonresidential Buildings, Section 150.1(c)(8)(A), available at http://www.energy.ca.gov/title24/2016standards/index.html.

code, the California code allows builders to choose an alternate compliance path, which allows use of any water heater.[10]

Conclusion

The core requirement for a building code to avoid preemption is that it not require above-minimum efficiency appliances. This requirement is met by the NRDC proposal because the proposal offers multiple ways that minimum efficiency water heaters can be used under both the prescriptive and performance pathways.

[10] *See* International Energy Conservation Code, R401.2, available at http://codes.iccsafe.org/app/book/toc/2015/I-Codes/2015%20IECC%20HTML/index.html.

Bibliography: U.S. Department of Energy, Energy Efficiency and Renewable Energy Office. Water Heater Technical Support Document Analytical Tools. Retrieved on January 11, 2019 from https://www.regulations.gov/document?D=EERE-2006-STD-0129-0046.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal provides a list of options for a builder to choose from. In some instances the builder may choose an option which increases construction costs, but there are many options that will not increase costs. For instance, the US Department of Energy's analysis for the water heater standard that took effect in 2015 found that high-efficiency gas storage water heaters cost less upfront to install in new construction than

standard efficiency models, due to lower venting costs of the high-efficiency equipment.

RE126-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proposal limits potential technological development. Good first step, please bring back, being cautious of staying within federal minimums (Vote: 11-0).

Assembly Action: **None**

RE126-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R403.5.1 (IRC N1103.5.1) (New), TABLE R403.5.1 (IRC N1103.5.1) (New), SECTION R202 (N1101.6), 202 (New)

Proponents:
Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.5.1 (IRC N1103.5.1) Water heating equipment. Service water heating equipment shall be one or more of the following types:

1. ~~Storage gas water heater with a uniform energy factor (UEF) that meets the requirements of Table R403.5.1.~~
2. ~~Storage electric water heater, utilizing and not less than 1.0 kW of on-site renewable energy.~~
3. Heat pump water heater.
4. Tankless water heater.
5. *Grid-enabled water heater.*
6. ~~Solar water heating system having a *solar fraction* of not less than 0.5.~~

Exception: Installation of one or more of the following types:

1. Replacement water heating equipment
2. Storage gas water heater with a uniform energy factor (UEF) that meets the requirements of Table R403.5.1.
3. Storage electric water heater, utilizing and not less than 1.0 kW of on-site renewable energy.
4. Solar water heating system having a *solar fraction* of not less than 0.5.
5. Any other type of water heating system not explicitly listed in Section R403.5.1 (IRC N1103.5.1), and not less than 1.0 kW of on-site renewable energy.

TABLE R403.5.1 (IRC N1103.5.1)
MINIMUM UNIFORM ENERGY FACTOR (UEF) FOR STORAGE GAS WATER HEATERS

FIRST HOUR RATING[a]	MINUMUM UEF
Very Small	0.24
Low	0.50
Medium	0.64
High	0.68

a. The first hour rating of a water heater is determined by the federal test procedure. It is listed on the Energy Guide label affixed to the water heater.

SECTION R202 (N1101.6) GENERAL DEFINITIONS

GRID-ENABLED WATER HEATER. An electric water heater that includes controls that enable activation for use as part of an electric thermal storage or demand response program.

SOLAR FRACTION. The fraction of total annual water heating energy met by a solar water heater.

Commenter's Reason:
This proposal should be approved as modified. It has been modified to provide additional clarity and flexibility, while maintaining the integrity of the original proposal.

The proposal requires builders to install either a tankless water heater, a grid-enabled water heater, or a heat pump water heater, with an exception for if a builder installs a water heating system from a list of additional options. The additional options include storage gas water heaters (some of which must be more efficient than the federal minimum standard), electric resistance water heaters (if the home also has at least 1.0 kW of on-site renewable energy generation) and solar water heating systems, among others. The proposal is structured in this way to respond to the Committee's comments about being clear which water heating efficiency levels are set at federal minimum standards, and which are more efficient or require installation of additional components.

Tankless water heaters, grid-enabled water heaters, and heat pump water heaters clearly do not exceed the federal requirements. But even if these options were not available for a home, or did not make economic sense, many of the options in the exception can utilize water heater heating equipment that meets the federal standard if combined with other options. For example, a builder may install any electric resistance water heater, provided the home also has at least 1 kW of on-site renewable energy. Similarly, any type of water heater may be paired with a solar water heating system.

Other states and jurisdictions are already incorporating water heaters into their building codes. Washington state recently passed legislation that would require all electric water heaters to have a modular demand response communications port compliant with certain standards that make it grid-enabled. The Washington requirement takes effect January 1, 2021, and applies to all electric storage water heaters offered for sale, for use in both new and existing buildings. California's Title 24 building code requires installation of either gas/propane instantaneous water heaters or gas/propane storage type water heaters in new residential dwellings. In the case of California, the prescriptive compliance path allows use of certain minimum efficiency water heaters, but does not allow use of every type of minimum efficiency water heater. As such, the proposal at hand is significantly more permissible and flexible than what is currently in place in California.

This proposal continues to be relevant only to the prescriptive path of the code. Builders may use any type of water heater they choose if they follow the performance or ERI path of the code.

Bibliography: State of Washington, House Bill Report 2SHB 1444, As Passed Legislature: http://lawfilesext.leg.wa.gov/biennium/2019-20/Pdf/Bill%20Reports/House/1444-S2%20HBR%20PL%2019.pdf

California Energy Commission, Building Energy Efficiency Standards, Title 24, Section 150 (Mandatory Features and Devices):http://lawfilesext.leg.wa.gov/biennium/2019-20/Pdf/Bill%20Reports/House/1444-S2%20HBR%20PL%2019.pdf

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The requirements of the code change will increase the cost of construction, as tankless water heaters, grid-enabled, and heat pump water heaters tend to cost more than some "conventional" tank water heating models. However, if a builder chooses to comply via the options available in the exception, there may be little or no increased cost. As mentioned in the reason statement, many of these options allow for installation of minimum efficiency equipment when paired with other options like on site renewable energy production.

RE130-19

IECC: R403.6.2 (IRC N1103.6.2) (New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Add new text as follows:

R403.6.2 (IRC N1103.6.2) Testing. Mechanical ventilation systems shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood or box, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals or grilles, outlet terminals or grilles, or in the connected ventilation ducts. Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official.

> **Exception:** Kitchen range hoods that are ducted to the outside with 6” or larger duct and one or less 90° elbow or equivalent in the duct run are exempt from this requirement to test air flow.

Reason: As we continue to be guided by sound building science to build tight homes as required by the IECC to achieve better predictability and control of air flow, thermal flow, and moisture flow spot/local and whole house ventilation becomes an even more crucial aspect of ensuring that the full intent of the IECC is met. This includes durability, safety, healthy, flexibility in how we build, as well as, efficiency of the structure. If we do not more actively ensure that the systems in our homes are not only there, but are also performing as intended we have missed the mark with regards to the intent of the code and creating dwellings that are durable, safe, healthy, and efficient. The testing experience gained through the verification of the EnergyStar program has clearly demonstrated that ventilation fans are installed but are not performing as required by the code. Fan rated flow does not equate to the flow that is actually produced once a fan has been installed. The quality of the installation of the duct from the fan to the termination of the duct to the outside, as well as, the quality of the termination device ultimately governs the amount of air that any fan can push. Simple cost-effective testing is available to ensure that the systems in our homes are not only there but have been installed in such a way that they work as intended by the code.
Allison Bailes Energy Vanguard blog post titled, “The 2 Main Problems With Kitchen Ventilation” which can be found here https://www.energyvanguard.com/blog/2-main-problems-kitchen-ventilation Offers additional rational regarding the consequences of poor ventilation from research conducted by Brett Singer and others at Lawrence Berkeley Laboratory. If you are interested there are additional links at the end of his post to related articles that further discuss this issue. I offer this background information to demonstrate that beyond the physical failure of measured fan flow to meet the requirements of code, that there is an extensive study being produced on the effects of improper ventilation. Requiring testing of spot/local and whole house ventilation system will move the building industry into compliance with the code by offering direct feedback on the fan choice and the installation. In the most flexible way possible this feedback will guide fan choice and installation techniques that will become compliant with the code.

Cost Impact: The code change proposal will increase the cost of construction
The cost implications of this code change are small. Qualified testing personnel are already available and at the building performing blower door and duct leakage tests. Adding simple flow measurements of ventilation systems at the same time a blower door test occurs, for example, is not only practical but cost-effective. An increase is cost of $25-$50 is well worth the reduction in builder risk, occupant health, and efficiency issues that are associated with poor implementation of code required moisture and pollutant management.

RE130-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: It makes sense to test these pieces of equipment and there is a standard we can rely on (Vote: 6-5).

Assembly Action: **None**

RE130-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R403.6.2 (IRC N1103.6.2) (New)

Proponents:
Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.6.2 (IRC N1103.6.2) Testing. Mechanical ventilation systems shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6. Testing shall be performed according to the ventilation equipment manufacturer's instructions, or by using a flow hood or box, flow grid, or other airflow measuring device at the mechanical ventilation fan's inlet terminals or grilles, outlet terminals or grilles, or in the connected ventilation ducts. Where required by the code official, testing shall be conducted by an approved third party. A written report of the results of the test shall be signed by the party conducting the test and provided to the code official.

~~Exception~~ Exceptions:

1. Kitchen range hoods that are ducted to the outside with 6” or larger duct and one or less 90° elbow or equivalent in the duct run are exempt from this requirement to test air flow.
2. Mechanical ventilation systems verified by an approved, independent laboratory to provide the following are exempt from any requirement for third party airflow testing: programmable and self-modulating flow rate, ability to achieve the programmed flow rate within 10% or 5 CFM, and a user interface that communicates when the flow rate is achieved.

Commenter's Reason: Verification of ventilation system flow rate is critical to ensuring systems meet minimum code requirements. This modification to the original proposal is in keeping with the objective of verifying flow rate, but it adds another option for doing so by encouraging innovation of products that are laboratory-verified to modulate flow to the user's selected flow rate and communicate via a user-interface whether or not the user's selected flow is achieved. To encourage the development and specification of such laboratory-verified self-modulating systems, this proposal waives any requirement for third-party field verification of the flow rate.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The original proposal will increase the cost of construction by adding testing requirements. The PC to the proposal will help to reduce costs by providing additional compliance options.

Public Comment# 2122

Public Comment 2:

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: The proposed change which proposed to require testing of ventilation flow rates has no meaning and should be disapproved. The proposal states that "Mechanical ventilation systems shall be tested and verified to provide the minimum ventilation flow rates required by Section R403.6." Section R403.6 references Table R403.6.1. Table R403.6.1 is for Whole-House Mechanical Ventilation System Fan Efficacy and has flow rates for bathroom/utility room fans to determine the minimum efficacy of the fan. The flow rates for other fans listed have no minimum or maximum flow rate. Testing of the fans is to determine minimum efficacy (CFM/WATT).

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1195

RE132-19 Part I

IECC: R403.6 (IRC N1103.6)

Proposed Change as Submitted

Proponents: Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

Revise as follows:

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). ~~The *building*~~ Buildings and dwelling units shall be provided with mechanical ventilation that complies with the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Reason: Changes to R303.4
Section N1102.4 establishes MANDATORY requirements for air sealing of the building envelope, including mandatory requirements to follow the air barrier and insulation installtion criteria in Table N1102.4.1.1 and the mandatory blower door testing and verification requirements in Section N1102.4.1.2. Further, all dwelling units complying with Section N1102.4 require a blower door test with results that achieve 5 ACH50 or less. Thus, all dwelling units complying with Section N1102.4 already require whole-house mechanical ventilation. This change simplifies Section R303.4 and future-proofs the intent of the section by ensuring that tight dwelling units will continue to be provided with whole-house mechanical ventilation, regardless of the metric used to verify that the dwelling units are tight (e.g. there are several proposals being heard in Group B that would move from the metric of ACH50 to a metric of cfm50/ft2).

These changes are aligned with Group A action on proposal M20. M20 was approved and removed the specific reference to 5 ACH50 as the air leakage metric that triggers a mechanical ventilation requirement in Section 401.2 of the IMC as follows:

401.2 Ventilation required. Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. *< Strikeout the following text: Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2-inch water column (50 Pa) in accordance with Section R402.4.1.2 of the International Energy Conservation Code, the dwelling unit shall be ventilated by ... End strikeout section >* Dwelling units complying with the air leakage requirements of the International Energy Conservation Code or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403.

Changes to Section 403.6

In keeping with IRC Section R303.4 and IMC Section 401.2, the heading of section 403.6 requires "mechanical" ventilation for buildings complying with the IECC-Residential. To clarify that this is the intent of this section and is coordinated with the IRC and IMC (which contain mechanical ventilation requirements for buildings and dwelling units), the words "mechanical" and "dwelling units" are proposed for inclusion within the text of R403.6.

These changes are aligned with Group A action on proposal M20. M20 was approved and removed the specific reference to 5 ACH50 as the air leakage metric that triggers a mechanical ventilation requirement in Section 401.2 of the IMC as follows:

401.2 Ventilation required. Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. *< Strikeout the following text: Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2-inch water column (50 Pa) in accordance with Section R402.4.1.2 of the International Energy Conservation Code, the dwelling unit shall be ventilated by ... End strikeout section >* Dwelling units complying with the air leakage requirements of the International Energy Conservation Code or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is a clarification of current requirements of the IRC, IMC, and IECC and does not increase or decrease the cost of construction.

RE132-19 Part I

Public Hearing Results

Committee Action: **As Modified**

Committee Modification: R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). Buildings and dwelling units complying with Section 402.4.1 shall be provided with mechanical ventilation that complies with the requirements of Section M1505 of the International Residential Code or

International Mechanical Code, as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Committee Reason: With modification the proposal provides necessary guidance for builders and inspectors in install ventilation correction, the modification adds the two sections needed for a reasonable pointer (Vote: 8-3).

Assembly Action: **None**

RE132-19 Part I

Individual Consideration Agenda

Public Comment 1:

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: RE132-19 Part I and RE132-19 Part II are joint proposed code changes and they should both be disapproved. Disapproval of one and approval of the other would have no meaning and create confusion in the code. Contrary to the Reason Statement and Cost Impact which states "the changes are a "clarification" of current requirements, they greatly expand the requirements for mechanical ventilation to require all R occupancies to be mechanically ventilated. The proposals do not include any justification to support the change and the statement that the proposed changes will not increase or decrease the cost of construction is in error. Clearly requiring mechanical ventilation when it is not currently required will have a cost increase.
The proposed change to RE132-19 Part 1 to Section R403.6 adds the word "mechanical" before ventilation which in effect changes the current code requirements and will require mechanical ventilation of all R occupancies. This conflicts with the reference to the International Residential Code or International Mechanical Code. The IMC currently allows natural ventilation or mechanical ventilation. The proposed change is not necessary as the requirements for ventilation are already covered in the current codes.

Changes of this type should be proposed to the IMC which clearly in the current codes has the provisions for what type of ventilation is required.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1217

RE132-19 Part II

IRC®: R303.4

Proposed Change as Submitted

Proponents: Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Residential Code

Revise as follows:

R303.4 Mechanical ventilation. ~~Where the air infiltration rate of a *dwelling unit* is 5 air changes per hour or less where tested with a blower door at a pressure of 0.2 inch w.c (50 Pa) in accordance with Section N1102.4.1.2, the *dwelling unit*~~ Dwelling units complying with Section N1102.4.1 shall be provided with whole-house mechanical ventilation in accordance with Section M1505.4.

Reason: Changes to R303.4
Section N1102.4 establishes MANDATORY requirements for air sealing of the building envelope, including mandatory requirements to follow the air barrier and insulation installtion criteria in Table N1102.4.1.1 and the mandatory blower door testing and verification requirements in Section N1102.4.1.2. Further, all dwelling units complying with Section N1102.4 require a blower door test with results that achieve 5 ACH50 or less. Thus, all dwelling units complying with Section N1102.4 already require whole-house mechanical ventilation. This change simplifies Section R303.4 and future-proofs the intent of the section by ensuring that tight dwelling units will continue to be provided with whole-house mechanical ventilation, regardless of the metric used to verify that the dwelling units are tight (e.g. there are several proposals being heard in Group B that would move from the metric of ACH50 to a metric of cfm50/ft2).

These changes are aligned with Group A action on proposal M20. M20 was approved and removed the specific reference to 5 ACH50 as the air leakage metric that triggers a mechanical ventilation requirement in Section 401.2 of the IMC as follows:

401.2 Ventilation required. Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. *< Strikeout the following text: Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2-inch water column (50 Pa) in accordance with Section R402.4.1.2 of the International Energy Conservation Code, the dwelling unit shall be ventilated by ... End strikeout section >* Dwelling units complying with the air leakage requirements of the International Energy Conservation Code or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403.

Changes to Section 403.6

In keeping with IRC Section R303.4 and IMC Section 401.2, the heading of section 403.6 requires "mechanical" ventilation for buildings complying with the IECC-Residential. To clarify that this is the intent of this section and is coordinated with the IRC and IMC (which contain mechanical ventilation requirements for buildings and dwelling units), the words "mechanical" and "dwelling units" are proposed for inclusion within the text of R403.6.

These changes are aligned with Group A action on proposal M20. M20 was approved and removed the specific reference to 5 ACH50 as the air leakage metric that triggers a mechanical ventilation requirement in Section 401.2 of the IMC as follows:

401.2 Ventilation required. Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. *< Strikeout the following text: Where the air infiltration rate in a dwelling unit is less than 5 air changes per hour when tested with a blower door at a pressure of 0.2-inch water column (50 Pa) in accordance with Section R402.4.1.2 of the International Energy Conservation Code, the dwelling unit shall be ventilated by ... End strikeout section >* Dwelling units complying with the air leakage requirements of the International Energy Conservation Code or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal is a clarification of current requirements of the IRC, IMC, and IECC and does not increase or decrease the cost of construction.

RE132-19 Part II

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:

R303.4 Mechanical ventilation. Buildings and ~~D~~dwelling units complying with Section N1102.4.1 shall be provided with ~~whole-house~~ mechanical ventilation in accordance with Section M1505~~.4~~ of this code, or with other approved means of ventilation.

Committee Reason: This provides consistency between IRC and IECC pointing to the Mechanical Code, the modification adds the two sections needed for a reasonable pointer with the retention of the word "mechanical" (Vote: 8-1).

Assembly Action: **None**

RE132-19 Part II

Individual Consideration Agenda

Public Comment 1:

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests Disapprove

Commenter's Reason: RE132-19 Part I and RE132-19 Part II are joint proposed code changes and they should both be disapproved. Disapproval of one and approval of the other would have no meaning and create confusion in the code. Contrary to the Reason Statement and Cost Impact which states “the changes are a “clarification” of current requirements, they greatly expand the requirements for mechanical ventilation to require all R occupancies to be mechanically ventilated. The proposals do not include any justification to support the change and the statement that the proposed changes will not increase or decrease the cost of construction is in error. Clearly requiring mechanical ventilation when it is not currently required will have a cost increase.
The proposed change to RE132-19 Part 1 to Section R403.6 adds the word “mechanical” before ventilation which in effect changes the current code requirements and will require mechanical ventilation of all R occupancies. This conflicts with the reference to the International Residential Code or International Mechanical Code. The IMC currently allows natural ventilation or mechanical ventilation. The proposed change is not necessary as the requirements for ventilation are already covered in the current codes.

Changes of this type should be proposed to the IMC which clearly in the current codes has the provisions for what type of ventilation is required.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
No change to code.

Public Comment# 1218

RE136-19

IECC; TABLE R403.6.1 (IRC N1103.6.1)

Proposed Change as Submitted

Proponents: Mike Moore, Newport, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE R403.6.1 (IRC N1103.6.1)
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]

FAN LOCATION	AIR FLOW RATE MINIMUM(CFM)	MINIMUM EFFICACY(CFM/WATT)	AIR FLOW RATE MAXIMUM(CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	2.8 cfm/watt	Any
Bathroom, utility room	10	1.4 cfm/watt	< 90
Bathroom, utility room	90	2.8 cfm/watt	Any

For SI: 1 cfm = 28.3 L/min.

a. When tested in accordance with HVI Standard 916. <u>Fan efficacy for HRV, ERV, balanced, and in-line fans shall be taken at a static pressure >= 0.2 in. w.c. Fan efficacy for range hoods, bathroom, and utility room fans shall be taken at a static pressure >= 0.1 in. w.c.</u>

Reason: Fan efficacy varies as a function of static pressure, so it is necessary to identify the minimum static pressure required for determining the rating. These pressures are aligned with industry practice and ENERGY STAR's requirements for reporting fan efficacy.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal clarifies a current requirement of the code. There is no expected change in construction costs.

RE136-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The proponent requested disapproval because the standard referenced in his modification is not yet available (Vote 11-0).

Assembly Action: **None**

RE136-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R403.6.1, TABLE R403.6.1 (IRC N1103.6.1)

Proponents:
Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R403.6.1 Whole-house mechanical ventilation system fan efficacy. Fans used to provide whole-house mechanical ventilation shall meet the efficacy requirements of Table R403.6.1 <u>at one or more rating points</u>. <u>Fans shall be tested in accordance with HVI Standard 916 and listed. The airflow shall be reported in the product listing or on the label. Fan efficacy shall be reported in the product listing or shall be derived from the input power and airflow values reported in the product listing or on the label. Fan efficacy for fully ducted HRV, ERC, balanced, and in-line fans shall be determined at a static pressure of not less than 0.2 inch w.c. Fan efficacy for ducted range hoods, bathroom, and utility room fans shall be determined at a static pressure of not less than 0.1 inch w.c.</u>

TABLE R403.6.1 (IRC N1103.6.1)
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]

FAN LOCATION	AIR FLOW RATE MINIMUM(CFM)	MINIMUM EFFICACY(CFM/WATT)	AIR FLOW RATE MAXIMUM(CFM)
HRV or ERV	Any	1.2 cfm/watt	Any
Range hoods	Any	2.8 cfm/watt	Any
In-line fan	Any	2.8 cfm/watt	Any
Bathroom, utility room	10	1.4 cfm/watt	< 90
Bathroom, utility room	90	2.8 cfm/watt	Any

For SI: 1 cfm = 28.3 L/min.

a. ~~When tested in accordance with HVI Standard 916 Fan efficacy for HRV, ERV, balanced, and in-line fans shall be taken at a static pressure >= 0.2 in. w.c. Fan efficacy for ducted range hoods, bathroom, and utility room fans shall be taken at a static pressure >= 0.1 in. w.c.~~

Commenter's Reason: Fan efficacy varies as a function of static pressure, so it is necessary to identify the minimum static pressure required for determining the rating. The static pressures proposed are aligned with industry practice and ENERGY STAR's requirements for reporting fan efficacy. This comment provides needed clarification to the original proposal and improves enforceability. The addition of "and listed" aligns this section with the requirements of M1505.3 (as modified by Group A's RM30, which was approved as submitted) for consistency.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal provides clarification to a current requirement and therefore does not increase or decrease the cost of construction.

Public Comment# 1916

RE139-19

IECC: R403.6.1 (IRC N1103.6.1) (New)

Proposed Change as Submitted

Proponents: Mike Moore, Newport Ventures, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

Revise as follows:

R403.6 (IRC N1103.6) Mechanical ventilation (Mandatory). The *building* shall be provided with ventilation that complies with the requirements of the International Residential Code or International Mechanical Code, as applicable, or with other *approved* means of ventilation. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

Add new text as follows:

R403.6.1 (IRC N1103.6.1) Heat or Energy Recovery Ventilation (Prescriptive). Dwelling units shall be provided with a heat recovery or energy recovery ventilation system in climate zones 7 and 8. The system shall be balanced with a minimum sensible heat recovery efficiency of 65% at 32°F (0°C) at a flow greater than or equal to the design airflow.

Reason: A recent study conducted by Pacific Northwest National Laboratory showed HRVs and ERVs to be cost effective in climate zones 7 and 8, with annual energy savings from $138 to $233 on an initial investment of ~$1500 installed (corresponding to a first cost premium of ~$840 versus an exhaust only system and one entry-level bath fan; yielding simple paybacks of 4-6 years). This proposal is aligned with recent changes across most of Canada to require heat recovery ventilation for dwelling units. This proposal would require heat or energy recovery ventilators only for those dwelling units following the prescriptive path in the coldest climate zones, which represents a conservative improvement to the code.

Bibliography: Taylor, T. 2018. Residential Heat Recovery Ventilation Technical Brief. Pacific Northwest National Laboratory. PNNL-28354. https://www.osti.gov/servlets/purl/1488935.

Cost Impact: The code change proposal will increase the cost of construction
The first cost of construction (including costs for appliance, equipment, and installation) is expected to increase by ~$830 compared to an exhaust-only system. Based on PNNL's projected energy savings, this will be be recovered quickly, within 4-6 years. Assuming the $830 is financed in a traditional, 30-year mortgage at 4%, the annual energy savings of $138-$233 would generate $90 - $185 per year in cash flow for the home owner.

RE139-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This is a cost effective strategy that makes a lot of sense in climate zones 7 and 8 (Vote: 11-0).

Assembly Action: **None**

RE139-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Aaron Gary, representing Tempo Partners (aaron.gary@texenergy.org)

requests Disapprove

Commenter's Reason: This proposal appears to preempt the International Mechanical Code by requiring one mechanical ventilation technology over another. The IECC should set reasonable guidelines for deployment of each type of ventilation equipment so that the mechanical designer can select the equipment that best suits the needs of each specific project not favor a specific type of equipment.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
Disapproval of this proposal will not increase or decrease the cost of construction as the net result would be no change to the code.

Public Comment# 2093

RE145-19

IECC: R202, R404.1, R404.2 (New)

Proposed Change as Submitted

Proponents: Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org)

2018 International Energy Conservation Code

Add new definition as follows:

DIMMER. (IRC N1101.6). A control device that is capable of continuously varying the light output and energy use of light sources.

Revise as follows:

HIGH-EFFICACY LAMPS. (IRC N1101.6). ~~Compact fluorescent lamps, light-emitting diode (LED) lamps, T-8 or smaller diameter linear fluorescent lamps, or other lamps~~ Any lamps with an efficacy of not less than ~~the following:~~ 70 lumens per watt.

1. ~~1.60 lumens per watt for lamps over 40 watts.~~
2. ~~2.50 lumens per watt for lamps over 15 watts to 40 watts.~~
3. ~~3.40 lumens per watt for lamps 15 watts or less.~~

Add new definition as follows:

OCCUPANT SENSOR CONTROL. (IRC N1101.6). An automatic control device or system that detects the presence or absence of people within an area and causes lighting, equipment or appliances to be regulated accordingly.

Revise as follows:

R404.1 (IRC N1104.1) Lighting equipment (Mandatory). ~~Not less than 90 percent of the~~ All permanently installed lighting fixtures shall contain only high-efficacy lamps.

Add new text as follows:

R404.2 (IRC N1104.2) Lighting Controls (Mandatory). Permanently installed lighting fixtures shall be controlled with either a dimmer, an occupant sensor control, or other control that is installed or built into the fixture.

Exception: Lighting controls shall not be required for the following:

1. Bathrooms
2. Hallways
3. Exterior lighting fixtures
4. Lighting designed for safety or security

Reason: The purpose of this code change proposal is to increase lighting efficiency to better align with the current lighting market and upcoming changes to lighting standards.
DOE projects that light-emitting diode (LED) lighting will represent about half of the market share in 2020, and nearly 85% of the market share by 2030[1]. Goldman Sachs projects an even faster uptake of LEDs, projecting a full market penetration by the early 2020s[2]. The current definition of a "high efficacy lamp" in the energy code is outdated: it was added to the code in 2009, when LED market share was close to zero, and has not been updated since then. In fact, the definition no longer represents the "high efficacy" share of the market. New lighting standards will take effect in 2020 that will eliminate all bulbs on the market with efficiencies lower than 45 lumens per watt. Therefore, by the time the 2021 code is published, some of the bulbs currently defined by the IECC as "high efficacy" will be illegal to sell. Given these market and standard changes, the definition must be updated to remain relevant.

Once the updated federal standard takes effect, the baseline, least-efficient bulb on the market will no longer be an incandescent or even a halogen, but a compact fluorescent light bulb. In many cases, LEDs are close in price to – or even cheaper than - CFL alternatives while being a clearly superior product. CFLs contain mercury, are slow to come to full light, and few models are dimmable. In contrast, LEDs come in a wide range of light outputs, bulb shapes, color temperatures, socket types, do not contain mercury, and the vast majority of models are dimmable. Virtually all LEDs on the market today meet the 70 lumens per watt requirement specified in this proposal.

The table below summarizes a recent Home Depot search for a dimmable 60-watt equivalent bulb, one that gives off approximately 800 lumens of light. The LED bulb is significantly more efficient and longer-lasting than the CFL or halogen option. Recent searches found that sale prices of LED bulbs are often even lower than a halogen equivalent. Note that the CFL bulb is not dimmable; there was no equivalent dimmable CFL option. A separate search for dimmable CFL bulbs[3] shows that they are in the range of at least $7 per bulb and not widely available. The halogen option will not be legal to sell starting January 1, 2020.

Lighting Technology	Brand	Cost per Bulb	Lumens Per Watt	Estimated Annual Energy Cost	Lifetime	Dimmable?
LED	Philips[4]	$1.54 (sale price) $3.08 (full price)	84	$0.84	22 years	Yes
CFL	EcoSmart[5]	$1.49	64	$1.69	9 years	No
Halogen	Westinghouse[6]	$2.10	18.1	$5.06	0.9 years	Yes

The proposal also requires lighting controls, in the form of either a dimmer, occupancy control, or other such control (such as an automatic daylight sensor). Both dimmers and occupancy controls will save even more energy. Dimmers can reduce energy use by about 20%, while occupancy sensors reduce wasted energy by around 30%[7]. These controls are essentially permanent, with an extremely long lifetime. Connected occupancy controls, such as those in use with a home automation system, can add value and convenience to homeowners, as well.

[1] U.S. Department of Energy Building Technologies Office. “Solid State Lighting.” September 2014. Retrieved on January 10, 2019 from https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/energysavingsforecast14-summ.pdf

[2] Goldman Sachs. “The Low Carbon Economy.” November 28, 2016. Retrieved on January 10, 2019 from https://www.goldmansachs.com/insights/pages/new-energy-landscape-folder/report-the-low-carbon-economy/report-2016.pdf

[3] Home Depot (January 10, 2019). Retrieved from https://www.homedepot.com/b/Lighting-Light-Bulbs-CFL-Bulbs/Dimmable/N-5yc1vZbmatZ1z0u4xv

[4] Home Depot (January 10, 2019). Retrieved from https://www.homedepot.com/p/Philips-60-Watt-Equivalent-A19-Dimmable-LED-ENERGY-STAR-Light-Bulb-Soft-White-with-Warm-Glow-4-Pack-479576/303967548

[5] Home Depot (January 10, 2019. Retrieved from https://www.homedepot.com/p/EcoSmart-60-Watt-Equivalent-Spiral-Non-Dimmable-CFL-Light-Bulb-Soft-White-4-Pack-ESBM8144/205487792

[6] Home Depot (January 10, 2019). https://www.homedepot.com/p/Westinghouse-42-Watt-Eco-Halogen-A19-Soft-White-Medium-Base-Light-Bulb-4-Pack-3687600/300620938

[7] Powers, Alexis. “Congratulate Yourself on Achieving One Easy Energy-Saving Resolution.” U.S. Department of Energy, Energy Saver blog. Retrieved on January 10, 2019 from https://www.energy.gov/energysaver/articles/congratulate-yourself-achieving-one-easy-energy-saving-resolution

Bibliography: [1] U.S. Department of Energy Building Technologies Office. “Solid State Lighting.” September 2014. Retrieved on January 10, 2019 from https://www1.eere.energy.gov/buildings/publications/pdfs/ssl/energysavingsforecast14-summ.pdf
[2] Goldman Sachs. “The Low Carbon Economy.” November 28, 2016. Retrieved on January 10, 2019 from https://www.goldmansachs.com/insights/pages/new-energy-landscape-folder/report-the-low-carbon-economy/report-2016.pdf

[3] Home Depot (January 10, 2019). Retrieved from https://www.homedepot.com/b/Lighting-Light-Bulbs-CFL-Bulbs/Dimmable/N-5yc1vZbmatZ1z0u4xv

[4] Home Depot (January 10, 2019). Retrieved from https://www.homedepot.com/p/Philips-60-Watt-Equivalent-A19-Dimmable-LED-ENERGY-STAR-Light-Bulb-Soft-White-with-Warm-Glow-4-Pack-479576/303967548

[5] Home Depot (January 10, 2019. Retrieved from https://www.homedepot.com/p/EcoSmart-60-Watt-Equivalent-Spiral-Non-Dimmable-CFL-Light-Bulb-Soft-White-4-Pack-ESBM8144/205487792

[6] Home Depot (January 10, 2019). https://www.homedepot.com/p/Westinghouse-42-Watt-Eco-Halogen-A19-Soft-White-Medium-Base-Light-Bulb-4-Pack-3687600/300620938

[7] Powers, Alexis. “Congratulate Yourself on Achieving One Easy Energy-Saving Resolution.” U.S. Department of Energy, Energy Saver blog. Retrieved on January 10, 2019 from https://www.energy.gov/energysaver/articles/congratulate-yourself-achieving-one-easy-energy-saving-resolution

Cost Impact: The code change proposal will increase the cost of construction
This proposal will increase the cost of construction due to the increased cost of dimmer switches or occupancy controls. However, there is little, if any, incremental cost to move from CFL to LED bulbs even today, and the costs of this technology will continue to decrease. Given the change in technology and the improved federal standards, by the time the 2021 code is adopted, there may be no incremental cost to purchase a LED bulb.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: 10 percent was needed for fans and special fixtures, the inclusion of occupancy controls, the control language is too simplistic, need more information on cost (Vote 11-0).

Assembly Action: **None**

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

Individual Consideration Agenda

Public Comment 1:

IECC®: 202 (New), R404.1 (IRC N1104.1), R404.2 (IRC N1104.2) (New)

Proponents:
Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

~~**DIMMER. (IRC N1101.6).** A control device that is capable of continuously varying the light output and energy use of light sources.~~

OCCUPANT SENSOR CONTROL. (IRC N1101.6). An automatic control device or system that detects the presence or absence of people within an area and causes lighting, equipment or appliances to be regulated accordingly.

~~**R404.1 (IRC N1104.1) Lighting equipment (Mandatory).** All permanently installed lighting fixtures shall contain only high-efficacy lamps.~~

R404.2 (IRC N1104.2) Lighting Controls (Mandatory). <u>At least one </u>permanently installed lighting fixture~~s~~ <u>in each of the following spaces</u> shall be controlled with ~~either a dimmer,~~ an occupant sensor control <u> with manual on capability and which automatically turns off lights within 20 minutes after all occupants have left the space.</u>~~, or other control that is installed or built into the fixture.~~

~~**Exception:** Lighting controls shall not be required for the following:~~

1. Bathrooms
2. <u>Garages</u>
3. <u>Laundry Rooms</u>
4. <u>Utility Rooms</u>
5. ~~Hallways~~
6. ~~Exterior lighting fixtures~~
7. ~~Lighting designed for safety or security~~

Commenter's Reason: This proposal should be approved as modified because it reduces energy waste from lighting being left on when no one is in these spaces. The proposed modification has been simplified and streamlined to address issues raised at the Committee Action hearing:

- The Committee raised concerns about requiring all lamps to meet the definition of a high efficacy lamp, citing concerns about federal preemption and about this requirement being inappropriate for some situations (refrigerators, range hoods, etc). The increased efficiency requirements have been removed from this proposal, since proposal RE7 accomplishes the goal of improving lighting efficiency. RE7 received a recommendation of Approve As Submitted from the Committee.
- The Committee raised questions about occupant satisfaction with dimmers and occupant sensor controls. To respond to this concern, the proposal has been restructured to remove dimmers, and to require occupant sensor controls in only certain rooms: bathrooms, garages, laundry rooms, and utility rooms. This resolves the issues discussed about dissatisfaction with occupancy sensors in kitchens, bedrooms, or

other living spaces.
- Furthermore, a minimum of just one permanently installed fixture per room is required to be controlled with an occupant sensor control, in order to account for instances like lights in showers, cabinet lighting, and other situations where sensor controls would be difficult to use. This is modeled directly on the requirements of California's Title 24 energy code, which has had a residential lighting sensor control requirement in place since 2013.

Bibliography: Home Depot (accessed 7/23/19), cost and energy use of a CFL bulb: https://www.homedepot.com/p/Philips-100-Watt-Equivalent-T2-Twister-CFL-Light-Bulb-Daylight-Deluxe-4-Pack-433557/204855102
Home Depot (accessed 7/23/19), cost of an occupancy sensor control: https://www.homedepot.com/p/Leviton-Decora-Motion-Sensor-In-Wall-Switch-Auto-On-2-5-A-Single-Pole-White-R12-IPS02-1LW/203826482

California Statewide Codes and Standards Team (accessed 7/23/19), Residential Lighting, 2013 California Building Energy Efficiency Standards, October 2011: https://t24stakeholder.wpengine.com/wp-content/uploads/2017/10/2013_CASE-Report_Residential-Lighting.pdf

Powers, Alexis. "Congratulate Yourself on Achieving One Easy Energy-Saving Resolution." U.S. Department of Energy, Energy Saver blog. Retrieved on January 10, 2019 from https://www.energy.gov/energysaver/articles/congratulate-yourself-achieving-one-easy-energy-saving-resolution

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The California Utilities Statewide Codes and Standards Team analyzed the costs and energy savings from occupancy sensors prior to incorporating these measures into the 2013 version of Title 24. They found that, on average, a sensor costs around $25 and provides a 30% energy savings over standard manual switching. A recent internet search found occupancy sensor controls can be purchased for as little as $15-$20. The 30% energy savings information is consistent with the values NRDC provided in our original proposal, via the Department of Energy.

The total incremental cost will vary by home, depending on the number of bathrooms, utility rooms, or laundry rooms the home has, and whether it has a garage. Given that the proposal is structured such that a minimum of one permanently installed lighting fixture is required to have an occupancy sensor control, the incremental cost could be limited to as little as $80-$100 per home.

The California Codes and Standards Team found that in most cases, a single sensor controls multiple bulbs. For example, if a sensor in a bathroom controls a vanity light with 4 CFL bulbs, the energy cost is around $10-$12/year. If that was cut by 30% due to the use of a sensor, the energy savings would pay for the incremental cost of the sensor in around 5 years, well within the life of the bulb and the sensor.

Public Comment# 1220

RE146-19

IECC: R202 (IRC N1101.6), R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.2 (IRC N1104.2.2) (New)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6)
GENERAL DEFINITIONS

Add new definition as follows:

ELECTRIC VEHICLE. An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, and electric motorcycles, primarily powered by an electric motor that draws current from a building electrical service, EVSE, a rechargeable storage battery, a fuel cell, a photovoltaic array, or another source of electric current.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded, and equipment grounding conductors, and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

Add new text as follows:

R404.2 (IRC N1104.2) Electric vehicle ready parking (Mandatory). Where parking is provided, electric vehicle ready parking spaces shall be provided in compliance with Sections R404.2.1 and R404.2.2. Where more than one parking facility is provided on a site, electric vehicle ready parking spaces shall be calculated separately for each parking facility.

Exception: This section does not apply to parking spaces used exclusively for trucks or delivery vehicles.

R404.2.1 (IRC N1104.2.1) Electric vehicle ready parking spaces. Not less than two percent, but not less than one, parking spaces shall be electric vehicle ready parking and shall comply with Section R404.2.2.

Exception: Single-family and two-family dwelling units shall provide a not less than one electric vehicle ready parking space.

R404.2.2 (IRC N1104.2.2) Electric vehicle service equipment (EVSE) ready circuit. Each electric vehicle ready parking space shall be provided with a minimum 40-ampere branch circuit to accommodate a future dedicated Level 2 EVSE. The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a suitable electrical connector rated for 240 volts or greater service. The circuit shall have no other outlets. The service panel shall provide sufficient capacity and space to accommodate the circuit and over-current protective device. A permanent and visible label stating “EV READY” shall be posted in a conspicuous place at both the service panel and the circuit termination point.

Reason: As of January 1, 2019, more than one million EVs are on U.S. roads. EEI and IEI estimate that the number of plug-in EVs will increase to about seven million by 2025. See EEI and IEI, “Plug-in Electric Vehicle Sales Forecast Through 2025 and the Charging Infrastructure Required,” available at http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20PEV%20Sales%20and%20Infrastructure%20thru%202025_FINAL%20(2).pdf. BNEF and Energy Innovation have recently released projections that show accelerated growth in EVs as a percentage of new car sales beginning around the middle of the next decade. *See* BNEF, “Electric Vehicle Outlook: 2018,” *available at* https://bnef.turtl.co/story/evo2018?teaser=true, and Energy Innovation, “The Future of Electric Vehicles in the U.S., *available at* https://energyinnovation.org/wp-content/uploads/2017/10/2017-09-13-Future-of-EVs-Research-Note_FINAL.pdf. By 2040 BNEF estimates that EVs will account for 58% of all new car sales by 2040. *See* BNEF, “Electric Vehicles to Accelerate to 54% of New Car Sales by 2040,” *available at* https://about.bnef.com/blog/electric-vehicles-accelerate-54-new-car-sales-2040/. A major driver of this steep EV sales trend will be a dramatic decrease in battery costs of more than 70 percent by 2030. *See* BNEF, “Electric Vehicle Outlook 2018.”
The increase in EV sales will be accompanied by an increase in demand for on-site residential EV charging capacity. Up to 5.5 million chargers, which will be mostly installed in homes, will be required by 2025 to support a fleet of seven million EVs. See EEI and IEI, “Plug-in Electric Vehicle Sales Forecast Through 2025 and the Charging Infrastructure Required.” In the near term this will likely involve the installation of Level 2 chargers, which require an additional 240-volt circuit. The cost of retrofitting a home to accommodate a Level 2 charger, which can recover the full range of a typical EV in 10 hours or less, will be a financial burden on homeowners. Adding a requirement for EV-ready parking spaces to the code will facilitate future Level 2 charger installations, which will eventually become practically ubiquitous, at a much lower cost.

Increased adoption of EVs will have a positive effect on overall U.S. household energy spending and carbon emissions. In terms of energy savings, EV fuel economy is, on average, more than three times more efficient than conventional gasoline-fueled counterparts. Even when compared over the full lifecycle of fuel production and use, the average EV consumes less than half the energy per vehicle mile traveled. *See* InsideEVs, “Efficiency Compared: Battery-Electric 73%, Hydrogen 22%, ICE 13%,” *available at* https://insideevs.com/efficiency-compared-battery-electric-73-hydrogen-22-ice-13/, and Argonne National Laboratory, “Greenhouse Gases, Regulated Emissions, and Energy use in Transportation Model,” *available at* https://greet.es.anl.gov/index.php. NRDC and EPRI found that if 50 percent of personal vehicle miles traveled were powered by electricity in 2050, the U.S. would realize annual emissions reductions of 550 million metric tons of carbon dioxide. *See* NRDC, “Study: Electric Vehicles Can Dramatically Reduce Carbon Pollution from Transportation, and Improve Air Quality,” *available at* https://www.nrdc.org/experts/luke-tonachel/study-electric-vehicles-can-dramatically-reduce-carbon-pollution. The ideal solution would get this code change in place by the time adoption rates are expected to accelerate, which would help facilitate adoption of EVs and therefore lead to more efficient energy consumption and lower household carbon emissions.

Bibliography: Argonne National Laboratory, “Greenhouse Gases, Regulated Emissions, and Energy use in Transportation Model,” available at https://greet.es.anl.gov/index.php. Last accessed January 9, 2019.
InsideEVs, “Efficiency Compared: Battery-Electric 73%, Hydrogen 22%, ICE 13%,” October 2, 2017, available at https://insideevs.com/efficiency-compared-battery-electric-73-hydrogen-22-ice-13/. Last accessed January 9, 2019.

Bloomberg New Energy Finance, “Electric Vehicle Outlook: 2018,” available at https://bnef.turtl.co/story/evo2018?teaser=true. Last accessed January 9, 2019.

Bloomberg New Energy Finance, “Electric Vehicles to Accelerate to 54% of New Car Sales by 2040,” July 6, 2017, available at https://about.bnef.com/blog/electric-vehicles-accelerate-54-new-car-sales-2040/. Last accessed January 9, 2019.

Edison Electric Institute and Institute for Electric Innovation, “Plug-in Electric Vehicle Sales Forecast Through 2025 and the Charging Infrastructure Required,” June 2017, pgs. 1 and 9, available at http://www.edisonfoundation.net/iei/publications/Documents/IEI_EEI%20PEV%20Sales%20and%20Infrastructure%20thru%202025_FINAL%20(2).pdf. Last accessed January 9, 2019.

Energy Innovation, “The Future of Electric Vehicles in the U.S., September 27, 2017, pg. 3, available at https://energyinnovation.org/wp-content/uploads/2017/10/2017-09-13-Future-of-EVs-Research-Note_FINAL.pdf. Last accessed January 9, 2019.

NRDC, “Study: Electric Vehicles Can Dramatically Reduce Carbon Pollution from Transportation, and Improve Air Quality,” available at https://www.nrdc.org/experts/luke-tonachel/study-electric-vehicles-can-dramatically-reduce-carbon-pollution. Last accessed January 9, 2019.

Realtor.com, “Electric Car Charger Installation in Your Home: True Costs—and What You Need to Know,” November 2, 2017, available at https://www.realtor.com/advice/home-improvement/installing-electric-vehicle-charger/. Last accessed January 9, 2019.

Cost Impact: The code change proposal will increase the cost of construction
The additional branch circuit and associated wiring and conduit required to make parking spaces EV-ready will incrementally increase the cost of construction. But the cost of a retrofit to add the electrical panel capacity for a common Level 2 charger will be much higher—up to $2,000. See Realtor.com, “Electric Car Charger Installation in Your Home: True Costs—and What You Need to Know,” available at https://www.realtor.com/advice/home-improvement/installing-electric-vehicle-charger/.

RE146-19

Public Hearing Results

Committee Action: Disapproved

Committee Reason: The proposal does not save energy, this should not be in the IECC it should be part of an above-code program, and it should not be mandatory for single family (Vote: 7-4).

Assembly Action: None

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE146-19

Individual Consideration Agenda

Public Comment 1:

IECC®: APPENDIX X (New), X.1 (New)

Proponents:
Craig Conner, representing self (craig.conner@mac.com)

requests As Modified by Public Comment

Replace as follows:

2018 International Energy Conservation Code

APPENDIX X
ELECTRIC VEHICLE CHARGING

X.1 **Electric Vehicle charging spaces.** Where new single-family dwelling units include parking, a dedicated electric vehicle 40-ampere, 208/240-volt branch circuit to the parking shall be provided.

The branch circuit shall be identified as "EV READY" in the service panel or subpanel directory, and the termination location shall be marked as "EV READY".

Commenter's Reason: Some jurisdictions will choose not to require an EV circuit, therefore this is an appendix. This appendix is for the jurisdictions choosing to be "EV ready".
Retrofit of EV circuits can be very expensive where a path for the circuit must be created; for example,cutting, then covering, a path for the EV circuit under concrete. Building this circuit during construction of the new home is the least expensive way to provide that circuit in new construction.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Even though it is the least expensive time to do it, adding EV circuits will add cost.

Public Comment# 2162

Public Comment 2:

IECC®: R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.2 (IRC N1104.2.2) (New)

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R404.2 (IRC N1104.2) Electric vehicle ready parking (Mandatory). Where parking is provided, electric vehicle ready parking spaces shall be provided in compliance with Sections R404.2.1 and R404.2.2. Where more than one parking facility is provided on a site, the required number of electric vehicle ready parking spaces shall be calculated separately for each parking facility.

Exception: This section ~~does~~ shall not apply to short-term parking spaces used exclusively for trucks or delivery vehicles.

R404.2.1 (IRC N1104.2.1) Electric vehicle ready parking spaces. Not less than ~~two~~ one percent, but not less than one, parking spaces shall be electric vehicle ready parking and shall comply with Section R404.2.2.

Exception: Single-family and two-family dwelling units shall provide ~~a~~ not less than one electric vehicle ready parking space.

R404.2.2 (IRC N1104.2.2) Electric vehicle service equipment (EVSE) ready circuit. Each electric vehicle ready parking space shall be provided with a minimum ~~40~~ 50-ampere branch circuit to accommodate a future dedicated Level 2 EVSE. The circuit shall terminate in a NEMA 6-50 or NEMA 14-50 receptacle or a suitable electrical connector rated for 240 volts or greater service. The circuit shall have no other outlets. The service panel shall provide sufficient capacity and space to accommodate the circuit and over-current protective device. A permanent and visible label stating "EV READY" shall be posted in a conspicuous place at both the service panel and the circuit termination point.

Commenter's Reason: This modification will improve and clarify the language in the proposal. It will also have language that is consistent with the language approved for CE 217, Part I.
This modification will also reduce the costs of this proposal compared to the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment will reduce the cost increase of the original proposal by reducing the number of parking spaces required to be EV ready.

Public Comment# 1367

Public Comment 3:

Proponents:
Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Submitted

Commenter's Reason: The Committee disapproved this proposal (7-4) based largely on its erroneous belief that the proposal would not save energy. EV's are well documented to save transportation energy. In addition, they complement "smart" buildings by providing the means to enhance grid resiliency through ancillary services (like frequency regulation) and renewable energy integration.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The additional branch circuit and associated wiring and conduit required to make parking spaces EV-ready will incrementally increase the cost of construction. But the cost of a retrofit to add the electrical panel capacity for a common Level 2 charger will be much higher—up to $2,000. See Realtor.com, “Electric Car Charger Installation in Your Home: True Costs—and What You Need to Know,” available at https://www.realtor.com/advice/home-improvement/installing-electric-vehicle-charger/.

Public Comment# 1555

RE147-19

IECC: R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.2 (IRC N1104.2.2) (New), R404.2.3 (IRC N1104.2.3) (New)

Proposed Change as Submitted

Proponents: Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org)

2018 International Energy Conservation Code

Add new text as follows:

R404.2 (IRC N1104.2) Electric readiness (Mandatory) Systems using gas or propane water heaters, dryers, or conventional cooking equipment to serve individual dwelling units shall comply with the requirements of Sections R404.2.1 and R404.2.2. All water heating systems shall comply with Section R404.2.3.

R404.2.1 (IRC N1104.2.1) Receptacle. A dedicated 125-volt, 20-amp electrical receptacle that is connected to the electric panel with a 120/240 volt 3 conductor, 10 AWG copper branch circuit, shall be provided within 3 feet from each gas or propane water heater, dryer, and conventional cooking equipment, accessible with no obstructions.

R404.2.2 (IRC N1104.2.2) Electrification-ready circuits. Both ends of the unused conductors shall be labeled with the word “SPARE” and be electrically isolated. A single pole circuit breaker space shall be reserved in the electrical panel adjacent to each circuit breaker for the branch circuit and labeled with the words “FUTURE 240V USE.”

R404.2.3 (IRC N1104.2.3) Water heater space. An indoor space that is at least 3 feet by 3 feet by 7 feet high shall be available within 3 feet of the water heater.

Exception: The water heater space requirement does not need to be met where a heat pump water heater is installed.

Reason: This proposal enhances customer choice by making it easy for homeowners to choose either electric or gas appliances and water heating equipment. By ensuring that a home built with gas or propane can easily accommodate future electric appliances and equipment, this proposal protects homeowners from future costs, should natural gas become less affordable or even unavailable over the life of the building.
As the electric grid becomes cleaner, and high-efficiency electric heat pump technology increasingly offers utility bill and pollution reduction benefits over gas, more customers may want to transition from natural gas to electric space and water heating. Federal, state, and local environmental and public health policies may also encourage, or even require the transition in some areas over the life of the building. Electric-ready requirements will protect customers from potential high retrofit costs.

Cost Impact: The code change proposal will increase the cost of construction
The cost of meeting these electric-ready requirements when the house is being built, walls are open, and the trades are already on-site, is marginal. In comparison, the cost of retrofitting a building for these requirements can be orders of magnitude higher and act as a barrier for the homeowner to choose electric appliances. Not making new buildings electric-ready would leave homeowners exposed to potentially high retrofit costs in the future and will greatly inhibit customer choice.

RE147-19

Public Hearing Results

Committee Action: Disapproved

Committee Reason: Although in support of the concept, it impacts consumer choice, and sizing wires belongs in electrical code not energy code. Future proofing does not belong in the minimum code (Vote: 9-2).

Assembly Action: None

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE147-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R404.2 (IRC N1104.2) (New), R404.2.1 (IRC N1104.2.1) (New), R404.2.1 (New), R404.2.2 (New), R404.2.3 (New), R404.2.3 (IRC N1104.2.3) (New)

Proponents:
Lauren Urbanek, representing Natural Resources Defense Council (lurbanek@nrdc.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R404.2 (IRC N1104.2) Electric readiness (Mandatory) Systems using gas or propane water heaters, dryers, or conventional cooking equipment to serve individual dwelling units shall comply with the requirements of Sections R404.2.1 throught R404.2.3 ~~R404.2.1 and R404.2.2~~. All water heating systems shall comply with Section R404.2. 4~~3~~.

~~**R404.2.1 (IRC N1104.2.1) Receptacle.** A dedicated 125-volt, 20-amp electrical receptacle that is connected to the electric panel with a 120/240 volt 3 conductor, 10 AWG copper branch circuit, shall be provided within 3 feet from each gas or propane water heater, dryer, and conventional cooking equipment, accessible with no obstructions.~~

R404.2.1 **Household Ranges and Cooking Appliances.** An individual branch circuit outlet with aminimum rating of 250-volts, 40-amperes shall be installed within three feet of each gas or propane range or permanently installed cooking appliance.

R404.2.2 **Household Clothes Dryers and Water Heaters.** An individual branch circuit outlet with a minimum rating of 250-volts, 30-amperes shall be installed within three feet of each gas or propane household clothes dryer and water heater.

R404.2.3 ~~**R404.2.2 (IRC N1104.2.2)**~~ **Electrification-ready circuits.** The unused conductors required by Section s R404.2.1 or R404.2.2shall be labeled with the word “spare.” Space shall be reserved in the electrical panel in which the branch circuit originates for the installation of an overcurrent device. Capacity for the circuits required by Section s R404.2.1 or R404.2.2 shall be included in the load calculations of the original installation.

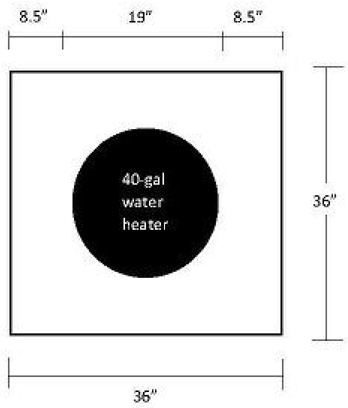
R404.2.3 (IRC N1104.2.3) Water heater space. An indoor space that is at least 3 feet by 3 feet by 7 feet high shall be available surrounding or within 3 feet of the installed water heater.

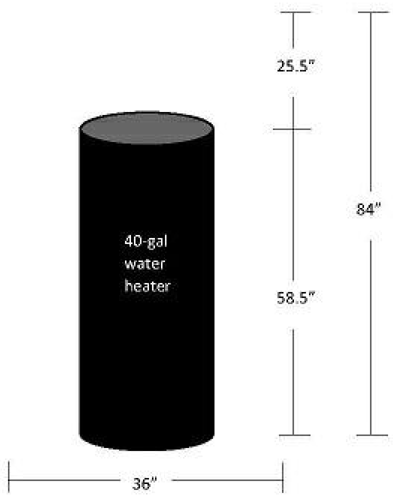
Exception: The water heater space requirement does not need to be met where a heat pump water heater or tankless water heater is installed.

Commenter's Reason: We request approval as modified, as this proposal enhances customer choice by making it easy for homeowners to choose either electric or gas appliances. The Committee expressed their support for this concept, but raised questions about some of the technical language of this proposal; the modification proposed here addresses these concerns.
The proposed modifications address the comments raised by the Committee as follows:

- The technical language related to electrical circuits and electrification-ready circuits has been clarified, in collaboration with the National Electrical Manufacturers Association.
- The water heater space requirement has been clarified. The intent of the water heater space requirement is to ensure that there is sufficient room for future installation of a heat pump water heater. The dimensions are specified by the heat pump water heater manufacturers. The attached illustration represents the typical dimensions of a 40 gallon gas water heater. In this situation, there would need to be just 8.5 inches clearance on either side of the water heater, and approximately 2’ of clearance on top of the water heater in order to meet the space requirements. [INSERT ATTACHMENT HERE]
- An exception has been added to clarify that the water heater space requirement does not apply when a tankless water heater is installed, as tankless products are often installed in close proximity to the hot water use in constrained spaces.

By ensuring that a home built with gas or propane can easily accommodate future electric appliances, this proposal protects homeowners from future costs, should natural gas become less affordable or even unavailable over the life of the building. As the electric grid becomes cleaner, and high-efficiency electric heat pump technology increasingly offers utility bill and pollution reduction benefits over gas, more customers may want to transition from natural gas to electric space and water heating. Federal, state, and local environmental and public health policies may also encourage, or even require the transition in some areas. Electric-ready requirements will protect customers from potentially high retrofit costs.





Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost of retrofitting a building for electrification can be orders of magnitude higher than adding the appropriate circuits when the house is being built. Exact cost estimates are not available and will vary by home. However, doing this work while the walls are open and the trades are already on site will unquestionably save the cost of additional drywall and finishing work. Furthermore, the additional hassle of retrofitting may act as a barrier for the homeowner to choose electric appliances in the future. Therefore, allowing the homeowner future flexibility at the time of construction is critical. Failing to make new buildings electric-ready would leave homeowners exposed to potentially high retrofit costs.

Public Comment# 1830

RE148-19

IECC: R404.1.1 (IRC N1104.1.1) (New)

Proposed Change as Submitted

Proponents: Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

2018 International Energy Conservation Code

Add new text as follows:

R404.1.1 (IRC N1104.1.1) Exterior lighting. Connected exterior lighting for Group R-2, R-3 and R-4 buildings shall comply with Section C405.4 of the International Energy Conservation Code—Commercial Provisions.

Exceptions:

1. Solar-powered lamps not connected to any electrical service.
2. Luminaires controlled by a motion sensors.

Reason: The IECC does not have any specific requirements for exterior lighting for residential buildings. This may not be a significant issue for single-family homes, duplexes and townhomes, but it is quite significant for Type-R occupancies like multifamily that are far more likely to have parking lots and other exterior lighting like their counterparts subject to the commercial code. A 4-story multifamily building with exactly the same systems and layout would therefore be subject to exterior lighting requirements while a 3-story variation would not. This creates a loophole in the code for low-rise R-occupancies.
This proposal directs exterior lighting for these occupancies to the commercial code and its LPD requirements. Small R-occupancy buildings are little different than small commercial buildings which are already subject to those requirements. The proposal exempts solar-powered lighting and any lighting controlled by a motion sensor.

When applied to the low-rise multifamily prototype developed by Pacific Northwest National Laboratories for the code determination studies, this requirement saved up to 0.5% (based on climate zone) whole building energy over the 2015 IECC. Since both 2018 and 2015 lack exterior lighting requirements, this is a reasonable approximation of savings.

Cost Impact: The code change proposal will increase the cost of construction
This will increase the cost of construction. However, the proposal refers only R-occupancies to the existing commercial exterior lighting requirements, which already cover smaller commercial buildings.

For example, a base light fixture cost for a 70 W halogen fixture is $118 .00 (https://www.lightingsupply.com/stonco-sla71mal-6) and the cost for an enhanced 80 W LED light fixture that will meet the proposed efficacy requirements is $158.33 (https://www.lightingsupply.com/best-lighting-products-ledmpal80-t-5k)

RE148-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: It references commercial provisions some of which do not apply. Recommended return with a public comment fine-tuning the proposal (Vote 7-4).

Assembly Action: **None**

RE148-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R404.1.1 (New)

Proponents:
Eric Makela, representing New Buildings Institute (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R404.1.1 ~~(IRC N1104.1.1)~~ Exterior lighting. Connected exterior lighting for ~~Group R-2, R-3 and R-4 buildings~~ residential buildings shall comply with Section C405.4 of the International Energy Conservation Code—Commercial Provisions.

Exceptions:

1. One and two family residential
~~1~~ 2. Solar-powered lamps not connected to any electrical service.
~~2~~ 3. Luminaires controlled by a motion sensors.
4. Lamps and luminaires that comply with Section R404.1.

Commenter's Reason: The Public Comment makes two modifications based on the IECC Residential Code Development Committee feedback. The first modification deletes the reference to the International Residential Code as this requirement is focused on residential buildings with common parking areas and shared walkways found in multifamily projects. The second correction of the proposal recognizes that exterior lighting in dwelling units, e.g. patio lighting, will need to comply with Section R404.1 high efficacy lighting. Lighting that complies with this requirement should not be required to comply with exterior lighting power allowances as required by the commercial provisions of the IECC.

The IECC does not have any specific requirements for exterior lighting for residential buildings. This may not be a significant issue for single-family homes, duplexes and townhomes, but it is quite significant for Type-R occupancies like multifamily that are far more likely to have parking lots and other grounds lighting like their counterparts subject to the commercial code. This proposal introduces an efficiency requirement for large wattage exterior luminaires. The 50W threshold ensures that this requirement will apply almost exclusively to lighting used in a commercial-like site lighting application and not the smaller lights common in single-family homes, duplexes and townhomes and other lighting that serves a more decorative function. The proposal also exempts solar-powered lighting and any lighting controlled by a motion sensor.

The proposal is modeled on language was in the 2012 version of the IECC for commercial buildings. It defines the building grounds lighting, which was used in the IECC but not defined, with a definition utilized in ASHRAE Standard 90.1.

When applied to the low-rise multifamily prototype developed by PNNL for the code determination studies, this requirement saved up to 0.5% whole building energy.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This will increase the cost of construction. However, the proposal refers only R-occupancies to the existing commercial exterior lighting requirements, which already cover smaller commercial buildings.

For example, a base light fixture cost for a 70 W halogen fixture is $118 .00 (https://www.lightingsupply.com/stonco-sla71mal-6) and the cost for an enhanced 80 W LED light fixture that will meet the proposed efficacy requirements is $158.33 (https://www.lightingsupply.com/best-lighting-productsledmpal80-t-5k).

When applied to the low-rise multifamily prototype developed by Pacific Northwest National Laboratories for the code determination studies, this requirement saved up to 0.5% (based on climate zone) whole building energy over the 2015 IECC. Since both 2018 and 2015 lack exterior lighting requirements, this is a reasonable approximation of savings.

Public Comment# 1875

Public Comment 2:

IECC®: R404.1.1 (IRC N1104.1.1) (New)

Proponents:
Hope Medina, representing Self (hmedina@coloradocode.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R404.1.1 (IRC N1104.1.1) Exterior lighting. Connected exterior lighting for Group R-2, R-3 and R-4 buildings shall comply with Section C405.4 of the International Energy Conservation Code—Commercial Provisions.

Exceptions:

1. Detached one- and two family dwellings
2. Townhouses
~~1.~~ 3. Solar-powered lamps not connected to any electrical service.
~~2.~~ 4. Luminaires controlled by a motion sensors.

Commenter's Reason: The proponent is correct that R2, R3, and R4 projects are built under the residential provisions of the IECC. We need to recognize that they are commercial type projects with parking lots. I believe by exempting the single family, duplexes and townhouses from the requirement should alleviate any of the committee's concerns.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
While most of these projects are provided with exterior lighting anyway, they may not be provided with the controls required by the code. There may be an increase in cost for providing the controls.

Public Comment# 1824

RE151-19

IECC: R405.2 (IRC N1105.2) , ICC Chapter 6 (IRC Chapter 44)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R405.2 (IRC N1105.2) Mandatory requirements. Compliance with this section requires that the mandatory provisions identified in Section R401.2 be met. The *building thermal envelope* shall be greater than or equal to levels of efficiency and *Solar Heat Gain Coefficients* in Table R402.1.1 or R402.1.3 of the 2009 *International Energy Conservation Code* . Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*-value of not less than R-6.

Add new text as follows:

ICC

International Code Council, Inc.
500 New Jersey Avenue NW 6th Floor
Washington DC 20001

IECC-2009: **International Energy Conservation Code**

Reason: The purpose of this code change is to help ensure long-term energy savings and occupant comfort by applying a reasonable, consistent minimum mandatory thermal envelope backstop across the IECC’s two performance-based compliance paths. Since 2015, the newest IECC compliance path, the Energy Rating Index (R406), has already included a minimum mandatory thermal envelope backstop based on the 2009 IECC prescriptive requirements. While a minimum backstop is most important for the ERI, it would also be useful if applied to the simulated performance alternative in Section R405. This proposal will accomplish this objective.
An important part of the logic behind the minimum thermal envelope requirements for the ERI applies to the performance path in Section R405 as well -- a well-built thermal envelope provides long-term energy savings and improved comfort for occupants over the lifetime of the home, and upgrades to the thermal envelope are easiest to incorporate (and most cost-effective) at construction. This is consistent with the intent of the IECC set forth in Section R101.3. Specifically, the IECC is intended to "regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building." Regardless of the compliance option selected by the code user, the IECC should require a reasonable minimum level of performance by the home's permanent thermal envelope. As a result, this proposal would apply the same minimum mandatory requirements, including envelope requirements, to Section R405 compliance as currently apply to Section R406 compliance.

To our knowledge, the 2009 IECC backstop in Section R406.2 has been adopted by every state that has adopted the ERI as part of the 2015 or 2018 IECC. A trade-off backstop recognizes the crucial importance of a reasonably efficient thermal envelope, irrespective of the efficiency tradeoffs among various other building components. While we would prefer an even more robust backstop than the 2009 prescriptive requirements (such as the 2015 requirements, which were established in 2018 for ERI compliance that includes on-site generation), the 2009 requirements are at least a reasonable starting place and are consistent with the current backstop for ERI.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Because this proposal only establishes a trade-off backstop to an alternative compliance path and not a prescriptive code requirement (the prescriptive requirements are already much more efficient than the proposed new backstop levels), and because most homebuilders are likely already meeting or exceeding these requirements, we conclude that there will not necessarily be any cost impact.

RE151-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: We do not need a backstop, the backstop is the reference design (Vote 11-0).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IECC®: R405.2 (IRC N1105.2)

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R405.2 (IRC N1105.2) Mandatory requirements. Compliance with this section requires that the mandatory provisions identified in Section R401.2 be met. ~~The *building thermal envelope* shall be greater than or equal to levels of efficiency and *Solar Heat Gain Coefficients* in Table R402.1.1 or R402.1.3 of the 2009 *International Energy Conservation Code*.~~ The proposed total building thermal envelope UA which is sum of U-factor times assembly area, shall be less than or equal to the building thermal envelope UA using the prescriptive U-factors from Table R402.1.4 multiplied by 1.15 in accordance with Equation 4-1. The area-weighted maximum glazed fenestration SHGC permitted in Climate Zones 1 through 3 shall be 0.30. Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*-value of not less than R-6.

$UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}}$ Equation 4-1

Commenter's Reason: This proposal should be approved as submitted or as modified because it would provide an envelope backstop that would help maintain a reasonable level of building envelope efficiency in homes constructed under the performance path. An efficient thermal envelope is crucial to a comfortable and energy efficient home and minimum levels of envelope efficiency should not be traded off under alternative compliance methods like the performance path. This principle has already been recognized in the ERI path and the purpose of this proposal is to apply this approach to the performance path as well. The original reason for the proposal further explains the benefits of an envelope backstop for the performance path.

The proposed modification would provide additional flexibility for builders by permitting a Total UA-based backstop instead of requiring certain R-values for each component and includes appropriate SHGC requirements for fenestration. The proposed modification would match the language recommended for approval in RE150-19, making the minimum thermal envelope requirements the same for both the Simulated Performance Alternative and the Energy Rating Index (without on-site generation). This modification would also reference the current edition of the IECC, instead of a static reference to the 2009 IECC.

The Committee reason confuses the proposed backstop and the standard reference design in the performance path, stating that “We do not need a backstop, the backstop is the reference design.” There is a big difference between the reference design, which merely establishes the baseline home for potential trade-offs, and a backstop requiring minimum performance for specific building elements. The performance path baseline is based on the prescriptive requirements of the current IECC, which are substantially more stringent than the proposed minimum values for the backstop, and elements of the standard reference design may be traded away. The backstop, on the other hand, is a more lenient set of requirements because it is intended as a “worst case scenario” for trade-offs and cannot be further traded away. When the ERI was added to the IECC in the 2015 IECC, it was widely recognized that a compliance path with so many trade-off opportunities would need to require compliance with mandatory measures and some amount of efficiency in the thermal envelope. Thus, minimum prescriptive requirements were included as a backstop for the efficiency of thermal envelope components. This backstop has been adopted by every state that has incorporated the ERI as part of a 2015 or 2018 IECC adoption.

This proposal is important for the same reasons that the Energy Rating Index includes a thermal envelope backstop. The efficiency of the permanent thermal envelope must be maintained at a reasonable level, since envelope components typically have a much longer life and are more likely to remain unaltered over the useful life of the building. The proposed backstop in this code change is a good first step in that it reflects a modest level of protection given the current performance path. Adopting the modification above would apply the same Total UA-based backstop to both the ERI and the performance path.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
As stated in the original proposal, because this only establishes a trade-off backstop to an alternative compliance path and not a prescriptive code requirement (the prescriptive requirements are already much more efficient than the proposed new backstop levels), and because most

homebuilders are likely already meeting or exceeding these requirements, we conclude that there will not necessarily be any cost impact.

Public Comment# 1485

RE153-19

IECC®: R405.3 (IRC N1105.3)

Proposed Change as Submitted

Proponents: Ted Williams, representing American Gas Association (twilliams@aga.org)

2018 International Energy Conservation Code

Revise as follows:

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design)* be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design.* Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

> **Exception:** The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be ~~permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 3.16. The source energy multiplier~~ 3.16 for electricity and 1.1 for fuels other than electricity ~~shall be 1.1.~~ , or other multipliers for national or regional annual average energy consumption from nationally-recognized and validated data sources.

Reason: The proposed change is consistent with the proposed change to C407.3 and is based upon the source energy metric usage in Federal energy programs including Energy Star for Commercial Buildings and Home Energy Score. This revised exception provides the only means of assessing energy performance on fuel cycle energy consumption and ultimately carbon footprints since site energy metrics alone cannot account for these upstream energy system losses. In addition, the allowance in the proposed exception language for use of “other multipliers” addresses a persistent criticism of national average multipliers, which do not reflect regional or local mixes of renewable energy in meeting building demands, and encourages authorities having jurisdiction to use locally-relevant multipliers that are available from utilities and other sources. Also, greater usefulness of the exception is critical since the basic requirements of R405.3 focusing on energy cost is not consistent with the intent of the IECC as stated in R101.3, which addresses energy use and conservation, not energy cost.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The proposal would not increase the cost of construction since the proposal is for changes to an exception. If the use of source energy metrics allows more alternatives for achieving energy performance improvements, it may decrease construction costs ultimately.

RE153-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Concern with language and there is confusion about the proper multiplier (Vote: 11-0).

Assembly Action: **None**

RE153-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R405.3 (IRC N1105.3)

Proponents:
Ted Williams, representing American Gas Association (twilliams@aga.org)

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design)* be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design.* Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

> **Exception:** Where jurisdictions use source energy rather than energy cost as a metric, ~~The~~ energy ~~use~~ consumption shall be based ~~on~~ upon source energy expressed in Btu or Btu per square foot of *conditioned floor area* and calculated using the source multipliers of ~~shall be~~ ~~3.16~~ 2.95 for grid-supplied electricity , 1.09 for natural gas, 1.15 for propane and 1.19 for fuel oil, or using ~~and 1.1 for fuels other than electricity , or~~ other multipliers for national , state, ~~or~~ regional , or local annual average energy consumption and published in governmental sources. ~~from nationally-recognized and validated data sources~~.

Commenter's Reason: The Committee reasoning that there is "too much confusion over source energy factors" ignores the fact that factors for primary fuels are well established
in literature and building rating tools, and the grid electricity factor of 2.95 has been used in the Pacific Northwest National Laboratory
(PNNL) May 2019 report, "Preliminary Energy Savings Analysis: 2018 IECC Residential Requirements," establishing use of this factor as a matter of federal
analytical policy and procedures. While this factor can be changed as an update, to date no documented effort has been extended to challenge use of this factor. "Consensus" in "standards" regarding this factor is a political and market argument among stakeholder, meanwhile the federal government and other authorities are proceeding with using these factors in building rating.

Bibliography: Taylor, T., Mendon, V., Zhan, M., and Liu, B., "Preliminary Energy Savings Analysis: 2018 IECC Residential Requirements," DOE/EERE, May 2019.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
By allowing the use of more reasonable source energy metrics for performance analysis of buildings, greater flexibility in building design would be facilitated and construction cost savings would be realized.

Public Comment# 2166

RE154-19

IECC: R405.3 (New), TABLE R405.3.1 [IRC N1105.3.1] (New)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org); Keith Dennis, representing NRECA (keith.dennis@nreca.coop)

2018 International Energy Conservation Code

Revise as follows:

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design)* be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design.* Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

> **Exception:** The energy use based on site energy or source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost. The source energy ~~multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.~~ estimate multipliers for energy sources shall be taken from Table R405.3.1.

Add new text as follows:

TABLE R405.3.1 (IRC N1105.3.1)
SOURCE ENERGY ESTIMATED MULTIPLIERS

SOURCE ENERGY TYPE	ESTIMATED SOURCE MULTIPLIER[a]
Electricity, Imported, General Grid	2.61
Electricity, Imported, Local or National RPS	Greater of [2.61 x (1 - RPS%)] or 1.00
Electricity, Off-Site Delivered Renewable	1.00
On-Site Renewable Electricity, used by building or exported	1.00
On-Site Stored Renewable Electricity (used by building or exported)	1.00
Natural Gas, domestic, no flaring/venting	1.09
Natural Gas, domestic, with 20% flaring/venting	1.37
Natural gas, imported as LNG	1.25
Fuel Oil (1, 2, 4, 5, 6, Diesel, Kerosene), domestic	1.19
Fuel Oil, imported from overseas	1.45
Propane, Liquid Propane, domestic	1.15
Propane, Liquid Propane, domestic, with 20% flaring/venting	1.49
Steam, Non-Renewable	1.45
Steam, Renewable	1.00
Hot Water, Non-Renewable	1.35
Hot Water, Renewable	1.00
Chilled Water, Non-Renewable	1.04
Chilled Water, Renewable	1.00
Coal or Other, domestic	1.05

a. Values represent averages for the United States.

Reason: The world of energy production and energy storage and choices of energy supply is changing rapidly. The current language is outdated and does not account for all of the changes going on and needs to be revised.
This proposal will make the provision more flexible for building designers, building owners, and code officials. By allowing the use of site energy, which was allowed in previous versions of the IECC, the performance path can be based on real measured data. By updating source energy estimates, there will be more information provided to code officials and building owners.

More buildings are producing and storing energy on-site, so it does not make technical or analytical sense to require the use of outdated "source energy" estimates.

Site Energy

Allowing the use of site energy is more appropriate for buildings that are producing or storing energy on-site. In the future, many buildings will be producing energy and storing energy, along with consuming energy. Building systems may be consuming energy that was produced from an off-site energy grid and/or produced from an on-site energy production system and/or delivered from an off-site energy storage system (e.g., a grid battery or EV battery) and/or delivered from an on-site energy storage system, (e.g., and battery or fuel storage tank or thermal energy storage system). At the same time, the building may be producing energy that is used by building equipment, sent to an on-site energy storage system, or exported to another building (or buildings) or to the energy grid.

In a letter to DOE, ASHRAE said:

"the Society believes that the multiple and varying weighting factors and algorithms required for estimating source energy conversions are often inconsistent and ultimately cloud and complicate understanding. Since source energy conversion factors vary widely from place to place and across time, the use of fixed national average conversion factors could lead to inconsistent estimates of consumption."

"Thus, in this case ***the best method for determining if a building is a NZEB is to look at the energy crossing the boundary at the site of the building; hence "site" energy is the best choice to use***." (emphasis added)

Site energy was part of the exception for many years until it was removed. There are many reasons to allow site energy to be used as an alternative to source energy or energy costs:

-Site energy is an actual metric that can be measured and verified by code officials, while source energy is an estimate.

-Site energy information is credible, as it is shown on customers' energy bills on a monthly basis and used in other consensus-based code documents, such as ASHRAE 90.1, use site energy metrics for efficiency requirements.

-DOE uses site energy information in many of its energy efficiency and energy consumption publications, such as the Residential Energy Consumption Survey. DOE uses site energy for its appliance energy efficiency standards program and the FTC uses site energy on the yellow EnergyGuide labels found on consumer appliances. EPA uses site energy to determine if an appliance or home qualifies for the Energy Star program.

-Site energy is reliable, since it can be measured by utilities, consumers, and independent 3 parties. In terms of energy efficiency upgrades, consumers rely on site energy information (amount used by older appliance or equipment compared to new appliance or equipment) to help them make energy efficiency decisions.

-Site energy is replicable, as the units of measurement (kWh, therms, gallons, Btu's) can be used throughout the United States and are familiar to consumers on their monthly energy bills. Source energy is not replicable, as different estimates must be used for different energy sources, and different entities can make different assumptions about upstream production and delivery of different energy sources.

-Site energy is transparent and easy to understand. It can be based on meter readings or DOE test procedures or FTC EnergyGuide labels or Energy Star labels. It is the metric that allows people to easily compare energy efficiency options in the marketplace. It is the metric that allows people to make good economic choices when faced with competitive alternatives.

Source Energy Estimates

There are many ways to estimate upstream energy losses. The energy production industry is very dynamic and subject to significant changes. In the United States in 2018, there was a record amounts of natural gas produced from hydraulic fracturing production techniques. In 2018, there was a record amount of oil produced and imported from oil sands production. In 2018, there was a record amount of electricity produced from renewable forms of energy and a record amount of electricity produced by combined-cycle natural gas turbines.

The values that are currently shown should be deleted and not used. The values shown are not consistent with values shown in other published documents. Many documents and articles have been published over the past several years with source energy estimates as shown in the bibliography. The current values in the IECC do not match and cannot be substantiated with any of these published documents.

Different fossil fuels have different upstream source estimates. In the current IECC, all fossil fuels are assumed to have the same multiplier. In other documents, there is a large and statistically significant variation in the upstream estimates that will have a significant impact on energy performance results. As one example, for fuel oil and propane, EPA's Portfolio Manager uses a factor of 1.01 for both, while NREL used estimated values of 1.158 and 1.151, while IGCC 2015 uses 1.19 for fuel oil and 1.15 for propane. The use of 3.16 for electricity is overstated for many parts of the United States and does not account for significant regional differences or the increase in the use of renewable power generation and combined cycle gas turbines.

In other publications and web sites, the estimates for electricity are shown on a national basis, a regional basis, or a state by state basis. This is due to the variety of electric generation techniques which have upstream energy losses that can vary by orders of magnitude based on local conditions, regional conditions, physical location, season, month, week, or day, as well as hourly fluctuations in the amount of sunlight or wind speed.

The revisions to the values are based on reports published by the US Energy Information Administration, the US Department of Energy, the US Environmental Protection Agency, national labs, and other public sources of information. It is a technical fact that there are significant differences in terms of upstream estimates for electricity as well as fossil fuels. The new estimates provide more defensible and accurate estimates.

Bibliography: National Renewable Energy Laboratory NREL/TP-550-38617 "Source Energy and Emission Factors for Energy Use in Buildings" (June 2007)
American Gas Association EA 2009-3 "A Comparison of Energy Use, Operating Costs, and Carbon Dioxide Emissions of Home Appliances" (October 2009)
Environmental Protection Agency "Energy Star Performance Ratings Methodology for Incorporating Source Energy Use" (August 2009 and 2017 update)
National Renewable Energy Laboratory NREL/TP-550-47246 "Building America Research Benchmark Definition" (January 2010)
International Code Council "International Green Construction Code" (May 2015)
American Gas Association "Dispatching Direct Use", Table 1, (November 2015)

US Department of Energy "Accounting Methodology for Source Energy of Non-Combustible Renewable Electricity Generation" (October 2016)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal only provides another option for the simulation used for the performance path.

RE154-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **Disapproved**

Committee Reason: While we need to move toward metric for carbon this proposal is not the right one (Vote: 11-0).

Assembly Action: **None**

RE154-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R405.3 (IRC N1105.3), TABLE R405.3.1 (IRC N1105.3.1) (New)

Proponents:
Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design)* be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design.* Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

> **Exception:** The energy use based on site energy or source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost. The source energy estimate multipliers for energy sources shall be taken from Table R405.3.1.

TABLE R405.3.1 (IRC N1105.3.1)
SOURCE ENERGY ESTIMATED MULTIPLIERS

SOURCE ENERGY TYPE	ESTIMATED SOURCE MULTIPLIER[a]
Electricity, Imported, General Grid	2.61
Electricity, Imported, Local or National RPS	~~Greater of [~~2.61 x (1 - RPS%)~~] or 1.00~~
Electricity, Off-Site Delivered Renewable	0~~1~~.00
On-Site Renewable Electricity, used by building or exported	0~~1~~.00
On-Site Stored Renewable Electricity (used by building or exported)	0~~1~~.00
Natural Gas, domestic, no flaring/venting	1.09
Natural Gas, domestic, with 20% flaring/venting	1.37
Natural gas, imported as LNG	1.25
Fuel Oil (1, 2, 4, 5, 6, Diesel, Kerosene), domestic	1.19
Fuel Oil, imported from overseas	1.45
Propane, Liquid Propane, domestic	1.15
Propane, Liquid Propane, domestic, with 20% flaring/venting	1.49
Steam, Non-Renewable	1.45
Steam, Produced by Renewable Electric	0~~1~~.00
Hot Water, Non-Renewable	1.35
Hot Water, Produced by Renewable Electric	0~~1~~.00
Chilled Water, Non-Renewable	1.04
Chilled Water, Produced by Renewable Electric	0~~1~~.00
Coal or Other, domestic	1.05

a. Values represent averages for the United States.

Commenter's Reason: There are three metrics typically used in the expression of energy efficiency; site energy, cost, and source energy. Site energy is a measured value (think electric meter, gas meter, etc.). It is typically expressed in terms of kilowatt hours or therms of gas. Because it is a measured value, it is regarded as the most precise metric of the three. For the same reason, it also serves as the basis for both energy cost and source energy.

Energy cost, on the other hand, is the product of multiplying the site energy value in representative units by the cost of such units. (kilowatt hours X cost per kilowatt hour, etc.) It is also the most meaningful metric to consumers.

Source of energy estimates are achieved by multiplying site energy by a source energy multiplier. Source energy multipliers attempt to express the raw energy input required to deliver one unit of energy to an ultimate end use. Because of the complexities inherent with the calculus that outsource energy factors, including the numerous assumptions, source energy Is the least precise of the three metrics.

Overwhelmingly, codes and standards adopted by jurisdictions have used energy costs as the metric used to demonstrate compliance. In 2009, the IECC first allowed source energy as an exception to cost.

Given that source energy is a less precise approach than site energy, this proposal simply argues to allow for the more efficient site energy metric its source energy is to remain in the code.

In addition, work by ASHRAE (Std. 189.1, WG7.5) has resulted in the use of a "0" multiplier for renewable energy. this proposal adopts that approach as well.

Finally, this comment adopts and renews the reasons provided when the proposal was first submitted without repeating those reasons here again.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal only provides another option for the simulation used for the performance path. Increasing available options allows for more designer control to avoid impacting construction costs.

Public Comment# 1651

Public Comment 2:

IECC®: R405.3 (IRC N1105.3), TABLE R405.3.1 (IRC N1105.3.1) (New)

Proponents:

Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design)* be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design.* Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

> **Exception:** The energy use based on site energy or source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost. The source energy estimate multipliers for energy sources shall be taken from Table R405.3.1, or from an *approved* local or regional source energy estimate multipliers.

TABLE R405.3.1 (IRC N1105.3.1)
SOURCE ENERGY ESTIMATED MULTIPLIERS

SOURCE ENERGY TYPE	ESTIMATED SOURCE MULTIPLIER[a]
Electricity, Imported, General Grid	2.61
Electricity, Imported, Local or National RPS[b]	Greater of [2.61 x (1 - RPS%)] or 1.00
Electricity, Off-Site Delivered Renewable	1.00
On-Site Renewable Electricity, used by building or exported	1.00
On-Site Stored Renewable Electricity (used by building or exported)	1.00
Natural Gas, domestic, ~~no flaring/venting~~	1.09
~~Natural Gas, domestic, with 20% flaring/venting~~	~~1.37~~
Natural gas, imported as LNG	1.25
Fuel Oil (1, 2, 4, 5, 6, Diesel, Kerosene), domestic	1.19
Fuel Oil, imported from overseas	1.45
Propane, Liquid Propane, domestic	1.15
~~Propane, Liquid Propane, domestic, with 20% flaring/venting~~	~~1.49~~
Steam, Non-Renewable	1.45
Steam, Renewable	1.00
Hot Water, Non-Renewable	1.35
Hot Water, Renewable	1.00
Chilled Water, Non-Renewable	1.04
Chilled Water, Renewable	1.00
Coal or Other, domestic	1.05

a. Values represent averages for the United States.

b. Renewable Portfolio Standard (RPS)

Commenter's Reason: This modification improves the proposal by doing the following:
-Providing more flexibility as it allows code officials to use regional or local estimates, instead of national estimates.

-Removing some of the more controversial estimates (even though they are technically accurate).

-Updating the outdated and incorrect estimates that have been in the code since 2009. Energy production has changed dramatically since then, and the current estimates are obsolete.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This public comment make simple clarifications in the proposed table. Clarifications to the code have no cost impact.

Public Comment# 1370

RE155-19

IECC: R405.3 (IRC N1105.3)

Proposed Change as Submitted

Proponents: Charles Foster, representing self (cfoster20187@yahoo.com)

2018 International Energy Conservation Code

Revise as follows:

R405.3 (IRC N1105.3) Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (*proposed design)* be shown to have an annual energy cost that is less than or equal to the annual energy cost of the *standard reference design.* Energy prices shall be taken from a source *approved* by the *code official*, such as the Department of Energy, Energy Information Administration's State Energy Data System Prices and Expenditures reports. *Code officials* shall be permitted to require time-of-use pricing in energy cost calculations.

> ~~**Exception:** The energy use based on source energy expressed in Btu or Btu per square foot of *conditioned floor area* shall be permitted to be substituted for the energy cost. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.~~

Reason: There is only one metric that consumers are concerned with. That metric is cost.
The IECC and its predecessor the model energy code traditionally relied on energy costs to demonstrate compliance. During the 2015 code cycle, this section added the current exception for the use of source energy as an alternative to cost.

Source energy is a relatively complex exercise used to estimate the approximate amount of raw energy consumed in the delivery of energy to ultimate customers. It is not a measurement nor a repeatable calculation across either geography or time.

Among its many limitations, source energy is particularly challenged when dealing with electricity as it treats electricity derived from renewables like solar and wind the same as electricity from an old coal fired generator.

The U.S. Department of Energy recognizes this absurdity – of treating wind the same as coal – and several years ago published a report on the topic. (SEE bibliography).

The overwhelming majority of jurisdictions using the IECC rely on cost.

There is no meaningful reason to keep the exception in the code and it should be removed.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal imposes no additional compliance requirements and, therefore, neither increases nor decreases the cost of construction.

RE155-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: We need a proper source, but we are better off leaving as is then moving to a solution there is little agreement for. Suggested proponents, opponents join in developing a joint solution as public comment (Vote: 11-0).

Assembly Action: **None**

RE155-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Submitted

Commenter's Reason:

There is only one metric that consumers are concerned with. That metric is cost.
The IECC and its predecessor the model energy code traditionally relied on energy costs to demonstrate compliance. During the 2009 code cycle, this section added the current exception for the use of source energy as an alternative to cost.

Source energy is a relatively complex exercise used to estimate the approximate amount of raw energy consumed in the delivery of energy to ultimate customers. It is not a measurement nor a repeatable calculation across either geography or time.

Among its many limitations, source energy is particularly challenged when dealing with electricity as it treats electricity derived from renewables like solar and wind the same as electricity from an old coal fired generator.

The U.S. Department of Energy recognizes this absurdity – of treating wind the same as coal – and several years ago published a report on the topic. (SEE bibliography).

The overwhelming majority of jurisdictions using the IECC rely on cost.

There is no meaningful reason to keep the exception in the code and it should be removed.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction The proposal imposes no additional compliance requirements and, therefore, neither increases nor decreases the cost of construction.

Public Comment# 1994

RE156-19

IECC: R405.4 (IRC N1105.4) (New)

Proposed Change as Submitted

Proponents: Joseph Cain, representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2018 International Energy Conservation Code

Add new text as follows:

R405.4 (IRC N1105.4) On-site renewable energy. *On-site renewable energy* shall be considered as a reduction in energy use of the building.

Reason: The IECC should integrate energy efficiency measures and renewable energy systems. Builders should get credit for what they do.
As presented by the Building Technologies Office of the Department of Energy's 2018 National Energy Codes Conference, according to the U.S. Energy Information Administration's AEO 2018 report, typical Residential End Uses include Space heating at 24% and Space cooling at 11%, for a combined space heating/cooling at 35% of all Residential Energy End Uses. Water heating accounts for 13.5% of Residential Energy End Uses. These figures illustrate that we have done a very good job of reducing regulated loads, such that unregulated loads now represent greater than 50% of all Residential Energy End Uses. Renewable energy systems can offset not only the unregulated loads, but can also offset the reduced regulated loads.

Compliance measures and compliance paths that focus only on building envelope measures and discourage or penaliz e renewable energy sytems -- or fail to make renewable energy systems attractive to builders as a compliance option -are focused on solving 35% of the problem.The IECC should encourage the use of energy efficiency plus renewable energy, to solve 100% of the problem.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Installation of an on-site photovoltaic system could increase or decrease the overall first cost of construction.

RE156-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Do not want to trade efficiency for solar, there is a place for renewables but they are not the same. The correct place to include would be in the ERI pathway (Vote: 7-4).

Assembly Action: **None**

RE156-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Craig Conner, representing self (craig.conner@mac.com)

requests As Submitted

Commenter's Reason: This change specifies that on-site renewables count as a reduction in the residence's energy use.
As we get to low and very low energy use in residences on-site renewables become more import. Almost all very low energy homes need renewables, often at levels well above 10 or 15%. For those going to "zero", efficiency can be perhaps 70% of the solution, but renewables are often needed to get about 30% of the energy reduction. Renewables need to count.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
Including equipment efficiency as an optional way to get the higher efficiency will often lower costs.

Public Comment 2:

Proponents:

Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests As Submitted

Commenter's Reason: The use of on-site renewable energy reduces a buildings demand on the energy grid and is operating off a renewable source and should be considered a reduction in the energy use. This terminology will help encourage the use of renewable energy.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal would not impact the cost of construction because it is not directly affecting how you construct a dwelling. The comment is simply acknowledging that on-site renewable energy shall be considered a reduction in energy use of the building because it is using less energy from the grid.

Public Comment# 1444

Public Comment 3:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: RE156 would be a huge efficiency rollback and should be disapproved as recommended by the Committee. RE156 is one of several proposals to add new trade-offs in the simulated performance compliance path for various measures such as appliances, renewables, lighting, heating/cooling equipment, and hot water equipment (see also RE152, RE175, RE176, RE179 and RE208). These proposals are collectively some of the biggest threats to energy efficiency proposed in this code cycle. These trade-offs do not even purport to increase efficiency, but instead would all result in less efficient buildings over the long-term that cost consumers more, use more energy and provide less comfort and sustainability. They would promote replacing long-lasting building efficiency measures, such as adequate insulation, efficient fenestration and reduced air and duct leakage, with measures that have much shorter useful lives, carry substantial free ridership and lack permanence. We fundamentally oppose simply creating more trade-offs that not only do not advance energy efficiency, but actually take a major step backward. We strongly support the IECC-Residential Committee's consistent recommendations to disapprove all of these proposals. It is important to note that similar proposals have been consistently disapproved by ICC Governmental Member Voting Representatives in the past three code cycles.

Turning to the specifics of RE156, this proposal is like RE152 in that RE156 is intended to allow 100% credit for on-site renewable energy as a trade-off to offset energy efficiency measures (unlike RE152, this proposal focuses exclusively on a trade-off for renewable generation). As discussed in our public comment on RE152, this concept is antithetical to maintaining the current level of energy efficiency in the IECC. The issue is not whether renewables are a good idea or whether they should be required by the code; the issue here is whether renewable energy should replace energy efficiency in a trade-off. Our answer (and the Committee's answer) is a clear "NO". Because the proposal adds a potentially unlimited source of trade-off credit to enable the builder to reduce efficiency measures without any increased stringency elsewhere in the code, RE156 serves only as a weakening amendment to the code and should be rejected.

Approval of RE156 would mean that a rooftop solar installation alone, for example, could be used to erase the efficiency improvements of the past decade or more (the amount of electric generation from a typical rooftop solar installation is a substantial percentage of the home's energy use). The proposal fails to take into account substantial free ridership, where solar would otherwise be installed anyway in addition to efficiency, often as a result of incentives or requirements of governmental entities or utilities. Moreover, allowing such a trade-off will result in increased energy use and cost and uncomfortable homes as efficiency is reduced based on trade-off credit from on-site renewable power generation.

We believe that while renewables are important and valuable additions to a building, they simply should not replace energy efficiency measures. Replacing energy efficiency with renewables means that renewable energy that could be used for other important purposes is simply being wasted in an inefficient building with no net gain. Such an approach is not consistent with sustainability or addressing our environmental challenges.

Aside from the efficiency rollbacks, RE156 also suffers from several problems of a technical nature:

- RE156 treats onsite renewable energy as “a reduction in energy use.” This is problematic because if on-site renewables are used as trade-offs against efficiency measures, the building will actually be using *more* energy with potentially higher peak demands (due to a less efficient building), even though during some parts of the day it will be supplied from on-site sources.

- The proposal does not provide any guidance as to how generation output will be calculated and credited in the performance path. Is the system required to be permanently a part of the real property (and owned), or will a leased system, that might be removed at any time, be sufficient?

- Should the code account for the likely shorter useful life of such a system, in comparison to other measures?

RE156 is a bad deal for consumers who might believe they are doing the right thing by installing on-site renewable energy, but whose homes will actually be uncomfortable energy hogs if these trade-offs are allowed. Rather than benefit from both the environmental benefits of renewable energy *and* reduced energy use, at best, homeowners would simply be trading one for the other.

RE156 risks rolling back the energy efficiency of the IECC with no limitation and it raises many technical questions that must be addressed. We strongly recommend disapproval of RE156.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1504

RE157-19

IECC: R405.4.2 (IRC N1105.4.2)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R405.4.2 (IRC N1105.4.2) Compliance report. Compliance software tools shall generate a report that documents that the *proposed design* complies with Section R405.3. A compliance report on the *proposed design* shall be submitted with the application for the building permit. Upon completion of the building, a compliance report based on the as-built condition of the building shall be submitted to the *code official* before a certificate of occupancy is issued. ~~Batch sampling of *buildings* to determine energy code compliance shall only be allowed for stacked multiple-family units.~~

Compliance reports shall include information in accordance with Sections R405.4.2.1 and R405.4.2.2. Where the *proposed design* of a building could be built on different sites where the cardinal orientation of the building on each site is different, compliance of the *proposed design* for the purposes of the application for the building permit shall be based on the worst-case orientation, worst-case configuration, worst-case *building* air leakage and worst- case duct leakage. Such worst-case parameters shall be used as inputs to the compliance software for energy analysis.

Reason: The purpose of this code change proposal is to remove confusing and incomplete language from the performance path regarding “batch sampling” of buildings. Section R405.4.2 contains orphan language that implies that batch sampling might be acceptable for stacked multiple family units, but there is no process or criteria for “batch sampling” defined anywhere in the IECC. Before any sort of sampling is allowed, a number of very important questions must be addressed, such as which parts of the building may be batch sampled, what sample size must be collected, what happens in the event of a failure, etc. Although some common voluntary programs permit sampling for certain specified measures, the IECC does not currently allow this practice and should not until these important questions are addressed. Moreover, we are concerned that batch sampling would fail to ensure that every home meets the code, since presumably only some homes would be included in the sampling.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal cleans up excess language that refers to sampling practices that do not currently exist in the IECC.

RE157-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This language must be retained to allow building officials to accept sampling (Vote: 7-4).

Assembly Action: **None**

RE157-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it eliminates language that is unnecessary and that could lead to confusion in enforcement. Moreover, elimination of this provision would make it clear that sampling is not permitted for purposes of code compliance. As discussed in more detail in our public comment on RE10, we believe that sampling is inappropriate for a mandatory minimum code, because it does not guarantee that every new building complies with the code.

In our view, the IECC currently does not specifically allow sampling for any code requirements. The language in R405.4.2 referencing “batch sampling of buildings” is a limit on sampling, not an authorization for sampling (and it is included in a section related to compliance reports for documentation of performance path compliance). Further, it is too vague and lacks any sort of effective guidelines for builders or code enforcement personnel. There are no other references to sampling in the residential energy code provisions. Unless and until a more specific sampling protocol (which we would oppose) is adopted into the code, this language should be eliminated.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
As stated in the original proposal, this cleans up excess language that refers to sampling practices that do not currently exist in the IECC.

Public Comment# 1486

RE161-19

IECC: TABLE R405.5.2(1) [IRC N1105.5.2(1)]

Proposed Change as Submitted

Proponents: Jennifer Hatfield, representing American Architectural Manufacturers Association (jen@jhatfieldandassociates.com)

2018 International Energy Conservation Code

Revise as follows:

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

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Vertical fenestration other than opaque doors	Vertical Fenestration ~~Total~~ area[h] = (a)The proposed vertical fenestration ~~glazing~~ area (AVF), where the proposed total fenestation ~~glazing~~ area (AF) is less than 15 percent of the conditioned floor area (CFA) (b)~~15 percent of the conditioned floor area~~The adjusted vertical fenestration area (AVF_{adj}), where the AF ~~proposed glazing area~~ is 15 percent or more of the ~~conditioned floor area~~ CFA. AVF_{adj} = AVF x (0.15 x CFA/AF)	As proposed
Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed	
U-factor: as specified for Fenestration in Table R402.1.4.	As proposed	
SHGC: as specified for Glazed Fenestration in Table R402.1.2 except for climate zones without an SHGC requirement, the SHGC shall be equal to 0.40.	As proposed	
Interior shade fraction: 0.92-(0.21 Ã□ SHGC for the standard reference design).	Interior shade fraction: 0.92-(0.21 Ã□ SHGC as proposed)	
External shading: none.	As proposed	
Skylights	~~None~~ Skylight area[h] = (a) The proposed skylight area (ASKY), where the proposed total fenestration area (AF) is less than 15 percent of the conditioned floor area (CFA) (b) The adjusted skylight area ($ASKY_{adj}$), where the AF is 15 percent or more of the CFA. $ASKY_{adj}$ = ASKY x (0.15 x CFA/AF)	As proposed
Orientation: as proposed	As proposed	

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
U-factor: as specified for Skylights in Table R402.1.2	As proposed	
SHGC: as specified for Glazed Fenestration and footnote (b) in Table R402.1.2, except for climate zones without an SHGC requirement, the SHGC shall be equal to 0.40.	As proposed	
For the area of proposed skylights equipped and rated with factory-installed interior shades: the interior shade fraction is 0.92 - (0.21 x SHGC) [SHGC as above for the standard reference design]	As proposed, with shades assumed closed 50% of the daylight hours	
External shading: none	As proposed	

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L,
°C = (°F-32)/1.8, 1 degree = 0.79 rad.

a. Where required by the *code official,* testing shall be conducted by an *approved* party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals,* or the equivalent, shall be used to determine the energy loads resulting from infiltration.

b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals,* page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals,* page 26.19 for intermittent mechanical ventilation.

c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.

d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.

f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the

predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.
h. Light-transmitting fenestration area includes the area of sash, curbing or other framing elements that are part of the conditioned space enclosure, including light-transmitting assemblies in the walls bounding conditioned basements. For doors where the light-transmitting opening is less than 50 percent of the door area, only the light-transmitting area is included.
For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine ~~glazing~~ fenestration area:

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

where:

AF = ~~Total glazing~~Proposed total fenestration area.
A_s = Standard reference design total ~~glazing~~ fenestration area.
FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 Ã□ below-grade boundary wall area).
F = (above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater~~.~~;
and where:Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.
Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.
Below-grade boundary wall is any thermal boundary wall in soil contact.
Common wall area is the area of walls shared with an adjoining dwelling unit.
~~L~~ AF, A_s and CFA are in the same units.

Reason: The IECC residential simulated energy performance analysis standard reference design specification table has historically included skylight area in the "Glazing" row, as reflected in the 2012 IECC:

TABLE R405.5.2(1)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Glazing[a]	Total area[b] = (a) The proposed glazing area; where proposed glazing area is less than 15% of the conditioned floor area. (b) 15% of the conditioned floor area; where the proposed glazing area is 15% or more of the conditioned floor area.	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed
	U-factor: from Table R402.1.3	As proposed
	SHGC: From Table R402.1.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed
	Interior shade fraction: 0.92-(0.21 × SHGC for the standard reference design)	0.92-(0.21 × SHGC as proposed)
	External shading: none	As proposed

...

a. Glazing shall be defined as sunlight-transmitting fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Glazing includes the area of sunlight-transmitting fenestration assemblies in walls bounding conditioned basements. For doors where the sunlight-transmitting opening is less than 50 percent of the door area, the glazing area is the sunlight transmitting opening area. For all other doors, the glazing area is the rough frame opening area for the door including the door and the frame.

b. For residences with conditioned basements, R-2 and R-4 residences and townhouses, the following formula shall be used to determine glazing area:

$AF = A_s \times FA \times F$

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

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

...

Footnote (a) clearly refers to "the area of … curbing …" in the definition of "Glazing", which is only germane to skylights on a roof. The commentary versions of the 2012 and prior editions reinforce this intent to cover skylight area in the glazing row for the reference design.

The approval of RE173-13 upset the applecart for skylights in the 2015 IECC. The proponent later acknowledged at 2018 IECC code hearings that it was not intentional, but the two major elements of that change took away the only place for skylights to be included in the reference design:

- "Glazing" was changed to "Vertical fenestration other than opaque doors"
- Footnote (a) was inexplicably deleted, rather than redefine fenestration area calculation rules.

Our proposed changes to Table R405.5.2(1) reinstate the allowance to include skylight area in the Standard Reference Design as part of the Total Fenestration Area when they are part of the proposed design, by adding the following:

1. Provisions for skylight area, U-factor and shading that mirror the Vertical Fenestration provisions, wherever practical.
2. Provisions for skylight SHGC that mirror those for Vertical Fenestration, with the addition of a reference to Footnote (b) of Table R402.1.2 specific to skylight SHGC.
3. Provisions for skylight orientation based upon "As Proposed". Typically, skylight installation in residential construction is not able to be equally distributed to all four cardinal compass orientations, as assumed for vertical fenestration under the Simulated Performance Alternative provisions.
4. Suitable interior shading provisions that are used when any of the proposed skylights are rated products that include integral interior shading.

This proposal also includes the following coordinating changes:

1. In footnote (h), reference to "glazing area" is replaced by "fenestration area", while restoring needed clarifying language from old footnote (a) defining what is included in calculating the area of various fenestration products regardless of slope or position on the envelope.
2. Provisions are added to reduce the vertical fenestration area and skylight area proportionally for the Standard Reference Design, whenever any skylight area is proposed and total fenestration area equals or exceeds 15% of conditioned floor area.

Bibliography: 2012 IECC, Table R405.5.2(1)

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The code change proposal will not increase the cost of construction but rather reinstates language that was unintentionally removed.

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: Appropriate to reintroduce unique features of skylights (Vote: 7-4).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it would reduce the efficiency of the performance path for homes that incorporate skylights, and would incorporate an entirely new, complicated and confusing calculation into the performance path that is completely unnecessary. A similar proposal was disapproved in the 2018 Code Development Cycle, and this one should be disapproved as well for several reasons:

- **RE161 reduces efficiency.** For several editions, the IECC performance path has included a glazing/vertical fenestration area assumption that adjusts the baseline depending on the proposed design. For below-average glazing area homes (<15%), the reference design glazing area is reduced to match that of the proposed design, eliminating unnecessary trade-off credit for homes with low glazing area. RE161 would take the difference between 15% and the proposed glazing area and repurpose it as skylight area. This is a big reduction in efficiency in such cases, since it essentially permits skylights (roughly equivalent to R-2) to replace ceiling insulation that would be required to achieve R-38 or R-49.

- **RE161 is unnecessary.** The prescriptive compliance path already allows unlimited skylight area, with no penalty whatsoever. Likewise, the Total UA path, which compares the proposed design to a geometrically equivalent standard reference design (i.e. same skylight area), also allows unlimited skylight area with no penalty. There is no need to establish a special approach for skylights in the performance path.

- **RE161 is technically flawed.** The proposal introduces a trade-off credit for interior shades for skylights and includes an arbitrary assumption in the proposed design that shades are "closed 50% of the daylight hours." The IECC has historically not allowed trade-offs related to interior shading; this is a step in the wrong direction. There is no technical foundation for such an assumption, and it does not match the shading assumption for other types of fenestration in the performance path. In short, this provides additional, unwarranted trade-off credit for skylights.

- **RE161's proposed changes do not "reinstate" an allowance for skylight area in the standard reference design as suggested by the proponent and the Committee.** The proponent's reason includes the statement: "Our proposed changes to Table R405.5.2(1) reinstate the allowance to include skylight area in the Standard Reference Design …" The brief Committee Reason on RE161-19 also reflects this concept: "Appropriate to reintroduce unique features of skylights." To be clear: *The language in RE161-19 is not re-introducing anything*. It is entirely new language that has never been part of the IECC. The proponent's Reason Statement claims that the IECC performance path historically "included skylight area in the 'Glazing' row." This appears to be incorrect. Going back to at least the 2006 IECC, skylights have never been included in the glazing row of the standard reference design. There has always been a separate row for skylights, and the assumed area has always been "none." Going back even farther to the first version of the IECC (1998), prior to the current table describing the elements of the standard reference design, the code simply stated: "Skylights … shall not be included in the Standard design …." (Section 402.1.1, Exception 4).

We do not think it is unreasonable to leave the assumption for skylights at "none" in the performance path, just as it has been for many IECC editions. Skylights are not a standard feature in most homes, and it does not make sense to create a trade-off credit for them at the expense of energy efficiency. This does not prohibit skylights from being installed in the performance path – it just requires builders to account for the reduced efficiency and avoids an unnecessary free trade-off credit. Again, builders who find this too restrictive can simply use the prescriptive or Total UA paths to specify an unlimited amount of skylight area with no penalty. But we do not see any good reason to introduce this complicated reduction in efficiency in the IECC's performance path.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1488

RE165-19

IECC: TABLE R405.5.2(2) [IRC N1105.5.2(2)]

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Revise as follows:

TABLE R405.5.2(2) [IRC N1105.5.2(2)]
DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS[a]

Portions of table not shown remain unchanged.

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS[b]
Distribution system components located in unconditioned space	—	0.95
Untested distribution systems entirely located in conditioned space[c]	0.88	1
<u>Proposed "reduced leakage" when the installed air distribution system is located entirely within the continuous air barrier assembly and building thermal envelope's defined conditioned space as verified through inspecton before drywall has been installed[e]</u>	<u>0.96</u>	<u>—</u>
“Ductless“Ductless” systems[d]	1	—

For SI: 1 cubic foot per minute = 0.47 L/s, 1 square foot = 0.093 m^2, 1 pound per square inch = 6895 Pa, 1 inch water gauge = 1250 Pa.

a. Default values in this table are for untested distribution systems, which must still meet minimum requirements for duct system insulation.
b. Hydronic systems shall mean those systems that distribute heating and cooling energy directly to individual spaces using liquids pumped through closed-loop piping and that do not depend on ducted, forced airflow to maintain space temperatures.
c. Entire system in conditioned space shall mean that no component of the distribution system, including the air-handler unit, is located outside of the conditioned space.
d. Ductless systems shall be allowed to have forced airflow across a coil but shall not have any ducted airflow external to the manufacturer’s air-handler enclosure.
e. <u>For homes with thermal distribution systems documented through visual verification at a rough stage of construction before drywall has been installed to be entirely within the continuous air barrier assembly and building thermal envelope of conditioned space, including all ducts and the manufacturer’s air handler enclosure, a DSE of 0.96 shall be applied to the Proposed Design without the requirement to conduct duct leakage testing. Alternatively, Total leakage of not greater than 4 cfm per 100 ft2 of conditioned floor area at a pressure difference of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer’s air handler enclosure, shall be deemed to meet this requirement without measurement of leakage to outdoors.</u>

Reason: The energy penalty or loss of duct leakage is different for duct systems that are located inside or outside of the buildings continuous air barrier assembly. The 2006 IECC recognized this in the IECC table titled, “DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS” that accompanies the proposed and reference home table for the Simulated Performance Alternative path. At some point this was removed, but since the energy code only requires testing for Total duct leakage it makes sense to add it back in. If the entirety of the duct system including the air handler cabinet is confirmed to be located inside conditioned space as defined by the continuous air barrier and thermal envelope assemblies, then the likelihood of the system leaking to the outdoors is little. Therefore, the energy loss of duct leakage to outside would also be little. If testing is not performed for duct leakage to outside a small penalty should be assessed which this proposal provided. If, alternatively, a total duct leakage test is performed then the total duct leakage test results can be used in the modeling for leakage to outside which this proposal also allows as long at the total duct leakage number in not greater than 4 CFM per 100 ft2 of conditioned floor area.
This proposal, although allowing verified HVAC duct systems not to be tested for duct leakage to outdoors, does assess a DSE of 0.96 which equates to a 4% energy loss for the system. Thus, if needed for compliance or to allow designed tradeoffs to be calculated in the software, duct leakage could be tested to demonstrate a reduced leakage level below this rate.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
In most cases this proposal would lower the cost of 3rd party compliance with the IECC as a single total duct leakage test could be used to document location and leakage of the duct system allowing for no testing to occur to quantify duct leakage to the outdoors

RE165-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
2018 International Energy Conservation Code

TABLE R405.5.2(2) [IRC N1105.5.2(2)]

DEFAULT DISTRIBUTION SYSTEM EFFICIENCIES FOR PROPOSED DESIGNS[a]

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS[b]
Distribution system components located in unconditioned space	—	0.95
Untested and Unverified distribution systems entirely located in conditioned space[c]	0.88	1
Untested and Verified d stribution systems entirely located in conditioned space. ~~Proposed~~ “Reduced leakage” when the installed air distribution system has been verified to be ~~is~~ located entirely within conditioned space. ~~the continuous air barrier assembly and building thermal envelope’s defined conditioned space as verified through inspection before drywall has been installed~~[e]	0.96	_
“Ductless“Ductless” systems[d]	1	—

For SI: 1 cubic foot per minute = 0.47 L/s, 1 square foot = 0.093 m^2, 1 pound per square inch = 6895 Pa, 1 inch water gauge = 1250 Pa.

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

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

c. Default distribution efficiency for homes where the thermal distribution system is not visible at the time of testing and has NOT been visually documented at a rough stage of construction before drywall has been installed to be entirely in conditioned space. Entire system in conditioned space shall mean that no component of the distribution system, including the air-handler unit, is located outside of the conditioned space.

d. Ductless systems shall be allowed to have forced airflow across a coil but shall not have any ducted airflow external to the manufacturer’s air-handler enclosure.

e. Default distribution efficiency for compliance with Sections R405 and R406 homes with thermal distribution systems documented through visual verification at a rough stage of construction before drywall has been installed to be entirely within the continuous air barrier assembly and building thermal envelope of conditioned space, including all ducts and the manufacturer’s air handler enclosure, a DSE of 0.96 shall be applied to the Proposed Design without the requirement to conduct duct leakage testing. Alternatively, Total leakage of not greater than 4 cfm per 100 ft2 of conditioned floor area at a pressure difference of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer’s air handler enclosure, shall be deemed to meet this requirement without measurement of leakage to outdoors.

Committee Reason: This provides more clarify and aligns with Standard 380. The modification clarifies language that was left out of the original proposal (Vote AM 10-1).

Assembly Action: **None**

RE165-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it reduces efficiency by awarding additional credit to untested but verified systems located entirely in conditioned space (thereby offsetting the need for other efficiency measures). The proposal also discourages testing by giving the system additional credit without testing. Further, the proposal is also inconsistent with the Committee’s recommendation to approve RE112, which will require duct testing in all new homes, including those with all ducts inside conditioned space. In short, RE165 awards far too much credit for distribution system efficiency for systems that have not been tested.

We believe that installing all supply and return ducts inside conditioned space is good design; however, information collected through field studies in multiple states shows that even where all ducts are located inside conditioned space, duct systems can still be extremely inefficient. As we noted in the reason for RE112, DOE field studies in Kentucky and Pennsylvania showed that homes with all ducts located inside conditioned space still had duct leakage in the range of 6.26 to 40.36 cfm (Kentucky) and 12.6 to a whopping 77.1 cfm (Pennsylvania). https://www.energycodes.gov/compliance/energy-code-field-studies.

Results of DOE Field Study Data Collection on Duct Tightness				
	Ducts in Conditioned Space (Exempt from Test)		Ducts Outside Conditioned Space (Testing Required)	
Kentucky	# Samples	24	# Samples	40
	Max Test Result	40.36	Max Test Result	18.90
	Min Test Result	6.26	Min Test Result	3.10
	Avg Test Result	18.46	Avg Test Result	9.71
Pennsylvania	# Samples	18	# Samples	52
	Max Test Result	77.10	Max Test Result	69.00
	Min Test Result	12.60	Min Test Result	2.44
	Avg Test Result	30.95	Avg Test Result	17.95

RE165 is unnecessary if RE112 is approved, since every new home will be required to be tested for duct tightness, and the actual result of the duct test will be included in the performance calculation. However, even if duct testing were not required universally, we still think it is not a reasonable assumption that homes with all ducts and air handlers located inside conditioned space will achieve a system efficiency of 0.96.

Bibliography: https://www.energycodes.gov/compliance/energy-code-field-studies.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1492

RE166-19

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

Proposed Change as Submitted

Proponents: Gary Klein, representing self (gsmklein@comcast.net)

2018 International Energy Conservation Code

Revise as follows:

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

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Service water heating[d, ~~e, f~~, g]	The efficiency shall be selected based on a water heater with the same first hour rating and draw pattern as the ~~As~~ proposed water heater. Use: same as proposed design.	As proposed Use, in units of gal/day = 30 + (10 × N_{br}) where: N_{br} = number of bedrooms.

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

a. Where required by the *code official,* testing shall be conducted by an *approved* party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals,* or the equivalent, shall be used to determine the energy loads resulting from infiltration.
b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals,* page 26.24 and the “Whole-house Ventilation” provisions of 2001 ASHRAE *Handbook of Fundamentals,* page 26.19 for intermittent mechanical ventilation.
c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.
d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.
f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.
h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing area:

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

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

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

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

and where:

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

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

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

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

L and *CFA* are in the same units.

Reason: The method of test for water heater efficiency was updated in 10 CFR §430.32 (2018). The proposed changes to the service water heating row in the performance table reflect these changes.
The two deleted footnotes referred to in this row do not appear to be related to water heating.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The updates to the table are the same in both the standard reference and the proposed columns. No new requirements are imposed on construction practices, hence no changes to the cost of constriuction are expected.

RE166-19

Public Hearing Results

Committee Action: **As Submitted**

Committee Reason: This adds language to clarify how water heaters are modeled and adds the 1-hour rating specification (Vote: 11-0).

Assembly Action: **None**

RE166-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it is unnecessary, does not improve the code, and could create confusion. The current standard reference design simply states that the service water heating shall be “as proposed.” It is clear that this language requires use of exactly the same water heater both in the standard reference design and proposed design and ensures that there is no trade-off for equipment efficiency. The modification to the language, while more specific, is unnecessary, since “as proposed” would already require the same first hour rating and draw pattern. However, language that limits “as proposed” by these factors could create confusion as to other aspects of the equipment. The simpler approach currently in the code of using “as proposed” is clearer and better. It is also important that any changes to equipment specifications not be viewed as reinstating some form of equipment trade-off. While the proposed change should not be interpreted to reinstate the trade-off, it is better to stick with the status quo and avoid any confusion or question on this matter.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1493

RE171-19

IECC: TABLE R405.5.2(1) [IRC N1105.5.2(1)]

Proposed Change as Submitted

Proponents: Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

2018 International Energy Conservation Code

Revise as follows:

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

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	Duct insulation: in accordance with Section R403.3.1. A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies. ~~for all systems other than tested duct systems.~~ ~~Exception: For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency~~. ~~(DSE) shall be 1.~~ ~~For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area at a pressure of differential of 0.1 inch w.g. (25 Pa).~~	Duct insulation: as proposed. As tested or, where not tested, as specified in Table R405.5.2(2)

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

Reason: With the current language in the Standard Reference Design for Thermal Distribution Systems, there is an inconsistent baseline. Depending on the configuration of the mechanical systems and testing, there could be at least 5 different Standard Reference Designs for a single house:

· Ducts completely inside conditioned space and tested

· Ducts completely inside conditioned space and not tested

· Ducts outside conditioned space

· Hydronic systems

· Ductless systems

This becomes really problematic when looking at a home with ducts in the attic (which hypothetically barely passes code in the performance path) and comparing it to the same home with ducts moved into conditioned space- which will typically not pass; this sends the wrong message. There is also no code related benefit for a hydronic system which has a higher distribution efficiency than a ducted system.

The proposed solution moves back to the format that RESNET uses and is nearly identical to the language in the 2006 IECC, but with a higher DSE (0.88 vs. 0.80). The modification results in a single Standard Reference Design.

A consistent baseline is essential to provide the proper credit and send the right message when designing thermal distribution systems. Systems inside conditioned space (0.88) should be encouraged over ducts in attics (0.80), credit should be given for a hydronic system (1.0) over a ducted system (0.88). None of this is true with the current language.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This will not effect the cost of construction.

RE171-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Although the committee applauds the intent to establish a baseline, there is disagreement on necessary the modification, and encourage a public comment (Vote: 6-5).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R405.5.2(1) [IRC N1105.5.2(1)]

Proponents:
Craig Drumheller, representing National Association of Home Builders (cdrumheller@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	Duct insulation: in accordance with Section R403.3.1. ~~A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies.~~ The leakage rate shall be 4 cfm (113.3 L/min) per ft2 (9.29 m2) of conditioned floor area at a pressure differential of 0.1 inch w.g. (25 Pa). .	Duct insulation: as proposed. As tested or, where not tested, as specified in Table R405.5.2(2)

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

Commenter's Reason: This modification is responding to the committee request.
The baseline is being modified to create a consistent Thermal Distribution System Standard Reference Design. The baseline assumption is that the duct system leaks at the rate of 4 CFM/100ft^2. This is consistent with only one of the current potential baselines. This change will properly incentivize good thermal distribution system design- so the more energy saved by the distribution system, the more credit is give toward code compliance.

Currently the lack of a consistent baseline is problematic when looking at a home with ducts in the attic (which hypothetically barely passes code in the performance path) and comparing it to the same home with ducts moved into conditioned space- which will typically not pass; this sends the wrong message. There is also no code related benefit for a hydronic system which has a higher distribution efficiency than a ducted system.

A consistent baseline is essential to provide the proper credit and send the right message when designing thermal distribution systems.

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This Public Comment provides builders and designers the opportunity to cost-effectively design thermal distribution systems and provide proper credit toward code compliance.

Public Comment# 2019

RE176-19

IECC: TABLE R405.5.2(1) [IRC N1105.5.2(1)], DOE Chapter 6

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com)

2018 International Energy Conservation Code

Revise as follows:

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

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems[d, e]	~~For other than electric heating without a heat pump: as proposed.~~ ~~Where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the IECC—Commercial Provisions.~~ ~~Capacity: sized in accordance with Section R403.7.~~ Fuel Type/ Capacity: Same as proposed design Product class: As proposed Efficiencies: Heat pump: Complying with Subpart C of 10 CFR 430.32 (2021) Furnaces: Complying with Subpart C of 10 CFR 430.32 (2021) Boilers: Complying with Subpart C of 10 CFR 430.32 (2021)	~~As proposed~~ As Proposed As Proposed As Proposed As Proposed As Proposed
Cooling systems[d, f]	~~As proposed. Capacity: sized in accordance with Section R403.7.~~ Fuel Type/ Capacity: Same as proposed design Efficiencies: Complying with Subpart C of 10 CFR 430.32 (2021)	~~As proposed~~ As Proposed As Proposed
Service water heating[d, ~~e, f~~, g]	~~As proposed. Use: same as proposed design.~~ Fuel Type: Same as proposed design Subpart C of 10 CFR 430.32 (2021) Efficiencies: Uniform Energy Factor Use: gal/day = 30 + 10 x Nbr Tank temperature: 120 °F	~~As proposed~~ ~~Use, in units of gal/day = 30 + (10 × N_{br})~~ ~~where:~~ ~~N_{br} = number of bedrooms.~~ As Proposed As Proposed Same as standard reference Same of standard reference

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.

f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

g.~~For a proposed design with a nonstorage-type water heater,~~A 40-gallon storage-type water heater ~~having the prevailing federal minimum energy factor for the~~ with the same fuel as the predominant heating fuel type shall be ~~assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.~~ assumed for the standard reference design. The minimum uniform energy factor shall be selected based on the Medium draw pattern found in Subpart C of 10 CFR 430.32 (2021). This water heater shall be used for the proposed water heater in the case of a proposed design without a proposed water heater.

Add new standard(s) as follows:

DOE U.S. Department of Energy 10 CFR, Part 430: Energy Conservation Program for Consumer Products: Test Procedures and Certification and Enforcement Requirement for Plumbing Products; and Certification and Enforcement Requirements for Residential Appliances.

10 CFR, Part 431: Energy Efficiency Program for Certain Commercial and Industrial Equipment: Test Procedures andEfficiency Standards; Final Rules

Reason: Equipment efficiency is a key part of home energy efficiency. This proposal restores equipment efficiency to the performance calculation. This proposal also corrects a long-standing error in the code, that of citing “prevailing federal minimum efficiency”.

The code’s use of "prevailing federal minimum efficiency"' is inappropriate and may hamper adoption. Yes, this language has been used for some time and is currently in three existing table footnotes, footnotes “e”, “f” and “g”. However, “prevailing” creates a problem. When states, counties and cities adopt laws, they are obligated to make the exact content of the law available to the public. When the ‘prevailing’ federal minimum efficiency changes; the jurisdiction’s code also changes automatically. Changing the “prevailing” standard without any jurisdictional process means another body, which is not the legislative body of the jurisdiction, changes the laws within the jurisdiction without any public hearing or vote by the local legislative body. This is called an illegal delegation of legislative authority. This is why I-code referenced standards always come with a date/edition (see the referenced standard chapter). The I-codes don’t reference any old edition of a standard, they reference a specific edition of that standard.

The other problem with simply saying ‘prevailing federal minimum efficiency’ is that it doesn’t tell the designer or the code official where to find those values. The solution is to cite the specific Federal law and date, just as is done with any standard referenced in the I-codes. Yes – this does lock in the efficiency standard used for 3 years. But that is what we do for every other standard.

Equipment efficiency is a key part of home energy efficiency. More efficient equipment saves more energy. Significant energy savings is available for every type of equipment efficiency. A high-efficiency 95 AFUE furnace saves energy. A high-efficiency 19 SEER air conditioner saves energy. Ground source heat pumps save considerable energy. Solar water heating saves energy. Homes that use more efficient equipment should get credit for choosing more efficient equipment. Equipment efficiency was a part of the residential IECC performance calculation in 2006 and prior. Equipment efficiency is part of the commercial IECC performance calculation, ASHRAE 90.1 and 90.2, to name a few.

Some argue that longer-life measures should not be traded for shorter-life measures. For example, don’t trade lower wall insulation for higher equipment efficiency. However the ERI allows one to trade higher-efficiency refrigerators, higher-efficiency clothes washers and higher-efficiency dishwashers for lower wall insulation. Clothes washers in particular are often moved with the owner when a house is sold. The lifetime of windows is less than insulation, should we allow better windows to be traded for lower wall insulation? I’d argue to keep all tradeoffs. However, if one argues to keep equipment efficiency tradeoffs out of Section R405 performance trades, then to be consistent one should also argue to keep equipment efficiency, refrigerators, clothes washers and dishwashers out of the tradeoffs for insulation in the ERI.

Why was equipment efficiency taken out of after the 2006 residential IECC? In the proponent’s opinion one reason was to protect the market for some types of products that thought equipment efficiency might compete and reduce their market share. For instance, some might use high efficiency equipment instead of higher levels of insulation. The goal of the code should be to deliver energy efficiency, not to protect products.

Moving to even higher levels of energy efficiency in the code will require restoring flexibility, part of which is equipment efficiency. If builders get credit for what they do, be it equipment efficiency, solar, or whatever, then this proponent is comfortable asking them to achieve higher levels of efficiency, even increasing requirements through code. However, without flexibility, then builders need more exceptions and lesser requirements to make up for the flexibility they are denied by code. Without restoring flexibility, additional energy efficiency in code is much more difficult to achieve.

Cost Impact: The code change proposal will decrease the cost of construction
Allowing credit for high efficiency equipment will encourage energy efficiency and promote lower cost ways to get to energy efficient homes.

Staff Analysis: A review of the standard proposed for inclusion in the code, 10 CFR 430.32 (2021), with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RE176-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The addition of tradeoffs in this compliance path would result in decreased envelopes and increased energy use. Tradeoffs are better handled in the ERI approach (Vote: 6-5).

Assembly Action: **None**

RE176-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Craig Conner, representing self (craig.conner@mac.com)

requests As Submitted

Commenter's Reason: High efficiency equipment is an important part of high efficiency residences. Acting as if equipment efficiency has no impact is silly. As we go towards lower energy use, perhaps even "zero", equipment efficiency will be a big part of very high efficiency.
The ERI path commonly includes and credits high efficiency equipment. Why should high efficiency equipment be in one path and not another?

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
High efficiency equipment is usually part of the least cost way to get to high efficiency.

Public Comment# 1940

Public Comment 2:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: RE176 would be a huge efficiency rollback and should be disapproved as recommended by the Committee. RE176 is one of several proposals to add new trade-offs in the simulated performance compliance path for various measures such as appliances, renewables, lighting, heating/cooling equipment, and hot water equipment (see also RE152, RE156, RE175, RE179 and RE208). These proposals are collectively some of the biggest threats to energy efficiency proposed in this code cycle. These trade-offs do not even purport to increase efficiency, but instead would all result in less efficient buildings over the long-term that cost consumers more, use more energy and provide less comfort and sustainability. They would promote replacing long-lasting building efficiency measures, such as adequate insulation, efficient fenestration and reduced air and duct leakage, with measures that have much shorter useful lives, carry substantial free ridership and lack permanence. We fundamentally oppose simply creating more trade-offs that not only do not advance energy efficiency, but actually take a major step backward. We strongly support the IECC-Residential Committee's consistent recommendations to disapprove all of these proposals. It is important to note that similar proposals have been consistently disapproved by ICC Governmental Voting Member Representatives in the past three code cycles.

Turning to the specifics of RE176, the primary purpose of this proposal is to reinstitute heating, cooling and hot water equipment trade-offs in the simulated performance path. These trade-offs were correctly eliminated in the 2009 version of the code and have been consistently rejected in every code cycle since then. Some of the specific issues and problems with equipment trade-offs are outlined below:

- **Equipment trade-offs drastically reduce energy efficiency.** ICF International, a nationally recognized energy consulting firm, conducted a detailed analysis of the negative impacts of a similar proposal to reinstate equipment tradeoffs during the 2015 code cycle (September 2013). Specifically, the study found that introducing equipment trade-offs into the performance path would have a huge negative impact on energy efficiency – a combined national average estimated impact of between 11% and 22% reduction in efficiency depending on the climate zones and trade-offs employed. For example, installing a 90 AFUE gas furnace would reduce energy efficiency under the code by 6% to 9% depending on the climate zone(note that furnaces considerably more efficient than this are commonly installed, which would create larger trade-off credit). Similarly, installing an instantaneous (tankless) water heater alone would yield 9% trade-off "credit," which means the rest of the home could be built 9% less efficient, on average, just for installing a better water heater. Massive trade-offs (efficiency reductions) of other important energy efficiency measures (insulation, windows, air and duct leakage) would be permitted if this approach were reinstated. This study can be found at: http://energyefficientcodes.com/wpcontent/uploads/2013/08/2013-9-23-FIN-Review-Analysis-of-Equipment-Trade-offs-in-Residential-IECC.FIN_.pdf

- **Equipment trade-offs are not "energy neutral" as claimed by proponents.** In fact, as noted in the ICF study, equipment trade-offs result in huge losses in energy efficiency – up to a reduction of 20% or more – essentially wiping out much of the progress made in advancing energy efficiency in the IECC over the last couple of decades. In addition to the discussion above, there are several reasons why trade-offs for heating, cooling, and water heating efficiency are not "neutral" and are in fact net reductions in energy efficiency – and thus would significantly weaken those homes that comply under the performance path:
    - **Federal preemption** – Equipment trade-offs are fundamentally a problem because unlike other parts of a building (such as building envelope components) that can be directly regulated by state and local governments (and the IECC), federal law prohibits states and cities from setting reasonable energy efficiency requirements for this equipment. Only the federal government has authority to set the minimum efficiency requirements for heating, cooling, and water heating equipment, and these federal standards are often outdated and lag far behind the efficiency of commonly-installed equipment.
    - **Free ridership** – Because federal minimum efficiency requirements are so far behind commonly-installed equipment, using these values as a trade-off comparative baseline as proposed in RE176 would create an artificial trade-off "gap," permitting builders to trade away the efficiency of the building thermal envelope for more efficient equipment that they would have installed anyway. This is a "free ridership" cost reduction for the builder, but it results in much higher energy costs being imposed on the homeowner.

      State-level field studies have consistently shown that equipment installed in new homes is typically far more efficient than the federal minimum efficiencies (without any trade-off credit). For example:
        - New York recently completed a residential baseline study that indicated 94% of new homes included a furnace with an AFUE of 90 or greater (despite a federal minimum of 80 AFUE, roughly 10% less efficient) and 71% of new homes with an AFUE of 94 or better. *See* https://www.nyserda.ny.gov/-/media/Files/Publications/building-stock-potential-studies/residential-baseline-study/Vol-3-HVACRes-Baseline.pdf
        - Likewise, in Pennsylvania, over 98% of homes studied had condensing furnaces with an AFUE above 90 and over 96% above 92 AFUE. *See* https://www.energycodes.gov/compliance/energy-code-field-studies
    -

      Allowing trade-off credit for above-minimum efficiency equipment in these situations would simply be a give-away to builders and a major blow to homeowners, as well as to sustainability and the environment.

- **Equipment trade-offs trade-away long-term energy efficiency for short-term builder cost reduction.** Aside from free ridership issues, another problem with equipment trade-offs is the likelihood that builders will trade away the long-term benefits (to homeowners) of features such as an efficient thermal envelope, in favor of short-term cost cutting in the form of more efficient equipment, which will be replaced several times over the lifetime of the home. For example, if a trade-off is permitted for water heater efficiency, an instantaneous natural gas water heater would allow the builder to reduce the efficiency of the rest of the home by an average of 9%. The remaining home will be 9% less efficient for its entire useful lifetime. As the water heater is replaced every 10-15 years, the envelope of that home will continue to underperform by 9%. By contrast, under the current code, no trade-off credit is awarded for the instantaneous water heater, which means the rest of the home will be built to meet the code. As the water heater is swapped out in future years, the current code home will outperform the trade-off home by 9%.

- **It is unnecessary to address efficient equipment in the performance path; the issues are already much better addressed in the ERI compliance path.** As the Committee pointed out in its reasons supporting its recommendation to disapprove RE176, the 2018 IECC does address equipment efficiency, but only within the Energy Rating Index. This is because the ERI Index target is set at a level low enough to recapture most of the free-ridership losses. The simulated performance path does not have the built-in protections of the ERI path.

- **Equipment trade-offs have been eliminated in the vast majority of states consistent with state and federal law and policy**. Most states have adopted the IECC and completely eliminated equipment trade-offs, turning the page on this efficiency loophole with no negative impact. Federal law has endorsed adoption of the 2009 IECC, which eliminated equipment trade-offs, as part of ARRA. Similarly, the U.S. Department of Housing and Urban Development and the U.S. Department of Agriculture have adopted energy conservation standards that apply to federally-insured mortgages. In order to qualify for one of these federally-insured loans (such as FHA), new homes must meet or exceed the requirements of the 2009 IECC.

Most states have been enforcing building energy codes with no equipment trade-offs for a number of years now, and with great success. There is no evidence that eliminating trade-offs has affected installation of high-efficiency furnaces, air conditioners, or water heaters. In fact, the market penetration of efficient equipment continues to grow. Reinstating these trade-offs, *after more than a decade without them,* would move energy efficiency for the rest of the home sharply backward for no good reason, and would create a host of new problems.

Bibliography: http://energyefficientcodes.com/wpcontent/uploads/2013/08/2013-9-23-FIN-Review-Analysis-of-Equipment-Trade-offs-in-Residential-IECC.FIN_.pdf.
https://www.nyserda.ny.gov/-/media/Files/Publications/building-stock-potential-studies/residential-baseline-study/Vol-3-HVACRes-Baseline.pdf

https://www.energycodes.gov/compliance/energy-code-field-studies

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1508

RE178-19

IECC: TABLE R405.5.2(1) [IRC N1105.5.2(1)], TABLE R403.6.1 (IRC N1103.6.1)

Proposed Change as Submitted

Proponents: Mike Moore, Newport Ventures, representing Broan-NuTone (mmoore@newportventures.net)

2018 International Energy Conservation Code

Revise as follows:

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

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air exchange rate	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 1 and 2: 5 air changes per hour. Climate Zones 3 through 8: 3 air changes per hour. The mechanical ventilation rate shall be in addition to the air leakagerate and shall be the same as in the proposed design, but not greater than0.01 × CFA + 7.5 × (N_{br} + 1) where: CFA = conditioned floor area, ft^2. N_{br} = number of bedrooms. The mechanical ventilation system type shall be the same as in the proposed design. Energy recovery shall not be assumed for mechanical ventilation.	The measured air exchange rate.[a] The mechanical ventilation rate[b] shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: NoneWhere mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal: $(1/e_f) \times [0.0876 \times CFA + 65.7 \times (N_{br} + 1)]$ where: e_f = the minimum ~~exhaust~~ fan efficacy, as specified in Table R403.6.1, corresponding to the system type at a flow rate of 0.01 × CFA + 7.5 × (N_{br}+1) CFA = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

a. Where required by the *code official,* testing shall be conducted by an *approved* party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals,* or the equivalent, shall be used to determine the energy loads resulting from infiltration.
b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals,* page 26.24 and the “Whole-house Ventilation” provisions of 2001 ASHRAE *Handbook of Fundamentals,* page 26.19 for intermittent mechanical ventilation.
c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.
d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.
f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.
h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing area:

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

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

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

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

and where:

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

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

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

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

L and *CFA* are in the same units.

TABLE R403.6.1 (IRC N1103.6.1)
WHOLE-HOUSE MECHANICAL VENTILATION SYSTEM FAN EFFICACY[a]

~~FAN LOCATION~~ SYSTEM TYPE	AIR FLOW RATE ~~MINIMUM~~(CFM)	MINIMUM EFFICACY(CFM/WATT)	~~AIR FLOW RATE MAXIMUM(CFM)~~
HRV, ~~or~~ ERV , or balanced	Any	1.2 cfm/watt	~~Any~~
Range hoods	Any	2.8 cfm/watt	~~Any~~
In-line supply or exhaust fan	Any	2.8 cfm/watt	~~Any~~
Other exhaust fan ~~Bathroom, utility room~~	~~10~~ < 90	1.4 cfm/watt	~~< 90~~
~~Bathroom, utility room~~	>= 90	2.8 cfm/watt	~~Any~~

For SI: 1 cfm = 28.3 L/min.

a. When tested in accordance with HVI Standard 916.

Reason: Changes to Table R405.5.2(1):
Ventilation system type is often selected as a function of climate, with supply systems seeing greater specification in the warm climates and exhaust systems seeing greater specification in cold climates. In keeping with ANSI/RESNET 301, this proposed change would compare the performance of the proposed design's ventilation system type with a comparable code-minimum ventilation system type for the reference home. The advantage of this change is that it permits builders and designers to select climate appropriate ventilation systems without receiving an automatic energy penalty that could be associated with the system type. As currently written, a builder selecting a heating or energy recovery ventilator (H/ERV) that meets the code minimum fan efficacy of 1.2 cfm/W would be penalized for not meeting the code minimum exhaust fan efficacy of 2.8-3.5 cfm/W, as determined by Table R403.6.1.

If approved, following are examples of how the reference home would be modeled based on the selection of the proposed design:

1. If the proposed design specifies an H/ERV, the reference home would be modeled with a balanced system without heat or energy recovery and having a fan efficacy of 1.2 cfm/W.

2. If the proposed design specifies a central fan integrated (CFI) system, the reference home would be modeled with an in-line supply fan with an efficacy of 3.8 cfm/W.

3. If the proposed design specifies a bathroom exhaust fan with a flow rate >= 90 cfm, the reference home would be modeled with an exhaust fan with an efficacy of 2.8 cfm/W.

Changes to Table R403.6.1:

Changes proposed to this table are for clarification and simplification. First, the table should not be based on the location of the fan but on the type of fan being installed. For example, an HRV or ERV is not a location, but a system type. Balanced fans without heat recovery are currently omitted from the table, and should be listed along side HRVs and ERVs, which are also balanced systems. Because balanced fans are grouped with HRVs and ERVs, the use of the term "in-line fan" should be clarified to include supply and exhaust in-line systems (also not a location, but a system type). Finally, if a "bathroom" fan is installed in a hallway to provide ventilation (a typical installation location for whole-house mechanical ventilation systems), the current table is silent on the minimum efficacy required, because it does not address "hallway" fans. So, this proposal combines typical bathroom, utility room, and hallway exhaust fans into the category of "other exhaust fans"; no changes are made to the fan efficacies for these products. The last column can be deleted by changing the "Air Flow Rate Minimum" column heading to "Air Flow Rate".

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Ultimately, ventilation system selection is up to the builder, so there is no increase or decrease in the cost of construction associated with this code change proposal.

RE178-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Concerns for reduction in energy efficiency based on the way mechanical ventilation is calculated in the performance path

(Vote: 9-1).

Assembly Action: **None**

RE178-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
Mike Moore, representing Broan-NuTone (mmoore@newportventures.net)

requests As Submitted

Commenter's Reason: There was some confusion at the Committee Action Hearings as to the intent and effect of this proposal. The committee approved RE178's changes to Table R403.6.1 with their action on RE137 as submitted, establishing fan efficacy requirements according to ventilation system type. That action reduces the net change proposed by RE178 to Table R405.5.2(1) as follows:
1. Set the reference design's mechanical ventilation system type to the same type as the proposed design, and

2. Set the efficacy of the reference design's mechanical ventilation system type to the minimum efficacy of the corresponding system type in Table R403.6.1.

These two changes ensure that when selecting a ventilation system type, there is an apples-to-apples comparison between the reference and the proposed design. This ensures that the ventilation system that is selected for the proposed design is compared to a comparable high-efficacy model within the same system type, and is not unduly penalized or rewarded for its performance based on system type alone. For example, without this PC, if a builder using the 2021 IECC specifies a supply ventilation system with an efficacy of 3.5 cfm/W for the proposed design (the minimum efficacy required in Table R403.6.1, based on the IECC-R Committee Action Hearing's as-submitted ruling on RE133), the performance path would credit the proposed design's supply fan for energy savings versus the reference home's exhaust fan with a minimum efficacy of 2.8 cfm/W. Conversely, if a builder specified an HRV with an efficacy of 1.2 cfm/W (the minimum efficacy required for HRVs in Table R403.6.1), then he would be penalized for not meeting the minimum exhaust fan efficacy of 2.8 cfm/W. By requiring the comparison between the proposed and reference designs to be within system type, RE178's changes to Table R405.5.2(1) would incentivize builders for selecting best-in-class products and would avoid steering them toward selecting a certain system type that may not be appropriate for their climate.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposed change improves accounting for energy savings of ventilation systems by comparing them with systems of similar type. It does not consistently increase or decrease construction costs.

Public Comment# 1899

RE182-19

IECC: R406.2 (IRC N1106.2) , TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R406.2 (IRC N1106.2) Mandatory requirements. Compliance with this section requires that the provisions identified in Sections R401 through R404 indicated as "Mandatory" and Section R403.5.3 be met. The *building thermal envelope* shall be greater than or equal to levels of efficiency and *Solar Heat Gain Coefficients* in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2018 *International Energy Conservation Code*.

Exception: Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*-value of not less than R-6.

TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX ~~a~~
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

~~a.Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.~~

Reason: The purpose of this code change proposal is to make two important updates to the Energy Rating Index.
First, this proposal makes an editorial improvement by moving footnote “a” of Table R406.4 into Section R406.2, which contains the other mandatory requirements for the ERI. Given that two different thermal envelope backstops apply to the ERI depending on whether on-site renewable energy is included in the calculation, it makes sense to put these two backstops side-by-side in the same section of the code to reduce or eliminate any confusion.

Second, this proposal will update the enhanced thermal envelope backstop for homes with on-site renewable energy from the 2015 to the 2018 IECC, maintaining the same approach as set in the 2018 IECC – specifically, using the prescriptive path from the previous code as a backstop in this situation. This backstop is crucial to use of the ERI with on-site renewable energy. We continue to be concerned about the potential magnitude of trade-off credit that may apply if on-site generation is included in the ERI calculation. Analyses have shown that homes can achieve a 20-40 HERS points reduction with average-sized solar PV systems, which would allow enormous trade-offs of the home’s permanent envelope efficiency. *See, e.g.,* RESNET, *The Impact of Photovoltaic Arrays on the HERS Index* (2015); and https://www.energycodes.gov/sites/default/files/documents/ECodes2016_06_Haack.pdf. Without reasonable limits on these solar trade-offs, homes with on-site generation could be built with far less efficiency, including substandard thermal envelopes, creating long-term problems for homeowners and reversing many of the benefits created by the IECC over the past 10 years.

Bibliography: RESNET, *The Impact of Photovoltaic Arrays on the HERS Index* (2015); and https://www.energycodes.gov/sites/default/files/documents/ECodes2016_06_Haack.pdf.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
The editorial change to move the footnote into Section R406.2 will have no cost impact, and because the 2018 IECC incorporated only very moderate increases in efficiency over the 2015 IECC (primarily window improvements with no real upgrade cost), we expect no real cost impact. Moreover, this enhanced backstop only applies to homes built to the ERI that incorporate on-site power production into the ERI calculation, which is currently a very small percentage of all code-compliant homes. Code users can also avoid any cost increase by using other compliance alternatives.

RE182-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There is no cost information, and proponent testimony and reason statement differed on whether the change to the 2018 IECC as a baseline was intended (Vote 9-2).

Assembly Action: **None**

RE182-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R406.2 (IRC N1106.2)

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R406.2 (IRC N1106.2) Mandatory requirements. Compliance with this section requires that the provisions identified in Sections R401 through R404 indicated as “Mandatory” and Section R403.5.3 be met. In addition, the following requirements shall be met: ~~The *building thermal envelope* shall be greater than or equal to levels of efficiency and *Solar Heat Gain Coefficients* in Table 402.1.1 or 402.1.3 of the 2009 International Energy Conservation Code. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2018 *International Energy Conservation Code.*~~

1. Where on-site renewable energy is not included for compliance using the ERI analysis of Section R406.4, the proposed total building thermal envelope UA, which is sum of U-factor times assembly area, shall be less than or equal to the building thermal envelope UA calculated using the prescriptive U-factors from Table R402.1.4 multiplied by 1.15 in accordance with Equation 4-1. The area-weighted maximum glazed fenestration SHGC permitted in Climate Zones 1 through 3 shall be 0.30.

   $UA_{\text{Proposed design}} \leq 1.15 \times UA_{\text{Prescriptive reference design}}$ Equation 4-1

2. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the proposed total building thermal envelope UA, which is sum of U-factor times assembly area, shall be less than or equal to the building thermal envelope UA calculated using the prescriptive U-factors from Table R402.1.4 in accordance with Equation 4-2. The area-weighted maximum glazed fenestration SHGC permitted shall be the SHGC values set forth in Table R402.1.2.

   $UA_{\text{Proposed design}} \leq UA_{\text{Prescriptive reference design}}$ Equation 4-2

Exception: Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*-value of not less than R-6.

Commenter's Reason: This proposal should be approved as modified or as submitted because it will update and improve the thermal envelope backstops applicable to the ERI compliance path, improving comfort and helping to ensure long-term energy efficiency for each home.
There are two thermal backstops currently applicable to ERI compliance (with and without on-site generation). The current backstop applicable where on-site renewables are not used, applies values from the 2009 IECC. The current backstop applicable where on-site renewables are used applies more stringent 2015 IECC values. In RE150, the Committee recommended a revised backstop format for the situation where on-site renewables are not used that includes a total UA approach and a multiplier to replace a reference to an earlier version of the IECC.

The proposed modification will make the two backstops consistent with the new approach endorsed by the Committee and many of the participants by applying the revised backstop format approved by the Committee under RE150 to both backstops. It should be noted that this proposal, like RE150, includes a 1.15 multiplier for the non-on-site renewable backstop since that backstop is based on 2009 IECC requirements (this multiplier has the effect of diluting the efficiency of current IECC prescriptive requirements to make them more comparable to the 2009 values). By contrast, there is no multiplier included in our proposal for the on-site renewable backstop since it currently references the 2015 IECC requirements, which are much more efficient and very close to current envelope requirements.

These modifications would provide additional flexibility for builders to achieve a reasonably efficient thermal envelope under the ERI. These backstops would replace references to old versions of the IECC with internal references to the current code. With this change, the new Total UA-based equation (for homes with and without on-site renewables) will update automatically with each new edition of the code, eliminating the need to constantly review and update these important provisions.

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

As stated in the original proposal, the editorial change to move the footnote into Section R406.2 will have no cost impact, and because the 2018 IECC incorporated only very moderate increases in efficiency over the 2015 IECC (primarily window improvements with no real upgrade cost), we expect no real cost impact. Moreover, this enhanced backstop only applies to homes built to the ERI that incorporate on-site power production into the ERI calculation, which is currently a very small percentage of all code-compliant homes. Code users can also avoid any cost increase by using other compliance alternatives.

Public Comment# 1494

RE184-19

IECC: R406.3 (IRC N1106.3)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R406.3 (IRC N1106.3) Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with RESNET/ICC 301 except for buildings covered by the International Residential Code , the ERI Reference Design Ventilation rate shall be in accordance with Equation ~~4-1.~~ 4-1.

Ventilation rate, CFM = (0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)]

(Equation 4-1)

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

For compliance purposes, any reduction in energy use of the rated design associated with on-site renewable energy shall not exceed 5 percent of the total energy use.

Reason: The purpose of this code change proposal is to help ensure that homes are built to an appropriate level of efficiency, irrespective of the amount of on-site generation that may be installed. The proposal adopts a 5 percent cap on the trade-off credit allowed for on-site power in the Energy Rating Index, similar to the 5 percent cap that applies in the simulated performance analysis of the 2018 IECC commercial chapter, Section C407.3, and ASHRAE Standard 90.1-2016 Energy Cost Budget Method.

- **2018 IECC C407.3**: "…The reduction in energy cost of the proposed design associated with on-site renewable energy shall be not more than 5 percent of the total energy cost."
- **ASHRAE Standard 90.1-2016, Section 11.4.3.1**: "…The reduction in *design energy cost* associated with *on-site renewable energy* shall be no more than 5% of the calculated *energy cost budget*."

It is important to note that this proposal does not limit the amount of on-site power production that can be installed on the home, nor does it apply any sort of "penalty" to homes with on-site power. The proposal simply recognizes that a reduction in energy use is not the same thing as on-site energy production, for purposes of code compliance. This proposal also supports the long-term goal of achieving net zero energy use by helping avoid steps backward in efficiency as on-site generation increases. If unlimited efficiency trade-off credit is allowed for increases in on-site generation, progress toward net-zero energy will stall. We do not see any good reason to allow steps backward in efficiency when it can be improved simultaneously with increases in on-site power production.

Cost Impact: The code change proposal will increase the cost of construction
The code change proposal will increase the cost of construction only if user selects the ERI compliance path and the cost of increased on-site power production is less than a commensurate amount of energy efficiency. However, given the long expected useful life of a home's permanent features (such as thermal envelope efficiency), we believe homeowners will experience lower costs and reduced risk over the long-term if trade-off credit for on-site power production is reasonably limited.

RE184-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Based on the proponents request for disapproval (Vote 11-0).

Assembly Action: **None**

RE184-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted as a reasonable limit on the use of renewable energy for compliance purposes in the ERI in order to ensure that every new home is also reasonably efficient overall.

An unlimited use of renewable energy for compliance could result in an inefficient home with a lot of on-site generation. We believe that this approach is backwards and that a home should first be designed to optimize energy efficiency and then on-site renewables should be added to make the home even more sustainable. This same approach has been recognized in the commercial energy code, which also applies a 5% limit on compliance credit from on-site renewables. It is important to recognize that these limits do not prevent adding more on-site generation; they simply limit the amount of code compliance credit from such generation that can be used to offset/replace required energy efficiency.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

As stated in the original proposal, this will increase the cost of construction only if the user selects the ERI compliance path and the cost of increased on-site power production is less than a commensurate amount of energy efficiency. However, given the long expected useful life of a home’s permanent features (such as thermal envelope efficiency), we believe homeowners will experience lower costs and reduced risk over the long-term if trade-off credit for on-site power production is reasonably limited.

Public Comment# 1495

RE186-19

IECC: R406.3 (IRC N1106.3)

Proposed Change as Submitted

Proponents: Craig Conner, representing self (craig.conner@mac.com); Joseph Lstiburek, representing self (joe@buildingscience.com)

2018 International Energy Conservation Code

Revise as follows:

R406.3 (IRC N1106.3) Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with RESNET/ICC 301 ~~except for buildings covered by the International Residential Code, the ERI Reference Design Ventilation rate shall be in accordance with Equation 4-1.~~

~~Ventilation rate, CFM = (0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)]~~

~~(Equation 4-1)~~

Exceptions:

1.For Table 4.2.2(1) of RESNET/ICC 301, the Reference Home and Rated Home air exchange rates shall be as specified for the air exchange rates in Table R405.5.2(1) of this code.
2.For Table 4.3.1(1) of RESNET/ICC 301, the air exchange rate shall be as specified for the air exchange rate for the standard reference design in Table R405.5.2(1) of this code.
3.The proposed ventilation rate shall comply with the mechanical ventilation requirements of Section M1505 of the International Residential Code or Section 403.3.3.2.1 of the International Mechanical Code.

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

Reason: RESNET/ICC 301 uses the ASHRAE 62.2 ventilation rate not the IRC and IMC ventilation rate. Following the ASHRAE 62.2 ventilation rate results in over ventilation in hot humid climates and cold climates and excessive energy use in all climates. In hot humid climates the resulting part load humidity problems result in mold. In cold climates the high ventilation rates result in excessive dryness.
Beyond the problems created by over ventilation, this is also a policy issue. Ventilation rates are set in the I-code development process, not by RESNET. The ERI is being used to show compliance with the I-codes. The IRC and the IMC set building code ventilation rates not RESNET. The ERI should be determined using building code ventilation rates specified by the IRC and the IMC not by RESNET.

RESNET/ICC 301 by following ASHRAE 62.2 also modifies the mechanical ventilation rate required based on infiltration measurements and this results in discouraging better building practices. Tighter houses are penalized compared to leakier houses which makes no sense. If a builder constructs a leakier house then the mechanical ventilation rate is reduced according to RESNET/ICC 301 and ASHRAE 62.2. Infiltration should not be relied on to provide ventilation in new code compliant house construction where enclosures are constructed to 3 ach@50 Pa and 5 ach@50 Pa. Finally, ventilating at a higher, and unnecessary, ventilation rate wastes energy.

If RESNET has an issue with the IRC and the IMC ventilation rates then RESNET should change the ventilation rates using the ICC code change process and not force the use of the ASHRAE 62.2 ventilation rates to judge I-code compliance.

The existing wording has proved confusing. The proposed wording is much clearer. This code change requires that the IRC and IMC ventilation rates be used to determine the ERI.

Cost Impact: The code change proposal will decrease the cost of construction
For those who believe they have to use ASHRAE 62.2 ventilation rates this reduce costs. Even if done "right" over ventilation increases costs due to the costs of dealing with excessive moisture, overly dry air, or mositure damage in some climates.

RE186-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: **As Submitted**

Committee Reason: The agreement among the parties fixes the ventilation the issue (Vote: 8-3).

Assembly Action: **None**

RE186-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R406.3 (IRC N1106.3)

Proponents:
Cy Kilbourn, Ekotrope, representing Ekotrope

requests As Modified by Public Comment

Further modify as follows:

2018 International Energy Conservation Code

R406.3 (IRC N1106.3) Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with RESNET/ICC 301.

Exceptions:

1. In Table 4.2.2(1) of RESNET/ICC 301, the Reference Home air exchange rate shall be modified to match the Reference Design air exchange rate in Table R405.5.2(1) of this code, except that the air leakage rate (not including ventilation) shall be a Specific Leakage Area (SLA) of 0.00036.
2. In Table 4.2.2(1) of RESNET/ICC 301, the Rated Home air exchange rate shall be modified to match the Proposed Design air exchange rate in Table R405.5.2(1) of this code.
3. The ventilation rate shall comply with the mechanical ventilation requirements of Section M1505 of the International Residential Code or Section 403.3.2.1 of the International Mechanical Code. <u>Any adjustments required or allowed by RESNET/ICC 301 that change the code-required ventilation rates shall be prohibited.</u>

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

Commenter's Reason: This amendment is intended to prevent the probably unintended consequence of RE186-19, which is that R406 ERI scores would be significantly shifted upward from RESNET/ICC 301 ERI scores because of the reduction in Reference Home infiltration rate. Such a shift would make compliance with path R406 much more difficult to achieve, since the target ERI scores were developed based on RESNET/ICC 301 ERI scores. This amendment prevents that significant upward ERI shift.

This amendment also maintains the intent of the original RE186-19 in that it achieves the following:

- ASHRAE 62.2 ventilation rates are completely eliminated from the Proposed and Reference designs. IRC ventilation rates are used instead. Thus, infiltration is not recognized as a means of providing indoor air quality.

- The home will receive a lower ERI score if it ventilates down to IRC levels rather than ASHRAE 62.2 levels.

- Clarification is made that ASHRAE 62.2 rates are **not** mandatory - IRC rates are.

The difference is that it keeps the ERI scores from increasing significantly by keeping the base *infiltration* rate the same while still modifying the ventilation rates. Summary below:

	Infiltration	+	Ventilation
Unabridged RESNET/ICC 301 Reference Home:	0.00036 SLA	+	ASHRAE 62.2-2013 ventilation
Original RE186-19 Reference Home:	3 or 5 ACH50	+	IRC ventilation
Proposed amended RE186-19 Reference Home:	0.00036 SLA	+	IRC ventilation

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction
This amendment will significantly decrease cost of construction because it will lower R406 ERI scores back down to the levels intended during the original development of R406 and make compliance with the R406 path more achievable.

Public Comment# 1919

RE190-19

IECC: R406.4 (IRC N1106.4), TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: Joseph H. Cain, Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

2018 International Energy Conservation Code

Revise as follows:

R406.4 (IRC N1106.4) ERI-based compliance. Compliance based on an ERI analysis requires that the *rated design* including renewable energy systems be shown to have an ERI less than or equal to the appropriate value indicated in Table R406.4 when compared to the *ERI reference design*.

TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX~~a~~
1	~~57~~ 52
2	~~57~~ 52
3	~~57~~ 51
4	~~62~~ 54
5	~~61~~ 55
6	~~61~~ 54
7	~~58~~ 53
8	~~58~~ 53

~~a.Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.~~

Reason: The Energy Rating Index is a voluntary path the ensures robust insulation and envelope measures while enabling on-site renewables that enhance the affordability of a home in select climate zones.
In the process of development of the 2018 IECC, in the Public Comment version of RE173-16 the ERI target scores were increased (relaxed) and Footnote a was added to treat projects differently if they do or do not incorporate an on-site renewable energy system. Projects that include a renewable energy system to offset consumption of energy and reduce energy flows at the meter are not rewarded in this revised approach, but are penalized by requiring a higher level of envelope measures. Footnote a requires IECC 2015 envelope backstop for projects with on-site renewable energy systems or 2009 envelope backstop for projects without on-site renewable energy systems. The result is an ERI compliance option that focuses on the building envelope with less-stringent target scores that can be attained without renewable energy systems -- a disincentive for builders to use renewable energy systems in the ERI path.

As presented by the Building Technologies Office of the Department of Energy's 2018 National Energy Codes Conference, according to the U.S. Energy Information Administration's AEO 2018 report, typical Residential End Uses include Space heating at 24% and Space cooling at 11%, for a combined space heating/cooling at 35% of all Residential Energy End Uses. Water heating accounts for 13.5% of Residential Energy End Uses. These figures illustrate that we have done a very good job of reducing regulated loads, such that unregulated loads (such as lighting loads, appliance loads, and plug loads) now represent greater than 50% of all Residential Energy End Uses. Renewable energy systems can offset not only the unregulated loads, but can also offset the reduced regulated loads.

Compliance measures and compliance paths that focus only on building envelope measures and discourage or penalize renewable energy sytems -- or fail to make renewable energy systems attractive to builders as a compliance option -- are focused on solving 35% of the problem.The IECC should encourage the use of energy efficiency plus renewable energy, to solve 100% of the problem. In fact, new homes with PV systems and EV chargers can also power our consumer vehicles with sunlight, solving greater than 100% of the building energy problem.

This proposal restores the lower, more stringent ERI target values of the 2015 IECC and again makes renewable energy systems an attractive option for builders.

Effective integration of energy efficiency measures and renewable energy systems is critical to the future of energy codes and green/stretch/reach codes. At the time of submittal of these code change proposals, there are four states with 100% renewable energy goals: Hawaii, California, New Jersey, and New York. Other communities are committing to renewable energy goals through their own local renewable goals for power supply or for installation of renewable energy systems. Distributed Generation (DG) is an important component of these overall portfolio standards.

Bibliography: U.S. Energy Information Administration Annual Energy Outlook 2018
https://www.eia.gov/outlooks/aeo/index.php

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal encourages the installation of renewable energy systems, which provides more flexibility to the builder and could result in either increased or decreased first cost of construction, depending on builder choices.

RE190-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Based on previous previous code actions on EIR scores (Vote: 11-0).

Assembly Action: **None**

RE190-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R406.4 (IRC N1106.4), TABLE R406.4 (IRC N1106.4)

Proponents:
Joseph H. Cain, P.E., Solar Energy Industries Association (SEIA), representing Solar Energy Industries Association (SEIA) (JoeCainPE@gmail.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R406.4 (IRC N1106.4) ERI-based compliance. Compliance based on an ERI analysis requires that the *rated design* ~~including renewable energy systems~~ be shown to have an ERI less than or equal to the appropriate value indicated in Table R406.4 when compared to the *ERI reference design*.

TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX FOR RATED DESIGNS NOT INCORPORATING RENEWABLE ENERGY	ENERGY RATING INDEX FOR RATED DESIGNS INCORPORATING RENEWABLE ENERGY
1	57	52
2	57	52
3	57	51
4	62	54
5	61	55
6	61	54
7	58	53
8	58	53

Commenter's Reason:
Background:

The IECC-Residential Committee approved RE150-19 by unanimous vote of 11-0.

Committee Reason: The proposal [RE150-19] as modified removed the 2009 IECC reference and retained the 15% UA backstop, the modification replaced the SHGC (Vote 11-0).

$UA_{\text{Proposed design}} <= 1.15 \times UA_{\text{Prescriptive reference design}}$ Equation 4-1

By this IECC-R committee action, there is no longer a 2009 IECC envelope backstop in the ERI method of R406.

For this Public Comment:

This proposal, RE190-19, seeks to remove Footnote a, which requires a 2015 envelope backstop for rated designs incorporating renewable energy, to create a level playing field for envelope backstop. If RE190-19 is successful AMPC, then all rated designs using the ERI method would be subject to the same UA envelope backstop, for greater consistency and less confusion.

This public comment creates a second column in Table R406.4, such that rated designs incorporating renewable energy are held to a lower, more-stringent ERI score.

The first column -- ERI for rated designs not incorporating renewable energy are held to 2018 ERI scores, which are higher and less stringent.

The second column -- ERI for rated designs incorporating renewable energy are held to the 2015 ERI scores, which are lower and more stringent.

The two-column format provides a foundation for revision of ERI scores in future editions of the IECC, for rated designs with and without renewable energy. The format is consistent with Proposal RE223-19, which could be viewed as a companion proposal.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
This proposal encourages the installation of renewable energy systems, which provides more flexibility to the builder and could result in either increased or decreased first cost of construction, depending on builder choices.

Public Comment# 1812

RE192-19

IECC: TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX[a]
1	~~57~~ 52
2	~~57~~ 52
3	~~57~~ 51
4	~~62~~ 54
5	~~61~~ 55
6	~~61~~ 54
7	~~58~~ 53
8	~~58~~ 53

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.

Reason: The purpose of this code change proposal is to establish lower, more efficient ERI target scores, improving efficiency for homes complying under the Energy Rating Index. More precisely, the proposal restores the lower ERI Index target scores from the 2015 IECC. Under the ERI, the lower the score, the more efficient the home. Although the ERI numbers were increased to the current levels as part of a broad compromise in the 2018 IECC, we believe that over time the ERI must continue to be improved, and improving the Index numbers by returning to the 2015 IECC levels at some point is a reasonable first step in the right direction.
Although a direct comparison between the ERI and other IECC compliance options is complicated, the ERI numbers proposed (and those in the 2015 IECC) are within the range of equivalence to other compliance paths under the IECC. U.S. DOE published an analysis that compared compliance under the IECC with HERS scores, using over 60,000 model runs to test the range of HERS scores that could apply to a 2012 IECC-compliant home. The study found that the 2015 ERI scores would be more likely to ensure compliance with the IECC, but even those scores could not guarantee compliance. “Thus, one can conclude that the [2015 IECC] ERIs are generally very near the conservative end of possible values, but not quite so low as to always guarantee that a home complying via the ERI path would also comply via the Performance Path.” *See* U.S. Department of Energy, *Identification of RESNET HERS Index Values Corresponding to Minimal Compliance with the IECC Performance Path*, at 4.17 (May 2014). Given that the other compliance options in the IECC have moderately improved since the 2012 IECC, we believe that these more stringent ERI scores would be appropriate as an upgrade to the current less efficient ERI levels for 2021.

Bibliography: *See* U.S. Department of Energy, *Identification of RESNET HERS Index Values Corresponding to Minimal Compliance with the IECC Performance Path*, at 4.17 (May 2014).

Cost Impact: The code change proposal will increase the cost of construction
To achieve a lower ERI score, builders must install more efficient products or systems in homes, which will increase construction costs. Because the ERI is a performance-based path, the costs and benefits to the consumer will vary depending on which improvements are incorporated into the home design. However, since the ERI is not mandatory and is one of only several compliance options, builders are not required to use this option if they do not find it acceptable for a specific project.

RE192-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This path is an above code program, this path is just getting its feet under it and raising it too high will eliminate use (Vote: 10-1).

Assembly Action: **None**

RE192-19

Individual Consideration Agenda

Public Comment 1:

Proponents:

William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it would improve the efficiency of the Energy Rating Index compliance path by restoring the more robust ERI values that were part of the original ERI in the 2015 IECC (and which were weakened in the 2018 edition). It should go without saying that the Energy Rating Index should improve over time, just as other compliance options improve. However, unlike the performance and Total UA paths, which improve automatically when parts of the prescriptive path improve, the ERI is based on a different (fixed) baseline that will not improve by itself. It is thus important to revisit the ERI scores each code update cycle to determine whether an update is necessary.

The ERI scores from the 2015 IECC have been adopted in several states, and we believe they are just as reasonable now as they were when the ERI was first incorporated into the 2015 IECC. Even though these scores were increased (which reduced their stringency) in 2018 as part of a broad compromise, the U.S. DOE found (in the study cited in the original supporting reason) that the more robust 2015 ERI scores were within the range of equivalency with the 2012 IECC prescriptive path. Given the improvements incorporated into the prescriptive path of the IECC since 2012, we believe the 2015 scores (or even more efficient scores) are well-justified. If the 2015 ERI scores were reasonable enough for approval 5 or 6 years ago, they are even more reasonable today.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As stated in the proposal, to achieve a lower ERI score, builders must install more efficient products or systems in homes, which will increase construction costs. Because the ERI is a performance-based path, the costs and benefits to the consumer will vary depending on which improvements are incorporated into the home design. However, since the ERI is not mandatory and is one of only several compliance options, builders are not required to use this option if they do not find it acceptable for a specific project.

Public Comment# 1496

RE194-19

IECC: R202 (IRC N1101.6), TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX[a,b]
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.

b. In a state, region, or country that has a renewable portfolio standard of 50% or greater, on-site renewable electric energy production systems shall receive credit only where they are installed with an on-site energy storage system that has a rated capacity of at least 3.5 kWh.

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

RENEWABLE PORTFOLIO STANDARD (RPS). A policy that requires electricity producers within a given jurisdiction to supply a certain minimum amount, capacity, or percentage of their electricity from designated renewable resources.

Reason: More states / areas of the United States are increasing their Renewable Portfolio Standards. As more distributed renewable electric energy systems are installed, there are situations where there is too much supply and too little demand, especially in the fall, winter, and spring.
In California, this has been called the "duck curve". In Hawaii, this has been called the "Nessie curve". In these cases, the grids are dealing with the issue of oversupply. In 2018, the California ISO had to curtail over 461,000 MWh (461 Million kWh) of solar and wind electric generation.

Energy storage, both grid-side and customer-side, will be needed to help address this situation. With energy storage, there is much less likelihood (or even no chance) that renewable electricity will be curtailed or not used.

In the newest version of Title 24, builders are allowed to adjust the size of residential PV systems if they also installed energy storage systems in combination with the PV.

This proposal is forward looking and will help both homeowners and the grid in the future, especially in areas with aggressive Renewable Portfolio Standards.

The definition is needed for support of the new language in the proposal. This is an "umbrella" definition that encompasses all of the variations of RPS policies throughout the United States (and world). RPS policies vary on a state by state basis, as there is no federal standard in the United States. However, in other countries that use the IECC, there may be country-wide policies that would be in effect.

More details about RPS policies can be found on numerous web sites, including the following:

https://www.eia.gov/todayinenergy/detail.php?id=4850 (US DOE/EIA article from 2012)

http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2018/10/Renewable-Portfolio-Standards-2018.pdf

http://programs.dsireusa.org/system/program?type=38&

Bibliography: California ISO, "What the duck curve tells us about managing a green grid", 2016, https://www.caiso.com/Documents/FlexibleResourcesHelpRenewables_FastFacts.pdf

NREL, "Overgeneration from Solar Energy in California: A Field Guide to the Duck Chart", November 2015 https://www.nrel.gov/docs/fy16osti/65023.pdf

GTM, "Hawaii's Solar-Grid Landscape and the 'Nessie Curve' ", February 10, 2014, https://www.greentechmedia.com/articles/read/hawaiis-solar-grid-landscape-and-the-nessie-curve

Cost Impact: The code change proposal will increase the cost of construction
Based on current battery technology and costs, the estimated cost impact will be approximately $1750 (3.5 kWh * $500/kWh installed) for homes that are located in areas with high RPS requirements and that install on-site renewable electric energy generation systems.

RE194-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This would negatively detract from using solar or other renewables, further demonstrates the complexity of the issue. The issues have not been worked out yet on safety issues (Vote: 11-0).

Assembly Action: **None**

RE194-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R406.4 (IRC N1106.4)

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX[a,b]
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.

b. In a state, region, or country that has a renewable portfolio standard of 50% or greater, on-site renewable electric energy production systems shall receive credit only where they are installed with an on-site energy storage system that has a rated capacity of at least ~~3.5~~ 2.0 kWh.

Commenter's Reason: In states or regions with higher levels of Renewable Portfolio Standards, on-site energy storage will help the homeowner as well as the local grid.
This modification reduces the size of the battery requirement, which will result in lower cost impacts compared to the original proposal.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment reduces the increase in the cost of construction by reducing the required size (and the cost) of the batteries in the on-site energy storage system.

Public Comment# 1372

Public Comment 2:

Proponents:
Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Submitted

Commenter's Reason: More states / areas of the United States are increasing their Renewable Portfolio Standards. As more distributed renewable electric energy systems are installed, there are situations where there is too much supply and too little demand, especially in the fall, winter, and spring.

In California, this has been called the "duck curve". In Hawaii, this has been called the "Nene curve". In these cases, the grids are dealing with the issue of oversupply. In 2018, the California ISO had to curtail over 461,000 MWh (461 Million kWh) of solar and wind electric generation. As of July 18, 2019, the California ISO has already curtailed over 697,000 MWh (697 Million kWh) of solar and wind generation in 2019. Energy storage, both grid-side and customer-side, will be needed to help address this situation. With energy storage, there is much less likelihood (or even no chance) that renewable electricity will be curtailed or not used.

In the newest version of Title 24, builders are allowed to adjust the size of residential PV systems if they also installed energy storage systems in combination with the PV. This proposal is forward looking and will help both homeowners and the grid in the future, especially in areas with aggressive Renewable Portfolio Standards.

The definition is needed for support of the new language in the proposal. This is an "umbrella" definition that encompasses all of the variations of RPS policies throughout the United States (and world). RPS policies vary on a state by state basis, as there is no federal standard in the United States. However, in other countries that use the IECC, there may be country-wide policies that would be in effect.

More details about RPS policies can be found on numerous web sites, including the following:
https://www.eia.gov/todayinenergy/detail.php?id=4850 (US DOE/EIA article from 2012)
http://ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2018/10/Renewable-Portfolio-Standards-2018.pdf
http://programs.dsireusa.org/system/program?type=38&

Bibliography:
California ISO, "What the duck curve tells us about managing a green grid", 2016

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction Based on current battery technology and costs, the estimated cost impact will be approximately $1750 (3.5 kWh * $500/kWh installed) for homes that are located in areas with high RPS requirements and that install on-site renewable electric energy generation systems.

Public Comment# 1571

RE195-19

IECC: TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: Steven Rosenstock, Edison Electric Institute, representing Edison Electric Institute (srosenstock@eei.org)

2018 International Energy Conservation Code

Revise as follows:

TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX[a,b]
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.

b. Where the installation of an on-site renewable energy system is a mandatory requirement in the code, the building shall receive credit only for the capacity installed that is above the minimum mandatory requirement.

Reason: In California, the latest version of Title 24 will go into effect on 1/1/2020. In the energy code, there is a requirement for new homes to install on-site PV systems, based on the following formula:
kW PV = (CFA x A)/1000 + (NDwell x B) where

kW PV = kWdc size of the PV system
CFA = Conditioned floor area
NDwell = Number of dwelling units
A = Adjustment factor from Table 150.1-C (range of 0.572 to 1.56)
B = Dwelling adjustment factor from Table 150.1-C (range of 1.06 to 1.51)

There are exceptions to the requirement, but most homes will be required to install systems that range in size from 2 to 5 kW.

Under the ERI compliance path, homes with such systems get credits (lower scores). However, if such systems are already required by the code, should they receive full credit?

With other efficiency programs, once the federal or state baseline is increased (e.g., 10 to 13 SEER, for example), the incentives for the 13 SEER system disappear, since it is no longer a "high efficiency" option, but a required minimum standard.

This proposal follows that precedent. Systems that meet the mandated minimum requirements should not receive credit, since they are not going "above and beyond" what is required. Only systems that exceed the minimum requirements should get credit for the incremental energy production they are providing.

Bibliography: California Energy Commission, "***2019 Standards Part 6 Chapter 8 (Section 150.1) Revised Express Terms***" TN-223257-3 Submitted 4/23/2018 https://www.energy.ca.gov/title24/2019standards/rulemaking/documents/2018-05-09_hearing/2019_Revised_EnergyCode.php
NREL, "*U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018*", November 2018 https://www.nrel.gov/docs/fy19osti/72399.pdf

Cost Impact: The code change proposal will increase the cost of construction
Where the PV system is sized larger than the required minimum, the extra cost will be on the order of $2,700 per kW (DC) of incremental peak rated capacity. The value is based on the November 2018 NREL report on US solar installations at residential facilities.

For example, if the minimum requirement is 3 kW (DC), and a 5 kW (DC) system is installed, the extra cost will be approximately $5,400.

RE195-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Since there are no requirements for mandatory renewables, this is premature (Vote: 11-0).

Assembly Action: **None**

RE195-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R406.4 (IRC N1106.4)

Proponents:
Charles Foster, representing EEI (cfoster20187@yahoo.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX

CLIMATE ZONE	ENERGY RATING INDEX[a,b]
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the 2015 International Energy Conservation Code.

b. Where the installation of an on-site renewable energy system is a mandatory requirement in the code, the building shall receive credit only for the <u>On-site Renewable Energy </u>capacity installed that is above the minimum mandatory requirement. <u>On-site Renewable Energy shall receive credit for 100% of the installed electrical or thermal capacity.</u>

Commenter's Reason:

In California, the latest version of Title 24 will go into effect on 1/1/2020. In the energy code, there is a requirement for new homes to install on-site PV systems, based on the following formula:
kW PV = (CFA x A)/1000 + (NDwell x B) where

kW PV = kWdc size of the PV system
CFA = Conditioned floor area
NDwell = Number of dwelling units
A = Adjustment factor from Table 150.1-C (range of 0.572 to 1.56)
B = Dwelling adjustment factor from Table 150.1-C (range of 1.06 to 1.51)

There are exceptions to the requirement, but most homes will be required to install systems that range in size from 2 to 5 kW.

Under the ERI compliance path, homes with such systems get credits (lower scores). However, if such systems are already required by the code, should they receive full credit?

With other efficiency programs, once the federal or state baseline is increased (e.g., 10 to 13 SEER, for example), the incentives for the 13 SEER system disappear, since it is no longer a "high efficiency" option, but a required minimum standard.

This proposal follows that precedent. Systems that meet the mandated minimum requirements should not receive credit, since they are not going "above and beyond" what is required. Only systems that exceed the minimum requirements should get credit for the incremental energy production they are providing.

In addition, it allows 100% credit for the installation of non-electric renewable energy systems, such as geothermal, biomass. and solar thermal. Solar thermal is inherently less complex with respect to export/import than PV.

Bibliography: California Energy Commission, "***2019 Standards Part 6 Chapter 8 (Section 150.1) Revised Express Terms***" TN-223257-3 Submitted 4/23/2018 https://www.energy.ca.gov/title24/2019standards/rulemaking/documents/2018-05-09_hearing/2019_Revised_EnergyCode.php
NREL, "*U.S. Solar Photovoltaic System Cost Benchmark: Q1 2018*", November 2018 https://www.nrel.gov/docs/fy19osti/72399.pdf

Cost Impact: The net effect of the public comment and code change proposal will decrease the cost of construction The net effect of the public comment and code change proposal will increase the cost of construction
Where the PV system is sized larger than the required minimum, the extra cost will be on the order of $2,700 per kW (DC) of incremental peak rated capacity. The value is based on the November 2018 NREL report on US solar installations at residential facilities.

For example, if the minimum requirement is 3 kW (DC), and a 5 kW (DC) system is installed, the extra cost will be approximately $5,400.

Public Comment 2:

Proponents:
Steven Rosenstock, representing Edison Electric Institute (srosenstock@eei.org)

requests As Submitted

Commenter's Reason: There is such a mandate in California that will go into effect on January 1, 2020. This proposal is needed to address that situation. There may be other cities and counties where such a mandate is being considered or will be implemented within the next several years.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The cost impact will be the same as in the original proposal, since this does not make any modifications.

Public Comment# 1373

RE196-19

IECC: TABLE R406.4 (IRC N1106.4)

Proposed Change as Submitted

Proponents: Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

2018 International Energy Conservation Code

Revise as follows:

TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX

.

CLIMATE ZONE	ENERGY RATING INDEX[a]
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be ~~greater than or equal to~~ within 15% of the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 ~~of the 2015 International Energy Conservation Code.~~

Reason: This modification gives on-site renewable energy a 15% credit of the current edition of the code when using the Energy Rating Index. It clears up confusion about calling reference to past editions of the IECC and enables the code user to use one edition of the code instead of referencing a past edition. As the code is written right now there is no credit for installing onsite renewable energy while mandating rigorous prescriptive requirement of the 2015 IECC with no room for flexibility. The prescriptive tables have been virtually untouched in the 2018 edition and could potentially go unchanged for cycles to come. The ERI path is intended to allow for flexibility while constructing an energy efficient home.The proposal gives a reasonable amount of flexibility without jeopardizing the integrity or efficiency of the homes. The 15% allowance will prevent from installing single pane windows and prevent significant reductions in building thermal envelope components.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This proposal does not change the cost of construction it increases the flexibility.

RE196-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: It is confusing to send users to another section which also lists another value; there was not substantial analysis and it is not consistent with previous action on RE188 (Vote: 7-4).

Assembly Action: **None**

RE196-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE R406.4 (IRC N1106.4)

Proponents:
Joel Martell, representing National Association of Home Builders (jmartell@nahb.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE R406.4 (IRC N1106.4)
MAXIMUM ENERGY RATING INDEX

.

CLIMATE ZONE	ENERGY RATING INDEX[a]
1	57
2	57
3	57
4	62
5	61
6	61
7	58
8	58

a. Where on-site renewable energy is included for compliance using the ERI analysis of Section R406.4, the building shall meet the mandatory requirements of Section R406.2, and the proposed total building thermal envelope UA shall be less than or equal to the UA of the building thermal envelope using the prescriptive U-factors from Table R402.1.4 multiplied by 1.05. SHGC shall not exceed limits in Table R402.1.2. ~~shall be within 15% of the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4~~

Commenter's Reason: This modification gives on-site renewable energy a 5% UA trade-off of the current edition of the code when using the ERI approach. It helps to address some of the concerns at the Committee Action Hearings with no backstops in place for SHGC, this public comment reduces the original 15% trade off down to 5% and sets in place and SHGC backstop to ease concerns. The existing language calls reference to past editions of the IECC which requires the use of two separate code versions to comply with the current, this helps clean up the language and removes the reference to past editions. Also, as the code is written right now there is no credit for installing onsite renewable energy while mandating rigorous prescriptive requirements of the 2015 IECC with no room for flexibility. The prescriptive tables have been virtually untouched in the 2018 editions. The ERI path is intended to allow for flexibility while constructing an energy efficient home. The public comment gives flexibility without jeopardizing the integrity or efficiency of the homes.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The code change will not impact the cost of construction because it is not directly affecting how you construct a dwelling. This proposal gives more flexibility in the ERI path and does not require a building to do certain metrics.

Public Comment# 1419

RE202-19

IECC®: R406.6.2 (IRC N1106.6.2)

Proposed Change as Submitted

Proponents: Kirk Nagle, City of Aurora, representing Myself (knagle@auroragov.org)

2018 International Energy Conservation Code

Revise as follows:

R406.6.2 (IRC N1106.6.2) Compliance report. Compliance software tools shall generate a report that documents that the ERI of the *rated design* complies with Sections R406.3 and R406.4. The compliance documentation shall include the following information:

1. Address or other identification of the residential building.
2. Declare Energy Rating Index on title page
3. An inspection checklist documenting the building component characteristics of the *rated design*. The inspection checklist shall show results for both the *ERI reference design* and the *rated design*, and shall document all inputs entered by the user necessary to reproduce the results.
4. Name of individual completing the compliance report.
5. Name and version of the compliance software tool.

Exception: Where an otherwise identical building model is offered in multiple orientations, compliance for any orientation shall be permitted by documenting that the building meets the performance requirements in each of the four (north, east, south and west) cardinal orientations.

Reason: This code change is being proposed to clarify the energy path to the code official and the documentation for permit. Many reports do not specify the path that is being proposed and the code official has to contact the applicant to verify the energy path they are intending to use, to comply with the energy code. By providing the method of compliance the code official can focus on the details of the report and this information will expidate the permit process time.

Cost Impact: The code change proposal will increase the cost of construction
This will increase the cost of construction by a minor ammount, adding a data entry to the report.

RE202-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: There is another proposal upcoming that puts it in the proper code section (Vote: 6-4).

Assembly Action: **None**

RE202-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R406.6.2 (IRC N1106.6.2)

Proponents:
Kirk Nagle, representing Myself (knagle@auroragov.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R406.6.2 (IRC N1106.6.2) Compliance report. Compliance software tools shall generate a report that documents that the ERI of the *rated design* complies with Sections R406.3 and R406.4. The compliance documentation shall include the following information:

1. Address or other identification of the residential building.
2. Declare Energy Rating Index on title page and building plans.
3. An inspection checklist documenting the building component characteristics of the *rated design*. The inspection checklist shall show results for both the *ERI reference design* and the *rated design*, and shall document all inputs entered by the user necessary to reproduce the results.
4. Name of individual completing the compliance report.
5. Name and version of the compliance software tool.

Exception: Where an otherwise identical building model is offered in multiple orientations, compliance for any orientation shall be permitted by documenting that the building meets the performance requirements in each of the four (north, east, south and west) cardinal orientations.

Commenter's Reason: This code change proposal is needed to clarify the intentions of the builder , to expedite the plan review process and provide a clear path for the inspectors as the approve the building components. The intentions of the designer being stated on the plans and the energy report provids the plan reviewer a path to follow and will speed up the review process. Knowing where to look in the energy energy code for the requirements and compare that to the plans and the energy report make the process of plan review much quicker. As a inspector it reduces the inspection time by making it very clear what the intentions of the designer are so the inspector can follow the energy plan and compare it to the building as the building is constructed. This code change is being submitted to give the plan reviewer, and the inspector a very clear path to follow as the plans are reviewed and the building is constructed so the process can be expedited.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This code change will increase the cost of construction slightly- data entry.

Public Comment# 2105

RE204-19

IECC: R202 (IRC N1101.6), R406.6.3 (IRC N1106.6.3) (New)

Proposed Change as Submitted

Proponents: jim edelson, representing New Buildings Institute (jim@newbuildings.org)

2018 International Energy Conservation Code

SECTION R202 (IRC N1101.6) GENERAL DEFINITIONS

Add new definition as follows:

RENEWABLE ENERGY CERTIFICATE (REC). An instrument that represents the environmental attributes of one megawatt hour of renewable energy; also known as an energy attribute certificate (EAC).

Add new text as follows:

R406.6.3 (IRC N1106.6.3) Renewable energy certificates (RECs) documentation. Where onsite renewable energy is included in the calculation of an ERI, one of the following forms of documentation shall be provided to the *code official*:

1. Substantiation that the *RECs* associated with the onsite renewable energy are owned by, or retired on behalf of, the homeowner.
2. A contract that conveys to the homeowner the *REC*s associated with the onsite renewable energy, or conveys to the homeowner an equivalent quantity of *RECs* associated with other renewable energy.

Reason: This proposal impacts who may claim the environmental attributes of an onsite-renewable energy system. The environmental attributes of solar power, or other renewable energy, have market value that is reflected and transacted in RECs.
When the installer, leasing company or financial agent in the solar panel transaction strips that value from the homeowner by taking posession of the RECs, according to the Federal Trade Commission the power produced by the solar panels on the house would have an "unqualified claim" as renewable energy. To prevent this, the proposal ensures that environmental attributes are not double counted towards compliance with the IECC. While this proposal does not cite Green-E, the Green-E Standard describes the double counting that occurs when RECs have been transferred to another party in the renewable transaction:

Examples of prohibited double uses include, but are not limited to:

1) When the same REC is sold by one party to more than one party, or any case where another party has a conflicting contract for the RECs or the renewable electricity;

2) When the same REC is claimed by more than one party, including any expressed or implied environmental claims made pursuant to electricity coming from a renewable energy resource, environmental labeling or disclosure requirements. This includes representing the energy from which RECs are derived as renewable in calculating another entity's product or portfolio resource mix for the purposes of marketing or disclosure;

3) When the same REC is used by an electricity provider or utility to meet an environmental mandate, such as an RPS, and is also used to satisfy customer sales under Green-e Energy; or

4) Use of one or more attributes of the renewable energy or REC by another party This includes when a REC is simultaneously sold to represent "renewable electricity" to one party, and one or more Attributes associated with the same MWh of generation (such as CO2 reduction) are also sold, to another party.

To prevent the situation where double counting is credited within the ERI calculation, thereby artificially reducing ERI scores and allowing the the home to install fewer energy efficiency features than otherwise would be required, this proposal ensures that the homeowner retains posession of the RECs associated with onsite renewable energy systems. In the case where those RECs for the onsite system cannot by tranferred to the homeowner, an equivalent quantity of RECs must be provided.

Bibliography: Federal Register, Volume 77, Number 197; October 11, 2012; 16 CFR Part 260; "Guides for the Use of Environmental Marketing Plans".
Green-e Renewable Energy Standard for Canada and the United States, Version 3.2; March 20, 2018.

Cost Impact: The code change proposal will increase the cost of construction
This proposal impacts who may claim the environmental attributes of an onsite-renewable energy system. The environmental attributes of the solar power have market value, reflected in RECs. The cost of installing solar panels may be reduced when the installer, leasing company or financial agent strips that value from the homeowner by taking posession of the RECs.

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This is not a building or building code issue, it is a legal issue (Vote: 11-0).

Assembly Action: **None**

Individual Consideration Agenda

Public Comment 1:

IECC®: R406.6.3 (IRC N1106.6.3) (New)

Proponents:
jim edelson, representing New Buildings Institute (jim@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R406.6.3 (IRC N1106.6.3) Renewable energy certificates (RECs) documentation. Where onsite renewable energy is included in the calculation of an ERI, ~~one of the following forms of documentation shall be provided to the *code official*:~~

1. ~~Substantiation that the *RECs* associated with the onsite renewable energy are owned by, or retired on behalf of, the homeowner.~~
2. ~~A contract that conveys to the homeowner the *REC*s associated with the onsite renewable energy, or conveys to the homeowner an equivalent quantity of *RECs* associated with other renewable energy.~~

<u>the property owner or owner's authorized agent shall demonstrate that any RECs or EACs associated with onsite renewab le energy are retained, or retired, on behalf of the property owner.</u>

Commenter's Reason: Onsite renewable energy is termed Onsite Power Production (OPP) in RESNET 301, and the application of OPP in Section 4.1.2 of RESNET 301 directly reduces the estimated energy consumption for the rated house. That reduction in energy consumption then reduces the calculated Energy Rating Index (ERI) which is used for compliance with the IECC. At the same time that the on-site renewable energy is helping the rated home meet the IECC, the environmental attributes associated with that renewable energy are commonly being counted towards additional obligations, such as Renewable Portfolio Standards.
According to the Green-E Standard, double counting occurs when RECs are not tracked to a single party.

Examples of prohibited double uses include, but are not limited to:

1) When the same REC is sold by one party to more than one party, or any case where another party has a conflicting contract for the RECs or the renewable electricity;

2) When the same REC is claimed by more than one party, including any expressed or implied environmental claims made pursuant to electricity coming from a renewable energy resource, environmental labeling or disclosure requirements. This includes representing the energy from which RECs are derived as renewable in calculating another entity's product or portfolio resource mix for the purposes of marketing or disclosure;

3) When the same REC is used by an electricity provider or utility to meet an environmental mandate, such as an RPS, and is also used to satisfy customer sales under Green-e Energy; or

4) Use of one or more attributes of the renewable energy or REC by another party This includes when a REC is simultaneously sold to represent "renewable electricity" to one party, and one or more Attributes associated with the same MWh of generation (such as CO2 reduction) are also sold, to another party.

This Public Comment provides revised language that clarifies and simplifies the original proposal. The Solar Energy Industry Association (SEIA) assisted NBI in drafting these revisions. The Comment clarifies that the owner or her agent shall show that the ownership or retirement of RECs have been properly tracked to the owner. This information about the treatment of RECs is found in typical leases, contracts and incentive agreements for installed solar energy systems. A reference to the contractual provision is all that is needed to satisfy the requirements of this proposal – and this reference to the RECs provision in the plans set is all that the code official would need to examine.

As an example, the following language from Austin Energy's solar program states (emphasis added):

Customers receiving service under either Non-Demand or Demand Value-Of-Solar Riders cannot combine services with the Load Shifting Voltage Discount Rider. Renewable Energy Credits (RECs) and all other renewable energy attributes for generation receiving Value-of-Solar credits are aggregated by Austin Energy. <u>All RECs for energy consumed onsite will be retired on behalf of the solar customer.</u>

This is a sample bilateral contract involving the Solano (CA) Community College District:

Environmental Attributes and Energy Credits. District shall own all right, title, and interest associated with or resulting from the development, construction, installation and ownership of any facilities installed on the Project ("Generating Facilities").

Bibliography: Green-e Renewable Energy Standard for Canada and the United States, Version 3.2; March 20, 2018.
Austin Energy, FY 2019 ELECTRIC TARIFF, Value-Of-Solar Rider, Shared Solar Customer

Solano (CA) Community College District, AGREEMENT FOR DESIGN, INSTALLATION AND COMMISSIONING OF SOLAR/PHOTOVOLTAIC SYSTEM http://www.solano.edu/measureq/1415/Energy%20Services%20Contract%20(design-build%20form_CCD)%20-%20use%20after%207_1_2012.pdf

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This proposal impacts who may claim the environmental attributes of an onsite-renewable energy system. The environmental attributes of the solar power have market value, reflected in RECs. The cost of installing solar panels may be reduced if the installer, leasing company or financial agent strips that value from the homeowner by taking possession or selling the RECs.

Public Comment# 2089

RE206-19

IECC: R401.2 (IRC N1101.13), R401.2.1 (IRC N1101.13.1) (New), R407 (IRC N1107) (New), R407.1 (IRC N1107.1) (New), R407.2 (IRC N1107.2) (New), TABLE R407.2 (IRC N1107.2) (New)

Proposed Change as Submitted

Proponents: William Fay, Energy-Efficient Codes Coalition, representing Energy-Efficient Codes Coalition (bfay@ase.org); Maureen Guttman, BCAP-IBTS, representing BCAP-IBTS (mguttman@bcapcodes.org)

2018 International Energy Conservation Code

Revise as follows:

R401.2 (IRC N1101.13) Compliance. Projects shall comply with Section R401.2.1 and one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.

Add new text as follows:

R401.2.1 (IRC N1101.13.1) Additional energy efficiency (Mandatory). This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying under Sections R401 through R404, one or more additional energy efficiency measures shall be installed in accordance with Section R407.2 that cumulatively equal or exceed 5 Flex Points.

2. For buildings complying under the simulated performance alternative in Section R405, the building shall meet one of the following:

2.1.One or more additional energy efficiency measures in Section R407.2 shall be installed that cumulatively equal or exceed five Flex Points, without including such measures in the proposed design under Section R405; or

2.2.The proposed design of the building under Section R405.3 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the standard reference design.

3. For buildings that comply under the energy rating index alternative in Section R406, the energy rating index value shall be at least 5 percent less than the energy rating index target specified in Table R406.4.

R407 (IRC N1107)
FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY

R407.1 (IRC N1107.1) Scope. This section establishes flex point alternatives to achieve additional energy efficiency in accordance with Section R401.2.

R407.2 (IRC N1107.2) Flex Points for additional energy efficiency. Measures shall be selected from Table R407.2. Each measure chosen shall receive credit for the Flex Points as indicated in the Table for the specific Climate Zone. Interpolation of points between measures shall not be permitted.

TABLE R407.2 (IRC N1107.2)
FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY

-	-	Flex Point Value								
Measure Number	Measure Description	Climate Zone 1	Climate Zone 2	Climate Zone 3	Climate Zone 4	Climate Zone 4C[a]	Climate Zone 5	Climate Zone 6	Climate Zone 7	Climate Zone 8
1a	≥ 2.5% reduction in total UA [b]	1	1	2	2	2	2	3	4	4
1b	≥ 5% reduction in total UA [b]	3	3	3	3	3	4	5	5	5
1c	≥ 7.5% reduction in total UA [b]	5	5	5	5	5	6	7	8	8
2a	≥ 10% reduction in glazed vertical fenestration area-weighted average SHGC	2	1	-	-	-	-	-	-	-
2b	≥ 20% reduction in glazed vertical fenestration area-weighted average SHGC	4	1	-	-	-	-	-	-	-
3a	≤ 3 ACH50 air leakage rate with ERV or HRV installed [c]	2	4	5	7	7	7	7	8	8
3b	≤ 2 ACH50 air leakage rate with ERV or HRV installed[c]	2	5	7	9	9	9	10	11	11
4a	≤ 2 CFM of total duct leakage per 100 square feet of conditioned floor area when tested in accordance with Section R403.3.3	1	1	1	1	-	1	1	1	1
4b	100% of ductless thermal distribution system or hydronic thermal distribution system located completely inside the *building thermal envelope* or 100% of duct thermal distribution system located in *conditioned space* [d]	8	8	9	11	8	12	15	17	17
5a	≥ 18 SEER and ≥ 14 EER cooling system efficiency [e]	9	7	3	2	-	-	-	-	-
5b	≥ 16 EER cooling system efficiency [e]	10	7	3	2	-	-	-	-	-
6a	≥ 96 AFUE heating system efficiency [f]	-	2	6	9	10	10	11	12	14
7a	≥ 10.5 HSPF heating system efficiency [f]	-	1	2	4	4	5	4	3	3
7b	≥ 3.5 COP heating system efficiency [f]	-	2	4	6	6	8	7	6	5
8a	≥ 0.8 EF for fossil fuel service water heating system	7	5	4	3	2	2	2	1	1
8b	≥ 1.15 EF for electric service water heating system	7	7	7	4	5	3	3	2	2
8c	≥ 0.4 Solar Fraction for service water heating system	8	9	9	7	9	6	5	4	3

a. Climate Zone 4C is Climate Zone Marine 4.

b. The Total UA shall be calculated in accordance with Section R402.1.5 Total UA alternative.

c. Minimum Heat Recovery Ventilator (HRV) and Energy Recovery Ventilator (ERV) requirements, measured at the lowest tested net supply airflow, shall be ≥ 75% Sensible Recovery Efficiency (SRE), ≤ 1.1 W/CFM Fan Energy and shall not use recirculation as a defrost strategy. In addition, the Energy Recovery Ventilator (ERV) shall be ≥ 50% Latent Recovery/Moisture Transfer (LRMT).

d. As defined by Section R403.3.7.

e. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2 and shall be sized to serve 100% of the cooling design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the cooling design load served by the system.

f. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2 and shall be sized to serve 100% of the heating design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the heating design load served by the system.

Reason: The purpose of this code change proposal is to improve overall residential building efficiency (heating, cooling and water heating energy) by roughly 5% and to create a scalable, flexible means of improving residential building efficiency for future IECC updates. Instead of requiring efficiency improvements to specific building components, the new “Flex Points” approach in Section R407 provides a multitude of options for builders to achieve the efficiency requirements of the IECC. This approach is also scalable according to a jurisdiction’s needs – states or localities who need additional energy savings to meet energy or climate policy goals can adjust the number of required points accordingly. Package- or points-based

approaches have been used for several years in Washington and Oregon. And since the 2012 IECC, the commercial provisions have included section C406 Additional Efficiency Package Options. We believe the updated approach in this proposal is a sensible means of achieving additional efficiency now and in the future.
This proposal is similar to the Flex Points proposal for the 2018 IECC in overall structure, but the points table has been simplified and updated based on feedback received in the previous Code Development Cycle. Like the previous version, this proposal also includes alternative compliance pathways for builders who select the simulated performance alternative or the Energy Rating Index, and will bring roughly equivalent improvements to all three compliance paths.

This Flex Points proposal is cost-effective, since it includes a number of options to achieve 5 points that are cost-effective.

The Flex Points proposal will provide three distinct benefits for jurisdictions adopting the 2021 IECC:

1. This proposal meets a clear need for efficiency improvements in the model energy code now and in the future.

Although the IECC has made small efficiency gains in the 2015 and 2018 editions, major gains have plateaued. Buildings still consume an estimated 42% of the nation's energy, 54% of its natural gas, and 71% of its electricity. Governors, legislators, and mayors are increasingly turning to building energy codes to meet energy and climate goals, and those codes should continue to provide reasonable improvements going forward. The U.S. Conference of Mayors, in its fourth consecutive resolution on the subject, reiterated their "concerted support for putting future triennial IECC updates on a "glide path" of steady efficiency gains that will improve the efficiency performance of millions of U.S. residential, multi-family, and commercial buildings." *See* 2018 U.S.C.M. Resolution 86 (June 11, 2018).

Several jurisdictions have already created or are in the process of creating package-based compliance paths or improved code provisions to meet their policy needs. The result is improved efficiency, but a lack of consistency in both format and requirements. Incorporating Flex Points into the 2021 IECC will not only provide a 5% boost in energy conservation but will also provide a realistic map for additional improvements going forward. And by providing more uniform targets for the efficiency of building components, this proposal will contribute to economies of scale, potentially lowering prices for builders and ultimately consumers.

2. This proposal will provide maximum flexibility for builders to achieve improved efficiency.

Flex Points trusts that builders and design professionals will select the most cost-effective and sensible efficiency improvements for a given project. There are several alternatives for compliance in each climate zone, along with options to comply in a performance- or rating-based path. There are alternatives related to more insulation, more efficient windows, reduced air and duct leakage and improved equipment. We believe that this approach provides the right incentives for builders to make long-lasting improvements in residential buildings that are in the best interests of homeowners.

The point values have been calculated based on the present value of energy cost savings over the current code (including relevant federal equipment efficiency standards) and reflect the estimated useful life of each measure over an assumed 30-year life of the building. While a 30-year period is consistent with the typical life of a mortgage, it is a very conservative period given the likelihood that some measures will provide efficiency benefits for decades beyond the initial 30-year period.

The analysis behind the flex points is based on the methodology and assumptions included in the U.S. Department of Energy's Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes, including the economic equations to obtain the present value of energy costs within the calculation methodology. The energy consumption calculations take into consideration heating, cooling, and water heating energy, using DOE-2 energy simulation across 105 TMY3 weather locations and 12 building types to account for varying stories, foundations, and fuel types for each of the baseline and upgrade measures. The analysis compares the annual energy savings between a home with and without an efficiency measure over the useful life of the efficiency measure using useful life data from NAHB and other sources. Energy costs were calculated using the most recent national EIA projections for natural gas and electricity. Because the analysis uses readily-available and widely-accepted tools and methodologies, we expect that future additions or changes will be straightforward.

3. This proposal will encourage efficiency improvements in building components that are currently difficult to regulate.

Flex Points addresses two issues that have complicated model energy codes for many years. First, innovative building practices or emerging technologies can benefit from being listed in codes, but states (and national code developing organizations) are reluctant to require new technologies or practices before they are market-tested. As a result, there are high barriers to entry for new technologies, even when they could transform the marketplace and provide energy- or cost-saving benefits for homeowners. As an example, Heat Recovery Ventilators (HRVs) are cost-effective and reasonable for much of the country, but individual circumstances or climate conditions may favor another approach. Rather than require HRVs in every case, or most cases with exceptions, HRVs and Energy Recovery Ventilators are included as one of several options available to builders in every climate zone. Not only will Flex Points create an opportunity for good technology to be used in more buildings, but it will open the door for market forces to make these technologies more widely available (and presumably less expensive to consumers). As new technologies or practices become available, these advances can be quickly and easily added into the Flex Points table, fast-tracking technology that is good for consumers.

Second, much of the heating, cooling, and water heating equipment installed in residential buildings is subject to federal preemption under the National Appliance Energy Conservation Act. As has been debated at length in ICC Code Development hearings over the last 15 years, including equipment efficiencies in performance trade-offs tends to weaken the efficiency of the energy code, since federal minimum efficiencies for nearly every covered product is well below the efficiency levels of commonly installed products. When these efficiency levels are used in trade-off baselines, builders use the improved efficiency of common heating, cooling, and water heating products as a means of trading away efficiency of more permanent building components and features, even though the equipment would have been installed anyway. This “free ridership” may provide short-term cost savings for homebuilders, but it saddles homeowners with unexpected high energy costs over the entire useful life of the building. Moreover, this equipment often carries a much shorter useful life, which is not typically captured in code compliance simulations.

Flex Points creates a new incentive to improve the efficiency of covered products without resulting in efficiency rollbacks elsewhere in the code. Heating, cooling, and water heating improvements (among others) are included among the Flex Points options with points calculated according to climate-specific energy cost savings and the longevity of the equipment. As compared to the previous Flex Points proposal, the list of options has been simplified and refocused on the equipment most likely to provide meaningful energy savings. Each of these upgrades will build upon the current IECC efficiency, rather than trading it away.

In sum, we believe that this proposal will improve efficiency by roughly 5% while unlocking the competitive market for new technologies or building components that are difficult to regulate and will provide a useful new tool for policymakers across the country – all without rolling back the effectiveness or efficiency of the IECC.

Bibliography: *Uniting Cities to Accelerate Focus on the Economic and Climate Benefits of Boosting America’s Building Energy Efficiency*, 2019 U.S.C.M. Resolution 86 (June 11, 2018), *available at* https://www.usmayors.org/the-conference/resolutions/?category=c9211&meeting=86th%20Annual%20Meeting.

Cost Impact: The code change proposal will increase the cost of construction
Requiring additional efficiency measures, such as more insulation, more efficient windows, reduced air leakage and duct leakage, and/or more efficient equipment, to save 5% energy will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

RE206-19

Public Hearing Results

Errata: This proposal includes published errata
Go to https://www.iccsafe.org/wp-content/uploads/Group-B-Consolidated-Monograph-Updates.pdf.

Committee Action: Disapproved

Committee Reason: No technical justification for the proposal, and the lack of public analysis does not allow future analysis and movement. Concerns with change of occupancy and lack of coordination between this and Chapter 5. Preference indicated for RE208 and RE209 (Vote: 8-3).

Assembly Action: None

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE206-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it will provide a roughly 5% efficiency improvement to the IECC through a very flexible, points-based set of residential efficiency improvement options (builders can choose the best options for the specific circumstances). RE206 also provides a mechanism for future updates to the code, either at the national or state level. A good number of cities, counties, and states have implemented improved energy conservation requirements beyond the 2018 IECC but these amendments tend to be developed independently of the national code update process, leading to a wide range of improvements across the country. RE206 will help standardize the process for achieving more efficiency, which will promote adoption and market transformation, producing economies of scale and reducing compliance costs, while also creating a framework for including other efficiency improvements going forward.

RE206 simultaneously improves all compliance paths of the code – prescriptive, performance, and ERI – helping ensure efficiency improvements in every home no matter which IECC compliance option is selected by the builder. RE206 encourages innovation and new technologies that would be more difficult to incorporate into the prescriptive path at this time. And it does so without cannibalizing the efficiency of the current IECC. RE206 also provides the opportunity to improve the efficiency of heating, cooling, and water heating equipment without weakening or trading off the base code requirements.

The two issues listed by the Committee for failing to approve the proposal are not persuasive:

Committee: *"No technical justification for the proposal and lack of public analysis does not allow future analysis and movement."* To the contrary, technical justification and analysis has been provided in support of the proposal. Section 2 of the original reason provided for RE206 outlines the methodology used to calculate the energy savings and point values. The calculations are based on the methodology and assumptions used in the U.S. Department of Energy's Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes, including the economic equations to obtain the present value of energy costs within the calculation methodology. For the complete DOE methodology, *see* https://www.energycodes.gov/methodology-evaluating-cost-effectiveness-residential-energy-code-changes. This methodology can be used in the future to revise or add measures to the Flex Points table. Thus, we believe the Committee's concerns are misplaced.

Committee: *"Concerns with change of occupancy and lack of coordination between this and Chapter 5."* Concerns regarding Chapter 5 do not justify rejecting this proposal. Chapter 5 only applies the requirements of the IECC specifically listed in that chapter to existing buildings. If a requirement is not specified in Chapter 5, that requirement does not apply to the existing building. Thus, because Chapter 5 does not specify new section R401.2.1 (Additional energy efficiency) or Section R407, this new requirement would not apply to existing buildings (either through change of occupancy or for additions, alterations or repairs). We see no need to complicate RE206 with changes to Chapter 5 if the end result is the same -- that the new provisions would not apply to existing buildings anyway. If there is some desire to apply the provisions of Section R407 to existing buildings, that can be accomplished in a future code change. Concerns about existing buildings should not derail the clear improvements for new buildings that would result from this proposal.

In sum, we believe RE206 will not only result in a meaningful improvement in efficiency without rolling back any of the 2018 IECC's provisions, but will also provide a framework for states and local jurisdictions to apply a more consistent set of improvements in building efficiency. It will also pave the way for future improvements to the IECC and will create space for new technologies and building methods that would be difficult to include at this point as standalone requirements in the current code.

Bibliography: https://www.energycodes.gov/methodology-evaluating-cost-effectiveness-residential-energy-code-changes

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As stated in the original proposal, requiring additional efficiency measures, such as more insulation, more efficient windows, reduced air leakage and duct leakage, and/or more efficient equipment, to save 5% energy will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

Public Comment# 1511

RE207-19

IECC: R401.2 (IRC N1101.13.1), R401.2.1 (IRC N1101.13.1) (New), R407 (IRC N1107) (New), R407.1 (IRC N1107.1) (New), R407.2 (IRC N1107.2) (New), TABLE R407.2 (IRC N1107.2) (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing Northwest Energy Codes Group (ericM@newbuildings.org)

2018 International Energy Conservation Code

Revise as follows:

R401.2 (IRC N1101.13) Compliance. Projects shall comply with Section R401.2.1 one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as “Mandatory.”
3. The energy rating index (ERI) approach in Section R406.

Add new text as follows:

R401.2.1 (IRC N1101.13.1) Additional Energy Efficiency (Mandatory) This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying under Sections R401 through R404, one or more additional energy efficiency measure(s) shall be installed in accordance with Section R407.2 that cumulatively equal or exceed 10 (ten) Flex Points.
2. For buildings complying under the simulated performance alternative in Section R405, the building shall meet one of the following: (a) one or more additional energy efficiency measure(s) in Section R407.2 shall be installed that cumulatively equal or exceed ten Flex Points, without including such measures in the proposed design under Section R405; or (b) the proposed design of the building under section R405.2 shall have an annual energy cost that is less than or equal to 90% of the annual energy cost of the *standard reference design.*
3. For buildings that comply under the energy rating index alternative in Section R406, the energy rating index value shall be at least 10% less than the energy rating index target specified in Table R406.4.

SECTION R407 (IRC N1107)
FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY

R407.1 (IRC N1107.1) Scope. This section establishes flex point alternatives to achieve additional energy efficiency in accordance with Section R401.2.1.

R407.2 (IRC N1107.2) Flex points for additional energy efficiency Measures shall be selected from Table R407.2.1. Each measure chosen shall receive credit for the Flex Points as indicated in the Table for the specific Climate Zone. Interpolation of points between measures shall not be permitted.

TABLE R407.2 (IRC N1107.2)
FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Flex Point Value								
		CZ 1	CZ 2	CZ 3	CZ 4	CZ 4C [a]	CZ 5	CZ 6	CZ 7	CZ 8
1a	≥ 2.5% reduction in total UA [b]	1	1	2	2	2	2	3	4	4
1b	≥ 5% reduction in total UA [b]	3	3	3	3	3	4	5	5	5
1c	≥ 7.5% reduction in total UA [b]	5	5	5	5	5	6	7	8	8
2a	≥ 10% reduction in glazed vertical fenestration area-weighted average SHGC	2	1	-	-	-	-	-	-	-
2b	≥ 20% reduction in glazed vertical fenestration area-weighted average SHGC	4	1	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-
3a	≤ 3 ACH50 air leakage rate with ERV or HRV installed [c]	2	4	5	7	7	7	7	8	8
3b	≤ 2 ACH50 air leakage rate with ERV or HRV installed [c]	2	5	7	9	9	9	10	11	11
-	-	-	-	-	-	-	-	-	-	-
4a	≤ 2 CFM of total duct leakage per 100 square feet of conditioned floor area when tested in accordance with Section R403.3	1	1	1	1	-	1	1	1	1
4c	100% of ductless thermal distribution system or hydronic thermal distribution system located completely inside the *building thermal envelope* or 100% of duct thermal distribution system located in *conditioned space* [d]	8	8	9	11	8	12	15	17	17
5a	≥ 18 SEER and ≥ 14 EER cooling system efficiency [e]	9	7	3	2	-	-	-	-	-
5b	≥ 16 EER cooling system efficiency [e]	10	7	3	2	-	-	-	-	-
6a	≥ 96 AFUE heating system efficiency [f]	-	2	6	9	10	10	11	12	14
7a	≥ 10.5 HSPF heating system efficiency [f]	-	1	2	4	4	5	4	3	3
7b	≥ 3.5 COP heating system efficiency [f]	-	2	4	6	6	8	7	6	5
-	-	-	-	-	-	-	-	-	-	-
8a	≥ 0.8 EF for fossil fuel service water heating system	7	5	4	3	2	2	2	1	1
8b	≥ 1.15 EF for electric service water heating system	7	7	7	4	5	3	3	2	2
8c	≥ 0.4 Solar Fraction for service water heating system	8	9	9	7	9	6	5	4	3

a. Climate Zone 4C is Climate Zone Marine 4.

b. The Total UA shall be calculated in accordance with Section R402.1.5 Total UA alternative.

c. Minimum Heat Recovery Ventilator (HRV) and Energy Recovery Ventilator (ERV) requirements, measured at the lowest tested net supply airflow, shall be ≥ 75% Sensible Recovery Efficiency (SRE), ≤ 1.1 W/CFM Fan Energy and shall not use recirculation as a defrost strategy. In addition, the Energy Recovery Ventilator (ERV) shall be ≥ 50% Latent Recovery/Moisture Transfer (LRMT).

d. As defined by Section R403.3.7.

e. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2.1 and shall be sized to serve 100% of the cooling design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the cooling design load served by the system.

f. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2.1 and shall be sized to serve 100% of the heating design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the heating design load served by the system.

Reason: This proposal, submitted by the Northwest Energy Codes Group, provides an alternative to the Flex Point proposal submitted by the Energy Efficient Codes Coalition by requiring ten flex points for an efficency increase of ten (10) percent over the base prescriptive codes. The Northwest pioneered the use of the prescriptive residential options that are currently in place in Washington, and formally were used in Oregon, and found them to be an effective method of increasing efficiency for residential construction using the prescriptive approach. This option does not require performance energy modeling or HERS verification which will increase it usefulness. This type of points based option can also be easily implemented in the U.S. DOE REScheck software. This approach is also similar in structure to the Points Option code change proposal that has

been submitted by the Northwest Energy Codes Group to C407 in the commercial provisions of the 2018 IECC. This proposal will provide more consistency between the IECC and the Washington State Residential Energy Code which is based on the IECC.
The purpose of this code change proposal is to improve overall residential building efficiency (heating, cooling and water heating energy) by roughly 10% and to create a scalable, flexible means of improving residential building efficiency for future IECC updates. Instead of requiring efficiency improvements to specific building components, the new “Flex Points” approach in Section R407 provides a multitude of options for builders to achieve the efficiency requirements of the IECC. This approach is also scalable according to a jurisdiction’s needs – states or localities who need additional energy savings to meet energy or climate policy goals can adjust the number of required points accordingly. Package- or points-based approaches have been used for several years in Washington and Oregon.

This proposal is similar to the Flex Points proposal for the 2018 IECC in overall structure, but the points table has been simplified and updated based on feedback received in the previous Code Development Cycle. Like the previous version, this proposal also includes alternative compliance pathways for builders who select the simulated performance alternative or the Energy Rating Index, and will bring roughly equivalent improvements to all three compliance paths.

This Flex Points proposal is cost-effective, since it includes a number of options to achieve 10 points that are cost-effective.

The Flex Points proposal will provide three distinct benefits for jurisdictions adopting the 2021 IECC:

1. <u>This proposal meets a clear need for efficiency improvements in the model energy code now and in the future</u>.

Although the IECC has made small efficiency gains in the 2015 and 2018 editions, major gains have plateaued. Buildings still consume an estimated 42% of the nation’s energy, 54% of its natural gas, and 71% of its electricity. Governors, legislators, and mayors are increasingly turning to building energy codes to meet energy and climate goals, and those codes should continue to provide reasonable improvements going forward. The U.S. Conference of Mayors, in its fourth consecutive resolution on the subject, reiterated their “concerted support for putting future triennial IECC updates on a “glide path” of steady efficiency gains that will improve the efficiency performance of millions of U.S. residential, multi-family, and commercial buildings.” *See* 2018 U.S.C.M. Resolution 86 (June 11, 2018).

Several jurisdictions have already created or are in the process of creating package-based compliance paths or improved code provisions to meet their policy needs. The result is improved efficiency, but a lack of consistency in both format and requirements. Incorporating Flex Points into the 2021 IECC will not only provide a 10% boost in energy conservation but will also provide a realistic map for additional improvements going forward. And, by providing more uniform targets for the efficiency of building components, this proposal will contribute to economies of scale, potentially lowering prices for builders and ultimately consumers.

2. <u>This proposal will provide maximum flexibility for builders to achieve improved efficiency</u>.

Flex Points trusts that builders and design professionals will select the most cost-effective and sensible efficiency improvements for a given project. There are several alternatives for compliance in each climate zone, along with options to comply in a performance- or rating-based path. There are alternatives related to more insulation, more efficient windows, reduced air and duct leakage and improved equipment. We believe that this approach provides the right incentives for builders to make long-lasting improvements in residential buildings that are in the best interests of homeowners.

The point values have been calculated based on the present value of energy cost savings over the current code (including relevant federal equipment efficiency standards) and reflect the estimated useful life of each measure over an assumed 30-year life of the building. While a 30-year period is consistent with the typical life of a mortgage, it is a very conservative period given the likelihood that some measures will provide efficiency benefits for decades beyond the initial 30-year period.

The analysis behind the flex points is based on the methodology and assumptions included in the U.S. Department of Energy’s Methodology for Evaluating Cost-Effectiveness of Residential Energy Code Changes, including the economic equations to obtain the present value of energy costs within the calculation methodology. The energy consumption calculations take into consideration heating, cooling, and water heating energy, using DOE-2 energy simulation across 105 TMY3 weather locations and 12 building types to account for varying stories, foundations, and fuel types for each of the baseline and upgrade measures. The analysis compares the annual energy savings between a home with and without an efficiency measure over the useful life of the efficiency measure using useful life data from NAHB and other sources. Energy costs were calculated using the most recent national EIA projections for natural gas and electricity. Because the analysis uses readily-available and widely-accepted tools and methodologies, we expect that future additions or changes will be straightforward.

3. <u>This proposal will encourage efficiency improvements in building components that are currently difficult to regulate</u>.

Flex Points addresses two issues that have complicated model energy codes for many years. First, innovative building practices or emerging technologies can benefit from being listed in codes, but states (and national code developing organizations) are reluctant to require new technologies or practices before they are market-tested. As a result, there are high barriers to entry for new technologies, even when they could transform the marketplace and provide energy- or cost-saving benefits for homeowners. As an example, Heat Recovery Ventilators (HRVs) are cost-effective and reasonable for much of the country, but individual circumstances or climate conditions may favor another approach. Rather than require HRVs in every case, or most cases with exceptions, HRVs and Energy Recovery Ventilators are included as one of several options available to builders in every climate zone. Not only will Flex Points create an opportunity for good technology to be used in more buildings, but it will open the door for market forces to make these technologies more widely available (and presumably less expensive to consumers). As new technologies or practices become available, these advances can be quickly and easily added into the Flex Points table, fast-tracking technology that is good for consumers.

Second, much of the heating, cooling, and water heating equipment installed in residential buildings is subject to federal preemption under the National Appliance Energy Conservation Act. As has been debated at length in ICC Code Development hearings over the last 15 years, including equipment efficiencies in performance trade-offs tends to weaken the efficiency of the energy code, since federal minimum efficiencies for nearly every covered product is well below the efficiency levels of commonly installed products. When these efficiency levels are used in trade-off baselines, builders use the improved efficiency of common heating, cooling, and water heating products as a means of trading away efficiency of more permanent building components and features, even though the equipment would have been installed anyway. This “free ridership” may provide short-term cost savings for homebuilders, but it saddles homeowners with unexpected high energy costs over the entire useful life of the building. Moreover, this equipment often carries a much shorter useful life, which is not typically captured in code compliance simulations.

Flex Points creates a new incentive to improve the efficiency of covered products without resulting in efficiency rollbacks elsewhere in the code. Heating, cooling, and water heating improvements (among others) are included among the Flex Points options with points calculated according to climate-specific energy cost savings and the longevity of the equipment. As compared to the previous Flex Points proposal, the list of options has been simplified and refocused on the equipment most likely to provide meaningful energy savings. Each of these upgrades will build upon the current IECC efficiency, rather than trading it away.

In sum, we believe that this proposal will improve efficiency by roughly 10% while unlocking the competitive market for new technologies or building components that are difficult to regulate and will provide a useful new tool for policymakers across the country – all without rolling back the effectiveness or efficiency of the IECC.

Bibliography: *Uniting Cities to Accelerate Focus on the Economic and Climate Benefits of Boosting America’s Building Energy Efficiency*, 2019 U.S.C.M. Resolution 86 (June 11, 2018), *available at* https://www.usmayors.org/the-conference/resolutions/?category=c9211&meeting=86th%20Annual%20Meeting.

Cost Impact: The code change proposal will increase the cost of construction
The code change proposal will increase the cost of construction. Requiring additional efficiency measures, such as more insulation, more efficient windows, reduced air leakage and duct leakage, and/or more efficient equipment, to save 10% energy will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

RE207-19

Public Hearing Results

Committee Action: Disapproved

Committee Reason: Proponent requested disapproval as an opportunity to provide greater transparency of analysis and work with opponents to resolve issues (Vote: 11-0).

Assembly Action: None

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as ‘mandatory’ will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE207-19

Individual Consideration Agenda

Public Comment 1:

IECC®: R401.2.1 (IRC N1101.13.1) (New), TABLE R407.2 (IRC N1107.2) (New)

Proponents:
Eric Makela, representing Northwest Energy Codes Group (ericm@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

R401.2.1 (IRC N1101.13.1) Additional Energy Efficiency (Mandatory) This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1. For buildings complying under Sections R401 through R404, one or more additional energy efficiency measures shall be installed in accordance with Section R407.2 that cumulatively equal or exceed ~~10~~ 5 (~~ten~~ five) Flex Points.
2. For buildings complying under the simulated performance alternative in Section R405, the building shall meet one of the following:
   2.1. One or more additional energy efficiency measures in Section R407.2 shall be installed that cumulatively equal or exceed ~~ten~~ five Flex Points, without including such measures in the proposed design under Section R405; or

   2.2. The proposed design of the building under section R405.2 shall have an annual energy cost that is less than or equal to ~~90~~ 95 percent of the annual energy cost of the *standard reference design*.
3. For buildings that comply under the energy rating index alternative in Section R406, the energy rating index value shall be at least ~~10~~ 5 percent less than the energy rating index target specified in Table R406.4.

TABLE R407.2 (IRC N1107.2)
FLEX POINTS FOR ADDITIONAL ENERGY EFFICIENCY

Measure Number	Measure Description	Flex Point Value								
		CZ 1	CZ 2	CZ 3	CZ 4	CZ 4C [a]	CZ 5	CZ 6	CZ 7	CZ 8
1a	≥ 2.5% reduction in total UA [b]	1	1	2	2	2	2	3	4	4
1b	≥ 5% reduction in total UA [b]	3	3	3	3	3	4	5	5	5
1c	≥ 7.5% reduction in total UA [b]	5	5	5	5	5	6	7	8	8
2a	≥ 10% reduction in glazed vertical fenestration area-weighted average SHGC	2	1	-	-	-	-	-	-	-
2b	≥ 20% reduction in glazed vertical fenestration area-weighted average SHGC	4	1	-	-	-	-	-	-	-
3a	≤ 3 ACH50 air leakage rate with ERV or HRV installed [c]	2	4	5	7	7	7	7	8	8
3b	≤ 2 ACH50 air leakage rate with ERV or HRV installed [c]	2	5	7	9	9	9	10	11	11
4a	≤ 2 CFM of total duct leakage per 100 square feet of conditioned floor area when tested in accordance with Section R403.3	1	1	1	1	-	1	1	1	1
4c	100% of ductless thermal distribution system or hydronic thermal distribution system located completely inside the *building thermal envelope* or 100% of duct thermal distribution system located in *conditioned space* [d]	8	8	9	11	8	12	15	17	17
5a	≥ 18 SEER and ≥ 14 EER cooling system efficiency [e]	9	7	3	2	-	-	-	-	-
5b	≥ 16 EER cooling system efficiency [e]	10	7	3	2	-	-	-	-	-
6a	≥ 96 AFUE heating system efficiency [f]	-	2	6	9	10	10	11	12	14
7a	≥ 10.5 HSPF heating system efficiency [f]	-	1	2	4	4	5	4	3	3
7b	≥ 3.5 COP heating system efficiency [f]	-	2	4	6	6	8	7	6	5
8a	≥ 0.8 EF for fossil fuel service water heating system	7	5	4	3	2	2	2	1	1
8b	≥ 1.15 EF for electric service water heating system	7	7	7	4	5	3	3	2	2
8c	≥ 0.4 Solar Fraction for service water heating system	8	9	9	7	9	6	5	4	3
9a	≥ 1 kW of photovoltaic or wind power[g]	1	1	1	1	1	1	1	1	1

a. Climate Zone 4C is Climate Zone Marine 4.

b. The Total UA shall be calculated in accordance with Section R402.1.5 Total UA alternative.

c. Minimum Heat Recovery Ventilator (HRV) and Energy Recovery Ventilator (ERV) requirements, measured at the lowest tested net supply airflow, shall be ≥ 75% Sensible Recovery Efficiency (SRE), ≤ 1.1 W/CFM Fan Energy and shall not use recirculation as a defrost strategy. In addition, the Energy Recovery Ventilator (ERV) shall be ≥ 50% Latent Recovery/Moisture Transfer (LRMT).

d. As defined by Section R403.3.7.

e. For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2.1 and shall be sized to serve 100% of the cooling design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the cooling design load served by the system.

f. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in Table R407.2.1 and shall be sized to serve 100% of the heating design load. As an alternative, each system installed shall receive credit for the percentage of the Flex Points for the measure equal to the percentage of the heating design load served by the system.

g. For each 1 kW of electrical generation per housing unit provided by on-site wind or solar equipment a 1.0 Flexpoint shall be allowed, up to 2 Flexpoints. Generation/capacity shall be calculated as follows: For solar electric systems, the design shall be demonstrated to meet this requirement using the analysis approved by the code official. Documentation of solar access shall be included on the plans. For wind generation projects designs shall document annual power generation based on the following factors: The wind turbine power curve; average annual wind speed at the site; frequency distribution of the wind speed at the site and height of the tower.

Commenter's Reason: The purpose of this code change proposal is to improve overall residential building efficiency (heating, cooling and water heating energy) by roughly 5% and to create a scalable, flexible means of improving residential building efficiency for future IECC updates. Instead of requiring efficiency improvements to specific building components, the new “Flex Points” approach in Section R407 provides a multitude of options

for builders to achieve the efficiency requirements of the IECC.
This Public Comment modifies RE 207 by reducing the number of points required to meet the requirements from 10 to 5 and by adding the ability to take credit for installing onsite solar or wind energy. This Public Comment also brings RE207 in line with the C406 Points Options proposal and the Washington State Residential Energy Code.

Reduction in Points

RE 207 originally required the code user to select Flexpoints that was equivalent to a 10% increase in efficiency over the prescriptive requirements in the code. A parallel proposal was also submitted into the commercial provisions of the IECC (CE 218) that provides for a Points Option for the prescriptive requirement of the code. This proposal requires the code user to select 10 credits that represent a 2.5% increase in efficiency. This Public Comment would require a 5% increase in efficiency which is easily achieved through modest increases in efficiency by selecting features from several options. Reducing the point requirement to 5% also brings this in line with states like Washington.

Addition of Renewable for Renewables

The Public Comment allows up to two Flexpoints to be selected for the installation of onsite solar or wind generation. The Flexpoint table will require at least one kW of onsite generation to be installed if this option is selected. The point values were selected based on a Northwest Energy Efficiency Alliance analysis for the Oregon Energy Code and also language New Buildings Institute proposed for New York Stretch Code. The threshold of renewable installation of 1 kW is also consistent with the WA Residential Energy Code that requires 1.2 kW of installation and also the level proposed by New Buildings Institute for the New York Stretch Code. Adding a renewable credit is also consistent with the renewable allowance that has been in the C406 Options Packages that was incorporated into the IECC in 2012. Adding a renewable component to the Flexpoint table will increase the flexibility of the table and also allow builders who install renewable systems to take credit.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The code change proposal will increase the cost of construction. Requiring additional efficiency measures, such as more insulation, more efficient windows, reduced air leakage and duct leakage, and/or more efficient equipment, to save 5% energy will increase the cost of construction, but the resulting energy and cost savings will recoup the initial costs and will continue to benefit consumers over the useful life of the home.

Public Comment# 2036

RE208-19

IECC: R401.2 (IRC N1101.13), R407 (IRC N1107) (New), R407.1 (IRC N1107.1) (New), Table R407.1 (IRC N1107.1) (New), R407.2 (IRC N1107.2) (New)

Proposed Change as Submitted

Proponents: Amanda Hickman, The Hickman Group, representing The Leading Builders of America (LBA) (amanda@thehickmangroup.com)

2018 International Energy Conservation Code

Revise as follows:

R401.2 (IRC N1101.13) Compliance. Projects shall comply with one of the following:

1. Sections R401 through R404 and Section R407.
2. Section R405 , Section R407 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.

Add new text as follows:

R407 (IRC N1107)
ADDITIONAL ENERGY EFFICIENCY REQUIREMENTS

R407.1 (IRC N1107.1) Scope. This section establishes options for additional criteria to be met for one- and two-family dwellings and townhouses, as defined in Section 101.2 of the *International Residential Code* to demonstrate compliance with this code.

Exception: These requirements shall not apply to:

1. Homes complying under the Energy Rating Index (R406)
2. Alternations, renovations and repairs to an existing building
3. Additions with a conditioned floor area of less than 1,200 square feet.

R407.2 (IRC N1107.2) Requirements In order to comply with this code:

1. Building utilizing the prescriptive path to comply with this code shall also comply with sufficient energy efficiency options from Table R407.1 in order to achieve a minimum of 3 energy credits.
2. Building utilizing the performance path to comply with this code shall use an adjusted annual energy cost that is 97% of the annual energy cost of the *standard reference design* when calculating Performance-based compliance (R405.3).

Table R407.1 (IRC N1107.1)
ENERGY EFFICIENCY MEASURES

_	_	Climate Zone	1	2	3	4	5	6	7,8
CATEGORY	OPT	DESCRIPTION	CREDITS						
1	a	Attic Insulation R-38	0.5	-	-	-	-	-	-
1	b	Attic Insulation R-49	0.5	0.5	1	-	-	-	-
1	c	Attic Insulation R-60	1	1	1	0.5	0.5	0.5	0.5
1	d	Attic Insulation R-71	1	1	1.5	1	1	1	1
2	a	Wall Insulation (16 o.c.) R-15	0.5	0.5	-	-	-	-	-
2	b	Wall Insulation (16 o.c.) R-13+3	2	2.5	-	-	-	-	-
2	c	Wall Insulation (16 o.c.) R-20	2.5	3.5	-	-	-	-	-
2	d	Wall Insulation (16 o.c.) R-21	2.5	3.5	-	-	-	-	-
2	e	Wall Insulation (16 o.c.) R-13+5	2.5	3.5	-	-	-	-	-
2	f	Wall Insulation (16 o.c.) R-15+5	2.5	3.5	1	1	1	-	-
2	g	Wall Insulation (16 o.c.) R-23 BIB	3	3.5	-	-	-	-	-
2	h	Wall Insulation (16 o.c.) R-13+10	3	3.5	3	3	3	-	-
2	i	Wall Insulation (16 o.c.) R-20+5	3	3.5	3	2.5	3	-	-
2	j	Wall Insulation (16 o.c.) R-15+10	3	3.5	3.5	3	3.5	0.5	0.5
2	k	Wall Insulation (16 o.c.) R-20+10	3	3.5	3.5	3	4.5	1.5	1.5
2	l	Wall Insulation (24 o.c.) R-20	3	3.5	0.5	0.5	-	-	-
2	m	Wall Insulation (24 o.c.) R-21	3	3.5	0.5	0.5	1	-	-
2	n	Wall Insulation (24 o.c.) R-23 BIB	3	4	1.5	1	1	-	-
2	o	Wall Insulation (24 o.c.) R-20+5	3	4	3	3	3	0.5	0.5
2	p	Wall Insulation (24 o.c.) R-20+10	3	4	3	4.5	4.5	2	2
2	q	Wall Insulation (24 o.c.) R-30+10	3	4	3	4.5	4.5	3	3.5
3	a	Mass Wall R-6 c.i.	2	-	-	-	-	-	-
3	b	Mass Wall (16 o.c.) R-13	4.5	3	-	-	-	-	-
3	c	Mass Wall (16 o.c.) R-20	4.5	6	-	-	-	-	-
3	d	Mass Wall R-12 c.i.	6	5.5	-	-	-	-	-
4	a	Basement Wall R-5 ci	-	-	-	-	-	-	-
4	b	Basement Wall R-10 ci	-	-	3.5	-	-	-	-
4	c	Basement Wall R-13	-	-	4	0.5	-	-	-
4	d	Basement Wall R-15	-	-	5	2	-	-	-
4	e	Basement Wall R-19	-	-	5	2	-	0.5	0.5
4	f	Basement Wall R-20	-	-	5.5	2.5	0.5	0.5	0.5
4	g	Basement Wall R-21	-	-	5.5	2.5	0.5	1	1
4	h	Basement Wall R-23 BIB	-	-	5.5	3	1	1.5	1.5
4	i	Basement Wall R-30 ccSPF	-	-	6.5	4	2	2.5	2.5
5	a	Slab Edge R-10, 2 ft depth	0.5	1.5	2.5	-	-	-	-
5	b	Slab Edge R-10, 4 ft depth	0.5	2	3.5	1	1	-	-
5	c	Slab Edge R-15, 4 ft depth	1	2	0.5	1.5	1.5	0.5	0.5
6	a	Windows U-0.40, SHGC-0.25	0.5	-	-	-	-	-	-
6	b	Windows U-0.32, SHGC-0.25	1.5	1.5	-	-	-	-	-
6	c	Windows U-0.30, SHGC-0.25	(1.5)	2	0.5	-	-	-	-
6	d	Windows U-0.27, SHGC-0.25	-	-	1.5	-	-	-	-
6	e	Windows U-0.30, SHGC-0.40	-	-	-	0.5	-	-	-

		Climate Zone	1	2	3	4	5	6	7,8
CATEGORY	OPT	DESCRIPTION	CREDITS						
6	f	Windows U-0.27, SHGC-0.40	-	-	-	2	1.5	1.5	1.5
6	g	Windows U-0.23, SHGC-0.40	-	-	-	3.5	3	4	4
6	h	Windows U-0.18, SHGC-0.40	-	-	-	5.5	5	6.5	7
6	i	Windows U-0.12, SHGC-0.40	-	-	-	8	8	10	10.5
7	a	Tightness- 4 ACH50	0.5	0.5	-	-	-	-	-
7	b	Tightness- 3 ACH50	0.5	1.5	-	-	-	-	-
7	c	Tightness- 2 ACH50	-	-	1.5	2.5	3.5	3	4.5
7	d	Tightness- 1.5 ACH50	-	-	2	3.5	5	4.5	6.5
7	e	Tightness- 0.6 ACH50	-	-	3	5	6.5	6.5	9
8	a	Ducts in Attic: Reduced Leakage ≤2cfm/100@25[j]	2	2.5	2	1.5	2	2	2
8	b	Compact Layout: duct surface area ≤15% of conditioned floor area for supply ducts and ≤4% for return ducts	0.5	0.5	0.5	0.5	1	1	1
8	c	Compact Layout + Reduced Leakage	2.8	2.5	2.5	2.5	3	3	3
8	d	Deeply Buried Ducts, in accordance with 2018 IECC section R403.3.6.1	1	1.5	1.5	1.5	2	2.5	2.5
8	e	Compact Layout + Deeply Buried	1	1.5	2	2	2.5	3	3
8	f	Compact + Deeply Buried Ducts + Reduced Leakage	3.5	3.5	4	3.5	4.5	4.5	4.5
8	g	Ducts 100% Inside Conditioned Space	6.5	6.5	7.5	7.5	9	9	9
9	a	Radiant Barrier- Roof Deck[k]	0.5	0.5	-	-	-	-	-
10	a	Furnace or Boiler- 92 AFUE, PSC	-	1	3	4	4.5	5	6
10	b	Furnace or Boiler- 92 AFUE, ECM	-	1	3.5	4.5	5	5.5	7
10	c	Furnace or Boiler- 95 AFUE, ECM	0.5	1.5	4.5	5.5	6	7	8
10	d	Furnace or Boiler- 96 AFUE, ECM	0.5	1.5	5	5.5	6.5	7	8
10	e	Furnace or Boiler- 97 AFUE, ECM	0.5	1.5	5	6	7	7.5	9
11	a	Air Conditioner 14 SEER	-	-	-	-	0.5	0.5	-
11	b	Air Conditioner 15 SEER	2	2.5	0.5	0.5	1	0.5	
11	c	Air Conditioner 16 SEER	4	4	1.5	1	1	0.5	0.5
11	d	Air Conditioner 18 SEER	7	6.5	2.5	1.5	-	-	-
11	e	Air Conditioner 19 SEER	8	7.5	3	2	-	-	-
11	f	Air Conditioner 20 SEER	9.5	8.5	3.5	2.5	-	-	-
11	g	Air Conditioner 24 SEER	13	11.5	5	3	-	-	-
12	a	Heat Pump 15 SEER/8.5 HSPF	2	3	1.5	1.5	1	0.5	2
12	b	Heat Pump 16 SEER/9 HSPF	4	5	3.5	3	3	2	2
12	c	Heat Pump 18 SEER/10 HSPF	7.5	8.5	7	6.5	6	5	5
12	d	Heat Pump 20 SEER/10 HSPF	10	10.5	7.5	7	6.5	5	5
12	e	Heat Pump 24 SEER/10 HSPF	13.5	13.5	9	7.5	7	5.5	5.5
13	a	Energy Star Gas, 40 gal, med draw, 0.65 UEF/0.64 EF	0.5	0.5	0.5	0.5	0.5	0.5	0.5
13	b	Gas instantaneous, 0.81 UEF/EF	2	2	2	1.5	1	1	1
13	c	Energy Star Gas instantaneous, 0.87 UEF/EF	2	2	2	1.5	1.5	1.5	1.5
13	d	High Eff Gas instantaneous, 0.9 UEF/EF	2.5	2	2	2	1.5	1.5	1.5
13	e	Energy Star elec heat pump, 50 gal, 2.0 UEF/1.82 EF	4	5	6	5.5	5	5	4
13	f	High Eff elec heat pump, 50 gal, 3.1 UEF/3.2 EF	5.5	7	8.5	8	7	7	6

_	_	Climate Zone	1	2	3	4	5	6	7,8
CATEGORY	OPT	DESCRIPTION	CREDITS						
14	a	LED 95% interior, exterior, garage	2.5	2.5	2.5	2.5	2.5	2.5	2.5

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a. Only one item in each Category can be counted.

b. CZ4 includes Climate Zone 4 except Climate Zone 4 Marine.

c. CZ5 includes Climate Zone 5 and Climate Zone 4 Marine.

d. R-values are minimum averages.

e. U-factors and SHGC are maximum weighted averages (exception: SHGC permitted to be higher in climate zones 5-8).

f. Building tightness and duct tightness are maximum.

g. Effectiveness, AFUE, SEER, HSPF, EF are minimums.

h. Cells containing a dash (-), indicate zero credits because that measure is the baseline requirement or was not shown to improve energy savings.

i. For any measure where the installed efficiency value falls between two thresholds from the table, credit shall be taken for the highest threshold that the installed value meets or exceeds.

j. Measured leakage is outside conditioned space.

k. Radiant Barriers shall comply with with IBC Section 1509 and shall be installed over the entire roof deck over conditioned space.

Revise as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass, where the proposed wall is a mass wall; otherwise, wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.4.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Basement and crawl space walls	Type: same as proposed.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.4, with the insulation layer on the interior side of the walls.	As proposed
Above-grade floors	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.4.	As proposed
Ceilings	Type: wood frame.	As proposed
	Gross area: same as proposed.	As proposed
	U-factor: as specified in Table R402.1.4.	As proposed
Roofs	Type: composition shingle on wood sheathing.	As proposed
	Gross area: same as proposed.	As proposed
	Solar absorptance = 0.75.	As proposed
	Emittance = 0.90.	As proposed
Attics	Type: vented with an aperture of 1 ft^2 per 300 ft^2 of ceiling area.	As proposed
Foundations	Type: same as proposed.	As proposed
	Foundation wall area above and below grade and soil characteristics: same as proposed.	As proposed
Opaque doors	Area: 40 ft^2 .	As proposed
	Orientation: North.	As proposed
	U-factor: same as fenestration as specified Table R402.1.4.	As proposed
Vertical fenestration other than opaque doors	Total area[h] = (a)The proposed glazing area, where the proposed glazing area is less than 15 percent of the conditioned floor area (b)15 percent of the conditioned floor area, where the proposed glazing area is 15 percent or more of the conditioned floor area.	As proposed
	Orientation: equally distributed to four cardinal compass orientations (N, E, S & W).	As proposed
	U-factor: as specified in Table R402.1.4.	As proposed
	SHGC: as specified in Table R402.1.2 except for climate zones without an SHGC requirement, the SHGC shall be equal to 0.40.	As proposed
	Interior shade fraction: 0.92-(0.21 × SHGC for the standard reference design).	Interior shade fraction: 0.92-(0.21 × SHGC as proposed)
	External shading: none.	As proposed
Skylights	None.	As proposed
Thermally isolated sunrooms	None.	As proposed
	The air leakage rate at a pressure of 0.2 inch w.g. (50 Pa) shall be Climate Zones 1 and 2: 5 air changes per hour. Climate Zones 3 through	The measured air exchange rate.[a] The mechanical ventilation rate[b] shall be in addition to

Air exchange rate	Climate Zones 1 and 2: 5 air changes per hour. Climate Zones 3 through 8: 3 air changes per hour. The mechanical ventilation rate shall be in addition to the air leakagerate and shall be the same as in the proposed design, but not greater than0.01 × CFA + 7.5 × (N_{br} + 1) where: CFA = conditioned floor area, ft^2. N_{br} = number of bedrooms. Energy recovery shall not be assumed for mechanical ventilation.	The mechanical ventilation rate[b] shall be in addition to the air leakage rate and shall be as proposed.
Mechanical ventilation	Where mechanical ventilation is not specified in the proposed design: NoneWhere mechanical ventilation is specified in the proposed design, the annual vent fan energy use, in units of kWh/yr, shall equal: $(1/e_f) \times [0.0876 \times CFA + 65.7 \times (N_{br} + 1)]$ where: e_f = the minimum exhaust fan efficacy, as specified in Table R403.6.1, corresponding to a flow rate of 0.01 × CFA + 7.5 × (N_{br}+1) CFA = conditioned floor area, ft^2. N_{br} = number of bedrooms.	As proposed
Internal gains	IGain, in units of Btu/day per dwelling unit, shall equal: 17,900 + 23.8 × CFA + 4,104 × N_{br} where: CFA = conditioned floor area, ft^2. N_{br} = number of bedrooms.	Same as standard reference design.
Internal mass	Internal mass for furniture and contents: 8 pounds per square foot of floor area.	Same as standard reference design, plus any additional mass specifically designed as a thermal storage element[c] but not integral to the building envelope or structure.
Structural mass	For masonry floor slabs: 80 percent of floor area covered by R-2 carpet and pad, and 20 percent of floor directly exposed to room air.	As proposed
	For masonry basement walls: as proposed, but with insulation as specified in Table R402.1.4, located on the interior side of the walls.	As proposed
	For other walls, ceilings, floors, and interior walls: wood frame construction.	As proposed
Heating systems[d, e]	~~For other than electric heating without a heat pump: as proposed. Where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the IECC—Commercial Provisions.~~ ~~Capacity: sized in accordance with Section R403.7.~~ Fuel Type/Capacity: Same as proposed design. Efficiencies: Electric: air source heat pump complying with prevailing federal minimum standards. Nonelectric furnaces: natrual gas furnace complying with prevailing federal minimum standards Nonelectric boilers: natrual gas boiler complying with prevailing federal minimum efficiencies	~~As proposed~~ As proposed As proposed As proposed As proposed

Cooling systems[d, f]	~~As proposed. Capacity: sized in accordance with Section R403.7.~~ Fuel Type/Capacity: Same as proposed design Efficiency: complying with federal minimum standards	~~As proposed~~ As proposed As proposed
Service water heating[d, e, f, g]	~~As proposed. Use: same as proposed design.~~ Fuel type: Same as proposed design Efficiency: complying with prevailing federal minimum standards Use: gal/day = 30 + 10 x Nbr Tank temperature: 120°F	~~As proposed~~ ~~Use, in units of gal/day = 30 + (10 × N_{br})~~ ~~where:~~ ~~N_{br} = number of bedrooms.~~ As proposed As proposed Same as standard reference Same as standard reference
Thermal distribution systems	Duct insulation: in accordance with Section R403.3.1. A thermal distribution system efficiency (DSE) of 0.88 shall be applied to both the heating and cooling system efficiencies for all systems other than tested duct systems. Exception: For nonducted heating and cooling systems that do not have a fan, the standard reference design thermal distribution system efficiency (DSE) shall be 1. For tested duct systems, the leakage rate shall be 4 cfm (113.3 L/min) per 100 ft^2 (9.29 m^2) of conditioned floor area at a pressure of differential of 0.1 inch w.g. (25 Pa).	Duct insulation: as proposed. As tested or, where not tested, as specified in Table R405.5.2(2)
Thermostat	Type: Manual, cooling temperature setpoint = 75°F; heating temperature setpoint = 72°F.	Same as standard reference design.

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

a. Where required by the *code official,* testing shall be conducted by an *approved* party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals,* or the equivalent, shall be used to determine the energy loads resulting from infiltration.
b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals,* page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE *Handbook of Fundamentals,* page 26.19 for intermittent mechanical ventilation.
c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.
d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.
e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.
f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.
g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.
h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing area:

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

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

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

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

and where:

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

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

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

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

L and *CFA* are in the same units.

Reason: This proposal introduces a new sectionwithin the code that will require additional efficiency measures (options) for residential buildings. When taking the prescriptive approach, options from the table with assigned credit values must be selected in order to achieve 3 credits. For the performance approach, the same number of percentage number will reduce the annual energy cost for the standard reference design. The ERI path has not been included in this proposal as it is currently the most stringent path in the code.
The energy efficiency measures listed in Table 407.1 were analyzed using Ekotrope Rater modeling software (v3.1.0) to estimate energy savings relative to a 2018 IECC prescriptive reference house baseline. The energy modeling was performed by Home Innovation Research Labs. For all building characteristics not defined in the IECC, the "Methodology for Calculating Energy Use in Residential Buildings" was followed. This Methodology was developed in 2012 by Home Innovation Research Labs (formerly NAHB Research Center) to provide guidance, uniformity, and practical construction and equipment choices for researchers comparing the energy performance differences resulting from potential code changes.

A two-story single-family house (2,352 square feet above grade) was analyzed in 9 different locations across climate zones 1 through 7. For each location, multiple house configurations were analyzed to capture the effects of regionally-typical foundations and wall construction types. An all-electric house and a house with gas space heating and gas water heating were analyzed, resulting in 48 baseline designs for each of these configurations. Climate-appropriate energy conservation measures (ECMs) were analyzed individually for each unique house configuration for each location, resulting in more than 2,200 discrete designs covering all major aspects of building envelope construction, air tightness, equipment efficiencies and lighting and appliances. The credits in Table 407.1 were assigned as the weighted averages of the estimated whole-building energy savings (%) for each house configuration for the location. The weighting was based on regional market data. The credits are the result of weighted average whole-building energy savings rounded down to a 0.5% increment; except where the total energy savings ranged between 0.4% and 0.5%, the values were rounded up to 0.5%.

In addition to individual measures, select packages of measures were also simulated for analysis across several climate zones. The comparison of additive energy savings from individual measures and the modeled net savings from packages of the same measures indicated that at the proposed 3% incremental levels of improvement, a simple addition of energy savings from individual measures is an adequate representation of their combined efficiency.

The energy performance target of 3% (or 3 credits) represents an incremental level of improvement that can be achieved through one or more compliance options (individual measures or a combination of measures) that meet the cost effectiveness metrics of simple payback of 10-15 years depending on the type of the measure.

The required credits and the paths to achieve these efficiency gains have been determined using current cost data provided by homebuilders from across the U.S. to have at a minimum a 10-year simple payback and to be cost effective when using the life cycle analysis method.

Cost Impact: The code change proposal will increase the cost of construction
This proposal will increase the cost of construction. However, it has been determined, using current homebuilder cost data, that this proposal provides paths with at least a 10-year (or better) simple payback. This proposal has also been determined to be cost effective using the life cycle analysis method.

RE208-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: This is not a mechanism to move forward, it is missing renewables, and cost justification is imperative, there are additional questions on values and equipment tradeoffs (Vote: 7-4).

Assembly Action: **None**

RE208-19

Individual Consideration Agenda

Public Comment 1:

IECC®: Table R407.1 (IRC N1107.1) (New), TABLE R405.5.2(1) [IRC N1105.5.2(1)], R407.1 (IRC N1107.1) (New)

Proponents:
Amanda Hickman, representing The Leading Builders of America (LBA) (amanda@thehickmangroup.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

Table R407.1 (IRC N1107.1)
ENERGY EFFICIENCY MEASURES

Portions of table not shown remain unchanged.

		Climate Zone	**1**	**2**	**3**	**4**	**5**	**6**	**7,8**
CATEGORY	**OPT**	**DESCRIPTION**	**CREDITS**						
2	g	Wall Insulation (16 o.c.) R-23 ~~BIB~~	3	3.5	-	-	-	-	-
2	n	Wall Insulation (24 o.c.) R-23 ~~BIB~~	3	4	1.5	1	1	-	-
4	e	Basement Wall R-19	-	-	5	2	-	~~0.5~~ -	0.5
4	h	Basement Wall R-23 ~~BIB~~	-	-	5.5	3	1	1.5	1.5
4	i	Basement Wall R-30 ~~ccSPF~~	-	-	6.5	4	2	2.5	2.5
~~10~~	~~a~~	~~Furnace or Boiler- 92 AFUE, PSC~~	~~-~~	~~1~~	~~3~~	~~4~~	~~4.5~~	~~5~~	~~6~~
10	b	Furnace or Boiler- 92 AFUE~~, ECM~~	-	1	3.5	4.5	5	5.5	7
10	c	Furnace or Boiler- 95 AFUE~~, ECM~~	0.5	1.5	4.5	5.5	6	7	8
10	d	Furnace or Boiler- 96 AFUE~~, ECM~~	0.5	1.5	5	5.5	6.5	7	8
10	e	Furnace or Boiler- 97 AFUE~~, ECM~~	0.5	1.5	5	6	7	7.5	9
13	a	~~Energy Star~~ Gas, 40 gal, med draw, 0.65 UEF/0.64 EF	0.5	0.5	0.5	0.5	0.5	0.5	0.5
13	c	~~Energy Star~~ Gas instantaneous, 0.87 UEF/EF	2	2	2	1.5	1.5	1.5	1.5
13	e	~~Energy Star~~ elec heat pump, 50 gal, 2.0 UEF/1.82 EF	4	5	6	5.5	5	5	4

a. Only one item in each Category can be counted.

b. CZ4 includes Climate Zone 4 except Climate Zone 4 Marine.

c. CZ5 includes Climate Zone 5 and Climate Zone 4 Marine.

d. R-values are minimum averages.

e. U-factors and SHGC are maximum weighted averages (exception: SHGC permitted to be higher in climate zones 5-8).

f. Building tightness and duct tightness are maximum.

g. Effectiveness, AFUE, SEER, HSPF, EF are minimums.

h. Cells containing a dash (-), indicate zero credits because that measure is the baseline requirement or was not shown to improve energy savings.

i. For any measure where the installed efficiency value falls between two thresholds from the table, credit shall be taken for the highest threshold that the installed value meets or exceeds.

j. Measured leakage is outside conditioned space.

k. Radiant Barriers shall comply with with IBC Section 1509 and shall be installed over the entire roof deck over conditioned space.

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

Portions of table not shown remain unchanged.

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems[d, e]	For other than electric heating without a heat pump: as proposed. Where the proposed design utilizes electric heating without a heat pump, the standard reference design shall be an air source heat pump meeting the requirements of Section C403 of the IECC - Commercial Provisions. Capacity: sized in accordance with Section R403.7. ~~Fuel Type/Capacity: Same as proposed design.~~ ~~Efficiencies:~~ ~~Electric: air source heat pump complying with prevailing federal minimum standards.~~ ~~Nonelectric furnaces: natrual gas furnace complying with prevailing federal minimum standards~~ ~~Nonelectric boilers: natrual gas boiler complying with prevailing federal minimum efficiencies~~	As proposed ~~As proposed~~ ~~As proposed~~ ~~As proposed~~ ~~As proposed~~
Cooling systems[d, f]	As proposed. Capacity: sized in accordance with Section R403.7. ~~Fuel Type/Capacity: Same as proposed design~~ ~~Efficiency: complying with federal minimum standards~~	As proposed ~~As proposed~~ ~~As proposed~~
Service water heating[d, e, f, g]	As proposed. Use: same as proposed design. ~~Fuel type: Same as proposed design~~ ~~Efficiency: complying with prevailing federal minimum standards~~ ~~Use: gal/day = 30 + 10 x Nbr~~ ~~Tank temperature: 120°F~~	As proposed Use, in units of gal/day = 30 + (10 N_{br}) where: N_{br}=number of bedrooms ~~As proposed~~ ~~As proposed~~ ~~Same as standard reference~~ ~~Same as standard reference~~

For SI: 1 square foot = 0.93 m^2, 1 British thermal unit = 1055 J, 1 pound per square foot = 4.88 kg/m^2, 1 gallon (US) = 3.785 L,

°C = (°F-32)/1.8, 1 degree = 0.79 rad.

a. Where required by the *code official,* testing shall be conducted by an *approved* party. Hourly calculations as specified in the ASHRAE *Handbook of Fundamentals,* or the equivalent, shall be used to determine the energy loads resulting from infiltration.

b. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE *Handbook of Fundamentals,* page 26.24 and the “Whole-house Ventilation” provisions of 2001 ASHRAE *Handbook of Fundamentals,* page 26.19 for intermittent mechanical ventilation.

c. Thermal storage element shall mean a component that is not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element shall be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or shall be connected to such a room with pipes or ducts that allow the element to be actively charged.

d. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

e. For a proposed design without a proposed heating system, a heating system having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design.

f. For a proposed design home without a proposed cooling system, an electric air conditioner having the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

g. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater having the prevailing federal minimum energy factor for the same fuel as the predominant heating fuel type shall be assumed. For a proposed design without a proposed water heater, a 40-gallon storage-type water heater having the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.

h. For residences with conditioned basements, R-2 and R-4 residences, and for townhouses, the following formula shall be used to determine glazing area:

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

where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

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

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

and where:

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

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

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

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

L and *CFA* are in the same units.

R407.1 (IRC N1107.1) Scope. This section establishes options for additional criteria to be met for one- and two-family dwellings and townhouses, as defined in Section 101.2 of the *International Residential Code* to demonstrate compliance with this code.

Exception: These requirements shall not apply to:

1. ~~Homes~~ Townhouses and one and two family dwellings complying under the Energy Rating Index (R406)
2. Alternations, renovations and repairs to an existing building
3. Additions with a conditioned floor area of less than 1,200 square feet.

Commenter's Reason: This public comment addresses concerns with the original proposal from both the committee and other stakeholders. The main area of opposition was with equipment efficiency trade-offs in the performance path, Table 405.5.2 (1). For this reason, we have reverted the language back to the current language, thereby removing the ability to trade off equipment efficiencies in the performance path. Additionally, this public comment removes product-specific descriptions, updates to correct terminology in the charging paragraph, and updates credits appropriately within Table 407.1 - Energy Efficiency Measures.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction

This public comment is mainly editorial in nature. The proposal will increase the cost of construction. However, it has been determined, using current homebuilder cost data, that this proposal provides paths with at least a 10-year (or better) simple payback. This proposal has also been determined to be cost effective using the life cycle analysis method.

Public Comment# 1244

Public Comment 2:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: RE208 would be a huge efficiency rollback and should be disapproved as recommended by the IECC-Residential Committee. RE208 combines an HVAC/hot water simulated performance path equipment trade-off with a proposal to add a new section requiring additional efficiency options. These two antithetical aspects of the proposal generate conflicting results, but the net impact would be a significant reduction in energy efficiency. While we would like to see additional energy efficiency requirements, we agree with the Committee that “This is not a mechanism to move forward … ” because the proposal pairs what, at best, may be considered a small step forward (additional efficiency options) with a huge step backward (equipment trade-offs) in energy efficiency. We support the Committee’s recommendations to reject all of the proposals that incorporate equipment trade-offs into the performance path baseline, including RE208 (see also our public comments on RE175, RE176, and RE179). As for a vehicle for establishing additional efficiency requirements, other proposals, such as RE206 or RE209, do a much better job and do not contain the disastrous equipment trade-off rollbacks.
RE208 is one of several proposals to add new trade-offs in the simulated performance compliance path for various measures such as appliances, renewables, lighting, heating/cooling equipment, and hot water equipment (see also RE152, RE156, RE175, RE176 and RE179). These proposals are collectively some of the biggest threats to energy efficiency proposed in this code cycle. These trade-offs do not even purport to increase efficiency, but instead would all result in less efficient buildings over the long-term that cost consumers more, use more energy and provide less comfort and sustainability. They would promote replacing long-lasting building efficiency measures, such as adequate insulation, efficient fenestration and reduced air and duct leakage, with measures that have much shorter useful lives, carry substantial free ridership and lack permanence.

We fundamentally oppose simply creating more trade-offs that not only do not advance energy efficiency, but actually take a major step backward. We strongly support the Committee’s consistent recommendations to disapprove all of these proposals. It is important to note that similar proposals have been consistently disapproved by ICC Governmental Member Voting Representatives in the past three code cycles.

While by far the biggest problem with this proposal is reintroduction of equipment trade-offs, this proposal also suffers from other significant issues. The proposal attempts to establish additional energy efficiency requirements under the IECC (an idea/concept we support) but is hamstrung by practical problems. The proposal looks like a variation on the Flex Points proposals offered by EECC in previous code cycles and in RE206 in this code cycle but is both problematic and far less efficient and reasonable. First, it offers less efficiency improvement (3%, according to proponents, as compared to 5% in RE206 and 10% in RE207). Second, it fails to incorporate or even consider the lifetime (durability) of the measure. Third, it contains far too many limited measures, some of which may already be included in the IECC’s prescriptive path after this cycle. Fourth, the proposal fails to adopt a consistent improvement to the ERI. EECC has submitted proposals (RE206 and RE209) that are far more efficient and do not include equipment trade-offs.

Despite the effort to outline additional efficiency measures, it seems like the primary purpose of RE209 is to reinstitute heating, cooling and hot water equipment trade-offs in the simulated performance code compliance path. These trade-offs were correctly eliminated in the 2009 version of the code and have been consistently rejected in every code cycle since then. Some of the specific issues and problems with equipment trade-offs are outlined in summary fashion below (a more detailed treatment can be found in our public comment on RE175):

- **Equipment trade-offs drastically reduce energy efficiency.** ICF International, a nationally recognized energy consulting firm, conducted a detailed analysis of the negative impacts of a similar proposal to reinstate equipment tradeoffs during the 2015 code cycle (September 2013). Specifically, the study found that introducing equipment trade-offs into the performance path would have a huge negative impact on energy efficiency – a combined national average estimated impact of between 11% and 22% reduction in efficiency depending on the climate zones and trade-offs employed. For example, installing a 90 AFUE gas furnace would reduce energy efficiency under the code by 6% to 9% depending on the climate zone (note that furnaces considerably more efficient than this are commonly installed, which would create larger trade-off credit). Similarly, installing an instantaneous (tankless) water heater alone would yield 9% trade-off "credit," which means the rest of the home could be built 9% less efficient, on average, just for installing a better water heater. Massive trade-offs (efficiency reductions) of other important energy efficiency measures (insulation, windows, air and duct leakage) would be permitted if this approach were reinstated.

- **Equipment trade-offs are not "energy neutral" as claimed by proponents.** In fact, as noted in the ICF study, equipment trade-offs result in huge losses in energy efficiency – up to a reduction of 20% or more – essentially wiping out much of the progress made in advancing energy efficiency in the IECC over the last couple of decades:
  - **Federal preemption** – Equipment trade-offs are fundamentally a problem because unlike other parts of a building (such as building envelope components) that can be directly regulated by state and local governments (and the IECC), federal law prohibits states and cities from setting reasonable energy efficiency requirements for this equipment. Only the federal government has authority to set the minimum efficiency requirements for heating, cooling, and water heating equipment, and these federal standards are often outdated and lag far behind the efficiency of commonly-installed equipment.
  - **Free ridership** – Because federal minimum efficiency requirements are so far behind commonly-installed equipment, using these values as a trade-off baseline as proposed in RE208 would create an artificial trade-off "gap", permitting builders to trade away the efficiency of the building thermal envelope for more efficient equipment that they would have installed anyway. This is a "free ridership" cost reduction for the builder, but it results in much higher energy costs being imposed on the homeowner. State-level field studies have consistently shown that equipment installed in new homes is typically far more efficient than the federal minimum efficiencies (due to market forces) without any code trade-off or requirement. For example, studies in NY and PA found the market penetration of 90 AFUE or better gas furnaces (roughly 10% more efficient than the federal minimum) was above 90%. Allowing trade-off credit for above-minimum efficiency equipment in these situations would simply be a give-away to builders and a major blow to homeowners, as well as to sustainability and the environment.

- **Equipment trade-offs trade away long-term energy efficiency for short-term builder cost reduction.** Equipment trade-offs encourage builders to trade away the long-term benefits (to homeowners) of features such as an efficient thermal envelope, in favor of short-term cost cutting in the form of more efficient equipment, which will be replaced several times over the lifetime of the home. For example, if a trade-off is permitted for water heater efficiency, an instantaneous natural gas water heater would allow the builder to reduce the efficiency of the rest of the home by an average of 9%. The remaining home will be 9% less efficient for its entire useful lifetime. As the water heater is replaced every 10-15 years, the envelope of that home will continue to underperform by 9%. By contrast, under the current code, no trade-off credit is awarded for the instantaneous water heater, which means the rest of the home will be built to meet the code. As the water heater is swapped out in future years, the current code home will outperform the trade-off home by 9%.

- **It is unnecessary to address efficient equipment in the performance path; the issues are already much better addressed in the ERI compliance path.** This is because the ERI Index target is set at a level low enough to recapture most of the free-ridership losses (in addition to reasonable thermal envelope backstops). The simulated performance path does not have the built-in protections of the ERI path.

- **Equipment trade-offs have been eliminated in the vast majority of states consistent with state and federal law and policy**. Most states have adopted the IECC and completely eliminated equipment trade-offs, turning the page on this efficiency loophole with no negative impact. Introducing these trade-offs also raises several complicated issues for states in the areas of ARRA compliance and federally-insured mortgages.

Most states have been enforcing building energy codes with no equipment trade-offs for a number of years now, and with great success. There is no evidence that eliminating trade-offs has affected installation of high-efficiency furnaces, air conditioners, or water heaters. In fact, the market penetration of efficient equipment continues to grow. Reinstating these trade-offs, *after more than a decade without them,* would move energy efficiency for the rest of the home sharply backward for no good reason, and would create a host of new problems.

Bibliography: https://www.nyserda.ny.gov/-/media/Files/Publications/building-stock-potential-studies/residential-baseline-study/Vol-3-HVACRes-Baseline.pdf
https://www.energycodes.gov/compliance/energy-code-field-studies

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1510

RE209-19

IECC®: R401.2, R401.2.1 (New), SECTION R407 (New), R407.1 (New), R407.2 (New), R407.2.1 (New), R407.2.2 (New), R407.2.3 (New), R407.2.4 (New), R407.2.5 (New)

Proposed Change as Submitted

Proponents: Daniel Bresette, Alliance to Save Energy, representing Alliance to Save Energy (dbresette@ase.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

2018 International Energy Conservation Code

Revise as follows:

R401.2 Compliance. Projects shall comply with Section R401.2.1 and one of the following:

1. Sections R401 through R404.
2. Section R405 and the provisions of Sections R401 through R404 indicated as "Mandatory."
3. The energy rating index (ERI) approach in Section R406.

Add new text as follows:

R401.2.1 Additional Energy Efficiency (Mandatory). This section establishes additional requirements applicable to all compliance approaches to achieve additional energy efficiency.

1.For buildings complying under Sections R401 through R404, one of the Additional Efficiency Package Options shall be installed according to Section R407.2.
2.For buildings complying under the simulated performance alternative in Section R405, the building shall meet one of the following::
2.1.One of the Additional Efficiency Package Options in Section R407.2 shall be installed without including such measures in the proposed design under Section R405; or
2.2.The proposed design of the building under Section R405.3 shall have an annual energy cost that is less than or equal to 95 percent of the annual energy cost of the *standard reference design*.
3.For buildings complying under the energy rating index alternative in Section R406, the energy rating index value shall be at least 5 percent less than the energy rating index target specified in Table R406.4.

The option selected for compliance shall be identified in the Certificate required by Section R401.3.

SECTION R407
ADDITIONAL EFFICIENCY PACKAGE OPTIONS

R407.1 Scope. This section establishes Additional Efficiency Package Options to achieve additional energy efficiency in accordance with Section R401.2.1.

R407.2 Additional Efficiency Package Options. Additional efficiency package options for compliance with Section R401.2.1 are set forth in Sections R407.2.1 through R407.2.5.

R407.2.1 Enhanced envelope performance option. The total building thermal envelope UA, the sum of U-factor times assembly area, shall be less than or equal to 95 percent of the total UA resulting from multiplying the U-factors in Table R402.1.4 by the same assembly area as in the proposed building. The UA calculation shall be performed in accordance with Section R402.1.5. The area-weighted average SHGC of all glazed fenestration shall be less than or equal to 95 percent of the maximum glazed fenestration SHGC in Table R402.1.2.

R407.2.2 More efficient HVAC equipment performance option. Heating and cooling equipment shall meet or exceed one of the following efficiencies:

1. Greater than or equal to 95 AFUE natural gas furnace and 16 SEER air conditioner.
2. Greater than or equal to 10 HSPF / 16 SEER air source heat pump.
3. greater than or equal to 3.5 COP ground source heat pump.

For multiple cooling systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the cooling design load. For multiple heating systems, all systems shall meet or exceed the minimum efficiency requirements in this section and shall be sized to serve 100 percent of the heating design load.

R407.2.3 Reduced energy use in service water heating option. The hot water system shall meet or exceed one of the following efficiencies:

1. Greater than or equal to 82 EF fossil fuel service water heating system.
2. Greater than or equal to 2.0 EF electric service water heating system.
3. Greater than or equal to 0.4 Solar Fraction solar water heating system.

R407.2.4 More efficient duct thermal distribution system option. The thermal distribution system shall meet or exceed one of the following efficiencies:

1. 100 percent of ducts and air handlers located entirely within the *building thermal envelope.*
2. 100 percent of ductless thermal distribution system or hydronic thermal distribution system located completely inside the *building thermal envelope.*
3. 100 percent of duct thermal distribution system located in *conditioned space* as defined by Section R403.3.7.

R407.2.5 Improved air sealing and efficient ventilation system option. The measured air leakage rate shall be less than or equal to 3.0 ACH50, with either an Energy Recovery Ventilator (ERV) or Heat Recovery Ventilator (HRV) installed. Minimum HRV and ERV requirements, measured at the lowest tested net supply airflow, shall be greater than or equal to 75 percent Sensible Recovery Efficiency (SRE), less than or equal to 1.1 W/CFM Fan Energy and shall not use recirculation as a defrost strategy. In addition, the ERV shall be greater than or equal to 50 percent Latent Recovery/Moisture Transfer (LRMT).

Reason: The purpose of this code change proposal is to improve the energy efficiency of residential buildings by roughly 5% or more, and to provide code users with flexibility to select the measures that make the most sense for each project. This proposal largely mirrors the format of Section C406 Additional Efficiency Package Options—an approach to improving commercial buildings that has been included in the commercial energy code since the 2012 IECC. Like Section C406, new Section R407 offers multiple straightforward improvements that will increase energy savings and reduce costs to the homeowner over the useful life of the building. In addition, Section R401.2.1 provides two additional means of demonstrating compliance: 1) code users may achieve a 5% improvement in the performance path; or 2) code users may comply by applying a 5% improvement in ERI Target score. The range of options will provide multiple paths for projects to achieve the intended improvement in the code. The technologies included in the packages of improvements are currently available in the relevant markets and the improved building practices have been proven feasible in residential buildings. However, many of these measures would be difficult to include in the current code format because of federal preemption of covered products, inapplicability to certain home designs, or other limitations. This proposal follows the lead of states like Oregon and Washington that have successfully created a list of options available to builders to meet the residential code improvements. This approach increases flexibility for code users while advancing the code's efficiency baseline.

Although the historic energy efficiency gains in the 2009 and 2012 IECC have been largely maintained in the 2015 and 2018 IECC, there is a clear need for more substantial improvements in the 2021 IECC. It is well understood that buildings have an outsized impact on the nation's energy demands. Buildings consume 42% of the nation's energy, including 54% of the nation's natural gas and 71% of its electricity. The nation's policymakers are increasingly turning to building energy codes as a means of addressing energy and climate goals. Several states have adopted improvements beyond the 2018 IECC, and the U.S. Conference of Mayors recently called for "putting future triennial IECC updates on a 'glide path' of steady efficiency gains that will improve the efficiency performance of millions of U.S. residential, multi-family, and commercial buildings." *See* 2018 U.S.C.M. Resolution 86 (June 11, 2018). While a much larger improvement in overall efficiency is warranted, a roughly 5% improvement through the adoption of this proposal would be a step in the right direction.

This proposal provides policymakers with additional options for improving the code going forward. A jurisdiction could increase the number of required options (and make a corresponding increase in the performance path and ERI required improvement). And as additional technologies and building methods become available, more options may be added to the initial list of improvements. (For example, Section C406 was expanded from 5 to 8 options in the 2018 IECC.) In sum, this proposal will allow the IECC to build upon recent improvements and create a new model for improving and adding flexibility to residential building energy codes going forward.

Bibliography: *Uniting Cities to Accelerate Focus on the Economic and Climate Benefits of Boosting America's Building Energy Efficiency*, 2019 U.S.C.M. Resolution 86 (June 11, 2018), *available at* https://www.usmayors.org/the-conference/resolutions/?category=c9211&meeting=86th%20Annual%20Meeting.

Cost Impact: The code change proposal will increase the cost of construction
For each climate zone, there are cost-effective options available that will generate energy savings and be cost effective over the useful life of the building. Although the savings will vary based on the option selected and design choices made in the building, there are multiple sensible options for achieving improved efficiency in each climate zone. On a broader scale, these improvements will help curb the nation's increasing demands for energy and contribute to a more secure energy future.

RE209-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Greatest concern is for methodology - lack of understanding and flexibility and lack of solar, it negatively impacts use of ERI (Vote: 6-5).

Assembly Action: **None**

Staff Analysis: If CE42-19 Part II is successful, sections being individually approved to be labeled as 'mandatory' will instead have their respective section numbers added to the new non-tradeable requirement tables.

RE209-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Submitted

Commenter's Reason: This proposal should be approved as submitted because it is the simplest, most straightforward proposal in this code change cycle for improving the efficiency of all homes built to the residential energy code by a significant amount. The user simply chooses among five packages of efficiency improvements – improved envelope, HVAC, hot water equipment, air sealing and ventilation (with HRV) or thermal distribution (duct leakage). Each of the packages reflects reasonable efficiency improvements readily available in the market. For those seeking more flexibility, the proposal also incorporates the full flexibility of the simulated performance compliance path or the ERI, along with a 5% improvement.

RE209 was narrowly disapproved by the IECC-Residential Committee by a vote of 6-5, with all four homebuilder representatives voting to disapprove it. Without the homebuilder representatives, the proposal would have been easily approved 5-2. Of all the points- or package-based proposals considered by the Committee, RE209 received the most Committee member votes, and for good reason. RE209's primary strength is its simplicity. For several years, some states (such as Oregon and Washington) have been using approaches based on tables of efficiency options to boost the efficiency of their codes. This provides flexibility for builders to identify the most reasonable, cost-effective option for a given project, but it also does not overwhelm the process with too many options. Over time, as building practices improve and the needs of jurisdictions change, the options can be modified, more options can be added, and/or the number of options required can change. RE209 is modeled on the IECC Section C406 Additional Efficiency Package Options, which has worked well for commercial buildings since it was added to the IECC in 2012.

We readily acknowledge that the costs and benefits (including energy savings) of individual option packages will vary across climate zones and even from one home to another. However, this is a positive feature of RE209, not a flaw. We expect that users will identify the option package that makes the most sense for each project. Indeed, we believe that most builders would rather have the flexibility of choosing from several options rather than requiring all homes to comply with a single set of measures that would produce a specific percentage improvement to the IECC. It is also important to note that builders will also have the flexibility and choice to comply under either the performance path or the Energy Rating Index and create their own approach to achieve a 5% savings in energy, if those compliance approaches are more familiar or better suited to a particular home.

The two concerns identified by those on the Committee who voted against this proposal are not persuasive and do not justify missing this crucial opportunity to substantially increase efficiency:

<u>Committee</u>: "Greatest concern is for methodology – lack of understanding and flexibility and lack of solar …" We do not think this concern is valid. As noted above, the proposal is relatively simple and straightforward. The five efficiency package options are easy to understand and offer a considerable amount of flexibility and choice. However, additional flexibility is available if desired from both the simulated performance compliance path or the ERI, with a 5% improvement.

RE209 does not include solar or other on-site renewable electricity generation among these efficiency options because generation is not an efficiency option - it would not actually reduce the energy use of the building like the proposed efficiency options would. While we are not opposed to properly incorporating on-site renewable energy into net-zero buildings, RE209 is designed specifically to improve efficiency, so RE209 focuses on reducing the actual energy use of the building. We think energy efficiency should be optimized before considering the impact of on-site generation, which can be addressed in other proposals. We do not want to promote a choice in the code between improved energy efficiency and renewable energy.

<u>Committee:</u> *"[I]t negatively impacts use of ERI."* It is not clear what is meant by this comment, since RE209 has no impact on the ERI, other than to set an improved ERI target. RE209 (like proposals RE206 and RE207) directly addresses the Energy Rating Index (and the performance path) to ensure that all three compliance paths improve simultaneously and consistently. The three compliance paths are difficult to compare directly, in terms of energy efficiency, because so many of the assumptions and options are different. However, where a significant improvement is proposed to one compliance path (such as 5% with RE206 and RE209 and 10% with RE207), all compliance paths should be improved to the same level.

Applying a 5% improvement to the ERI and a 5% improvement to the simulated performance path for those who choose these compliance pathways is a reasonable way to improve the IECC by roughly the same amount across all compliance paths.

In sum, RE209 provides a simple, straightforward means of improving efficiency in the IECC, while preserving flexibility and simplicity, and should be approved as submitted.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
As stated in the original proposal, for each climate zone, there are cost-effective options available that will generate energy savings and be cost effective over the useful life of the building. Although the savings will vary based on the option selected and design choices made in the building, there are multiple sensible options for achieving improved efficiency in each climate zone. On a broader scale, these improvements will help curb the nation’s increasing demands for energy and contribute to a more secure energy future.

Public Comment# 1512

RE210-19

IECC: R407 (IRC N1107) (New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

Add new text as follows:

SECTION R407 (IRC N1107)
PATHWAY TO ZERO, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

R407.1 (IRC N1107.1) Scope. This section establishes criteria for jurisdictions to attain zero energy compliance using an Energy Rating Index (ERI) analysis by the year 2042.

R407.2 (N1107.2) Mandatory requirements. Compliance with this section requires that the provisions identified in Sections R401 through R404 indicated as "Mandatory" be met.

Exception: Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*- value of not less than R-8.

R407.3 (IRC N1107.3) Energy Rating Index. The Energy Rating Index (ERI) shall be determined in accordance with RESNET/ANSI/ICC 301 except for buildings covered by the *International Residential Code*, the ERI Reference Design Ventilation rate shall be in accordance with Equation 4-2.

Ventilation rate, CFM = (0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)] **(Equation 4-2)**

Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

R407.4 (IRC N1107.4) ERI-based compliance. Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have a score less than or equal to the values in Table R407.4, for the ERI implementation date, when compared to the *ERI reference design* for each of the following conditions:

1. ERI value without on-site renewable energy generation
2. ERI value with on-site renewable energy generation

TABLE R407.4 (IRC N1107.4)
MAXIMUM ENERGY RATING INDEX

ERI Implementation date	ENERGY RATING INDEX WITHOUT ON-SITE RENEWABLES [a]	ENERGY RATING INDEX WITH ON-SITE RENEWABLES [b]
January 1st 2021	60	55
January 1st 2024	55	50
January 1st 2027	50	45
January 1st 2030	45	40
January 1st 2033	40	30
January 1st 2036	--	20
January 1st 2039	--	10
January 1st 2042	--	0

a. The maximum ERI without on-site renewables is fixed at an ERI of 40 after January 1st 2036, because thermal envelope and mechanical improvements cannot lower the ERI score significantly below that level.

b. The maximum ERI with on-site renewables can be achieved with or without installing onsite renewables until January 1st 2033 when on-site renewables are required to be used to lower the ERI below 40.

R407.5 (IRC N1107.5) Verification by an approved agency. Verification of compliance with the Section R407 as outlined in Section R407.4 and R407.6 shall be completed by an *approved* third party. Verification of Section R407.2 shall be completed by the authority having jurisdiction or an approved third party inspection agency per Section R105.4.

R407.6 (IRC N1107.6) Documentation. Documentation of the software used to determine the ERI and the parameters for the *residential building* shall be in accordance with Sections R407.6.1 through R407.6.3.

R407.6.1 (IRC N1107.6.1) Compliance software tools. Software tools used for determining ERI shall be approved software rating tools in accordance with RESNET/ICC 301.

R407.6.2 (IRC N1107.6.2) Compliance report. Compliance software tools shall generate a report that documents that the home and ERI score complies with Sections R407.2 through Section R407.4. The compliance documentation shall be created for the proposed design and submitted with the application for the building permit. Confirmed compliance documents of the built dwelling unit shall be created and submitted to the *code official for review* before a certificate of occupancy is issued. Compliance reports shall include information in accordance with Sections R407.6.2.1 and R407.6.2.2.

R407.6.2.1 (IRC N1107.6.2.1) Proposed Compliance report for permit application. Compliance reports submitted with the application for a building permit shall include the following:

1. Building street address, or other building site identification.
2. The name of the individual performing the analysis and generating the compliance report.
3. The name and version of the compliance software tool.
4. If Requested by the authority having jurisdiction, documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the proposed design has an ERI less than or equal to the appropriate scores indicated in Table R407.4 when compared to the ERI reference design. The certificate shall document the building component energy specifications that are included in the calculation including, component level insulation R-values or U-factors, assumed duct system and building envelope air leakage testing results, as well as the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water heating equipment to be installed. The type and production size of the proposed onsite renewable Energy systems shall be reported.
6. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

R407.6.2.2 (IRC N1107.6.2.2) Confirmed Compliance report for a certificate of occupancy. A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

1. Building street address or other building site identification.
2. The name of the individual performing the analysis and generating the report.
3. The name and version of the compliance software tool.
4. If requested by the authority having jurisdiction, documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
5. A final confirmed certificate indicating that the confirmed rated design of the built home complies with Sections R407.2 and R407.4. The certificate shall report the energy features that were confirmed to be in the home including component level insulation R- values or U-factors,

results from any required duct system and building envelope air leakage testing, as wells as, the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water heating equipment installed. The type and production size of the confirmed onsite renewable energy systems shall be reported.

R407.6.3 (IRC N1107.6.3) Additional Documentation. The code official shall be permitted to require the following Documents:

1. Documentation of the building component characteristics of the ERI reference design.
2. A certification signed by the builder providing the building component characteristics of the rated design.
3. Documentation of the actual values used in the software calculation for the rated design.

R407.6.4 (IRC N1107.6.4) Specific Approval. Performance analysis tools meeting the applicable section of Section R407 shall be approved. Documentation demonstrating the approval of the performance analysis with Section R407.6.1 shall be provided

R407.6.5 (IRC N407.6.5) Input values. Where calculation require input values not specified by Sections R402, R403, R404 and R405, those input values shall be taken from RESNET/ICC 301.

Reason: As the Energy Rating Index (ERI) diverges from the Home Energy Rating System Index (HERS) it becomes important to realize that although there are commonalities between the two, they are ultimately different from each other and should be thought of separately. As soon as the R406 ERI pathway was codified it locked in the ERI to a specific version of the RESNET/ANSI/ICC 301 standard while the HERS Index is based on a continually maintained version of the same ANSI 301 standard. Therefore, we now have divergent Index scores that mean different things.
The HERS Index benchmarks the efficiency of a home in comparison to a reference home that is based on the 2006 IECC. A HERS Rating is an asset rating of the energy features in a home. This means that in the process of a HERS Rating to generate the HERS Index a Rater does not necessarily inspect to see if energy features governed by the code are installed according to requirements of the code. For example, the HERS Ratings systems' insulation installation grading criteria gives guidance on how to de-rate the R-value of poorly installed insulation. The Rater is required to give a grade 3 to poor installations. The HERS Index score is intended to evaluate the performance of what is installed. It is not intended to determine if it was installed per the requirement of code. A code rating or evaluation for the generation of the ERI score, on the other hand, should only use a grade 1 because only grade 1 installation of insulation meets the requirements of manufacturer instructions and therefore code. If a Rater were to evaluate a home for an ERI score and come across grade 3 installation of insulation, the installation should fail the inspection and be re-installed to meet code requirements. In this way, an ERI rating and a HERS rating are fundamentally different. One is held to a pass/fail requirement of code and the other is a quantification and evaluation of energy assets or components of the home. This small example demonstrates how the HERS index score and the ERI score differ.

Another example that demonstrates a more pronounced difference between the indices is the codified ventilation requirements for the ERI score vs. the ventilation requirements for the HERS Index score. The ERI score uses the ASHRAE 62.2-2010 ventilation requirements while the HERS Index uses the ASHRAE62.2-2013 ventilation requirements. This difference can result in over a 10-point difference in the scores.

Many are troubled by this divergence in the index scores, but I am not because the ERI and the HERS Index are fundamentally different if related systems. The HERS Index has been adopted by builders and the public primarily as a sales and marketing tool and a means to compare the performance of houses. The HERS Index score is quite good for these purposes. The ERI, like the area weighted u-values in section R402.1.5 Total U-factor Alternative, or cost comparison in section R405 Simulated Performance Alternative is a matrix by which a home's performance can be compared to demonstrate compliance with the code. It is not intended for marketing or public consumption and as the scores continue to diverge the public will continue to be unaware of the ERI score just as they are unaware of area weighted u-values and cost compliance. If a common understanding can be created regarding this point then the ERI score can be a powerful tool to offer great flexibility for builders as well as a path forward for the code and municipalities who choose to use it to achieve greater energy efficiency.

This proposal has been designed to leverage the unique nature of the ERI and the already codified mandatory aspects of the IECC, so as to offer municipalities and builders an option that will continue the trend toward zero energy homes. As Section R407 is an optional pathway municipalities and builders can choose a code compliance path that allows great flexibility in energy specifications and design while the homebuilding industry learns how to incorporate new technologies or better use old ones. The IECC's emphasis on protecting the thermal envelope is protected not by a punitive R-value backstop, but rather by a before renewables ERI requirement. A Pre-renewables ERI score opens up flexibility through cost-effective energy tradeoffs that are the most flexible for the builder as they would include mechanical, thermal or conductive, convective losses through envelope, along with duct tightness, lights, appliances, and more. Any feature that lowers the ERI can be used. This integrated energy evaluation acknowledges that the ERI of a home cannot be lowered beyond a certain threshold unless renewables are installed, but also sets the pre-renewable ERI at a level that ensures current levels of efficiency will be created as the starting point. For example, when a builder maximizes the thermal envelope and mechanical efficiencies of their design the ERI cannot go lower than approximately 35-40. To get an ERI score below that range on-site renewables must be installed. In this way, R407, as proposed, ensures a sound building envelope and efficient mechanical systems before renewables are considered.

The uniqueness of this proposal is that it creates a timeline by which a clear incremental approach for achieving increases in efficiencies that would lead to zero energy homes can be achieved. Although this will be new to the code development world, it is tremendously important to allow the path to zero to be phased in and for giving builders and jurisdictions a timeline for planning to achieve the ultimate goal. This phased-in approach has precedence in two Colorado jurisdictions. The City of Boulder and Boulder County have both set a phased approach for attaining zero energy in their municipalities.

Section R407 is optional so only those municipalities and builders that are searching for code compliant incremental approaches need take part. It has become a difficult argument to increase R-values, house tightness or duct leakage requirements in the 2021 IECC development cycle. This ERI approach to Zero Energy offers a logical, market-driven approach that creates a timeline for achieving significant increases in efficiency while simultaneously giving industry time to adjust and provide cost-effective solutions. This proposal also guards against building poor thermal envelopes and offsetting with on-site renewable systems. This proposal offers builders the greatest flexibility to choose how to build to meet the requirements of code.

Cost Impact: The code change proposal will increase the cost of construction
This **R407 PATHWAY TO ZERO, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE** is just that and optional alternative path way to not only demonstrate compliance with the IECC but to help jurisdictions that are interested define a measurable and incremental approach to create zero energy homes. This approach is being used in Colorado although it is true that cost of construction increases it is only required if the jurisdiction chooses to adopt the pathway.

RE210-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Supporting the intent, it provides a roadmap. Although it needs to be in an appendix, because as written it mandatory. Not convinced the ERI is the only path (Vote: 11-0).

Assembly Action: **None**

RE210-19

Individual Consideration Agenda

Public Comment 1:

IECC®: APPENDIX RB (New), SECTION R407 (IRC N1107) (New), RB101 (New), RB102 (New), RB103 (New), RB103.1 (New), RB103.2 (New), RB103.3 (New), RB103.4 (New), TABLE RB103.4 (New), RB103.5 (New), RB103.6 (New), RB103.6.1 (New), RB103.6.2 (New), RB103.6.2.1 (New), RB103.6.2.2 (New), RB103.6.3 (New), RB103.6.4 (New), RB107.6.5 (New)

Proponents:
Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

APPENDIX RB
PATHWAY TO ZERO ENERGY RESIDENTIAL BUILDINGS, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE

~~SECTION R407 (IRC N1107)~~
~~PATHWAY TO ZERO, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE~~

RB101 ~~**R407.1 (IRC N1107.1)**~~ **Scope.** These provisions shall be applicable for new *residential* buildings where zero energy provisions are required ~~This section establishes criteria for jurisdictions to attain zero energy compliance~~ using an Energy Rating Index (ERI) analysis. ~~by the year 2042.~~

RB102 Compliance Existing *residential buildings* shall comply with Chapter 5. New *residential buildings* shall comply with Section RB103.

RB103
ZERO ENERGY RESIDENTIAL BUILDINGS

RB103.1 General. New *residential buildings* shall comply with Section RB103.

RB103.2 ~~**R407.2 (N1107.2)**~~ **Mandatory requirements.** Compliance with this section requires that the provisions identified in Sections R401 through R404 indicated as "Mandatory" be met.

Exception: Supply and return ducts not completely inside the *building thermal envelope* shall be insulated to an *R*- value of not less than R-8.

RB103.3 ~~**R407.3 (IRC N1107.3)**~~ **Energy Rating Index.** The Energy Rating Index (ERI) shall be determined in accordance with the most recent version of the RESNET/ANSI/ICC 301 standard ~~except for buildings covered by the *International Residential Code*, the ERI Reference Design Ventilation rate shall be in accordance with Equation 4-2.Ventilation rate, CFM = (0.01 × total square foot area of house) + [7.5 × (number of bedrooms + 1)]~~ ~~**(Equation 4-2).**~~ Energy used to recharge or refuel a vehicle used for transportation on roads that are not on the building site shall not be included in the *ERI reference design* or the *rated design*.

RB103.4 ~~**R407.4 (IRC N1107.4)**~~ **ERI-based compliance.** Compliance based on an ERI analysis requires that the *rated proposed design* and confirmed built dwelling be shown to have a score less than or equal to the values in Table RB103.4, for the ERI implementation plane ~~date~~, when compared to the *ERI reference design* for each of the following conditions:

1. ERI value without on-site renewable energy generation
2. ERI value with on-site renewable energy generation

TABLE RB103.4 ~~407.4 (IRC N1107.4)~~
MAXIMUM ENERGY RATING INDEX

Portions of table not shown remain unchanged.

ERI Implementation Plane ~~date~~ (Phased implementaion dates to be determined at the time of adoption)	**ENERGY RATING INDEX WITHOUT ON-SITE RENEWABLES [a]**	**ENERGY RATING INDEX WITH ON-SITE RENEWABLES [b]**
Pha se 1 (e.g.January 1st 2021)	60	55
Phase 2 (e.g January 1st 2024)	55	50
Phase 3 (e.g January 1st 2027)	50	45
Phase 4 (e.g January 1st 2030)	45	40
Phase 5 (e.g January 1st 2033)	≤40	30
Phase 6 (e.g January 1st 2036)	≤40	20
Phase 7 (e.gJanuary 1st 2039)	≤40	10
Phase 8 (e.g January 1st 2042)	≤40	0

a. The ~~maximum~~ lowest ERI without on-site renewables is fixed at an ERI of ≤40 at the 6th implementation phase, ~~after January 1st 2036~~ because thermal envelope and mechanical improvements cannot lower the ERI score significantly below that level.

b. The ~~maximum~~ ERI with on-site renewables can be achieved with or without installing onsite renewables until implementation phase 5 ~~January 1st 2033~~ when on-site renewables are required to be used to lower the ERI below 40.

RB103.5 ~~R407.5 (IRC N1107.5)~~ Verification by an approved agency. Verification of compliance with appendix RB ~~the Section R407~~ as outlined in Section RB103.4 and RB103.6 ~~R407.4 and R407.6~~ shall be completed by an *approved* third party. Verification of Section RB103.5 ~~R407.2~~ shall be completed by the authority having jurisdiction or an approved third party inspection agency per Section R105.4.

RB103.6 ~~R407.6 (IRC N1107.6)~~ Documentation. Documentation of the software used to determine the ERI and the parameters for the *residential building* shall be in accordance with Sections RB103.6.1 through RB103.6.3. ~~R407.6.1 through R407.6.3.~~

RB103.6.1 ~~R407.6.1 (IRC N1107.6.1)~~ Compliance software tools. Software tools used for determining the ERI score shall be approved software rating tools in accordance with ANSI/RESNET/ICC 301.

RB103.6.2 ~~R407.6.2 (IRC N1107.6.2)~~ Compliance report. Compliance software tools shall generate a report that documents that the home and ERI score complies with Sections RB103.2 ~~R407.2~~ through Section RB103.4 ~~R407.4~~. The compliance documentation shall be created for the proposed design and submitted with the application for the building permit. Confirmed compliance documents of the built dwelling unit shall be created and submitted to the *code official for review* before a certificate of occupancy is issued. Compliance reports shall include information in accordance with Sections RB103.6.2.1 and RB103.6.2.2. ~~R407.6.2.1 and R407.6.2.2~~.

RB103.6.2.1 ~~R407.6.2.1 (IRC N1107.6.2.1)~~ Proposed Compliance report for permit application. Compliance reports submitted with the application for a building permit shall include the following:

1. Building street address, or other building site identification.
2. The name of the individual performing the analysis and generating the compliance report.
3. The name and version of the compliance software tool.
4. ~~If Requested by the authority having jurisdiction~~, Documentation of all inputs entered into the software used to produce the results for the reference design and/or the rated home.
5. A certificate indicating that the proposed design has an ERI less than or equal to the appropriate scores indicated in Table R407.4 when compared to the ERI reference design. The certificate shall document the building component energy specifications that are included in the calculation including, component level insulation R-values or U-factors, assumed duct system and building envelope air leakage testing results, as well as the type and rated efficiencies of proposed heating, cooling, mechanical ventilation, and service water heating equipment to be installed. The type and production size of the proposed onsite renewable Energy systems shall be reported.
6. When a site-specific report is not generated, the proposed design shall be based on the worst-case orientation and configuration of the rated home.

RB103.6.2.2 ~~R407.6.2.2 (IRC N1107.6.2.2)~~ Confirmed Compliance report for a certificate of occupancy. A confirmed compliance report submitted for obtaining the certificate of occupancy shall be made site and address specific and include the following:

1. Building street address or other building site identification.
2. The name of the individual performing the analysis and generating the report.
3. The name and version of the compliance software tool.
4. ~~If requested by the authority having jurisdiction,~~ Documentation of all inputs entered into the software used to produce the results for the

reference design and/or the rated home.

5. A final confirmed certificate indicating that the confirmed rated design of the built home complies with Sections R407.2 and R407.4. The certificate shall report the energy features that were confirmed to be in the home including component level insulation R- values or U-factors, results from any required duct system and building envelope air leakage testing, as wells as, the type and rated efficiencies of the heating, cooling, mechanical ventilation, and service water heating equipment installed. The type and production size of the confirmed onsite renewable energy systems shall be reported.

RB103.6.3 **~~R407.6.3 (IRC N1107.6.3)~~** **Additional Documentation.** The code official shall be permitted to require the following Documents:

1. Documentation of the building component characteristics of the ERI reference design.
2. A certification signed by the builder providing the building component characteristics of the rated design.
3. Documentation of the actual values used in the software calculation for the rated design.

RB103.6.4 **~~R407.6.4 (IRC N1107.6.4)~~** **Specific Approval.** Performance analysis tools meeting the applicable section of Appendix RB ~~Section R407~~ shall be approved. Documentation demonstrating the approval of the performance analysis with Section RB103.6.1 ~~R407.6.1~~ shall be provided

RB107.6.5 **~~R407.6.5 (IRC N407.6.5)~~** **Input values.** Where calculation require input values not specified by Sections R402, R403, R404 and R405, those input values shall be taken from RESNET/ICC 301.

Commenter's Reason: The committee supported the intent of this zero energy proposal as it provides a road map and a phased in approach. They believed it should be in an appendix rather than a new Section R407. Therefore the proposal has been changed into an appendix. In addition the object of the proposal is to demonstrated a phased in approach to get to zero energy building so Table RB103.4 has been reworked with phases and example time lines. The ERI path to Zero may not be the only way to quantify achieving zero energy as the committee noted but is is a currently a proven path that jurisdictions now can adopt if they choose to.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This **APPENDIX RB PATHWAY TO ZERO ENERGY RESIDENTIAL BUILDINGS, ENERGY RATING INDEX COMPLIANCE ALTERNATIVE** is just that, an optional alternative path way to, not only demonstrate compliance with the IECC, but to help jurisdictions that are interested define a measurable and incremental approach to create zero energy homes. This approach is being used in Colorado although it is true that cost of construction increases it is only required if the jurisdiction chooses to adopt the pathway.

Public Comment# 2120

RE212-19

IECC: R502.1 (IRC N1108.1), R502.1.1 (IRC N1108.1.1), R502.1.1.1 (IRC N1108.1.1.1), R502.1.2 (IRC N1108.1.2), R502.1.2.1 (IRC N1108.1.2.1) (New), R502.1.3 (IRC N1108.1.3) (New), R502.1.3.1 (IRC N1108.1.3.1) (New), R502.1.4 (IRC N1108.1.4) (New), R502.1.4.1 (IRC N1108.1.4.1) (New)

Proposed Change as Submitted

Proponents: Robby Schwarz, EnergyLogic, representing EnergyLogic (robby@nrglogic.com)

2018 International Energy Conservation Code

SECTION R502
ADDITIONS

Revise as follows:

R502.1 (IRC N1108.1) General. *Additions* to an existing *building*, *building* system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing *building* or *building* system to comply with this ~~code.~~ code unless required to do so by the chosen compliance pathway. *Additions* shall not create an unsafe or hazardous condition or overload existing *building* systems. An *addition* shall be deemed to comply with this code where the *addition* ~~alone~~ complies, ~~where the existing *building* and *addition* comply with this code as a single building, or where the *building* with the *addition* does not use more energy than the existing *building*. *Additions* shall be in accordance with Section R502.1.1 or R502.1.2.~~ by using either the prescriptive path in Section R502.1.1, simulated performance path in Section R502.1.2, or the energy rating index path In Section R502.1.3 .

R502.1.1 (IRC N1108.1.1) ~~Prescriptive~~ Additions prescriptive compliance. *Additions* shall comply with Sections R502.1.1.1 through R502.1.1.4.

R502.1.1.1 (IRC N1108.1.1.1) Building envelope. New *building* envelope assemblies that are part of the *addition* *alone* shall comply with the prescriptive Sections R402.1, R402.2~~, R402.3.1 through R402.3.5, and R402.4~~ , R402.3, and R402.4.1.1.

> ~~**Exception:** Where *unconditioned space* is changed to *conditioned space*, the *building* envelope of the addition shall comply where the Total UA, as determined in Section R402.1.5, of the existing building and the *addition*, and any *alterations* that are part of the project, is less than or equal to the Total UA generated for the existing *building*.~~

R502.1.1.2 (IRC N1108.1.1.2) Heating and cooling systems. New heating, cooling and duct systems that are part of the *addition* shall comply with Section R403.

> **Exception:** Where ducts from an existing heating and cooling system are extended to an *addition*, duct systems with less than 40 linear feet (12.19 m) in *unconditioned spaces* shall not be required to be tested in accordance with Section R403.3.3.

R502.1.1.3 (IRC N1108.1.1.3) Service hot water systems. New service hot water systems that are part of the *addition* shall comply with Section R403.4.

R502.1.1.4 (IRC N1108.1.1.4) Lighting. New lighting systems that are part of the *addition* shall comply with Section R404.1.

Revise as follows:

R502.1.2 (IRC N1108.1.2) Existing plus addition compliance (Simulated Performance Alternative). Cost compliance verification shall demonstrate that the existing building plus the addition does not use more energy than the existing *building* did prior to the addition. This method requires the project to create cost compliance verification at three stages:

1. A baseline cost compliance of the existing structure prior to construction.
2. Projected cost compliance of the existing building plus the addition based on the proposed design for the building in its entirety.
3. Confirmed cost compliance to verify whole building performance.~~Where *unconditioned space* is changed to *conditioned space*, the *addition* shall comply where the annual energy cost or energy use of the *addition* and the existing *building*, and any *alterations* that are part of the project, is less than or equal to the annual energy cost of the existing *building* when modeled in accordance with Section R405. The *addition* and any *alterations* that are part of the project shall comply with Section R405 in its entirety.~~

Add new text as follows:

R502.1.2.1 (IRC N1108.1.2.1) Reporting. Both the baseline and the projected cost compliance reports that include documentation of the proposed design shall be submitted with the construction documents. A confirmed cost compliance report shall be submitted prior to final inspection.

R502.1.3 (IRC N1108.1.3) Existing plus addition compliance (Energy Rating Index Alternative). An energy rating index score shall demonstrate that the existing building plus the addition does not use more energy than the existing *building* did prior to the addition. This method requires the project to obtain an ERI score at three stages:

1. A baseline ERI of the existing structure prior to construction.
2. A projected ERI of the existing building plus the addition based on the proposed design for the building in its entirety.

3. A confirmed ERI to verify whole building performance.

R502.1.3.1 (IRC N1108.1.3.1) Reporting. Both the baseline and the projected ERI compliance reports that include documentation for the proposed design shall be submitted with the construction documents. A confirmed ERI report shall be submitted prior to final inspection.

R502.1.4 (IRC N1108.1.4) Existing plus addition compliance (Prescriptive). The existing building plus the addition shall demonstrate that the structure in its entirety does not use more energy than the existing *building* did prior to adding the addition. All prescriptive measures shall be installed in the addition in accordance Section R402.1. A blower door test shall be performed to establish a baseline air leakage rate for the existing building prior to construction. Prior to final building inspection, a blower door test shall be conducted on the existing building plus addition to demonstrate an air leakage rate equal to or less than the baseline measurement.

R502.1.4.1 (IRC N1108.1.4.1) Reporting. A baseline blower door testing report for the existing building prior to construction shall be submitted with the construction documents. A confirmed blower door testing report shall be submitted after construction is complete and prior to final inspection.

Reason: The current existing buildings chapter 5 of the IECC has always struggled with clearly executing the energy code previsions on additions to an existing building. A building science approach teaches us that the house is a system. Therefore, if an addition is added to an existing building then the system's configuration has changed and assessing compliance on a portion of the system becomes a problem. In really, it is not possible to assess a portion of the system separated from its entirety for energy code compliance. However, the code has established a method, but not a clear means for trying to do so.
In one form or another the IECC has always stated that an addition shall be deemed to comply where the building with the addition does not used more energy than the existing building did without the addition. The proposal for this section leverages this language (or method) and the existing paths (the means) in the code to offer better compliance mechanisms. The proposed Section R502.1.4 Existing plus addition compliance (Prescriptive), for example, uses a baseline pre-blower door test compared to a final confirmed blower door test to demonstrate if the final product is better than or equal to the existing benchmarked building. The assumption is that the prescriptive R-values, U-values, and installation requirements for the specification installed in the addition will be better than what has been installed in the existing portions of the building. Since it is not practical and, in most cases, possible to perform a blower door on just the addition the requirement changes in order to use the blower door as a compliance mechanism.

A Simulated Performance and Energy Rating Index path have been added as alternative compliance mechanisms in this section of the code for three reasons. First, the blower door is moved back to an assessment of energy performance rather than used as a compliance mechanism. Second, it is our experience that existing portions of a building are almost always touched during the creation of an addition on a building. Therefore, these compliance paths look at the entirety of the building rather than just the addition. Third, design flexibility is achieved when one is not required to use every portion of the prescriptive specification outlined in the code. The clear ability to use tradeoffs in existing buildings fits better with the reality of construction in this arena. Forth, these two pathways enable and encourage pre-planning as well as offer a very clear matrix of compliance. The software analysis to generate the proposed design for the existing building plus the addition clearly projects if the new building in its entirety, will be better than or equal to the existing benchmarked building. The projection enables the designer to forecast what in the existing building must be addressed which helps create better building budgets and expectations. In addition, a variety of options can be presented to pick what in the existing and new sections of the building makes the most sense to address.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
Demonstration of compliance with this code is required regardless, so adding additional options for demonstrating compliance would not add to the cost. It is not a certainty, but added flexibility could reduce the cost of construction as well as jurisdictional time spent on enforcement.

RE212-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: The code currently does not requiring upgrading existing buildings that are not effected, this would undo that. This adds to complexity. (Vote: 9-2)

Assembly Action: **None**

RE212-19

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION R502, R502.1 (IRC N1108.1), R502.1.1 (IRC N1108.1.1), R502.1.1.1 (IRC N1108.1.1.1), R502.1.1.2 (IRC N1108.1.1.2), R502.1.1.3 (IRC N1108.1.1.3), R502.1.1.4 (IRC N1108.1.1.4), R502.2 (IRC N1108.2) (New), R502.1.2.1 (IRC N1108.1.2.1) (New), R502.3 (IRC N1108.3), R502.4 (IRC N1108.4) (New), R502.1.3.1 (IRC N1108.1.3.1) (New)

Proponents:

Robert Schwarz, representing EnergyLogic (robby@nrglogic.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION R502
ADDITIONS

R502.1 (IRC N1108.1) General. *Additions* to an existing *building*, *building* system or portion thereof shall conform to the provisions of this code as those provisions relate to new construction without requiring the unaltered portion of the existing *building* or *building* system to comply with this code. ~~unless required to do so by the chosen compliance pathway.~~ *Additions* shall not create an unsafe or hazardous condition or overload existing *building* systems. An *addition* shall be deemed to comply with this code where the *addition* alone complies using section R502.1.1, ~~by using either the prescriptive path in Section R502.1.1, simulated performance path in Section R502.1.2, or the energy rating index path In Section R502.1.3~~ where the existing *building* and *addition* comply with this code as a single *building*, or where the *building* with the *addition* does not use more energy than the existing *building did using Sections* **R502.2, R502.3 or R502.4.**

~~*Additions* shall be in accordance with Section R502.1.1 or R502.1. **2**~~

R502.1.1 (IRC N1108.1.1) ~~Additions~~ Prescriptive compliance. *Additions* shall comply with Sections R502.1.1.1 through R502.1.1.4.

R502.1.1.1 (IRC N1108.1.1.1) Building envelope. New *building* envelope assemblies that are part of the *addition* ~~*alone*~~ shall comply with ~~the prescriptive~~ Sections R402.1, R402.2, R402.3, and R402.4.~~1.1~~.

- **Exception:** Where *unconditioned space* is changed to *conditioned space*, the *building* envelope of the addition shall comply where the Total UA, as determined in Section R402.1.5, of the existing *building* and the *addition*, and any *alterations* that are part of the project, is less than or equal to the Total UA generated for the existing *building.*

R502.1.1.2 (IRC N1108.1.1.2) Heating and cooling systems. New heating, cooling and duct systems that are part of the *addition* shall comply with Section R403.

Exception: Where ducts from an existing heating and cooling system are extended to an *addition*, duct systems with less than 40 linear feet (12.19 m) in *unconditioned spaces* shall not be required to be tested in accordance with Section R403.3.3.

R502.1.1.3 (IRC N1108.1.1.3) Service hot water systems. New service hot water systems that are part of the *addition* shall comply with Section R403.4.

R502.1.1.4 (IRC N1108.1.1.4) Lighting. New lighting systems that are part of the *addition* shall comply with Section R404.1.

~~R502.1.4~~ R502.2 (IRC ~~N1108.1.4~~ N1108.2) Existing plus addition compliance (Prescriptive plus blower door). The existing building plus the addition shall demonstrate that the structure in its entirety does not use more energy than the existing *building* did prior to adding the addition. All prescriptive measures shall be installed in the addition in accordance with Section R402.1. This method requires the project to demonstrate compliance verification and reporting as follows:

1. A blower door test shall be performed and reported to the code official with the construction documents at the time of permit to establish a baseline air leakage rate for the existing building prior to construction.
2. Prior to the final building inspection, a confirmed blower door test shall be conducted on the existing building plus addition to demonstrate an air leakage rate equal to or less than the baseline measurement.
3. The final confirmed blower door testing report shall be submitted to the code official for the issuance of the certificate of occupancy.

~~**R502.1.2.1 (IRC N1108.1.2.1) Reporting.** Both the baseline and the projected cost compliance reports that include documentation of the proposed design shall be submitted with the construction documents. A confirmed cost compliance report shall be submitted prior to final inspection.~~

~~R502.1.2~~ R502.3 (IRC ~~N1108.1.2~~ N1108.3) Existing plus addition compliance (Simulated Performance Alternative). Cost compliance verification using Section R405 software analysis shall demonstrate that the existing building plus the addition does not use more energy than the existing *building* did prior to the addition. This method requires the project to demonstrate compliance verification and reporting as follows: ~~This method requires the project to create cost compliance verification at three stages:~~

1. A baseline cost compliance analysis report of the existing structure shall be submitted to the code official with the construction documents at the time of permit prior to construction.

2. A Projected cost compliance analysis report of the existing building plus the addition based on the proposed design specifications for the building in its entirety shall be submitted to the code official with the construction documents at the time of permit prior to construction.

3. A confirmed cost compliance analysis report ~~to verify~~ verifying whole building cost compliance shall be submitted to the code official to demonstrate that the completed project's cost compliance is equal to or better than the baseline cost compliance for the issuance of the certificate of occupancy. performance.

~~**R502.1.2.1 (IRC N1108.1.2.1) Reporting.** Both the baseline and the projected cost compliance reports that include documentation of the proposed design shall be submitted with the construction documents. A confirmed cost compliance report shall be submitted prior to final inspection.~~

~~R502.1.3~~ R502.4 (IRC ~~N1108.1.3~~ N1108.4) Existing plus addition compliance (Energy Rating Index Alternative). An energy rating index score shall demonstrate that the existing building plus the addition does not use more energy than the existing *building* did prior to the addition. This method requires the project to to demonstrate compliance verification and reporting as follows: ~~obtain an ERI score at three stages:~~

1. A baseline ERI analysis and report of the existing structure shall be submitted to the code official with the construction documents at the time of permit prior to construction .

2. A projected ERI analysis and report of the existing building plus the addition based on the proposed design specifications for the building in its entirety shall be submitted to the code official with the construction documents at the time of permit prior to construction.

3. A confirmed ERI analysis and report ~~to verify~~ verifying whole building ~~performance~~ ERI compliance shall be submitted to the code official to demonstrate that the completed project's ERI score is equal to or better than the baseline ERI score for the issuance of the certificate of occupancy.

~~**R502.1.3.1 (IRC N1108.1.3.1) Reporting.** Both the baseline and the projected ERI compliance reports that include documentation for the proposed design shall be submitted with the construction documents. A confirmed ERI report shall be submitted prior to final inspection.~~

Commenter's Reason: Public Comment Reason Statement
The committee rightly pointed out that the current existing buildings code does no upgrading portions of the building that has not been touched by the addition. However, the existing code language can require the addition to demonstrate compliance in ways that are impossible because it is generally impossible to completely separate the addition from the existing building. For example, the existing language requires the addition to comply with Section R402.4 Air Leakage including blower door testing. In most cases, it is not possible to perform a blower door test on an addition alone. In addition, when it is possible the volume of the addition is usually so small that it becomes impossible to achieve 3 or 5 ACH50.

To address the committee's concerns this section has been adapted to continue to allow true prescriptive compliance based on the addition alone. The three alternative paths that have been added have been adapted and upgraded to leverage existing code language that states, "an addition shall be deemed to comply with the code….~~-~~where the existing *building* and *addition* comply with this code as a single *building*, or where the *building* with the *addition* **does not use more energy than the existing *building***." The three alternative compliance pathways added to this section of the code offer existing means to quantify the energy use of the existing structure and the new existing structure plus the addition so that a code official can offer greater flexibility for the construction of additions and their interaction with the existing structure.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction
The proposal is intended to be cost-neutral. Demonstration of compliance with this code is required regardless, so adding additional options for demonstrating compliance would not add to the cost. That being said additional flexibility could be perceived to add cost because of extra verification, modeling, or testing. The reality is that Simulated Energy Cost Compliance is already allowed so additional options would not raise cost unless the path is chosen. It is not a certainty, but added flexibility could reduce the cost of construction as well as jurisdictional time spent on enforcement.

Public Comment# 2061

RE217-19

IECC: R503.1.1 (IRC N1109.1.1)

Proposed Change as Submitted

Proponents: Darren Meyers, P.E., IECC_LLC representing the National Roofing Contractors Association, representing the National Roofing Contractors Association (dmeyers@ieccode.com)

2018 International Energy Conservation Code

Revise as follows:

R503.1.1 <u>(IRC N1109.1.1)</u> Building envelope. Building envelope assemblies that are part of the alteration shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.13, R402.3.1, R402.3.2, R402.4.3 and R402.4.5.

Exception: The following alterations shall not be required to comply with the requirements for new construction provided that the energy use of the building is not increased:

1.	Storm windows installed over existing fenestration.
2.	Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
3.	Construction where the existing roof, wall or floor cavity is not exposed.
4.	Roof re-cover.
5.	~~Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.~~ <u>*Roof replacement* , where the required *R* -value of insulation entirely above the roof deck cannot be provided due to thickness limitations presented by existing rooftop conditions, including an HVAC system or refrigeration equipment, skylight curb(s), low door or glazing heights, weep holes, parapet or roof flashing heights, the maximum *approved* thickness of insulation compatible with the available space and existing uses shall be installed.</u>
6.	Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.

Reason: This proposal is based on CE287-16, and resubmitted for flat-roof residential applications where the required R-value of insulation entirely above the roof deck cannot be provided due to thickness limitations. CE287-16 received a Committee recommendation of “Disapproval,” a Public Comment recommendation of “As Modified by Public Comment” (AMPC), but ultimately did not receive the two-thirds necessary to prevail during the “Online Governmental Consensus Vote” (OGCV), leading to “Disapproval” as its Final Action.
Specifically, the newly proposed exception addresses the AMPC and the challenge of constructability when installing additional roof insulation in *reroofing* situations including *roof recover* and *roof replacement* where existing conditions do not allow for the full thickness of insulation required by Table R402.1.2 or Table R402.1.4. Consider the square footage of residential buildings with flat roofs (i.e., “two-flats” and “three-flats”) constructed before an adoption of the 2009 IECC, that now require *reroofing*, without adequate “clear space” to accommodate up to 5+ inches (R-25-ish) or 6+ inches (R-30-ish) of insulation as the IECC evolved thru 2012 to 2015 and now the 2018 Editions. The building stock now considered 10 to 20 to 30+ years old, is far more likely to avail itself of skylight and structural curb heights, scupper and sump depths, door and window access thresholds that would turn into ponds, if five to six inches of insulation were "retroactively" foisted upon building ownership.

Moreover, if the IECC CDC were to consult the premise to Section R505.1, that "... [neither] an increase in demand for either fossil fuel [nor] electrical energy shall comply with this code," so long as the current level of insulation in the roof is replaced with an equivalent thickness/level/R-value of NEW! insulation product, you'd likely conclude that he newly proposed Exception 5 is a "do-no-harm" proposition.

Should the Committee agree with the newly proposed Exception 5, then the continuance of current Exception 5 is unnecessary, as both the current Exception 4 (*Roof re-cover*) and the New! Exception 5 (*Roof replacement*) address all circumstances defined as *Reroofing*.

We believe the proposal makes clear that the maximum thickness of insulation compatible within the technically-feasible limitations of "available space" and maintaining "positive drainage" is to be installed.

Cost Impact: The code change proposal will not increase or decrease the cost of construction
This change better positions the IECC to be clearer, more easily applied to *reroofing*, more competitive than the 90.1 Standard alternative on this issue; thereby no cost impact when compared with current provisions.

RE217-19

Public Hearing Results

Committee Action: **As Modified**

Committee Modification:
R503.1.1 (IRC N1109.1.1) Building envelope. Building envelope assemblies that are part of the alteration shall comply with Section R402.1.2 or R402.1.4, Sections R402.2.1 through R402.2.13, R402.3.1, R402.3.2, R402.4.3 and R402.4.5.

Exception: The following alterations shall not be required to comply with the requirements for new construction provided that the energy use of the building is not increased:

Storm windows installed over existing fenestration.

Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.

Construction where the existing roof, wall or floor cavity is not exposed.

Roof re-cover.

Roof replacement, where the required *R*-value of insulation entirely above the roof deck cannot be provided due to thickness limitations presented by existing rooftop conditions, including an HVAC system or refrigeration equipment, skylight curb(s), low door or glazing heights, weep holes, parapet or roof flashing heights, the maximum *approved* thickness of insulation compatible with the available space and existing uses shall be installed.

Surface-applied window film installed on existing single pane fenestration assemblies to reduce solar heat gain provided that the code does not require the glazing or fenestration assembly to be replaced.

Roofs without insulation in the cavity and where the sheathing or insulation is exposed during *reroofing* shall be insulated either above or below the sheathing.

Committee Reason: The proposal as modified provides necessary provisions for builders and code officials to address this situation, the modification retains previous exception 5 as needed (Vote 6-5).

Assembly Action: **None**

RE217-19

Individual Consideration Agenda

Public Comment 1:

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it is unnecessary and creates an overbroad exception to the roof replacement requirements of the IECC. The result will be less discretion on the part of the code official and reduced energy efficiency.
The IECC currently sets a straightforward, clear set of requirements that apply to roof replacements, and then leaves it to code officials to exercise judgment as to whether specific circumstances warrant exceptions to these requirements. RE217 creates several problems:

- It creates a long list of automatic exemptions from the insulation requirements, even where it might have been perfectly feasible to properly insulate these areas of the roof.
- It implies that even more exemptions may apply, by starting the list with “including ….”
- It will discourage code officials from requiring some amount of effort on the part of the roofing contractor to meet the code requirements, because contractors will view this list as an exemption from the code.

Roof replacement is one of very few opportunities to significantly improve the efficiency of existing buildings. Any exceptions should be narrowly written and well-justified. RE217 is too broad and takes too much discretion out of the hands of code officials, and it should be disapproved.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1497

Public Comment 2:

Proponents:

Justin Koscher, representing Polyisocyanurate Insulation Manufacturers Association (jkoscher@pima.org); marcin pazera, Polyisocyanurate Insulation Manufacturers Association, representing Polyisocyanurate Insulation Manufacturers Association (mpazera@pima.org)

requests Disapprove

Commenter's Reason: This proposal should be disapproved because it reduces building energy efficiency and creates confusion within the code.

- First, the proposal will create confusion because it references requirements for “insulation entirely above the roof deck.” The residential energy code does not include any requirements for insulation entirely above the roof deck.
- Additionally, the proposed exception to Section R503.1.1 for roof replacements is unnecessary because the code already provides authority to the code official where practical difficulties make compliance with the strict letter of the code impractical.
- Notwithstanding the fact that the residential energy code does not include requirements for above deck roof insulation, the proposal is overly broad because it lists common rooftop conditions that do not create barriers to compliance for residential building envelope assemblies.
- Finally, the proponent incorrectly cites the general requirement that building alterations shall not increase energy use in the reasoning statement as justification for the proposal. This general requirement is superseded by the specific code language that states that building envelope alterations shall comply with the requirements for thermal efficiency. Therefore, adding an unnecessary exception to this specific requirement will result in a weakening of the overall code.

Cost Impact: The net effect of the public comment and code change proposal will not increase or decrease the cost of construction No change to code.

Public Comment# 1626

RE223-19

IECC: Appendix RB (IRC Appendix Q) (New)

Proposed Change as Submitted

Proponents: Eric Makela, New Buildings Institute, representing New Buildings Institute (ericM@newbuildings.org); Lauren Urbanek, Natural Resources Defense Council, representing Natural Resources Defense Council (lurbanek@nrdc.org)

2018 International Energy Conservation Code

Add new text as follows:

Appendix RB (IRC Appendix Q)
ZERO ENERGY RESIDENTIAL BUILDING PROVISIONS

RB102 (IRC AQ 102) COMPLIANCE *(Note: language to replace R401.2 Compliance)*

Existing *residential buildings* shall comply with Chapter 5. New *residential buildings* shall comply with Section RB103.

RB103 (IRC AQ 103)
ZERO ENERGY RESIDENTIAL BUILDINGS

RB103.1 (IRC AQ103.1) General. New *residential buildings* shall comply with Section RB103.

RB103.2 (IRC AQ103.2) Energy Rating Index Zero Energy Score. Compliance with this section requires that the *rated design* be shown to have a score less than or equal to the values in Table RB103.2 when compared to the *ERI reference design* determined in accordance with RESNET/ICC 301 for each of the following:

1. ERI value not including net onsite power production calculated in accordance with RESNET/ICC 301, and
2. ERI value including net onsite power production calculated in accordance with RESNET/ICC 301

TABLE RB103.2 (IRC AQ103.2)
MAXIMUM ENERGY RATING INDEX[a]

CLIMATE ZONE	ENERGY RATING INDEX not including onsite power	ENERGY RATING INDEX including onsite power (as proposed)
1	43	0
2	45	0
3	47	0
4	47	0
5	47	0
6	46	0
7	46	0
8	45	0

a. The building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4. of the 2015 *International Energy Conservation Code*.

Reason: This proposal provides cities and states an appendix to the residential section of the 2021 IECC that would result in a residential building that has zero energy consumption over the course of a year. Jurisdictions would have the prerogative to adopt the appendix in support of policy goals related to energy efficiency and renewable energy.
The provisions contained in this appendix are not mandatory unless specified as such in the jurisdiction's adopting ordinance.

Why is this needed?

States and cities across the country are pursuing policies to reduce the energy consumption of buildings. More than 270 cities and counties and 10 states are signatories to the "We Are Still In" commitment supporting climate action to meet the goals of the Paris climate accord. Thus far, seventy cities have committed to to being powered by 100% renewable energy and more are joining all the time. The building energy code is an important policy tool for jurisdictions as they pursue these types of policy goals.

Many of these energy and climate-related goals have a target year of 2030, so the time is ripe to provide this option in the model energy code. While jurisdictions already can modify the model code to meet their needs, many do not have the in-house expertise to develop and vet this type of code language. Integrating a zero energy building pathway into the 2021 IECC as a jurisdictional option will make the model energy code a more robust policy tool. Use of appendices in the IECC have proven successful with the solar provisions in the 2018 IECC appendices.

Including a zero energy building appendix in the model energy code can smooth the transition to zero energy for builders. Rather than jurisdictions going alone— leading to a patchwork of zero energy residential code approaches—a single IECC appendix would provide consistent national language across the residential industry for manufacturers, builders and trades. Builders can standardize their construction practices across jurisdictions and states to meet these requirements. This makes education, incentive programs, and implementation significantly more straightforward and cost-effective.

How the Zero Energy appendix works

While there are a number of definitions of "zero energy buildings" (also referred to as "zero net energy," "net zero energy," or simply, "net zero"), the Appendix is based on the Energy Rating Index (ERI) compliance path found in section R406 of the 2018 IECC. In principle, the proposal works as follows:

1. Required ERI values are based on a highly efficient energy use performance level before considering on-site power generation.

2. The remaining energy use, on an annual level, is satisfied with on-site power generation.

The Energy Rating Index scores are set for a highly efficient level of energy consumption, which importantly, is still cost effective for the homeowner. These scores, which range from 42 to 48 based on climate zone, were calculated based on a thorough analysis of HERS scores nationwide, a survey of HERS scores for model high-performance home, modeling done for ASHRAE 90.2, and the U.S. DOE Zero Energy Ready Home program.

On-site renewable energy capacity is then required to meet the remaining energy use, resulting in an Energy Rating Index score of zero. Software required in the RESNET 301 standard can easily generate an ERI score of the home before and after the inclusion of renewable energy (known as Onsite Power Production in HERS). All renewable energy is required to be on-site. The minimum envelope backstops required in section R406 are also required in this appendix. Homes may use any fuel in accordance with RESNET 301 to comply with the Appendix.

Bibliography: Presentation: 90.2 Compliance Requirements. Results from EnergyGuage 5.0 Simulations and Economic Analysis SSPC 90.2

Orlando Meetings January 25-26, 2016. P. Fairey. Florida Solar Energy Center.
ASHRAE Standard 90.2018. Energy Efficient Design of Low-Rise Residential Buildings

Cost Impact: The code change proposal will increase the cost of construction
If adopted by the state or jurisdiction, complying with this appendix will increase the first cost of construction but the Energy Rating Index values, before the addion of onsite power production, that have been selected were found to be cost effective based on information presented to the ASHRAE Standard 90.2 committee. All of the ERI scores without onsite power production have been found to have Savings/Investment Ratios (SIR) of greater than 1.0.

RE223-19

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: It needs additional compliance language for buildings without solar. Does not offer guidance or flexibility, it needs the term "net" included in title, and the EIR numbers are too low (Vote: 6-5).

Assembly Action: **None**

RE223-19

Individual Consideration Agenda

Public Comment 1:

IECC®: TABLE RB103.2 (IRC AQ103.2) (New)

Proponents:
William Fay, representing Energy-Efficient Codes Coalition (bfay@ase.org); William Prindle, representing EECC (wprindle@icfi.com); Daniel Bresette, representing Alliance to Save Energy (dbresette@ase.org); Maureen Guttman, representing Building Codes Assistance Project (mguttman@bcapcodes.org); Harry Misuriello, American Council for an Energy-Efficient Economy, representing American Council for an Energy-Efficient Economy (misuriello@verizon.net)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE RB103.2 (IRC AQ103.2)
MAXIMUM ENERGY RATING INDEX[a]

CLIMATE ZONE	ENERGY RATING INDEX not including onsite power	ENERGY RATING INDEX including onsite power (as proposed)
1	43	0
2	45	0
3	47	0
4	47	0
5	47	0
6	46	0
7	46	0
8	45	0

a. The building shall meet the mandatory requirements of Section R406.2; ~~and~~ the proposed total building thermal envelope UA, which is sum of U-factor times assembly area, shall be less than or equal to the building thermal envelope UA calculated using the prescriptive U-factors from Table R402.1.4 in accordance with Equation RB-1; and the area-weighted maximum glazed fenestration SHGC permitted shall be the SHGC values set forth in Table R402.1.2.~~, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4. of the 2015 *International Energy Conservation Code.*~~

$UA_{Proposed\ design} \le UA_{Prescriptive\ reference\ design}$ Equation RB-1

Commenter's Reason: RE223 should be approved as submitted or as modified because it establishes a reasonable optional appendix that can be adopted by interested jurisdictions that wish to promote more efficient homes with on-site renewables to achieve net zero energy homes. (It should be noted that this proposal only failed at the Committee hearing by one vote – 6-5 – and four of the six votes against were by the builder representatives on the Committee). By making this an appendix in this cycle, it will also create a common starting place for potential further improvements in the next code cycle.

We offer the proposed modification to incorporate a Total UA-based approach into the thermal envelope backstop, using an approach similar to the compromise that was recommended by the Committee to be approved in RE150. This modification would maintain the stringency of the thermal envelope backstop but would provide some additional flexibility for builders. The modification would also reference the U-factor and R-value tables of the current code, replacing an external reference to the 2015 IECC. This will help keep the backstop up-to-date without requiring new proposals every code development cycle.

Although several proposals address on-site renewable energy in the current code development cycle, RE223 is the only residential proposal on this subject that is workable in our view. We urge approval of RE223, with or without the modification above, for the following reasons:

- It maintains and builds upon the efficiency incorporated into the IECC, rather than maintaining, or even worse, reducing energy efficiency to “make room” for on-site renewable energy. A fundamental principle should be to eliminate wasted energy in the building before turning to renewable generation for the home’s energy needs.

- It sets a strong thermal envelope trade-off backstop that will help ensure that the efficiency of the building’s permanent thermal envelope will not be traded away for less-durable components or on-site generation.

- It places the new requirements in an appendix, where progressive jurisdictions can easily incorporate them into state or local codes. Jurisdictions that are not yet ready for these requirements, or for which the requirements are logistically unworkable, need not adopt the appendix.

- The appendix is essentially an overlay of the Energy Rating Index path and will be a familiar approach to building net-zero buildings for many builders.

- The appendix offers a “net zero” and renewable option that is sought by a number of jurisdictions.

Incorporating on-site renewable energy into the IECC poses a number of challenges and risks for jurisdictions, but RE223 is the only proposal that appears to reasonably account for these risks. RE223 is a reasonable improvement to the IECC and should be approved.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The modification in this public comment, if approved, could in some cases moderate the impact of these costs by adding more flexibility to the proposed thermal envelope backstop. Overall, for jurisdictions that adopt this new appendix (with or without this modification), the additional requirements for improved efficiency and renewable energy will add first costs. However, we agree with the proponent that the efficiency improvements are cost-justified.

Public Comment 2:

IECC®: RB103.2 (IRC AQ103.2) (New), TABLE RB103.2 (IRC AQ103.2) (New)

Proponents:

Eric Makela, representing New Buildings Institute (ericm@newbuildings.org); jim edelson, representing New Buildings Institute (jim@newbuildings.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

RB103.2 (IRC AQ103.2) Energy Rating Index Zero Energy Score. Compliance with this section requires that the *rated design* be shown to have a score less than or equal to the values in Table RB103.2 when compared to the *ERI reference design* determined in accordance with RESNET/ICC 301 for each of the following:

1. ERI value not including ~~net~~ onsite power production (OPP) calculated in accordance with RESNET/ICC 301, and
2. ERI value including ~~net~~ onsite power production calculated in accordance with RESNET/ICC 301 with the OPP in Equation 4.1.2 of RESNET/ICC 301 adjusted as follows

(Equation RB-1)

Adjusted OPP = OPP + CREF + REPC

Where:

CREF (Community Renewable Energy Facility power production): The yearly energy, in kilowatt hour equivalent (kWh_{eq}), contracted from a community renewable energy facility that is qualified under applicable state and local utility statutes and rules, and that allocates bill credits to the rated home.

REPC (Renewable Energy Purchase Contract power production): The yearly energy, in kilowatt hour equivalent (kWh_{eq}), contracted from an energy facility that generates energy with photovoltaic, solar thermal, *geothermal energy*, or wind systems, and that is demonstrated by an energy purchase contract or lease with a duration of not less than 15 years.

TABLE RB103.2 (IRC AQ103.2)
MAXIMUM ENERGY RATING INDEX[a]

CLIMATE ZONE	ENERGY RATING INDEX not including ~~onsite power~~ OPP	ENERGY RATING INDEX including Adjusted ~~onsite power~~ OPP (as proposed)
1	43	0
2	45	0
3	47	0
4	47	0
5	47	0
6	46	0
7	46	0
8	45	0

a. The building shall meet the mandatory requirements of Section R406.2, and the building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4. of the 2015 *International Energy Conservation Code*.

Commenter's Reason: RE223 should be approved as modified by this Public Comment. The original proposal was recommended for disapproval by the committee by a narrow vote of 6-5. The reasons cited by the committee have been addressed through this modification.
The modification address the Committee concerns as follows:

- The Committee requested that this proposal include an additional method of compliance for buildings without solar, and additional flexibility for buildings that have a limited ability to generate sufficient renewable energy on-site. These concerns are addressed through the addition of the Adjusted Onsite Power Production calculation, which allows compliance via a combination of onsite power production, energy generated through community renewable energy facilities, and renewable energy purchase contracts or leases.
  - The information needed about how much energy is being procured from each source (onsite, community facility, or through a contract/lease) will be disclosed in the contracting documents. From there, the Adjusted OPP is calculated through simple addition and entered into Equation 4.1.2 of RESNET/ICC 301. Calculation proceeds as usual within Section 4.1.2 using the Adjusted OPP to determine the Energy Rating Index.
- A home must meet two ERI score requirements, one without considering power production (ie, considering only energy efficiency) and one taking power production into consideration. The Adjusted OPP calculation for procurement of offsite kWh_{eq} is only used when calculating whether a home fulfills the requirement to have zero net energy consumption.
- This modification provides substantial flexibility for builders to comply in the way that is most cost-effective and best suits the local market.

- There was discussion during the Committee hearings that this proposal needs the term “net” included in the title. We do not feel this is necessary, as we are following the Department of Energy protocol by using the “Zero Energy Buildings” terminology.
- There was discussion during the Committee hearings that the ERI numbers are too low. In fact, the ERI values not including OPP are buildable and were found to be cost-effective based on a thorough analysis of HERS scores nationwide, a survey of HERS scores for model high-performance homes, modeling performed for ASHRAE 90.2, and the U.S. DOE Zero Energy Ready Home. The required scores are designed to be aggressive yet achievable, adopted by cities and jurisdictions ready to lead the market by adopting this optional appendix.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
Complying with this appendix will increase the first cost of construction. Meeting the Energy Rating Index values before onsite power production will typically require increasing the efficiency of the building envelope (e.g. higher insulation levels, more efficient windows and reduced air envelope air leakage), increasing the heating, cooling and water heating equipment efficiencies, and also installing more efficient appliances. The additional fist cost will be dependent on the package of features that the builder chooses to meet the ERI score. While there will be an additional first cost to meet the ERI score prior to addition of onsite power production, the ERI scores selected were found to be cost effective based on information presented to the ASHRAE Standard 90.2 committee. All of the ERI scores without onsite power production have been found to have Savings/Investment Ratios (SIR) of greater than 1.0.”

Public Comment# 1904

Public Comment 3:

IECC®: TABLE RB103.2 (IRC AQ103.2) (New)

Proponents:
Martha VanGeem, self, representing Masonry Alliance for Codes and Standards

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

TABLE RB103.2 (IRC AQ103.2)
MAXIMUM ENERGY RATING INDEX[a]

CLIMATE ZONE	ENERGY RATING INDEX not including onsite power	ENERGY RATING INDEX including onsite power (as proposed)
1	43	0
2	45	0
3	47	0
4	47	0
5	47	0
6	46	0
7	46	0
8	45	0

a. The building shall meet the mandatory requirements of Section R406.2.~~, and building thermal envelope shall be greater than or equal to the levels of efficiency and SHGC in Table R402.1.2 or Table R402.1.4 of the~~ ~~*2015 International Energy Conservation Code.*~~

Commenter's Reason: This public comment neither supports or is asking for disapproval of RE223. Rather, it is modifying it in the event that it is approved.
The mandatory requirements of Section R406.2 already include minimum stringency requirements for U-factors and SHGC (backstops). Therefore they are not needed here and are struck in this public comment. Furthermore, the backstops in RE150 as approved as modified by the committee for Section R406.2 are preferable to those in this proposal.

Lastly, it would be best if these mandatory requirements and backstops were consistent and changed in one place rather than in multiple places.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
This public comment does not increase the cost of the construction because the comment is only redirecting the reader to the backstop that is (and for 2021, will be) in Section R406.2. What that backstop will be for the 2021 IECC is covered by other proposals. Because this public comment has no cost impact but the original proposal does have a cost increase, the net effect of both will still be an increase in the cost of construction.

Public Comment# 1597

RE224-19 Part I

IECC: APPENDIX RB (New)

Proposed Change as Submitted

Proponents: Theresa Weston, representing DuPont Performance Building Solutions (theresa.a.weston@dupont.com)

THIS IS A 2 PART CODE CHANGE PROPOSAL. PARTS I AND II WILL BE HEARD BY IECC-RE COMMITTEE. PLEASE SEE THE TENTATIVE HEARING ORDERS FOR THIS COMMITTEE.

2018 International Energy Conservation Code

Add new text as follows:

Appendix RB
STRETCH ENERGY CODE PROVISIONS

SECTION RB101
GENERAL

RB101.1 Scope. The provisions of this appendix shall be applicable for new construction or portions of existing residential buildings undergoing renovation or addition where increased levels of energy efficiency are required.

SECTION RB102
REQUIREMENTS

RB102.1 Requirements. Residential buildings or portions of residential buildings shall meet the requirements of ASHRAE/IES Standard 90.2.

SECTION RB103
REFERENCE STANDARDS

Add new standard(s) as follows:

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329
US

90.2-2018: Energy-Efficient Design of Low-Rise Residential Buildings

Reason: Some jurisdictions are interested in adopting stretch energy codes. Providing a stretch code through the reference of ANSI/ASHRAE/IES Standard 90.2-2018 allows for a stretch code that is based on an ERI methodology that is compatible with the ERI pathway within the base IECC. The ERI levels specified within 90.2-2018 have been specified as Tier 3 within the CEE New Residential Construction Specification, while the IECC 2018 ERI path is specified as Tier 1. (https://library.cee1.org/content/cee-residential-new-construction-specification/)

Cost Impact: The code change proposal will increase the cost of construction
The cost of construction will increase in the jurisdictions which addopt the stretch code appendix, but Standard 90.2 has been analyzed to be cost effective. The cost effectiveness analysis is reported in **FSEC-RR-584-15 Maximum Energy Efficiency Cost Effectiveness in New Home Construction,** dated May 20, 2015 (available at http://www.fsec.ucf.edu/en/publications/pdf/FSEC-RR-584-15.pdf).

Staff Analysis: A review of the standard proposed for inclusion in the code, ASHRAE 90.2-2018, with regard to the ICC criteria for referenced standards (Section 3.6 of CP#28) will be posted on the ICC website on or before April 2, 2019.

RE224-19 Part I

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: If it is in an appendix it takes a specific action by a jurisdiction. If it is an alternative path it belongs there. Unclear if mandatory requirements are included. There is an unconfirmed potential conflict with the 2018 IECC and the potential unconfirmed comments on the 90.2.

(Vote: 7-4).

Assembly Action: **None**

RE224-19 Part I

Individual Consideration Agenda

Public Comment 1:

IECC®: SECTION RB102 (New), RB102.1 (New)

Proponents:
Connor Barbaree, representing ASHRAE (cbarbaree@ashrae.org)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

SECTION RB102
REQUIREMENTS

RB102.1 Requirements. Residential buildings or portions of residential buildings shall meet the requirements of ASHRAE/IES Standard 90.2 <u>and the requirements identified as "mandatory" in Chapter 4</u>.

Commenter's Reason: The inclusion of Standard 90.2 as reference for a stretch code appendix is desirable because this will encourage municipalities to adopt a uniform beyond code option to achieve greater levels of energy efficiency. As 90.2 was developed to be a leadership standard it is an excellent fit as a stretch code.
The modification is provided addresses the committee's concerns that mandatory requirements within the base code are still carried forward into the stretch code.

In reference to the committee's concerns with potential unresolved commenters during the publication process, the process allows members and interested parties to maintain their technical differences during the publication approval process. It is commonplace to have differing technical opinions during this process and is essential to the development of consensus based standards.

Bibliography: ASHRAE Standard 90.2-2018

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The first cost of construction will likely increase in the jurisdictions which adopt the stretch code appendix, but Standard 90.2 has been analyzed to be cost effective. The cost effectiveness analysis is reported in FSEC-RR-584-15 Maximum Energy Efficiency Cost Effectiveness in New Home Construction, dated May 20, 2015 (available at http://www.fsec.ucf.edu/en/publications/pdf/FSEC-RR-584-15.pdf).

Public Comment# 1348

Public Comment 2:

IECC®: Appendix RB (New), SECTION RB101 (New), RB101.1 (New), SECTION RB102 (New), RB102.1 (New), SECTION RB103 (New), ASHRAE (New)

Proponents:
Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Energy Conservation Code

Appendix RB
STRETCH ENERGY CODE PROVISIONS

SECTION RB101
GENERAL

RB101.1 Scope. The provisions of this appendix shall be applicable for new construction or portions of existing residential buildings undergoing renovation or addition where increased levels of energy efficiency are required.

SECTION RB102
REQUIREMENTS

RB102.1 Requirements. Residential buildings or portions of residential buildings shall meet the requirements of ASHRAE/IES Standard 90.2 <u>and the requirements identified as "mandatory" in Chapter 4.</u>

SECTION RB103
REFERENCE STANDARDS

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329
US

90.2-2018: Energy-Efficient Design of Low-Rise Residential Buildings

Commenter's Reason: The inclusion of Standard 90.2 as reference for a stretch code appendix is desirable because this will encourage municipalities to adopt a uniform beyond code option to achieve greater levels of energy efficiency. As 90.2 was developed to be a leadership standard it is an excellent fit as a stretch code.
The modification is provided addresses the committee's concerns that mandatory requirements within the base code are still carried forward into the stretch code.

In reference to the committee's concerns with potential unresolved commenters during the publication process, the process allows members and interested parties to maintain their technical differences during the publication approval process. It is commonplace to have differing technical opinions during this process and is essential to the development of consensus based standards.

Cost Impact: The net effect of the public comment and code change proposal will increase the cost of construction
The first cost of construction will likely increase in the jurisdictions which adopt the stretch code appendix, but Standard 90.2 has been analyzed to be cost effective. The cost effectiveness analysis is reported in FSEC-RR-584-15 Maximum Energy Efficiency Cost Effectiveness in New Home Construction, dated May 20, 2015 (available at http://www.fsec.ucf.edu/en/publications/pdf/FSEC-RR-584-15.pdf).

Public Comment# 1174

RE224-19 Part II

IRC: APPENDIX U (New)

Proposed Change as Submitted

Proponents: Theresa Weston, representing DuPont Performance Building Solutions (theresa.a.weston@dupont.com)

2018 International Residential Code

Add new text as follows:

Appendix U
STRETCH ENERGY CODE PROVISIONS

SECTION AU101
GENERAL

AU101.1 Scope. The provisions of this appendix shall be applicable for new construction or portions of existing residential buildings undergoing renovation or addition where increased levels of energy efficiency are required.

Revise as follows:

SECTION AU102
REQUIREMENTS

AU102.1 Requirements. Residential buildings or portions of residential buildings shall meet the requirements of ASHRAE/IES Standard 90.2.

SECTION AU103
REFERENCE STANDARDS

Add new standard(s) as follows:

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329
US

90.2-2018: Energy-Efficient Design of Low-Rise Residential Buildings

RE224-19 Part II

Public Hearing Results

Committee Action: **Disapproved**

Committee Reason: Keeping in alignment with the decision for Part 1. If it is in an appendix it takes a specific action by a jurisdiction. If its an alternative path it belongs there. Unclear if mandatory requirements included. There is an unconfirmed potential conflict with the 2018 IECC and the potential unconfirmed comments on the 90.2. (Vote: 7-4).

Assembly Action: **None**

RE224-19 Part II

Individual Consideration Agenda

Public Comment 1:

IRC®: Appendix U (New), SECTION AU101 (New), AU101.1 (New), SECTION AU102 (New), AU102.1 (New), SECTION AU103 (New), ASHRAE (New)

Proponents:
Theresa Weston, representing Air Barrier Association of America (ABAA) (theresa.a.weston@dupont.com)

requests As Modified by Public Comment

Modify as follows:

2018 International Residential Code

Appendix U
STRETCH ENERGY CODE PROVISIONS

SECTION AU101
GENERAL

AU101.1 Scope. The provisions of this appendix shall be applicable for new construction or portions of existing residential buildings undergoing renovation or addition where increased levels of energy efficiency are required.

SECTION AU102
REQUIREMENTS

AU102.1 Requirements. Residential buildings or portions of residential buildings shall meet the requirements of ASHRAE/IES Standard 90.2 and the requirements identified as "mandatory" in Chapter N11. .

SECTION AU103
REFERENCE STANDARDS

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta GA 30329
US

90.2-2018: Energy-Efficient Design of Low-Rise Residential Buildings

Commenter's Reason: The inclusion of Standard 90.2 as reference for a stretch code appendix is desirable because this will encourage municipalities to adopt a uniform beyond code option to achieve greater levels of energy efficiency. As 90.2 was developed to be a leadership standard it is an excellent fit as a stretch code.
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Public Comment# 1175