EC45–07/08
402.2.1, 402.2.2; IRC N1102.2.1, N1102.2.2

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

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

402.2.1 Ceilings with attic spaces. When Section 402.1.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the U-factor alternative approach in Section 402.1.3 and the Total UA alternative in Section 402.1.4.

402.2.2 Ceilings without attic spaces. Where Section 402.1.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section 402.1.1shall be limited to 500 square feet (46 m^2) of ceiling area. This reduction shall not apply to the U-factor alternative approach in Section 402.1.3 and the Total UA alternative in Section 402.1.4.

PART II – IRC

Revise as follows:

N1102.2.1 Ceilings with attic spaces. When Section N1102.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly R-38 shall be deemed to satisfy the requirement for R-49 wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves. This reduction shall not apply to the U-factor alternative approach in Section N1102.1.2 and the Total UA alternative in Section N1102.1.3.

N1102.2.2 Ceilings without attic spaces. Where Section N1102.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section 402.1.1shall be limited to 500 square feet (46 m^2) of ceiling area. This reduction shall not apply to the U-factor alternative approach in Section N1102.1.2 and the Total UA alternative in Section N1102.1.3.

Reason: The purpose of this code change is to clarify that the reduced levels in the ceiling insulation sections only apply to the prescriptive requirements as specified in Table 402.1.1 of the IECC and Table N1102.1 of the IRC. The special allowances are only needed in the prescriptive approach as both the U-factor alternative and the total UA alternative allow for the proper calculation of ceiling U-factors and permit trade-offs to allow for reduced ceiling insulation. In fact, the fundamental nature of the U-factor and UA approach is to be based on the actual envelope component construction rather than utilize the special “fudge factors” needed to make the R-value approach more practical. As these code sections already state that these only apply to Section 402.1.1 and N1102.1, this proposal is only a clarification. This has been a point of confusion in DOE’s technical assistance role for the IECC and IRC.

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

PART I - IECC

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

PART II – IRC B/E

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

EC46–07/08
402.2.2

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

Revise as follows:

402.2.2 Ceilings without attic spaces. Where Section 402.1.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section 402.1.1 shall be limited to 500 square feet (46 m2) <u>or 20%</u> of <u>the total insulated</u> ceiling area<u>, which ever is less</u> .

Reason: The current language in the code allows for homes of any size to have a 500 square foot exception for ceiling insulation to be reduced in cathedral ceilings. In the current language, a small home could have close to 100% of the ceiling meet the cathedral ceiling exception. This proposal removes this loophole, by setting a maximum exception equal to either 20% of the ceiling area or 500 square feet, which ever is less.

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

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

EC47–07/08
402.2.3; IRC N1102.2.3

Proponent: Charles Bloomberg, City of Southlake, TX, representing the North Texas Chapter, ICC

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

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

> <u>**Exception:** A fenestration product tested and labeled in accordance with Section 102.1.3 shall be permitted to be used for attic access provided the product is included in the energy analysis of the dwelling.</u>

PART II – IRC

Revise as follows:

N1102.2.3 (Supp) Access hatches and doors. Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment which prevents damaging or compressing the insulation. A wood-framed or equivalent baffle or retainer is required to be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed *R*-value of the loose fill insulation.

> <u>**Exception:** A fenestration product tested and labeled in accordance with Section N1101.5 shall be permitted to be used for attic access provided the product is included in the energy analysis of the dwelling.</u>

Reason: This gives an alternative method of compliance without compromising the intent of this code section. Prior to this new section in the 2007 Supplement, this method of compliance has been used by code officials. The concern expressed by the proponents of the new section was that these openings were being ignored. Limiting the options to providing a complete wall assembly or equivalent is too restrictive. Doors are permitted elsewhere in the building thermal envelope.

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

PART I – IECC

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

PART II – IRC B/E

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

EC48–07/08

402.2.3; IRC N1102.2.3

Proponent: Lawrence Brown, CBO, National Association of Home Builders (NAHB)

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

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

> **Exception:** Vertically installed access doors, from conditioned spaces to unconditioned spaces, shall meet the requirements of typical exterior doors.

PART II – IRC

Revise as follows:

N1102.2.3 (Supp) Access hatches ~~and doors~~. Access ~~doors~~ hatches from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be ~~weatherstripped and~~ insulated ~~to a level equivalent~~ to the required minimum insulation rating of the adjacent thermal envelope ~~on the surrounding surfaces~~. ~~Access shall be provided to all equipment which prevents damaging or compressing the insulation.~~ A wood framed or equivalent baffle or retainer shall be installed to ~~is required to be provided when loose fill insulation is installed, the purpose of which is to~~ prevent ~~the~~ loose fill insulation from spilling into the ~~living~~ conditioned space when the ~~attic access~~ hatch is opened~~, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation~~.

> **Exception:** Vertically installed access doors, from conditioned spaces to unconditioned spaces, shall meet the requirements of typical exterior doors.

Reason: What is being described in this Section is a "hatch" as used elsewhere in the I-Codes, not particularly a door. The aspect of weather-stripping is explicitly covered in Section N1102.4.1, Item 10. The rating of the envelope separating the conditioned spaces to unconditioned spaces is already covered in Table N1102.1. Also, the Exception is added as typical exterior doors are allowed in any thermal envelope as covered in Chapter 11.

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

PART I – IECC

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

PART II – IRC B/E

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

EC49–07/08

402.2.3 (New); IRC N1102.1.3 (New)

Proponent: Shirley Muns, US Green Fiber, LLC

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

402.2.3 Attic access openings. Attic access openings that penetrate the building envelope shall be protected by one of the following:

1. Doors and pre-manufactured assemblies shall have a maximum U-factor of 0.35.
2. Site-built assemblies shall provide a minimum of R-10 of rigid insulation permanently attached to the opening panel.

(Renumber subsequent sections)

PART II – IRC

Add new text as follows:

N1102.1.3 Attic access openings. Attic access openings that penetrate the building envelope shall be protected by one of the following:

1. Doors and pre-manufactured assemblies shall have a maximum U-factor of 0.35.
2. Site-built assemblies shall provide a minimum of R-10 of rigid insulation permanently attached to the opening panel.

(Renumber subsequent sections)

Reason: Protection of openings into the building envelope is a cornerstone of the IECC and Chapter 11 of the IRC, just look at fenestration U-factor requirements, wall and ceiling R-values. Yet homes are constructed with one or more attic access openings that are left unprotected. Adding this section will provide clarification to the contractor and inspector as to how to achieve code compliance in an area that has never been properly addressed.

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

PART I – IECC

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

PART II – IRC B/E

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

EC50–07/08
402.2.4; IRC N1102.2.4

Proponent: Jonathan Humble, AIA, American Iron and Steel Institute (AISI), representing AISI and the Steel Framing Institute

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

402.2.4 Steel-frame ceilings, walls, and floors. Steel frame ceilings, walls, and floors shall meet the insulation requirements of Table 402.2.4 or shall meet the U-factor requirements in Table 402.1.3. The calculation of the U-factor for a steel frame envelope assembly shall use a series-parallel path calculation method.

> **Exception:** In climate zones 1 and 2, the continuous insulation in Table N1102.2.4 shall not be required for steel frame wall assemblies.

PART II – IRC

Revise as follows:

N1102.2.4 Steel-frame ceilings, walls, and floors. Steel frame ceilings, walls, and floors shall meet the insulation requirements of Table N1102.2.4 or shall meet the U-factor requirements in Table N1102.1.2. The calculation of the U-factor for a steel frame envelope assembly shall use a series parallel path calculation method.

> **Exception:** In climate zones 1 and 2, the continuous insulation in Table N1102.2.4 shall not be required for steel frame wall assemblies.

Reason: The purpose of this proposal is to delete the requirement for continuous insulation in climate zones where the continuous insulation would result in a steel wall assembly substantially exceeding the requirements for other materials.

The proposed language is superior to the existing language because it creates equal requirements for energy efficiency for all materials by removing a requirement that unnecessarily adds to the cost of building with steel. Further, the cost of continuous insulation is an undue burden on a material that offers great durability benefits. Steel offers protection over the life of the home, but the current requirement for continuous insulation is too expensive for those in the affordable housing market to exercise this option.

From an energy efficiency standpoint, simulations run with REM Design for a typical home in New Orleans (climate Zone 2) show that the energy use in a home built with steel walls and R-13 in the cavity is within 1% of the energy used by a similar home with wood walls and R-13 cavity insulation. The differences only begin to become significant in colder climate zones, but not in zones 1 and 2.

The basis for the equivalency table in the current Table N1102.2.4, which applies an across the board fix that is independent of climate zone, is simplistic and not economically defensible. The steel industry recognizes the need to develop economics-based solutions to energy efficiency for all materials. Until this work can be accomplished, this proposed change will immediately correct one of the most glaring deficiencies in the code that does not pass the test of being economically justified.

From an economics standpoint, the installed cost of continuous insulation, including labor and materials for jamb extensions, extended length fasteners with specialty washers, and the insulation itself, is estimated at just under $1000 ($980) for a typical 1200 Sq. Ft home. For a larger home of 2100 Sq. Ft., the cost of the continuous insulation adds over $1800. This extra cost buys the homeowner negligible to no energy savings.

Cost Impact: This proposal will not increase the cost of construction. It will reduce the cost of a steel framed building.

PART I – IECC

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

PART II – IRC B/E

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

EC51–07/08
Table 402.2.4; IRC Table N1102.2.4

Proponent: Jonathan Humble, AIA, American Iron and Steel Institute (AISI), representing AISI and the Steel Framing Institute

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise table as follows:

TABLE 402.2.4
STEEL FRAME CEILING, WALL AND FLOOR INSULATION
(R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE [a]
Steel Framed Wall	
R-13	R-13+5 or R-15+4 or R-21+3 or R-0+8.5
R-19	R-13+9 or R-19+8 or R-25+7
R-21	R-13+10 or R-19+9 or R-25+8

(Portions of table and footnotes not shown remain unchanged)

PART II – IRC

Revise table as follows:

TABLE N1102.2.4
STEEL FRAMED CEILING, WALL AND FLOOR INSULATION
(R-VALUE)

WOOD FRAME R-VALUE REQUIREMENT	COLD-FORMED STEEL EQUIVALENT R-VALUE [a]
Steel Framed Wall	
R-13	R-13+5 or R-15+4 or R-21+3 or R-0+8.5
R-19	R-13+9 or R-19+8 or R-25+7
R-21	R-13+10 or R-19+9 or R-25+8

(Portions of table and footnotes not shown remain unchanged)

Reason: The proposal is requesting the inclusion of an additional tabular R-value to the steel framed wall category of Table N1102.2.4. In this case the value proposed would represent an assembly with only continuous insulation (No cavity insulation) on cold-formed steel framed walls for the equivalent wood walls category R-13. The basis for this proposal is to permit another method of installing insulation to a cold-formed steel framed wall assembly. This method is used in the field, but if applied to the strict application of the IECC would require the homeowner or builder to seek permission, through IRC Section 103 (Alternative Materials – Methods of Construction, Design or Insulating Systems), in order to comply with the provisions. We feel this unnecessary since this application is readily used in both the non-residential building construction and residential building today.

Using the IRC Table N1102.1.2 we simply take the wood wall tabular R-value for Climate zones #1, #2, #3, or #4 which equals R-13 and use that as our goal. Wood framed wall is calculated (Source ASHRAE Handbook-Fundamentals):

R(Cavity)	R(Studs)	Descriptions
0.17	0.17	Outside air film
0.62	0.62	Wood Panels
13.00	--	Cavity insulation
--	4.38	Wood Stud Framing
0.45	0.45	Gypsum board interior side
0.68	0.68	Inside air film
14.92	6.3	***R-value Totals***
0.0670	0.1587	***U-factor Totals***

U-Factor = (0.25 (25% studs) x R(Studs)) + (0.75 (75% cavity) x R(Cavity)) =
U-Factor = (0.25 x 0.1587) + (0.75 x 0.0670) = 0.0900 Btu/h*ft2*Degrees F, or R-value = R-11.12

To find out the necessary value for the minimum R-value for the rigid board insulation we use the following analysis:

R(w/Plywood)	R(w/o Plywood)	Descriptions
0.17	0.17	Outside air film
0.62	---	20% wood panels and 80% no wood panels on wall framing (IRC minimum wall sheathing requirements)
8.50	8.50	Continuous insulation
1.14	1.14	Benefit for a cavity wall with no insulation (Source- ASHRAE Handbook of Fundamentals)
0.45	0.45	Gypsum board interior side
0.68	0.68	Inside air film
12.56	10.94	***R-value Totals***
0.0865	0.0914	***U-factor Totals***

U-Factor = (0.20 (20% panels) x 0.0914) + (0.80 (80% no panels) x 0.0865) = 0.0877 Btu/h*ft2*Degrees F

As a result, the use of R-8.5 continuous insulation should be deemed an acceptable alternative to an R-13 Wood Frame Wall.

Bibliography:
ASHRAE, ASHRAE Handbook-Fundamentals, American Society of Heating, Refrigerating and Air-conditioning Engineers, Atlanta, GA, 2005 edition, Chapter 25.

Cost Impact: The proposal may decrease the cost of construction by permitting the application of only one insulation, versus two as required in the other equivalency measures.

PART I – IECC

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

PART II – IRC B/E

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

EC52–07/08
402.2.5

Proponent: Lamont Millspaugh, Reflectix, Inc., representing the Reflective Insulation Manufacturers Association

Revise as follows:

402.2.5 Floors. Insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

Exception: Reflective insulation systems that include an enclosed air space adjacent to the material.

Reason: The purpose of the exception is to allow the use of reflective insulation systems designed to have an adjacent enclosed air space in applications below subfloor decking. Section 402.2.5 as written does not allow an air space between the insulation material and the subfloor decking. Reflective insulation derive their performance from enclosed air spaces bounded on at least one side by a low-emittance surface. The enclosed air space is between the reflective insulation and the subfloor decking.

Acceptance of the new text will permit use of reflective insulation systems below subfloor decking. A brief discussion follows of the technical aspects of the proposed new text.

Discussion for Exception to 402.2.5:

The requested exception is for the requirement that floor insulation be installed in contact with subfloor decking. Reflective insulation systems are specifically designed to provide an enclosed air space between the insulation and the subfloor decking.

Air and water vapor (moisture) do not move through reflective insulations installed below subfloor decking. It is not necessary, therefore, to have these products in contact with the subfloor decking in order to provide resistance to air movement or moisture movement from the region below the floor to the subfloor decking.

Reflective insulation systems used below subfloor decking derive a major part of their thermal performance from the reflective air space between the reflective insulation material and the subfloor. A typical reflective insulation installed between floor joists to form a reflective air space between the insulation and the decking has a material R-value of approximately 1.0 $ft^2 \cdot h \cdot °F/Btu$. The R-value contribution of the reflective air space ranges from 2 to 7 depending on the distance across the air space and the heat-flow direction. Examples of the thermal resistance provided by the reflective insulation system and the percentage of the total due to the reflective air space are shown below for 24-inch on-center joists, a 30°F temperature difference across the air space, and a 75°F average air space temperature.

Calculated R- Values for Reflective Insulation Systems Installed Below Subfloor Decking

Vertical Distance Across the Enclosed Air Space (inches)	Heat Flow Direction Down (ft2●h●° F/Btu)	Up (ft2●h●° F/Btu)
1	5 (80%)*	3 (67%)
2	7 (86%)	3 (67%)
3	7 (86%)	3 (67%)
4	8 (88%)	3 (67%)

*The numbers in parentheses are the contribution of the reflective air space thermal resistance to the total thermal resistance.

Summary:
The requirement in 402.2.5 is unnecessary for reflective insulation systems. The requirement in 402.2.5 eliminates reflective air spaces and the contribution of the reflective air space to the overall thermal performance. The exception permits use of reflective insulation systems below subfloor decking.

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

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

EC53–07/08

402.3 (New), Chapter 6 (New); N1103.4 (New), Chapter 43 (New)

Proponent: Shirley Muns, US Green Fiber, LLC

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Add new text as follows:

402.3 Roof reflectance. Low and medium sloped roofs in Climate Zones 1, 2, and 3 shall comply with the following requirements for reflectance when tested in accordance with ASTM C1549, ASTM E1918 or by testing with a portable reflectometer at near ambient conditions. The roof surface of low sloped roofs (2:12 or less) shall have an initial solar reflectance greater than or equal to 0.65 and shall maintain a reflectance equal or greater than 0.50 for three years after installation. Medium sloped roofs (greater than 2:12 and less than or equal to 5:12) shall have a solar reflectance equal to or greater than 0.15 initially and for three years after installation.

Exceptions:

1. The portion of the roof that is covered by a rooftop deck covering 1/3 or less of the aggregate area of the roof, or a rooftop garden, or a green roof.
2. An area including and adjacent to rooftop photovoltaic and solar thermal equipment, totaling not more than three times the area that is covered with such equipment.

(Renumber subsequent sections)

2. Add standards to Chapter 6 as follows:

ASTM

C1549-(04) Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer

E1918-(1997) Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field

PART II – IRC

Add new text as follows:

N1103.4 Roof reflectance. Low and medium sloped roofs in Climate Zones 1, 2, and 3 shall comply with the following requirements for reflectance when tested in accordance with ASTM C1549, ASTM E1918 or by testing with a portable reflectometer at near ambient conditions. The roof surface of low sloped roofs (2:12 or less) shall have an initial solar reflectance greater than or equal to 0.65 and shall maintain a reflectance equal or grater than 0.50 for three years after installation. Medium sloped roofs (greater than 2:12 and less than or equal to 5:12) shall have a solar reflectance equal to or greater than 0.15 initially and for three years after installation.

Exceptions:

1. The portion of the roof that is covered by a rooftop deck covering 1/3 or less of the aggregate area of the roof, or a rooftop garden, or a green roof.
2. An area including and adjacent to rooftop photovoltaic and solar thermal equipment, totaling not more than three times the area that is covered with such equipment.

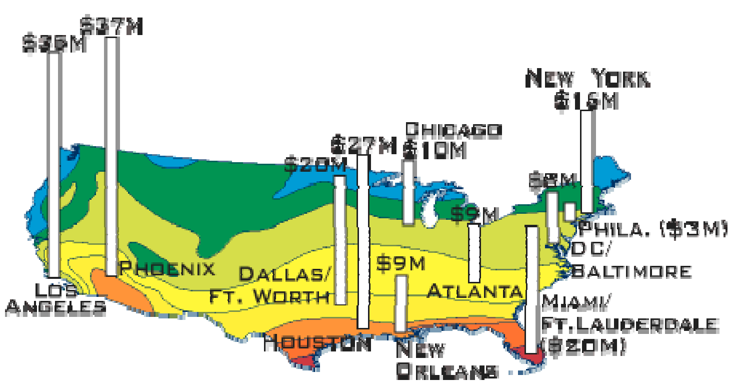
(Renumber subsequent sections)

2. Add standards to Chapter 43 as follows:

ASTM

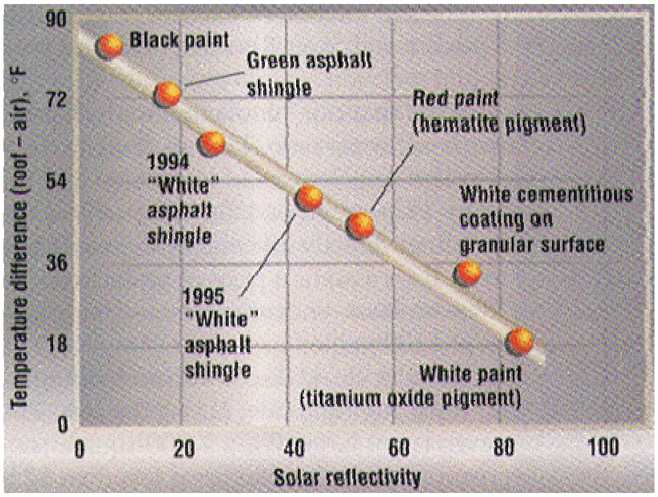
C1549-(04)	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
E1918-(1997)	Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field

Reason: Dark materials absorb more heat from the sun. Black surfaces in the sun can become up to 70°F (40°C) hotter than the most reflective white surfaces. If those dark surfaces are roofs, some of the heat collected by the roof is transferred inside. Staying comfortable under a dark shingle roof often means more air conditioning and higher utility bills. These roofs also heat the air around them, contributing to the heat island effect. Conversely, cool roofs can reduce the heat island effect and save energy. In a study funded by the U.S. EPA, the Heat Island Group carried out a detailed analysis of energy-saving potentials of light-colored roofs in 11 U.S. metropolitan areas. About ten residential and commercial building prototypes in each area were simulated. Energy Star considered both the savings in cooling and penalties in heating. We estimated saving potentials of about $175 million per year for the 11 cities. Extrapolated national energy savings were about $750 million per year.



Potential net energy savings from changing roof reflectivity. Savings are measured in dollars. The net savings are the savings of cooling energy use less the penalties of heating energy use.

The Heat Island Group has monitored buildings in Sacramento with lightly colored, more reflective roofs and found that these buildings used up to 40% less energy for cooling than buildings with darker roofs. The Florida Solar Energy Center performed a similar study, also showing up to 40% cooling energy savings.



Solar reflectivity is measured according to ASTM E903. Traditional roofing materials have an SRI of between 5% (brown shingles) and 20% (green shingles). White shingles with SRI's around 35% where popular in the 1960's, but they lost favor because they get dirty easily. The trend is to make white shingles more reflective.

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

Analysis: A review of the standard proposed for inclusion in the code, ASTM C1549 and ASTM E1918, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before January 15, 2008.

PART I – IECC

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

PART II – IRC B/E

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

EC54–07/08
402.3.3 (New), 402.3.3.1 (New), 402.3.3.2 (New)

Proponent: William E. Koffel, PE, Koffel Associates, Inc., representing the Glazing Industry Code Committee

Add new text as follows:

402.3.3 External shading. Where the effects of permanently attached overhangs, eaves, or other approved shading methods are used to adjust the SHGC of vertical fenestration, compliance with the requirements in Table 402.1.1 shall be determined by reducing the fenestration SHGC by a multiplier based upon the calculated projection factor as follows:

For a projection factor less than 0.25, no reduction in SHGC shall be allowed.
For a projection factor between 0.25 and 0.50, the SHGC multiplier shall be 0.84.
For a projection factor greater than 0.50, the SHGC multiplier shall be 0.66.

402.3.3.1 The projection factor shall be determined in accordance with Equation 4-1.

$PF = A/B$ **(Equation 4-1)**

where:
PF = Projection factor (decimal).

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

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

(Renumber subsequent sections)

Reason: Chapter 5 recognizes the benefits of projection factors for commercial buildings and a similar credit should be provided for residential occupancies.

The language starting with 403.3.1 is similar to the language in the Chapter 5. The SHGC multipliers are based on multipliers given in ASHRAE 90.1 for different projection factors. For PF = 0.25 and 0.50, the multipliers were calculated as the weighted average from the ASHRAE 90.1 multiplier for west/south/east orientation (75%) and the multiplier for northern orientation (25%). In comparison, the commercial chapter is effectively using SHGC multipliers of 0.76 and 0.62 for these PF ranges, so this proposal is more conservative.

Cost Impact: The code change proposal will not increase the cost of construction and may reduce the cost of construction by offering an alternative compliance method.

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

EC55–07/08

402.3.3 (New), 402.3.3.1 (New), 402.3.3.2 (New), Table 402.3.3 (New)

Proponent: William E. Koffel, PE, Koffel Associates, Inc., representing the Glazing Industry Code Committee

Add new text and table as follows:

402.3.3 External shading. As an alternative to the SHGC requirements of Table 402.1.1, vertical fenestration shall be permitted to meet the SHGC requirements of Table 402.3.3 based upon the calculated projection factor of permanently attached overhangs, eaves, or other approved shading methods.

402.3.3.1 Projection factor. The projection factor shall be determined in accordance with Equation 4-1.

PF = A/B **(Equation 4-1)**

where:

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

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

TABLE 402.3.3
EQUIVALENT SHGC REQUIREMENTS FOR VERTICAL FENESTRATION WITH EXTERNAL SHADING

Climate Zone	Maximum SHGC with *PF* < 0.25	Maximum SHGC with 0.25 ≤ *PF* < 0.50	Maximum SHGC with *PF* ≥ 0.50
1	0.37	0.44	0.56
2	0.37	0.44	0.56
3[a]	0.40	0.48	0.61

a. There are no SHGC requirements in the Marine zone.

Reason: Chapter 5 recognizes the benefits of projection factors for commercial buildings and a similar credit should be provided for residential occupancies.

The language starting with 403.3.3.1 is similar to the language in the Chapter 5. The SHGC multipliers are based on multipliers given in ASHRAE 90.1 for different projection factors. For PF = 0.25 and 0.50, the multipliers were calculated as the weighted average from the ASHRAE 90.1 multiplier for west/south/east orientation (75%) and the multiplier for northern orientation (25%). In comparison, the commercial chapter is effectively using SHGC multipliers of 0.76 and 0.62 for these PF ranges, so this proposal is more conservative.

The proposal is a simpler version of another proposal submitted by the Glazing Industry Code Committee.

Cost Impact: The code change proposal will not increase the cost of construction and may reduce the cost of construction by offering an alternative compliance method.

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

EC56–07/08
402.3.3, 402.3.4; IRC N1102.3.3, N1102.3.4

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

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

402.3.3 Glazed fenestration exemption. Up to 15 square feet ($1.4m^2$) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section 402.1.1. This exemption shall not apply to the U-factor alternative approach in Section 402.1.3 and the Total UA alternative in Section 402.1.4.

402.3.4 Opaque door exemption. One opaque door assembly is exempted from the *U*-factor requirement in Section 402.1.1. This exemption shall not apply to the U-factor alternative approach in Section 402.1.3 and the Total UA alternative in Section 402.1.4.

PART II – IRC

Revise as follows:

N1102.3.3 Glazed fenestration exemption. Up to 15 square feet ($1.4m^2$) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section N1102.1. This exemption shall not apply to the U-factor alternative approach in Section N1102.1.2 and the Total UA alternative in Section N1102.1.3.

N1102.3.4 Opaque door exemption. One opaque door assembly is exempted from the *U*-factor requirement in Section N1102.1. This exemption shall not apply to the U-factor alternative approach in Section N1102.1.2 and the Total UA alternative in Section N1102.1.3.

Reason: The purpose of this code change is to clarify that the glazing and door and exemptions identified in the proposal apply only to the prescriptive requirements as specified in Table 402.1.1 of the IECC and Table N1102.1 of the IRC. The special allowances are only needed in the prescriptive approach as both the U-factor alternative and the total UA alternative permit trade-offs. As these code sections already state that these only apply to Section 402.1.1 and N1102.1, this proposal is only a clarification. This has been a point of confusion in DOE's technical assistance role for the IECC and IRC.

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

PART I – IECC

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

PART II – IRC B/E

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

EC57–07/08
402.3.3, 402.3.6; IRC N1102.3.3

Proponent: Thomas S. Zaremba, Roetzel & Andress, representing Pittsburgh Corning Corporation

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

402.3.3 Glazed fenestration exemption. Up to 15 square feet (1.4 m^2) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section 402.1.1.

> **Exception:** Up to 25 square feet (2.3m²) of glazed fenestration per dwelling unit shall be exempt from the *U*-factor and SHGC requirements in Section 402.1.1 where:
>
> 1. One or more existing fenestration units are being replaced with new fenestration products, or,
> 2. A fenestration product does not meet the *U*-factor or SHGC limitations specified in Section 402.6 for the use of the trade offs specified in Section 402.1.4 or Section 404.

402.3.6 Replacement fenestration. Where some or all of an existing fenestration unit is replaced with a new fenestration product, including sash and glazing, the replacement fenestration unit shall meet the applicable requirements for *U*-factor and SHGC in Table 402.1.1 except as noted in Section 402.3.3.

PART II – IRC

Revise as follows:

N1102.3.3 Glazed fenestration exemption. Up to 15 square feet (1.4 m2) of glazed fenestration per dwelling unit shall be permitted to be exempt from *U*-factor and solar heat gain coefficient (SHGC) requirements in Section N1102.1.

> **Exception:** Where trade-offs are not permitted. Up to 25 square feet (2.3m²) of glazed fenestration per dwelling unit shall be exempt from the *U*-factor and SHGC requirements in Section N1102.1 where one or more existing fenestration units are being replaced with new fenestration products.

Reason (Part I): This proposed change is intended to increase the 15 square foot fenestration exemption to 25 square feet where trade-offs cannot be used, namely: 1- Where the trade-offs under Section 402.1.4 cannot be used because existing fenestration is being replaced with new fenestration, and 2- where Section 402.6 prohibits the use of the trade-off provisions.

Section 402.1.4 and Section 404 are intended to allow fenestration products that do not otherwise meet the U-factor and SHGC requirements of the code, to be "traded-off" and used in combination with other envelope materials so long as there is no net decrease in overall energy performance. However, these trade-off provisions cannot be used when fenestration is being replaced in an existing building. In addition, Section 402.1.4 imposes an artificial ban on the use of certain products even when trade-offs are used and their use would not result in a net decrease in overall energy performance.

Glass block is one example. It does not meet the prescriptive U-factors and SHGC of Table 402.1.1 and its use in trade-offs is blocked by the artificial limitations imposed by Section 402.6.

If the code is going to prohibit the use of any product, there must be a fair and rational basis for doing so. The limitations imposed by Section 402.6 are not fair or rational. Indeed, they are completely arbitrary and have no rational or fair basis since they block the use of some building materials with no demonstrable energy consequence. Accordingly, when trade-offs cannot be used, the 15 square foot exemption of Section 402.3.3 should be increased to 25 square feet.

In a typical, 2300 square foot home, an increase from 15 sq. ft. to 25 sq. ft. represents less than a ½% increase in the fenestration exemption. To help visual the size of the proposed increase, the 15 square foot exemption exempts four windows, each measuring slightly less than 2' x 2'. Increasing the exemption to 25 square feet would exempt four small windows, each measuring only 2½' x 2½'. Since a standard glass block is 8"x 8", increasing the exemption from 15 square feet to 25 square feet would add less than a total of 12 glass blocks to the envelope of a 2300 square foot home.

Reason (Part II): This proposed change is intended to increase the 15 square foot fenestration exemption to 25 square feet where a trade-off cannot be used, namely, where existing fenestration is being replaced with new fenestration.

Section N1102.1.3 is intended to allow fenestration products that do not otherwise meet the U-factor and SHGC requirements of the code, to be "traded-off" and used in combination with other envelope materials so long as there is no net decrease in overall energy performance. However, these trade-off provisions cannot be used when fenestration is being replaced in an existing building.

In a typical, 2300 square foot home, an increase from 15 sq. ft. to 25 sq. ft. represents less than a ½% increase in the fenestration exemption. To help visual the size of the proposed increase, the 15 square foot exemption of N1102.3.3 exempts four windows, each measuring slightly less than 2 square feet. Increasing the exemption to 25 square feet when trade-offs are not possible would exempt four windows, each measuring 2½ square feet.

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

PART I – IECC

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

PART II – IRC B/E

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

EC58–07/08
402.3.4; IRC N1102.3.4

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

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

402.3.4 Opaque door exemption. One opaque door assembly <u>up to 24 square feet (2.22 m^2) in area</u> is exempted from the *U*-factor requirement in Section 402.1.1.

PART II - IRC

Revise as follows:

N1102.3.4 Opaque door exemption. One opaque door assembly <u>up to 24 square feet (2.22 m^2) in area</u> is exempted from the *U*-factor requirement in Section N1102.1.

Reason: This change limits the area of the exempt door allowed in section 402.1.1.

Under the current standard, any size opaque door assembly is exempt from the door requirement. This includes anything from a reasonable wood entry door to a large roll up door. This proposal maintains a reasonable exemption for most opaque entry doors. Larger doors will be required to either meet the minimum U-factor under the prescriptive option or include the door u-factor in a u-factor trade off approach.

This exception, with the 24 square foot limit, has been in effect in Washington State since 1991.

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

PART I – IECC

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

PART II – IRC B/E

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

EC59–07/08
402.3.7; IRC N1102.3.7

Proponents: Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America; Tom Mewbourne, representing AFG Industries, Inc.

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

402.3.7 Alternate path Zones 5-8. In zones 5 through 8, if the SHGC and U-factor of a fenestration assembly meets any of the following SHGC ranges and corresponding maximum *U*-factors, it shall be considered in compliance with the fenestration requirements of Table 402.1.1:

1. SHGC from 0.40 to 0.43 with a maximum U-factor of 0.36,
2. SHGC from 0.44 to 0.48 with a maximum U-factor of 0.38,
3. SHGC from 0.49 to 0.54 with a maximum U-factor of 0.40.

PART II – IRC

Add new text as follows:

N1102.3.7 Alternate path Zones 5-8. In climate zones 5 through 8, if the SHGC and U-factor of a fenestration assembly meets any of the following SHGC ranges and corresponding maximum *U*-factors, it shall be deemed to be in compliance with the fenestration requirements of Table N1102.1:

1. SHGC from 0.40 to 0.43 with a maximum U-factor of 0.36,
2. SHGC from 0.44 to 0.48 with a maximum U-factor of 0.38,
3. SHGC from 0.49 to 0.54 with a maximum U-factor of 0.40.

Reason: The purpose of the proposed change is to provide an alternative to the prescriptive requirements of IECC Table 402.1.1 and IRC Table N1102.1 in heating dominated zones 5 through 8. In these zones, the prescriptive table mandates a 0.35 U-factor but, provides no rating (NR) for SHGC. This allows any SHGC value to be used in these northern climates, even low-SHGC products manufactured specifically to reduce solar gain in southern, cooling dominated climates.

The SHGC and U-Factor combinations used in the proposal are taken from a report entitled "Analysis Results for Performance-based Ratings for the Energy Star Windows Program" prepared in 2004 by the Windows and Daylighting Group at Lawrence Berkeley National Laboratory (LBNL Report). The LBNL Report was commissioned by the US Department of Energy, in part, to determine what U-factor and SHGC combinations would yield equivalent energy performance to the 0.35 U-factor currently mandated by Table 402.1.1 and Table N1102.1.

Adding this alternative path of compliance in zones 5 through 8 will not jeopardize energy efficiency while, at the same time, benefiting code officials, builders and consumers by providing them with SHGC values needed to select fenestration products that will maximize the use of free solar energy in these heating dominated climate zones.

Bibliography:
Analysis Results for Performance-based Ratings for the ENERGY STAR Windows Program" Prepared by the Windows and Daylighting Group of the Lawrence Berkeley National Laboratory for the US Department of Energy (October 1, 2004).

Cost Impact: The code change proposal will not increase the cost of construction and may decrease the cost of construction by providing greater product diversity to the marketplace.

PART I – IECC

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

PART II – IRC B/E

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

EC60–07/08
402.4.1; IRC N1102.4.1

Proponent: Craig Conner, Building Quality, representing himself

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

402.4.1 (Supp) Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:

1. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating a garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Attic access openings.
11. Rim joists.

~~11~~12. Other sources of infiltration.

PART II – IRC

Revise as follows:

N1102.4.1 (Supp) Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.

1. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating a garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Attic access openings.
11. Rim joists.

~~11~~12. Other sources of infiltration.

Reason: Rim joists, also called band joists, are a important source of infiltration. In principle, rim joists are already sealed. In practice, rim joists are more likely to be sealed when named as a specific area to seal.

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

PART I – IECC

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

PART II – IRC B/E

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

EC61–07/08

202 (New), 402.4.1, 402.4.1.1 (New), 402.4.1.2 (New), 402.4.1.3 (New), 402.4.1.4 (New), 402.4.1.5 (New), 402.4.1.6 (New)

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

1. Add new definition as follows:

SECTION 202
GENERAL DEFINITIONS

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

2. Revise as follows:

402.4.1 (Supp) Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration and prevent thermal bypasses. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The thermal envelope, including insulation and air barriers, shall be inspected in accordance with Sections 402.4.1.1 through 402.4.1.6. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

1. ~~All joints, seams and penetrations.~~
2. ~~Site-built windows, doors and skylights.~~
3. ~~Openings between window and door assemblies and their respective jambs and framing.~~
4. ~~Utility penetrations.~~
5. ~~Dropped ceilings or chases adjacent to the thermal envelope.~~
6. ~~Knee walls.~~
7. ~~Walls and ceilings separating a garage from conditioned spaces.~~
8. ~~Behind tubs and showers on exterior walls.~~
9. ~~Common walls between dwelling units.~~
10. ~~Attic access openings.~~
11. ~~Other sources of infiltration.~~

3. Add new text as follows:

402.4.1.1 Walls adjoining exterior walls or unconditioned spaces. Walls adjoining exterior walls or unconditioned spaces, including walls behind shower/tub, walls behind fireplaces, attic slopes for un-vented attic spaces, attic knee walls, skylight shaft walls, walls adjoining a porch roof, staircase walls, and double walls shall be fully insulated and in substantial contact with an air barrier at both the exterior and interior. Alignment with the interior air barrier is not required in Climate Zones 1 through 3.

402.4.1.2 Floors between conditioned and exterior spaces. An air barrier shall be installed at any exposed insulation edges of floors between conditioned spaces and exterior spaces. Insulation shall be installed to maintain substantial contact w/ sub-floor above and air barrier below. The following areas shall meet these requirements: Insulated floor above un-conditioned and semi-conditioned space.

402.4.1.3 Shafts. Openings and gaps in shaft enclosures to unconditioned space, including duct, piping and flue shafts and associated penetrations shall be fully sealed with an air barrier.

402.4.1.4 Attic and ceiling interface. Attic penetrations and dropped ceilings shall include a full interior air barrier aligned with insulation with any gaps fully sealed. Insulation shall fit snugly in opening and the opening air barrier shall be fully gasketed. The following areas shall meet these requirements: attic access panel, attic drop-down stair, dropped ceiling/soffit, recessed lighting fixtures, whole-house fan.

402.4.1.5 Common walls between dwelling units. Gaps between drywall shaft wall (common wall) and structural framing between dwelling units shall be sealed at all exterior boundary conditions.

402.4.1.6 Gaps and Penetrations. Gaps and penetrations in the thermal envelope of the home shall be sealed and insulated. The following areas shall meet these requirements: the perimeters of windows, doors, skylights, and utility penetrations, hose bibs, exterior electrical outlets and light fixtures.

Reason: This proposal expands on existing code language that requires thermal envelope sealing. The proposed language is intended to clarify and enhance the usefulness of the thermal envelope sealing requirements. This is also intended to be easier to enforce than the current vague language. Current code enforcement does not have enough information to properly determine compliance with minimum construction practice to ensure the thermal envelope is effective.

The proposal adds specific information to each of the major areas of the thermal envelope that need particular construction and inspection attention. By accepting this proposal, future codes will have increased enforceability and future homes will have improved thermal envelope performance.

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

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

EC62–07/08

402.4.1, 502.4.3, Chapter 6 (New); IRC N1102.4.1

Proponent: Gabe Farkas, Icynene, Inc.

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Revise as follows:

402.4.1 (Supp) Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration. Building envelope components covered by or including continuous materials having an air permeance not exceeding 0.004 cfm/ft^2 under a pressure differential of 0.3” w.g.(1.57 pcf) (0.02 L/s/m^2 @ 75 PA) where tested in accordance with ASTM E 2178 or ASTM E 283 shall be deemed to be sealed. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:

1. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating a garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Attic access openings.
11. Other sources of infiltration.

502.4.3 Sealing of the building envelope. Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Building envelope components covered by or including continuous materials having an air permeance not exceeding 0.004 cfm/ft^2 under a pressure differential of 0.3" w.g. (1.57 pcf) (0.02 L/s/m^2 @ 75 Pa) when tested in accordance with ASTM E 2178 or ASTM E 283 shall be deemed to be sealed. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.

2. Add standard to Chapter 6 as follows:

ASTM

E2178 Standard Test Method for Air Permeance of Building Materials

PART II – IRC

1. Revise as follows:

N1102.4.1 (Supp) Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material <u>defined as having an air permeance not exceeding 0.004 cfm/ft² under a pressure differential of 0.3"w.g. (1.57 psf) (0.02 L/s/m² @ 75 Pa) when tested in accordance with ASTM E 2178-03 or ASTM E 283-04.</u>

1. All joints, seams and penetrations.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. Utility penetrations.
5. Dropped ceilings or chases adjacent to the thermal envelope.
6. Knee walls.
7. Walls and ceilings separating the garage from conditioned spaces.
8. Behind tubs and showers on exterior walls.
9. Common walls between dwelling units.
10. Attic access openings.
11. Other sources of infiltration.

2. Add standard to Chapter 43 as follows:

ASTM
<u>E2178</u> <u>Standard Test Method for Air Permeance of Building Materials</u>

Reason: To define air barrirer material. Although the current code language addresses air sealing, the end result is uncertain because the materials employed may or may not enhance air sealing performance of the envelope. The additional language ensures that materials employed, meet the requirements of an air barrier, thus ensuring the building envelope air infiltration/exfiltration performance.

Studies titled "The Next Big Energy Savings Frontier: Airtight Building Envelopes" and 30 Year History Proves Energy Savings From Air Barrier Retrofit" concur with numerous studies that the tighter the building envelope, the greater the reduction of energy use.

Bibliography:
"The Next Big Energy Savings Frontier: Airtight Building Envelopes" and "30 Year History Proves Energy savings From Air Barrier Retrofit" both by Tony Woods and printed by Building Envelope Forum.

Cost Impact: This code change will not add to the cost of construction since air leakage is currently referenced. This change only defines the air permeance of materials used to provide sealing of the building envelope.

Analysis: A review of the standard proposed for inclusion in the code, ASTM E2178, for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before January 15, 2008.

PART I – IECC

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

PART II – IRC B/E

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

EC63–07/08
402.4.1; IRC N1102.4.1

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

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

402.4.1 (Supp) Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:

1. ~~All joints, seams and penetrations.~~ Joints, seams and penetrations including between foundation and sill plate, bottom plate of exterior walls and band joist cavities between floors.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. ~~Utility penetrations.~~ Utility penetrations including all electrical, plumbing, and HVAC penetrations open to unconditioned space or to the exterior.
5. ~~Dropped ceilings or chases adjacent to the thermal envelope.~~ Framed cavities, such as air chases, soffits, coffered or dropped ceiling and behind tub/shower units adjacent to the thermal envelope.
6. ~~Knee walls.~~ Block and seal kneewalls and cantilevered floors open to unconditioned space or to the exterior.
7. Walls and ceilings separating a garage from conditioned spaces.

~~8. Behind tubs and showers on exterior walls.~~

~~9~~ 8. Common walls between dwelling units.

~~10~~ 9. Attic access openings.

~~11~~10. Other sources of infiltration.

PART II – IRC

Revise as follows:

N1102.4.1 (Supp) Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material.

1. ~~All joints, seams and penetrations.~~ Joints, seams and penetrations including between foundation and sill plate, bottom plate of exterior walls and band joist cavities between floors.
2. Site-built windows, doors and skylights.
3. Openings between window and door assemblies and their respective jambs and framing.
4. ~~Utility penetrations.~~ Utility penetrations including all electrical, plumbing, and HVAC penetrations open to unconditioned space or to the exterior.
5. ~~Dropped ceilings or chases adjacent to the thermal envelope.~~ Framed cavities, such as air chases, soffits, coffered or dropped ceiling and behind tub/shower units adjacent to the thermal envelope.
6. ~~Knee walls.~~ Block and seal kneewalls and cantilevered floors open to unconditioned space or to the exterior.
7. Walls and ceilings separating the garage from conditioned spaces.

~~8. Behind tubs and showers on exterior walls.~~

~~9~~ 8. Common walls between dwelling units.

~~10~~ 9. Attic access openings.

~~11~~10. Other sources of infiltration.

Reason: The modifications to the air sealing requirements are being proposed to provide clarity and improve implementation and enforcement of this section.

The air sealing description has been taken from the National Association of Home Builders - Model Green Home Building Guideline 3.3.**1** B Building Envelope on page 98.

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

PART I – IECC

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

PART II – IRC B/E

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

EC64–07/08

202 (New), 402.4.2 (New), Table 402.4.2 (New), 402.4.3 (New), 403.6 (New); IRC R202 (New), N1102.4.2 (New), Table N1102.4.2 (New), N1102.4.3 (New), N1103.6 (New)

Proponent: Craig Conner, Building Quality, representing himself

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Add new text and table as follows:

SECTION 202
GENERAL DEFINITIONS

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

402.4.2 Air sealing and insulation. Building envelope air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Section 402.4.2.1 or 402.4.2.2:

402.4.2.1 Testing option. Building envelope tightness and insulation installation shall be considered acceptable when tested air leakage is less than 7 ACH when tested with a blower door at a pressure of 50 pascals. Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed;
2. Dampers shall be closed, but not sealed; including exhaust, intake, makeup air, back draft, and flue dampers;
3. Interior doors shall be open;
4, Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s) shall be turned off;
6. HVAC ducts shall not be sealed; and
7. Supply and return registers shall not be sealed.

402.4.2.2 Visual inspection option: Building envelope tightness and insulation installation shall be considered acceptable when the items listed in Table 402.4.2, applicable to the method of construction, are field verified. Where required by the code official, an approved party independent from the installer of the insulation, shall inspect the air barrier and insulation.

(Renumber subsequent sections)

TABLE 402.4.2
AIR BARRIER AND INSULATION INSPECTION

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal insulation is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material. Air permeable insulation is inside of an air barrier.
Ceiling / attic	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
Walls	Corners and headers are insulated. Junction of foundation and sill plate is sealed.
Windows and doors	Space between window/door jambs and framing is sealed.
Rim joists	Rim joists are insulated and include an air barrier.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of insulation.
Crawlspace walls	Insulation is permanently attached to walls. Exposed earth in unvented crawlspaces is covered with class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit, or narrow cavities are filled by spayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures are airtight, IC rated, and sealed to drywall. Exception--fixtures in conditioned space.
Plumbing and Wiring	Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
Shower / tub on exterior wall	Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.
Electrical / phone box on exterior walls	Air barrier extends behind boxes or an air sealed type boxes are installed.
Common wall	Air barrier is installed in common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace	Fireplace walls include an air barrier.

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

(Renumber subsequent sections)

PART II – IRC

Add new text and table as follows:

SECTION R202
GENERAL DEFINITIONS

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

N1102.4.2 Air sealing and insulation. Building envelop air tightness and insulation installation shall be demonstrated to comply with one of the following options given by Section N1102.4.2.1 or N1102.4.2.2:

N1102.4.2.1 Testing option. Tested air leakage is less than 7 ACH when tested with a blower door at a pressure of 50 pascals. Testing shall occur after rough in and after installation of penetrations of the building envelope, including penetrations for utilities, plumbing, electrical, ventilation, and combustion appliances.

During testing:

1. Exterior windows and doors, fireplace and stove doors shall be closed, but not sealed;
2. Dampers shall be closed, but not sealed; including exhaust, intake, makeup air, back draft, and flue dampers;
3. Interior doors shall be open;
4. Exterior openings for continuous ventilation systems and heat recovery ventilators shall be closed and sealed;
5. Heating and cooling system(s) shall be turned off;
6. HVAC ducts shall not be sealed; and
7. Supply and return registers shall not be sealed.

2. Visual inspection option: The items listed in Table N1102.4.2, applicable to the method of construction, are field verified. Where required by the code official, an approved party independent from the installer of the insulation, shall inspect the air barrier and insulation.

(Renumber subsequent sections)

TABLE N1102.4.2
AIR BARRIER AND INSULATION INSPECTION

COMPONENT	CRITERIA
Air barrier and thermal barrier	Exterior thermal insulation is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material.
Ceiling / attic	Air barrier in any dropped ceiling / soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
Walls	Corners and headers are insulated. Junction of foundation and sill plate is sealed.
Windows and doors	Space between window/door jambs and framing is sealed.
Rim joists	Rim joists are insulated and include an air barrier.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of floor.
Crawlspace walls	Insulation is permanently attached to walls. Exposed earth in unvented crawlspaces is covered with class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit, or narrow cavities are filled by spayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures are airtight, IC rated, and sealed to drywall. Exception--fixtures in conditioned space.
Plumbing and Wiring	Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
Shower / tub on exterior wall	Showers and tubs on exterior walls have insulation and an air barrier separating them from the exterior wall.
Electrical / phone box on exterior walls	Air barrier extends behind boxes or air sealed type boxes are installed.
Common wall	Air barrier is installed in common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace	Fireplace walls include an air barrier.

N1102.4.3 Fireplaces. New wood-burning fireplaces shall have gasketed doors and outdoor combustion air.

(Renumber subsequent sections)

Reason: This proposal is intended to reduce the energy lost to infiltration and to improve insulation installation. The details that seal against air infiltration also tend to benefit the thermal integrity of the wall, and vise versa. The energy code requirements for infiltration control have changed little in the last 15 years, except for the addition of recessed lighting specifications. This would be a substantial change that would lead to significant energy savings.

In principal there are no infiltration leaks. Everything is supposed to be sealed. The IECC and IRC both specify “all joints, seams and penetrations”, add a list of specific items, and to cover anything that was missed include “other sources of infiltration” are to be “sealed with an air barrier material …” (IECC 402.4.1, IRC N1102.4.1). In practice energy losses from infiltration are large. Infiltration is 16% of the cooling load and 28% of the heating load (2006 Buildings Energy Data Book). Others have higher estimates of infiltration energy loads.

Air infiltration requires air movement. Controlling air means enclosing air, eliminating big holes and paying attention to important details. This proposal includes two methods for showing a home includes at least a moderate level of air control. The first option is a “blower door” test, a house pressurization test with a specified a maximum air leakage. The maximum is 7 ACH50, or 7 Air Changes per Hour at 50 pascals. The ACH50 is a common measurement made where doing air infiltration tests and therefore a reasonable metric for use in the code. ACH50 can be roughly translated into “natural air changes” by dividing by 20. Therefore the 7 ACH50 translated into a natural air change rate of 0.35.

The second option is a visual inspection of many air sealing elements and items that relate to the quality of insulation installation. Most of the items listed in the visual inspection are already in code, this adds a specific requirement to inspect for them as a way of showing compliance with the air-sealing requirement. Two examples of existing requirements specified for inspection in the table-- the 2006 IRC (N1102.4) and IECC (402.4) specify “*The building thermal envelope shall be durably sealed to limit infiltration.”*, which covers most of the items in the table. Many items are covered explicitly, either on the list of items in IRC Section N1102.4 and IECC Section 402.4, or explicitly in another section. An example of a section with explicit requirements would be the IECC Section 402.2.5 and IRC Section N1102.2.5 both require insulation to “*maintain permanent contact with the underside of the subfloor.”*

This proposal adds a requirement for better performing fireplaces, including gasketed doors and outside combustion air, both for the energy savings and the indoor air quality. It also adds a definition of “air barrier”, principally to make it clear that an air barrier can be a combination of materials, rather

Measured data shows a wide variation in the air tightness of individual homes. The biggest effect of this proposal would be to improve the underperforming half of new homes. (Nevada Study, Page 32; Washington State Study, Page 11; Wisconsin Study, Page 30) A secondary effect would be to improve the air sealing in most homes due to the increased attention to the important areas. Improved air sealing and better insulation installation is also likely to increase comfort, for example decreasing cold spots; and to improve the structures resistance to moisture problems.

The cost for a blower door test varies from about $200 to perhaps $400. The energy savings from reduced infiltration is harder to estimate. As noted already, summaries of infiltration measurements show large variations in the infiltration rates for actual homes, for example a study of infiltration measurements (LBNL study, page 2) showed the standard deviation in “normalized leakage area”, which relates directly to infiltration, was almost as big as the mean; therefore bringing the high infiltration homes down to average would be significant by itself. The same study compared conventional new homes to energy efficient new homes and showed that reductions in air leakage of 40-50% are common in energy efficient homes (LBNL study, page 6). Based on the range of infiltration seen in new housing and the large reduction in infiltration in energy efficiency programs, it seems reasonable to estimate that this code change could produce a 20-30% the reduction in air infiltration rates with a similar reduction in energy costs for infiltration.

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Max Sherman and Nance Matson. March 2002. *Air Tightness of New U.S. Houses: A Preliminary Report.* LBNL-48671. Lawrence Berkeley National Laboratory (LBNL) Berkeley, CA

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

PART I – IECC

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

PART II – IRC B/E

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

EC65–07/08

402.4.3, 502.4.7; IRC N1102.4.3

Proponent: Lawrence Brown, CBO, National Association of Home Builders (NAHB)

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Revise as follows:

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

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

PART II – IRC

Revise as follows:

N1102.4.3 Recessed lighting. Recessed luminaires ~~installed in~~ that penetrate the building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces, ~~by being:~~ and shall be labeled as meeting

ASTM E 283 when tested at 1.57 psi (75 Pa) pressure differential with no more than 2.0 cfm (0.944 L/s) of air movement from the conditioned space to the ceiling cavity. Recessed luminaires in contact with insulation shall be listed and labeled as IC-rated.

1. ~~IC-rated and labeled with enclosures that are sealed or gasketed to prevent air leakage to the ceiling cavity or unconditioned space; or~~
2. ~~IC-rated and labeled as meeting ASTM E 283 when tested at 1.57 pounds per square foot (75 Pa) pressure differential with no more than 2.0 cubic feet per minute (0.944 L/s) of air movement from the conditioned space to the ceiling cavity; or~~
3. ~~Located inside an airtight sealed box with clearances of at least 0.5 inch (13 mm) from combustible material and 3 inches (76 mm) from insulation.~~

Reason: To provide consistency between the IECC and the IRC for luminaries that penetrate the building thermal envelope.

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

PART I – IECC

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

PART II – IRC B/E

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

EC66–07/08
402.6

Proponents: Lawrence Brown, CBO, National Association of Home Builders (NAHB); Craig Conner, Building Quality, representing himself; William E. Koffel, PE, Koffel Associates, Inc., representing the Glazing Industry Code Committee; Vickie J. Lovell, InterCode Incorporated, representing the Association of Industrial Metallized Coaters and Laminators

Delete without substitution:

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

Reason (Brown): Limits on fenestration U-factor and SHGC tradeoffs restrict ways by which code compliance can be achieved. By definition, trade-offs are energy neutral, and do not save energy, so this section is not necessary.

Cost Impact (Brown): Potential cost savings.

Reason (Conner): This section should be deleted because it has proven to be confusing, limits flexibility, and does not save energy. A similar code change passed the IRC committee in the last code cycle.

This section confuses most code users who often interpret it as another prescriptive code requirement comparable to the more stringent prescriptive U-factor in Tables 402.1.1 and 402.1.3. I have found this requirement very hard to explain and agree with the IRC committee that the code would be better if it relied only on the U-factor and SHGC requirements in the main requirements table.

The original intent of this section was to eliminate condensation-prone windows in cold climates. The market is already eliminating condensation-prone windows.

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

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

Reason (Koffel): The IECC is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve the effective use of energy. The sections proposed for deletion not only limit flexibility, they are confusing and do not save energy. Section N1102.5.1 of the *International Residential* Code was recommended for deletion by the committee and passed by the members during the last code cycle.

It should be noted that the performance design still requires one to demonstrate that annual energy cost that is less than or equal to the annual energy cost of the standard reference design. A true performance approach should not contain limits unless the limits can be justified as being something that cannot be truly evaluated using the performance approach. It should be noted that the ICC Performance Code for Buildings and Facilities does not contain such limits with respect to energy efficiency or any other provision. The current limits are similar to saying that one may use the performance code provided the building is still protected with an automatic sprinkler system.

Cost Impact (Koffel): The code change proposal will not increase the cost of construction and in fact may decrease the cost of construction by providing additional options.

Reason (Lovell): The U-factor and SHGC cap for fenestration has been deleted in the 2007 Supplement to the International Residential Code. Eliminating this provision in the code has simplified the process for demonstrating compliance and in doing so allowed more flexibility in the UA trade-off approach. Unfortunately this artificial cap continues to exist in the International Energy Conservation Code. Those that argue that the cap is needed claim that builders will install inefficient windows in new homes if this cap is not in place yet they have offered no technical support for this argument. Also, the envelope provisions in the 2006 IECC have made it very difficult to trade-off non-low E glazing U-factors in Climate Zones 4 and above. Eliminating the glass area restriction from the IECC has put the emphasis on fenestration U-factor which typically requires the code user to install a Low E window even using U.S. DOE's REScheck software or a Section 404 performance based approach.

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

As with window U-factor, the primary housing markets in Climate Zones 1- 3 are already using low SHGC windows. For example, housing markets in Southern Nevada, Arizona and Texas have been routinely installed Low E windows to meet the 0.40 SHGC requirements of the 2003 IECC. This artificial SHGC requirement will have no impact on these markets.

Currently under the 2006 IECC, fenestration SHGC and U-factor are the only two features that have restrictions. Trade-offs are allowed for all other building envelope features under the Total UA Alternative or the Simulated Performance Alternative even though reduced levels of insulation in building assemblies will affect the performance of the building. Even California's Title 24 Energy Code allows unlimited trade-offs with glazing features under the performance based compliance approach. It is important to note that when a proposal was brought before the IECC Code Development Committee during the 2004/2005 Cycle that would have placed mandatory minimums on insulation levels, it was disapproved. One of the reasons for disapproval was that "it would somewhat circumvent the trade off procedure and the simulated performance methods."

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

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

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

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

EC67–07/08

403, 403.1, 403.1.1, 403.2.2, 403.2.3, 403.3, 403.4, 403.5, 403.6, 404.2, Table 404.5.2(1)

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

Revise as follows:

SECTION 403
SYSTEMS ~~(Mandatory)~~

403.1 Controls. **(Mandatory)** At least one thermostat shall be provided for each separate heating and cooling system.

403.1.1 Heat pump supplementary heat. **(Mandatory)** Heat pumps having supplementary electric-resistance heat shall have controls that, except during defrost, prevent supplemental heat operation when the heat pump compressor can meet the heating load.

403.2.2 Sealing. **(Mandatory)** All ducts, air handlers, filter boxes, and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3 of the *International Residential Code*.

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

403.3 Mechanical system piping insulation. **(Mandatory)** Mechanical system piping capable of carrying fluids above 105°F (41°C) or below 55°F (13°C) shall be insulated to a minimum of R-2.

403.4 Circulating hot water systems. **(Mandatory)** All circulating service hot water piping shall be insulated to at least R-2. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

403.5 Mechanical ventilation. **(Mandatory)** Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

403.6 Equipment sizing. **(Mandatory)** Heating and cooling equipment shall be sized in accordance with Section M1401.3 of the *International Residential Code.*

404.2 Mandatory Requirements. Compliance with this section requires that the mandatory provisions identified in Section 401.2 ~~criteria of Section 401, 402.4, 402.5, 402.6, and 403~~ be met. All supply and return ducts not completely inside the building thermal envelope shall be insulated to a minimum of R-4.

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	A thermal distribution system efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies. Duct insulation: From Section 403.2.1.	Same as standard reference design, except as specified by Table 404.5.2(2).

(Portion of table and footnotes not shown remain unchanged)

Reason: The purpose of this code change is to allow duct insulation to be reduced to R-4 in the simulated performance path. The current code requires either R-6 or R-8 duct insulation with no possibility for trade-offs. R-4 is a more reasonable mandatory minimum value.

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

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

EC68–07/08

403.1.1 (New); IRC N1103.1.1 (New)

Proponent: Thomas D. Culp, Ph.D., Birch Point Consulting LLC

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Add new text as follows:

403.1.1 Programmable thermostat. At least one thermostat per dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55ºF (13ºC) or up to 85ºF (29ºC). The thermostat shall initially be programmed with a heating temperature set point no higher than 70ºF (21ºC) and a cooling temperature set point no lower than 78ºF (26ºC).

(Renumber subsequent sections)

PART II – IRC

Add new text as follows:

N1103.1.1 Programmable thermostat. At least one thermostat per dwelling unit shall be capable of controlling the heating and cooling system on a daily schedule to maintain different temperature set points at different times of the day. This thermostat shall include the capability to set back or temporarily operate the system to maintain zone temperatures down to 55ºF (13ºC) or up to 85ºF (29ºC). The thermostat shall initially be programmed with a heating temperature set point no higher than 70ºF (21ºC) and a cooling temperature set point no lower than 78ºF (26ºC).

(Renumber subsequent sections)

Reason: This proposal adds a new requirement in residential buildings to provide a programmable thermostat with scheduling and setback capabilities. These thermostats are now commonplace at any home store. A typical programmable thermostat will add between $20-$40 over the cost of manual thermostats. The U.S. EPA Energy Star website promotes that when used properly, programmable thermostats can save about $150/year in energy costs. Even if the actual savings are only a fraction of that amount, the payback period is very short. This proposal also specifies that the thermostat be initially programmed with heating and cooling temperature set points consistent with the Energy Star program.

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

PART I – IECC

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

PART II – IRC B/E

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

EC69–07/08

202, 403.2 (New); IRC R202, N1103.2

Proponent: Craig Conner, Building Quality, representing himself

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

FURNACE ELECTRICITY RATIO. The ratio of furnace electricity use to total furnace energy computed as ratio = $(3.412*E_{AE})/(1000*E_F + 3.412*E_{AE})$, where E_{AE} (average annual auxiliary electrical consumption) and E_F (average annual fuel energy consumption) are defined in Appendix N to subpart B of part 430 of title 10 of the Code of Federal Regulations and E_F is expressed in millions of Btus per year.

403.2 Furnace electricity ratio. Where not prohibited by Federal law, the furnace electricity ratio shall not be greater than 2%.

(Renumber subsequent sections)

PART II – IRC

Add new text as follows:

SECTION R202
GENERAL DEFINITIONS

FURNACE ELECTRICITY RATIO. The ratio of furnace electricity use to total furnace energy computed as ratio = $(3.412*E_{AE})/(1000*E_F + 3.412*E_{AE})$, where E_{AE} (average annual auxiliary electrical consumption) and E_F (average annual fuel energy consumption) are defined in Appendix N to subpart B of part 430 of title 10 of the Code of Federal Regulations and E_F is expressed in millions of Btus per year.

N1103.2 Furnace electricity ratio. Where not prohibited by Federal law, the furnace electricity ratio shall not be greater than 2%.

(Renumber subsequent sections)

Reason: Residential furnaces use blowers to distribute warm air. The blower motors account for most of fossil-fuel furnace electricity consumption. Currently, no minimum efficiency requirement exists for furnace electricity use. In some cases, the furnace blower is the largest consumer of electricity in the household. Substantial cost-effective electricity savings are available from using efficient blower motors already in use in some furnaces.

DOE has the authority to regulate furnace electricity; however, DOE chose not regulate furnace blower motors or at least to delay regulation until an unspecified date in its recent furnace efficiency rulemaking. Although Federal law (NAECA) regulates residential heating equipment efficiency, the law allows states and regions to petition DOE for a waiver to set higher requirements. Some states and regions are moving towards higher efficiency requirements for electrical use in furnaces, usually based on the requirement presented here.

Currently most furnace blowers use a permanent split capacitor (PSC) motor. The efficiency level proposed here would probably be achieved by switching to a brushless permanent magnet (BPM) motor also called an electronically-commutated motor (ECM). Furnaces with the higher level of efficiency and the BPM motor are available in the market today.

A simple payback can be estimated from DOE's rulemaking. DOE's recent furnace rulemaking estimated an annual energy savings of about 215 kwh per year (DOE TSD page 8.5-6), or about $21.5 per year for a BPM at $0.10/kwh. DOE estimates the cost of the new fan at about $213 (TSD page 6.4-2), perhaps decreasing by about 78% (TSD page 8.5-2) to about $166 by 2012 for mature market costs. The simple payback would be about 8 years in the mature market.

Estimated savings from other studies have been higher. Four other studies are cited in BPM Motors in Residential Gas Furnaces: What are the Savings? . Based on the cited estimates of savings the simple payback would be 3 to 8 years.

It should be noted that the "furnace electricity ratio" specified in this proposal is based solely on efficiency information already provided by the manufacturers.

Adoption and use of this proposal would promote significant electricity savings. Inclusion of this change in the IECC/IRC would encourage states and regions that do get a waiver to use the same requirement; thereby, creating a large market for furnaces with high efficiency blowers.

Bibliography:

BPM Motors in Residential Gas Furnaces: What are the Savings? *James Lutz, Victor Franco, Alex Lekov, and Gabrielle Wong-Parodi. Lawrence Berkeley National Laboratory, Berkeley, California.* LBNL-59866

DOE's Federal Register Notice dated October 6, 2006. 10 CFR Part 430, *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnaces and Boilers; Proposed Rule*, and its technical support document (TSD) available at: http://www.eere.energy.gov/buildings/appliance_standards/residential/furnaces_boilers_1113_r.html

Consumers' Directory of Certified Efficiency Ratings. Gas Appliance Manufacture's Association..
http://www.gamanet.org/gama/inforesources.nsf/vContentEntries/Furnace+electrical+efficiency?OpenDocument

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

PART I – IECC

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

PART II – IRC B/E

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

EC70–07/08
403.2.2; IRC N1103.2.2

Proponent: Craig Conner, Building Quality, representing himself

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Revise as follows:

403.2.2 Sealing. All ducts, air handlers, filter boxes, and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3 of the *International Residential Code*

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

PART II – IRC

Revise as follows:

N1103.2.2 Sealing. Ducts, air handlers, filter boxes, and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3.

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

Reason: The 2006 IECC and IRC already require sealed air handlers. Requiring sealed air handlers offers, but does not require, one method for demonstrating what is "sealed." Under the existing code it is difficult for either a builder or inspector to know if an air handler is "sealed." This proposal adds an option based on a measurement that originated in Florida to verify that an air handler is sealed, a measurement that is already being used by several manufacturers. Air handlers that are sealed, tested, and labeled by the manufacturer as "sealed in the factory" provide a practical way to verify code compliance in the field.

This change was approved for the IECC during the last code cycle but disapproved in the final action hearing. The main argument against this change was that manufacturers could not meet the requirement and that few or perhaps no "air-tight" air handlers were available on the market, which is incorrect. Many manufactures are producing sealed air handlers using the specification proposed here. Examples of available products that can be verified on the web include those listed below. Other manufacturers also produce air handlers that meet this requirement.

Amana- Three product lines use this test and meet this requirement. Product specifications for AEPF, ASPF, ARPF (1½ to 5 ton) state the following,

> "*Complies with the Factory-sealed Air Handling Credit as listed in the 2001 Florida Building Code, Chapter 13, Section 610.2.A.2.1*."
> "*Factory-sealed to achieve 2% or less leakage rate with or without field-installed filter kits at 1.0" water gauge external duct static pressure*."

http://www.amana-hac.com/Home/Products/AirHandlers/tabid/292/Default.aspx
http://www.amana-hac.com/Portals/1/pdf/SS-AAEPF.pdf
http://www.amana-hac.com/Portals/1/pdf/SS-AASPF.pdf
http://www.amana-hac.com/Portals/1/pdf/SS-AARPF.pdf

Goodman- Three product lines use this test and meet this requirement. Product specifications for AEPF, ASPF, ARPF (1½ to 5 ton) state the following:

> *"Complies with the Factory-sealed Air Handling Credit with or without field-installed filter kits as listed in the 2001 Florida Building Code, Chapter 13, Section 610.2.A.2.1."*
> *"Factory-sealed to achieve 2% or less leakage rate with or without field-installed filter kits at 1.0" water gauge external duct static pressure."*

http://www.goodmanmfg.com/Home/Products/AirHandlers/tabid/262/Default.aspx
http://www.goodmanmfg.com/Portals/0/pdf/SS-GAEPF.pdf
http://www.goodmanmfg.com/Portals/0/pdf/SS-GASPF.pdf
http://www.goodmanmfg.com/Portals/0/pdf/SS-GARPF.pdf

Lennox- Two product lines use this test and meet this requirement. Product specifications for
Merit® Series CBX26UH/CB26UH-R and Elite® Series CBX27UH/CB27UH air handlers state the following:

> *"Meets Florida standards for less than 2% air leakage from unit."*

http://www.lennox.com/products/list.asp?type=8
http://www.lennox.com/products/overview.asp?model=CBX26UH
http://www.lennox.com/products/overview.asp?model=CBX27UH

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

PART I – IECC

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

PART II – IRC B/E

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

EC71–07/08
403.2.2, Table 404.5.2(1), Table 404.5.2(2); IRC N1103.2.2

Proponents: Craig Conner, Building Quality, representing himself; Ronald Majette, U.S. Department of Energy

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Revise as follows:

403.2.2 Sealing. All ducts, air handlers, filter boxes, and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3 of the *International Residential Code*. Duct tightness shall be verified by either of the following:

1. Post-construction test: Leakage to outdoors shall be less than or equal to 8 CFM per 100 ft^2 of conditioned floor area or a total leakage less than or equal to 12 CFM per 100 ft^2 of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 6 CFM per 100 ft^2 of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 CFM per 100 ft^2 of conditioned floor area.

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

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

Thermal Distribution Systems	A thermal distribution system efficiency (DSE) of ~~0.80~~ 0.88 shall be applied to both the heating and cooling system efficiencies for all systems other than tested duct systems. For tested duct systems, the leakage rate shall be the applicable maximum rate from Section 403.2.2.	~~Same as standard reference design, except~~ As tested or as specified in Table 404.5.2(2) if not tested.

(Portions of table and footnotes not shown remain unchanged)

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

DISTRIBUTION SYSTEM CONFIGURATION AND CONDITION:	FORCED AIR SYSTEMS	HYDRONIC SYSTEMS[b]
Distribution system components located in unconditioned space	~~0.80~~ --	0.95
Untested d~~D~~istribution systems entirely located in conditioned space [(c)]	0.88	1.00
~~*Proposed* "reduced leakage" with entire air distribution system located in the conditioned space [(d)]~~	~~0.96~~	–
~~*Proposed* "reduced leakage" air distribution system with components located in the unconditioned space~~	~~0.88~~	–
"Ductless" systems [(~~d~~e)]	1.00	--

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

~~d. Proposed "reduced leakage" shall mean leakage to outdoors not greater than 3 cfm per 100 ft2 of conditioned floor area and total leakage not greater than 9 cfm per 100 ft2 of conditioned floor area at a pressure differential of 0.02 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Total leakage of not greater than 3 cfm per 100 ft2 of conditioned floor area at a pressure difference of 0.02 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure, shall be deemed to meet this~~

~~requirement without measurement of leakage to outdoors. This performance shall be specified as required in the construction documents and confirmed through field-testing of installed systems as documented by an approved independent party.~~

~~c~~ d . Ductless systems may have forced airflow across a coil but shall not have any ducted airflows external to the manufacturer's air handler enclosure.

PART II – IRC

Revise as follows:

N1103.2.2 Sealing. Ducts, air handlers, filter boxes, and building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3. Duct tightness shall be verified by either of the following:

1. Post-construction test: Leakage to outdoors shall be less than or equal to 8 CFM per 100 ft^2 of conditioned floor area or a total leakage less than or equal to 12 CFM per 100 ft^2 of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test.
2. Rough-in test: Total leakage shall be less than or equal to 6 CFM per 100 ft^2 of conditioned floor area when tested at a pressure differential of 0.1 inches w.g. (25 Pa) across the roughed in system, including the manufacturer's air handler enclosure. All register boots shall be taped or otherwise sealed during the test. If the air handler is not installed at the time of the test, total leakage shall be less than or equal to 4 CFM per 100 ft^2 of conditioned floor area.

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

Reason (Conner): Duct losses account for a substantial portion of the energy used in residences. A practical and relatively low cost means is needed to reduce duct losses. This proposal attempts to get all ducts up to a moderate level of efficiency, it is not attempting to build a "super duct". This proposal has several practical aspects. It lets the duct testing occur at one of two different stages in the building process. This proposal does not specify who has to do the testing. Testing can be avoided by bringing the ducts indoors.

By their nature, duct leaks are unintentional; therefore, the location of the leakage in any particular house is unpredictable and unknown. Duct leakage will usually create imbalances in the air distribution. Duct leaks can potentially create air quality problems by pulling pollutants or irritants directly into the house. As our houses get tighter, reducing duct leakage becomes more important for both housing performance and air quality.

Cost Impact (Conner)**:** The code change proposal will increase the cost of construction.

Reason (Majette): The purpose of this proposal is to reduce energy losses in air-ducted distribution systems.

Is the IECC/IRC requirement for duct sealing working? Despite good intentions, the answer is a convincing "no". Visual inspection of ducts is not adequate. Ducts are often located in difficult to access areas such as attics and crawl spaces. Cracks and other leakage points in ducts may not be visible because they are covered by insulation, hidden from view, or simply too small to be readily apparent to the human eye. Testing of completed homes in Washington state where prescriptive code requirements for duct sealing apply "showed no significant improvement" over non-code homes (Washington State University 2001). Another study from Washington State concluded: "Comparisons to air leakage rates reported elsewhere for homes built before the implementation of the 1991 WSEC show no significant improvement by the general population" despite years of training emphasizing duct sealing (Hales et al. 2003).

Numerous other studies around the nation show substantial duct leakage in new homes, including those in states with codes requiring duct sealing. For example, a 2001 study of 186 houses built under the Model Energy Code in Massachusetts reported "serious problems were found in the quality of duct sealing in about 80% of these houses" (Xenergy 2001). Pressurization tests in 22 of these houses found an average leakage to the outside of the house of 183 cfm, or 21.6% of the system flow, at a pressure of 25 Pascals.

The energy savings of improved duct sealing are very substantial. A California study estimated a sales-weighted state annual average savings from duct sealing of 38 therms and 239 kWh for a 1761 ft^2 house (Hammon and Modera 1999). This is based on an estimated 12% improvement in duct efficiency based on previous studies indicating a 12-15% improvement potential. Assuming $1.20/therm gas and 9 cents/kWh electricity, this is a savings of $67/year. As much of California's population is in mild climates savings should be considerably higher on a national average.

Hammon and Modera (1999) estimate a cost of $214 for materials and labor plus $131 to $163 for testing and suggest costs will be even lower in a mature market. This does not account for possible cost savings from downsizing HVAC systems because of decreased design loads. Even with the conservatively low California energy savings estimate, this is a simple payback of 5.1 to 5.6 years. The Journal of Light Construction (2003) quotes an even lower cost of $220, which indicates a simple payback of under 4 years. Duct pressurization testing equipment commonly known as "duct blasters" cost about $1500-2000 (Sherman, 2004, PDF page 171). Presumably, this equipment would come down in price as the market for this equipment grows.

The proposed leakage limits from duct testing sets a modest target that is reasonable for a mandatory minimum code. For example, Energy Star Qualified Homes must have a leakage of 6 CFM per 100 ft^2 of conditioned floor area (or 4 CFM if the "builder option packages" are used) compared to the 8 cfm per 100 ft^2 proposed here. The proposal allows a variety of compliance methods. Notably, the testing can be done at rough-in stage immediately after the ducts are installed. This allows potentially costly call backs to be avoided if the tested leakage rate exceeds code requirements. Testing is not required if the air handler and ducts are inside the conditioned space.

The residential building energy efficiency requirements in ICC codes have not had a substantial national improvement in 14 years, since 1993. The most notable improvement since 1993 was the addition of the 0.40 SHGC requirement for glazing, and that applies to only the southern third of the nation and occurred 10 years ago. During that time, fuel prices have increased dramatically and environmental concerns from energy usage (notably global warming) have come to the forefront. It's time for the ICC to take serious action to improve energy efficiency in buildings and the Department of Energy believes improved duct systems are the place to start. Poor duct sealing is a widespread problem that will result in senseless energy loss for many decades after a new building is occupied. This proposal represents a reasonable and cost effective improvement that is badly needed.

Bibliography:
Washington State University. 2001. *Washington State Energy Code Duct Leakage Study Report*. WSUCEEP01105. Washington State University Cooperative Extension Energy Program, Olympia, Washington.

Hales, D., A. Gordon, and M. Lubliner. 2003. 2003. *Duct Leakage in New Washington State Residences: Findings and Conclusions.* ASHRAE transactions. KC-2003-1-3.

Hammon, R. W., and M. P. Modera. 1999. "Improving the Efficiency of Air Distribution Systems in New California Homes-Updated Report." Consol. Stockton, California. http://www.energy.ca.gov/title24/ducttape/documents/IMPROVE_EFFICIENCY_RES.PDF

Journal of Light Contuction. April 2003. "Pressure-Testing Ductwork." Michael Uniacke.

Sherman et al. 2004. Instrumented HERS and Commissioning.
http://www.energy.ca.gov/pier/final_project_reports/500-04-012.html

Xenergy. 2001. Impact Analysis Of The Massachusetts 1998 Residential Energy Code Revisions.
http://www.mass.gov/Eeops/docs/dps/inf/inf_bbrs_impact_analysis_final.pdf

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

PART I – IECC

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

PART II – IRC B/E

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

EC72–07/08

403.2.2, 403.2.3; IRC N1103.2.2, N1103.2.3, M1601.1.1; IMC 602.3

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

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC, THE IRC B/E, THE IRC–M AND THE IMC CODE DEVELOPMENT COMMITTEES AS FOUR SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

403.2.2 Sealing. All ducts, air handlers, filter boxes, ~~and building cavities used as ducts~~ shall be sealed. Joints and seams shall comply with Section M1601.3 of the *International Residential Code,* <u>or Section 603.9 of the *International Mechanical Code*, as applicable</u>.

403.2.3 Building cavities. Building framing cavities shall not be used as ~~supply~~ ducts.

PART II – IRC B/E

Revise as follows:

N1103.2.2 Sealing. Ducts, air handlers, filter boxes ~~and building cavities used as ducts~~ shall be sealed. Joints and seams shall comply with Section M1601.3.

N1103.2.3 Building cavities. Building framing cavities shall not be used as ~~supply~~ ducts <u>or plenums</u>.

PART III – IRC–M

Revise as follows:

M1601.1.1 Above-ground duct systems. Above-ground duct systems shall conform to the following:

1. Equipment connected to duct systems shall be designed to limit discharge air temperature to a maximum of 250°F (121°C).
2. Factory-made air ducts shall be constructed of Class 0 or Class 1 materials as designated in Table M1601.1.1(1).
3. Fibrous duct construction shall conform to the SMACNA *Fibrous Glass Duct Construction Standards* or NAIMA *Fibrous Glass Duct Construction Standards*.
4. Minimum thickness of metal duct material shall be as listed in Table M1601.1.1(2). Galvanized steel shall conform to ASTM A 653.
5. Use of gypsum products to construct return air ducts or plenums is permitted, provided that the air temperature does not exceed 125°F (52°C) and exposed surfaces are not subject to condensation.
6. Duct systems shall be constructed of materials having a flame spread index not greater than 200.
7. Stud wall cavities and the spaces between solid floor joists shall not be used as a component of a duct system in new structures. For existing structures, stud wall cavities and the spaces between solid floor joists to be used as air plenums shall comply with the following conditions:
   - 7.1. These cavities or spaces shall not be used as a plenum for supply air.
   - 7.2. These cavities or spaces shall not be part of a required fire-resistance-rated assembly.
   - 7.3. Stud wall cavities shall not convey air from more than one floor level.
   - 7.4. Stud wall cavities and joist-space plenums shall be isolated from adjacent concealed spaces by tight fitting fire blocking in accordance with Section R602.8.

PART IV – IMC

Revise as follows:

602.3 Stud cavity and joist space plenums. Stud wall cavities and the spaces between solid floor joists shall not be used as a component of a duct system in new structures. For existing structures, stud wall cavities and the spaces between solid floor joists to be utilized as air plenums shall comply with the following conditions:

1. Such cavities or spaces shall not be utilized as a plenum for supply air.
2. Such cavities or spaces shall not be part of a required fire-resistance-rated assembly.
3. Stud wall cavities shall not convey air from more than one floor level.
4. Stud wall cavities and joist space plenums shall comply with the floor penetration protection requirements of the *International Building Code*.
5. Stud wall cavities and joist space plenums shall be isolated from adjacent concealed spaces by approved fireblocking as required in the *International Building Code*.

Reason: This proposal has been submitted to reduce the duct leakage in residential structures. This method is prescriptive and is easy to inspect.
This use of building cavities as duct work has been noted to be a major contributor to duct leakage. Even when a concentrated effort has been made by the contractor to provide an air tight seal, ducts used as building cavities almost always leak. The following quotes from a number of researchers makes the documents the problems with building cavities used as ducts.

Washington State University study of duct leakage in new homes

> *Systems with ducted returns were 47% tighter than systems that used building cavities as part of the return system.* [1]

In the final report form "Improved Air Distribution Systems for Forced Air Heating" a project funded by the Bonneville Power Administration the authors noted,

> *No matter how hard you try to seal a panned joist or wall cavity, you'll never make it tight enough. In fact, one contractor convinced the project's organizers that he could seal a panned joist. He failed even after concerted effort. The three houses with panned joists were all among the top five leakers. One house had 460 cfm of duct leakage.* [2]

In a report by Iain S. Walker, of Lawrence Berkeley National Laboratory the problems of building cavity duct runs were described,

> *Duct leakage is common when parts of the walls or floor cavities used as ducts, e.g., spaces between ceiling or floor joists or internal wall stud spaces. Figure 9 shows basement joists that have been made into a duct using sheet metal "panning". In addition to the leakage at the unsealed sheet metal edges, these panned joists often have holes for plumbing or electrical wires/conduit. Usually it is the air returning to the furnace or air conditioner that flows through these ducts.* [3]

The US Department of Energy Recommends eliminating the use of building cavities as duct work.

> *The entire air distribution system should be "hard" ducted, including returns (i.e., building cavities, closets, raised-floor air handler plenums, platform returns, wall stud spaces, panned floor joists, etc., should not be used)* [4].

[1] David Hales, Washington State Energy Code Duct Leakage Study Report Washington State University Extension Energy Program, 2001. http://www.energy.wsu.edu/pubs/

[2]. Energy Source Builder http://oikos.com/esb/42/airdisproj.html

[3].Iain S. Walker, Sensitivity of Forced Air Distribution System Efficiency to Climate, Duct Location, Air Leakage and Insulation, Lawrence Berkeley National Laboratory, LBNL 43371

[4].AIR DISTRIBUTION SYSTEM DESIGN Good Duct Design Increases Efficiency, Written and prepared for the U.S. Department of Energy by: Southface Energy Institute www.southface.org U.S. Department of Energy's Oak Ridge National Laboratory Buildings Technology Center www.ornl.gov/btc
www.toolbase.org/PDF/DesignGuides/doe_airdistributionsystemdesign.pdf

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

PART I – IECC

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

PART II – IRC B/E

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

PART III – IRC–M

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

PART IV – IMC

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

EC73–07/08
403.2.4 (New)

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

Add new text as follows:

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

Exceptions:

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

Reason: This proposal is intended to significantly improve the energy efficiency of the HVAC system in residential buildings. It establishes a requirement that the ducts be located in conditioned space or alternately that the system meet a DSE of 0.88 or better. For those who do not want to improve the duct system, the exception permits installation of a better (15% over minimum federal standards) cooling or heating system (depending on the climate) instead.

This proposal effectively establishes a more stringent standard for the system allows for a trade-off within the HVAC system. This trade-off is internally consistent, since improved ducts and improved heating or cooling equipment will both improve the HVAC system. This will allow residential buildings with highly efficient heating and cooling equipment to not need to meet distribution system efficiency (DSE) requirement of 0.88 or greater.

The requirements are set up to allow for high efficiency cooling equipment as a trade-off (exception) in climate zones 1-2, either high efficiency cooling or heating equipment as a trade-off in zone 3 or high efficiency heating equipment as a trade-off in climate zones 4-8.

The DSE option can be met through ASHRAE 152 or through the standard table already in the IECC. By using an ASHRAE 152 approach, the efficiency of the distribution system accounts for the duct design, duct leakage, duct insulation, and duct location. This will help to improve the incentives for good duct design and installation. Currently duct requirements include only insulation requirements and sealing guidance, however by including a distribution system efficiency requirement, one of the largest energy losses in homes can be properly addressed, quantified or traded off with easy to quantify and install high efficiency equipment.

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

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

EC74–07/08

403.3; IRC N1103.3

Proponents: Michael J. Resetar, Armacell LLC; Roger Schmidt, Nomaco K Flex

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Revise as follows:

403.3 Mechanical system piping insulation. Mechanical system piping capable of carrying fluids above 105 °F (41 °C) or below 55 °F (13 °C) shall be insulated to a minimum of ~~R-2~~ <u>R-3</u>.

PART II – IRC

Revise as follows:

N1103.3 Mechanical system piping insulation. Mechanical system piping capable of carrying fluids above 105 °F (41 °C) or below 55 °F (13 °C) shall be insulated to minimize ~~R-2~~ <u>R-3</u>

Reason (Part I): In the previous versions of the IECC (2000 IECC & 2003 IECC) there was a table (503.3.3.1) indicating the minimum pipe insulation required (thickness in inches) for low temperature. In an effort to simplify the code in 2006 IECC Section 403.3 reduced the table to a single R Value of 2 and eliminated the table. In the 2 previous published tables the minimum pipe insulation thickness for pipes 1" and less for low temperature called for 1" thick insulation which is R-4. On Runouts up to 2" not exceeding 12 feet the table calls for ½" or R-2. Runouts of less than 12 feet are not common in residential piping and therefore this ½" insulation requirement is rarely invoked. Most residential plumbing falls into the category of low temperature and is less the 1" pipe size which in prior publications would require 1" thick insulation R-4. We do support the effort to simplify codes, but we feel the reduction in insulation thickness has substantially weakened the code itself. We feel that the R-4 Requirement was correct as previously published but feel that a reasonable compromise would be R-3 or ¾" thick as we are proposing.

Reason (Part II): In the previous versions of the IRC (2000 IRC & 2003 IRC) there was a table (N1103.5) indicating the minimum pipe insulation required (thickness in inches) for low temperature. In an effort to simplify the code in 2006 IRC Section N1103.3 reduced the table to a single R Value of 2 and eliminated the table. In the 2 previous published tables the minimum pipe insulation thickness for pipes 1" and less for low temperature called for 1" thick insulation which is R-4. Most residential plumbing falls into the category of low temperature and is in prior publications would require 1" thick insulation R-4. We do support the effort to simplify codes, but we feel the reduction in insulation thickness has substantially weakened the code itself. We feel that the R-4 Requirement was correct as previously published but feel that a reasonable compromise would be R-3 or ¾" thick as we are proposing.

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

PART I – IECC

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

PART II – IRC B/E

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

EC75–07/08
403.4, 403.4.1 (New), 403.4.2 (New), 403.4.3 (New)

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

1. Add new text as follows:

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

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

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

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

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

(Renumber subsequent sections)

Reason: This proposal requires insulation on all hot water pipes and the installation of a solar hot water stub-in, unless a currently available high efficiency domestic hot water heater is installed, including instantaneous water heaters. As homes have become more efficient, the federal minimum efficiency standard for hot water systems has not kept pace over the years. This proposal will improve the distribution of hot water, improve the likelihood for having renewable solar hot water systems get installed or have the installation of high efficient currently available hot water heating equipment.

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

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

EC76–07/08
403.5; IRC M1701.3

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

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC–M CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

403.5 Mechanical ventilation. Outdoor air intake~~s~~ and exhaust~~s~~ openings shall have automatic or gravity dampers that close when the ventilation system is not operating. Combustion air ducts shall not be required to close except where such openings are provided with motorized volume dampers, The dampers shall be electrically interlocked with the firing cycle of the appliances served, Manually operated dampers or back-draft dampers shall not be installed in combustion air openings.

PART II – IRC

Add new text as follows:

M1701.2 Combustion air duct opening. Where combustion air openings are provided with volume dampers, the dampers shall be electrically interlocked with the firing cycle of the appliances served, so as to prevent operation of any appliance that draws combustion and dilution air from the room when any of the dampers are closed. Manually operated dampers or back-draft dampers shall not be installed in combustion air openings.

Reason (Part I): Although openings should be closed when not in use, the global statement the text makes is not completely accurate. Some dampered openings are prohibited and when they are not, certain provisions are required. This text further clarifies what needs to happen with respect to combustion air openings and as a result, avoids a blanket statement and provides further guidance.

Reason (Part II): Dampers are not necessarily prohibited. There are cases such as multi-million BTU snow melt systems where the designer will employ motorized dampers interlocked with the boilers firing cycle to limit air into the building when the appliances are not in operation. There is nothing wrong with type of system. The new text addresses the original intent.

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

PART I – IECC

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

PART II – IRC–M

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

EC77–07/08
403.10

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

Revise as follows:

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

403.6.1 Oversizing limits. The maximum oversizing limit for air conditioners and air-source and ground-source heat pumps is 15% with the following two exceptions: single-speed air-source and ground-source heat pumps in buildings with heating loads that exceed cooling loads have a limit of 25%, and multi-stage heat pumps do not have a strict limit, but shall be sized to allow adequate humidity control in the cooling mode. The maximum oversizing limit for gas, oil or propane heating equipment is 40%.

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

1. Outdoor temperatures shall be the 99.0% and 1.0% design temperatures as published in the ASHRAE Handbook of Fundamentals for the home's location or most representative city for which design temperature data are available;
2. Indoor temperatures shall be 75 F for cooling and 70 F for heating;
3. Infiltration rate shall be selected as "tight", or the equivalent term.

403.6.3 Specifying equipment. ~~In~~ Specification of the next available manufactured size shall be acceptable. In addition, indoor and outdoor coils shall be matched in accordance with ARI Standard 210/240.

Reason: Research and survey data is limited, but typically indicates that HVAC systems are over-sized by as much as 50%, resulting in increased energy consumption and adverse impacts on energy use, comfort and moisture control. This proposal provides an explicit limit on over-sizing and also dictates certain inputs for use in sizing calculations. These inputs will help to ensure that systems are sized in a consistent and reasonable manner.

Current code language, in M1401.3 references ACCA Manual J for load calculation, but does not require that the installed equipment meet a required size. The new language sets a requirement and includes explicit information needed for consistent load calculations and installed equipment size. The actual installed equipment size may be oversized and installed at the next available manufactured size.

The proposed requirements are primarily based on limits that are suggested in ACCA Manual S, which states the following:

- Cooling-only equipment should be sized so that the total cooling capacity does not exceed the total cooling load by more than 15%.
- If heat pump equipment (air-source or water-source) is installed in a warm or moderate climate, the total cooling capacity should not exceed the total cooling load by more than 15%.
- If heat pump equipment (air-source or water-source) is installed in a cold climate (where heating costs are a primary concern), the total cooling capacity can exceed the total cooling load by as much as 25%.
- Furnace and boiler oversizing is not recommended because comfort may be compromised when a furnace or boiler short-cycles. The output capacity of the furnace or boiler must be greater than the design load, but no more than 40% larger than the design heating load.

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

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

EC78–07/08

403.7 (New), Table 403.7 (New), Table 404.5.2(1); IRC N1103.7 (New), Table N1103.7 (New)

Proponent: Craig Conner, Building Quality, representing himself

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

1. Add new text and table as follows:

403.7 Furnace efficiency. Where not prohibited by Federal law, furnace efficiency shall be as prescribed in Table 403.7

(Renumber subsequent sections)

TABLE 403.7
MINIMUM FURNACE EFFICIENCY

FURNACE	AFUE
New residences non-weatherized gas furnaces in zones 5, 6, 7, 8, and 4 Marine	90
All other non-weatherized gas furnaces	80
Weatherized gas furnaces	83
Oil-fired furnaces	82
Gas boilers	84
Oil-fired boilers	83

2. Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems[h, i]	Fuel type: same as proposed design Efficiencies: Electric: air-source heat pump with prevailing ~~federal~~ minimum efficiency Nonelectric furnaces: natural gas furnace with prevailing ~~federal~~ minimum efficiency Nonelectric boilers: natural gas boiler with prevailing ~~federal~~ minimum efficiency Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	(No change)

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Cooling systems[h, j]	Fuel type: Electric Efficiency: in accordance with prevailing ~~federal~~ minimum ~~standards~~ efficiency Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	(No change)
Service water heating[h, k]	Fuel type: same as proposed design Efficiency: in accordance with prevailing ~~federal~~ minimum ~~standards~~ efficiency Use: gal/day = 30 + 10 x N_{br} Tank temperature: 120°F	(No change)

(Portions of table and footnotes not shown remain unchanged)

PART II – IRC B/E

Add new text and table as follows:

N1103.7 Furnace efficiency. Where not prohibited by Federal law, furnace efficiency shall be as in prescribed Table N1103.7

TABLE N1103.7
MINIMUM FURNACE EFFICIENCY

FURNACE	AFUE
New residences non-weatherized gas furnaces in zones 5, 6, 7, 8, and 4 Marine	90
All other non-weatherized gas furnaces	80
Weatherized gas furnaces	83
Oil-fired furnaces	82
Gas boilers	84
Oil-fired boilers	83

Reason: Although Federal law (NAECA) preemptively regulates residential heating equipment efficiency, the law allows states and regions to petition DOE for a waiver to set higher local requirements. In the event that a state sets a higher requirement, the IECC/IRC in its current form will be left with an inconsistency. Prescriptively complied homes will have higher heating efficiency than the code will use as a baseline in the performance path, resulting in a loophole.

The northern US furnace market is moving towards high-efficiency furnaces at or above 90 AFUE. DOE's Federal Register Notice says that almost 50% of the new homes in parts of the northern US have condensing efficiencies. Some states and regions are in the process of petitioning DOE to require higher AFUEs more will likely follow.

As part of its analysis, DOE determined cost-effective AFUEs for various types of furnaces. Those levels are the basis for this code change. As shown in the proposed table, the cost-effective level DOE found varied somewhat with furnace type. Unfortunately, DOE will not mandate these more efficient, cost-effective levels until 2015, presuming no further delays. Given the large amount of energy devoted to heating, it seems prudent to establish higher furnace efficiency levels prior to 2015. Furthermore, several states/regions are likely to petition DOE for these higher AFUEs prior to 2015.

In one important case DOE determined it did not have the authority to implement a more cost-effective furnace--a 90 AFUE gas furnace inside new homes in northern climates. DOE examined the northern states with heating degree days (HDD) >5000 separately (roughly climate zones 5 through 8 and Marine 4), which are almost the same areas as those proposed here for 90 AFUE. In the DOE analysis, the indoor 90 AFUE furnace in the northern states generated a substantial net present value (Federal Register Notice, page 29253, Table VI.1) with substantial energy savings (1.72 Quads over 24 years). DOE commented that a 90 AFUE requirement in the northern states and a lower AFUE in the southern states had a significantly higher net present value than the single uniform requirement DOE was required to propose.

DOE examined the 90 AFUE gas furnaces separately for new and existing homes, breaking the cost into equipment cost and installation cost. The equipment cost for a 90 AFUE gas furnace is more than the cost for a 78 AFUE gas furnace. However, the situation is reversed for venting costs. Condensing furnaces (90 AFUE) and non-condensing furnaces (78 or 80 AFUE) use significantly different venting. Condensing furnaces typically use a short horizontal plastic pipe, while non-condensing furnaces need a chimney. An inside 90 AFUE condensing gas furnace replacing an existing 80 AFUE non-condensing furnace probably incurs additional costs to modify the venting. However, in new construction condensing furnaces are actually cheaper to vent. DOE estimated that in new homes the condensing furnace venting actually saved $138 (TSD, page 6-34, Table 6.5.7). Because DOE was constrained to lump new home furnaces (25%) and existing home furnaces (75%) together, it could not take advantage of the cost-effectiveness of the 90 AFUE furnace in new construction. However, states, regions, and the I-codes are not constrained to lump new and existing requirements together if they have a waiver from DOE.

Based on the DOE analysis, high-efficiency furnaces are very cost-effective for new homes in northern heating-dominated climates. This proposal sets the cost-effective 90 AFUE as the minimum inside gas furnace efficiency for new homes in the northern US.

In its Federal Register Notice, DOE almost encourages states/regions to petition for a waiver, and suggests northern climates have a strong argument for an inside 90 AFUE gas furnace due to the higher heating loads. DOE suggests that it would look favorably on the higher AFUE (90 AFUE) already in common use in northern climates and on uniform requirements covering large contiguous geographical areas. If this code change prevails, states/regions would also be able to argue that they are petitioning to be allowed to be consistent with the IECC/IRC. Several states, or groups of states, are preparing or planning petitions for higher AFUE furnaces.

This change promotes higher equipment efficiency where it is cost-effective, and eliminates a loophole in the performance calculation.

Note:
U.S. Department of Energy Federal Register Notice dated October 6, 2006. *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnaces and Boilers; Proposed Rule*, or from its technical support document available at: http://www.eere.energy.gov/buildings/appliance_standards/residential/furnaces_boilers_1113_r.html

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

PART I – IECC

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

PART II – IRC B/E

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

EC79–07/08

403.7 (New); IRC N1104.2 (New)

Proponent: Shirley Muns, US Green Fiber, LLC

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Add new text as follows:

403.7 Gas water heaters. All gas water heaters shall be equipped with a pilotless electronic ignition system.

(Renumber subsequent sections)

PART II – IRC

Add new text as follows:

N1104.2 Gas water heaters. All gas water heaters shall be equipped with a pilotless electronic ignition system.

Reason: The water heater accounts for about 1/3 of all home energy use. The pilot lights in gas water heaters waste a lot of energy and increase emissions. Pilotless ignitions in gas ranges save about 30 percent of gas usage over the constantly burning pilot light, the same savings could be attributed to pilotless water heaters. Installing a water heater with an electronic ignition system in lieu of one with a standing gas pilot light would require the addition of one receptacle, which should be a minimum cost increase in new construction. Additional costs would be the difference in costs between the pilotless and the standing pilot water heaters. Eliminating standing pilots will reduce the energy usage considerably and should have a payback of less than 2 years.

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

PART I – IECC

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

PART II – IRC B/E

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

EC80–07/08
403.7 (New); IRC N1103.7 (New)

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

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Add new text as follows:

403.7 Snow melt system controls. Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50°F and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F.

(Renumber subsequent sections)

PART II – IRC

Add new text as follows:

N1103.7 Snow melt system controls. Snow- and ice-melting systems, supplied through energy service to the building, shall include automatic controls capable of shutting off the system when the pavement temperature is above 50°F and no precipitation is falling and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F.

Reason: This code change proposal requires a snow detector that will activate the system from the idle mode to the snow melt mode; require a slab temperature sensor that turns the system off when the surface temperature is above 50°F, and a temperature control that shuts the system down when the outdoor temperature is above 40°F. This code change is based on ANSI/ASHRAE/IESNA Standard 90.1 Section 6.4.3.8 Freeze Protection and Snow/Ice Melting Systems.

Commercial snow melt equipment is installed to eliminate the need for snow removal equipment by chemical means, provides greater safety for pedestrians and vehicles, and reduces the labor and cost of slush removal. The other advantages include eliminating piled snow, reducing liability, and reducing health risks of manual and mechanized shoveling. Snow melt equipment has being installed on a greater frequency in residential projects in communities with a high snow melt for example Aspen, CO, Sun Valley, ID and Park City, UT, Jackson WY and around the Lake Tahoe region in Nevada. Currently, the energy code only requires that the building be built to a certain level of efficiency but there is no limit placed on the energy use for snow melt which can be twice the energy use per square foot than the building.

This code change proposal does not restrict the use or sizing of snow melt but it does require that controls be installed on the equipment so that the system will operate more efficiently. The automatic controls provide efficient operation by keeping the system in an idle mood until light snow begins to fall, and allowing adequate warm-up before a heavy snow fall. Systems that only use manual controls require the building owner to manually turn on the system on when it starts to snow or to leave the system running in the snow melting mode using significantly more energy. Chapter 50 – Snow Melting and Freeze Protection, 2003 ASHRAE Applications Handbook states that using a manual switch to operate snow melt equipment may not melt snow effectively and allow snow to accumulate.

This requirement is also referenced in ANSI/ASHRAE/IESNA Standard 90.1 Section 6.4.3.8 Freeze Protection and Snow/Ice Melting Systems.

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

PART I – IECC

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

PART II – IRC B/E

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

EC81–07/08

403.7 (New), 403.7.1 (New), 403.7.2 (New), 403.7.3 (New); IRC N1103.7 (New), N1103.7.1 (New), N1103.7.2 (New), N1103.7.3 (New)

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

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Add new text as follows:

403.7 Pools. Pools shall be provided with energy conserving measures in accordance with Sections 403.7.1 through 403.7.3.

403.7.1 Pool heaters. All pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas shall not have continuously burning pilot lights.

403.7.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and waste-heat-recovery pool heating systems.

403.7.3 Pool covers. Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12.

Exception: Pools deriving over 60 percent of the energy for heating from site-recovered energy or solar energy source.

(Renumber subsequent sections)

PART II – IRC

Add new text as follows:

N1103.7 Pools. Pools shall be provided with energy conserving measures in accordance with Sections N1103.1 through N1103.7.3.

N1103.7.1 Pool heaters. All pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas shall not have continuously burning pilot lights.

N1103.7.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and waste-heat-recovery pool heating systems.

N1103.7.3 Pool covers. Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12.

Exception: Pools deriving over 60 percent of the energy for heating from site-recovered energy or solar energy source.

Reason: The text for energy conservation for swimming pools has been taken from the commercial chapter of this code. This text was also included in the 2003 IECC, Chapter 5 for residential projects. Similar language also appears in ANSI/ASHRAE 90.1-2004. This language should also be included in the residential sections of this code.

A pool cover will reduce pool water heating energy requirements by 50%–70% percent, reduce the make-up water needed by 30%–50%, and reduce the pool's chemical consumption by 35%–60%. The pool cover will also reduce the ventilation and dehumidification energy required to control interior moisture loads, and reduce the moisture loads on building assemblies that enclose pools. [1]

Time switches reduce pumping energy use by reducing the run time of a pool filter pump from 24 hours a day to 2 to 3 hours per day. Providing easily accessible manual control for pumps and heaters allow the user to easily save more energy.

[1]U.S. Department of Energy - Energy Efficiency and Renewable Energy, A Consumer's Guide to Energy Efficiency and Renewable Energy, Swimming Pool Covers.

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

PART I – IECC

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

PART II – IRC B/E

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

EC82–07/08

403.7 (New), 403.7.1 (New), 403.7.2 (New), 403.7.3 (New)

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

Add new text as follows:

403.7 Pools. Pools shall be provided with energy conserving measures in accordance with Sections 403.7.1 through 403.7.3

403.7.1 Pool heaters. All pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas or LPG shall not have continuously burning pilot lights.

403.7.2 Time switches. Time switches that can automatically turn off and on heaters and pumps according to a preset schedule shall be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar-and-waste-heat-recovery pool heating systems.

403.7.3 Pool covers. Heated pools shall be equipped with a vapor-retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of R-12.

Reason: The change adds the existing commercial pool provisions contained in Section 504.7 as Section 403.7. These provisions were set forth as Section 504.3 in the IECC 1998, 2000 and 2003 residential requirements, taken from the 1995 Model Energy Code, but relocated by DOE in their massive IECC 2004 Supplement proposal to the commercial provisions of the IECC 2004 Supplement, Chapter 8 that had no pool provisions. One requirement has been added prohibiting standing pilot lights on LPG heaters as well as natural gas models.
Since energy conservation compliance can now be made without reliance on ASHRAE 90.1, the requirements are necessary in both chapters, otherwise a whole category of pools in residential occupancies is unregulated. It makes absolutely no sense for pools serving low-rise multiple family dwellings not to be required to conserve energy on the same basis as required in the high-rise apartments next door.

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

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

EC83–07/08
403.7 (New); IRC N1103.7 (New)

Proponent: Thomas S. Zaremba, Roetzel & Andress, representing himself

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Add new text as follows:

403.7 Furnaces, boilers and central air conditioners. Furnaces, boilers and central air conditioners shall meet or exceed the performance criteria required by the U.S. Environmental Protection Agency to qualify as an Energy Star furnace, boiler or central air conditioner. When an existing furnace, boiler or central air conditioner is replaced with a new furnace, boiler or central air conditioner, the replacement furnace, boiler or central air conditioner shall meet or exceed the performance criteria required by the U.S. Environmental Protection Agency to qualify as an Energy Star furnace, boiler or central air conditioner. All new and replacement furnaces, boilers and central air conditioners shall bear the Energy Star label.

PART II – IRC

Add new text as follows:

N1103.7 Furnaces, boilers and central air conditioners. Furnaces, boilers and central air conditioners shall meet or exceed the performance criteria required by the U.S. Environmental Protection Agency to qualify as an Energy Star furnace, boiler or central air conditioner. When an existing furnace, boiler or central air conditioner is replaced with a new furnace, boiler or central air conditioner, the replacement furnace, boiler or central air conditioner shall meet or exceed the performance criteria required by the U.S. Environmental Protection Agency to qualify as an Energy Star furnace, boiler or central air conditioner. All new and replacement furnaces, boilers and central air conditioners shall bear the Energy Star label.

Reason: This proposed change is intended to increase the energy efficiency of the furnaces, boilers and central air conditioners used in new residential construction and when furnaces, boilers and central air conditioning units are replaced in the existing building stock. The United States Environmental Protection Agency establishes criteria for the top performing furnaces, boilers and central air conditioners on the market and monitors the use of the Energy Star label in the marketplace. Energy Star qualified boilers use technology such as electric ignition and sealed combustion that uses approximately 10% less energy than non-Energy Star qualified models. Energy Star qualified furnaces are approximately 15% more energy efficient than non-Energy Star qualified models. Energy Star qualified central air conditioners are approximately 8% more efficient than non-Energy Star qualified products. About $1/7^{th}$ of all electricity generated in the US is used to air condition buildings. One in every four furnaces in the US is 20 years old or older. If adopted, this change will ensure that only the most efficient furnaces, boilers and central air conditioners will be used.

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

PART I – IECC

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

PART II – IRC B/E

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

EC84–07/08

202, 404, 404.1, 404.2 (New); IRC R202 (New), N1104 (New), N1104.1 (New), N1104.2 (New)

Proponent: Craig Conner, Building Quality, representing himself

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

1. Delete and substitute as follows:

SECTION 202
GENERAL DEFINITIONS

~~**HIGH-EFFICACY LUMINAIRE (Supp).** A lighting fixture that does not contain a medium screw base socket (E24/E26) and whose lamps have a minimum efficacy of:~~

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

DEFINITION: HIGH-EFFICACY LAMPS: Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps, or lamps with a minimum efficacy of:

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

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

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

404.1 Scope. This section applies to lighting equipment, related controls and electric circuits serving the interior spaces and exterior building facades of all residential buildings, including accessory structures and garages.

2. Add new text as follows:

404.2 Lighting equipment. A minimum of fifty percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps.

(Renumber subsequent sections)

PART II – IRC

Add new text as follows:

SECTION R202
GENERAL DEFINITIONS

DEFINITION: HIGH-EFFICACY LAMPS: Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps, or lamps with a minimum efficacy of:

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

SECTION N1104
ELECTRICAL POWER AND LIGHTING SYSTEMS

N1104.1 Scope. This section applies to lighting equipment, related controls and electric circuits serving the interior spaces and exterior building facades of all residential buildings, including accessory structures and garages.

N1104.2 Lighting equipment. A minimum of fifty percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps.

Reason: Lighting is about 12% of primary residential energy, making this requirement a substantial energy saver. The overwhelming majority of residential lighting is incandescent--the least energy efficient of all light types. More efficient lighting options are available.

One more efficient lighting option is the Compact Fluorescent Light (CFL). CFLs have become common and dropped markedly in price. 60 watt replacement CFLs are available for about $1.50 per bulb from multiple sources. (Ikea http://www.ikea.com/us/en/catalog/products/00067731, Wal-Mart http://www.walmart.com/catalog/product.do?product_id=5650618)

CFLs use about 80% less energy than standard incandescent lighting. CFLs last 6 to 10 times longer than incandescent. Assuming a cost of $1.50 per bulb, electricity at 9 cents per kwh, and that each light averages half hour per day of use, then the payback time is less than 2 years. Many lights are used more than an hour per day, yielding paybacks of less than a year.

Limiting this requirement to 50% of the lamps in a residence ensures there will be plenty of exceptions for situations where a CFL might not work as well, such as dimmable fixtures.

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

PART I – IECC

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

PART II – IRC B/E

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

EC85–07/08
Table 404.5.2(1)

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

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Glazing [a]	Total area [b] = (a) The proposed glazing area; where the proposed glazing area is less than 18% of the conditioned floor area (b) 18% of the conditioned floor area; where the proposed glazing area is 18% or more of the conditioned floor area	As proposed
	Orientation: equally distributed to four cardinal compass orientation (N,E,S, & W)	As proposed
	U-factor: from Table 402.1.2	As proposed
	SHGC: From Table 402.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used	As proposed
	Interior shade fraction: Summer (all hours when cooling is required) = ~~0.70~~ 0.90 Winter (all hours when heating is required) = ~~0.85~~ 0.90	Same as standard reference design [c]
	Exterior shading: none	As proposed

(Portions of table and footnotes not shown remain unchanged)

Reason: This proposal alters the assumptions regarding interior window shades in the standard reference design. It assumes that a typical occupant will not alter their behavior with regards to interior shade operation by season. It also assumes that the majority of windows will not have shades drawn during daytime hours to block solar radiation. As a result, the purchased energy estimated using the performance approach will be more accurate and representative of an actual residential building.

This proposal makes the performance path more accurate by assuming an equal interior shade fraction in all seasons. The current standard reference design assumes that 30% of the solar gain in the summer has already been blocked by shade use, while only 15% is blocked in the winter. Because the performance path assumes that interior shading is used twice as much in the summer as in the winter, the equation shows higher relative energy use in the heating months than in the cooling months. In the performance path calculation, this translates to an artificially inflated heating budget and a bias in favor of measures used to reduce heating energy. The assumption also makes no climate zone-specific distinctions, but rather assumes that shading tendencies are static nationally. The result is that the performance path may favor compliance measures that reduce heating energy over measures that reduce cooling energy, even in cooling-dominated climates.

Although it can be argued that a conscientious building occupant may reduce heating or cooling loads by operating shades to minimize sunlight during the summer and maximize sunlight during winter, there is no data to suggest that occupants actually engage in these practices for the purpose of saving energy. In fact, it is common practice in northern climates to use shades more often during the winter months for the perceived insulating benefits and to control glare. There are many reasons why shades are operated throughout the year, and almost all of them have nothing to do with energy use. For example, privacy concerns may lead occupants to leave shades closed year-round, whereas a beautiful view or day-lighting interest may induce an occupant to leave shades open year-round. Every building will have unique shading characteristics based on the climate zone, shade type, window type, orientation, exterior shading, and most importantly, the occupant's priorities.

Because there is no reliable data to support the current bias in the performance path, the shading fraction should be neutralized so that heating and cooling measures will be treated similarly. Moreover, given that lack of data as to actual operation, the safer assumption is that shades are largely left open (justifying a higher fraction); after all, it is reasonable to assume that the average person buys windows for views and light. This is the only solution that makes sense, given the wide range of climate zones and circumstances to which the performance path will apply. This change is not intended to affect the overall stringency of the code, nor should it generally increase the costs of compliance.

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

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

EC86–07/08
Table 404.5.2(1)

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

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermostat	Type: Manual, cooling temperature setpoint = ~~78~~ 75°F; Heating temperature set point = ~~68~~ 70 °F	Same as standard reference

(Portions of table and footnotes not shown remain unchanged)

Reason: This code change modifies the thermostat set points assumed in the standard reference design to reflect more realistic and more conservative values. There is no persuasive evidence that the current assumptions of 78°F in cooling months and 68°F in heating months are representative of actual occupant practice nationwide. Actual set points vary widely according to occupant comfort, climate, and other considerations, and it would be difficult to select a single set of values for the entire country. However, these set points are critical in the performance path because they determine the relative levels of heating and cooling energy used in the building. A builder or designer's choices to include measures to reduce heating or cooling energy in the home will be driven by the outcome of this equation, so it is imperative that the assumptions match reality. Given these issues, the best approach is to assume conservative numbers, not the "best case" figures currently in the performance path.

The proposed change accomplishes this objective by changing the assumed thermostat set points by two degrees for heating periods (70°F) and three degrees for cooling periods (75°F). These set points are more consistent with comfort considerations and are closer to the set points currently used for HVAC sizing (70°F heating, 75°F cooling). The result will be a more accurate analysis of energy use in homes complying under the simulated performance alternative. This change is not intended to affect the overall stringency of the code, nor should it generally increase the costs of compliance. It will, however, provide a more reasonable indication of the likely impacts of various choices on overall energy use and cost effectiveness.

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

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

EC87–07/08
Table 404.5.2(1)

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

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass wall if proposed wall is mass; otherwise wood frame Gross Area: same as proposed U-Factor: from Table 402.1.3 Solar absorptions = 0.75 Remittance = 0.90	As proposed As proposed As proposed, <u>assuming gaps/missing insulation equal to 5%, unless otherwise verified</u> As proposed As proposed
Basement and crawlspace walls	Type: same as proposed Gross Area: same as proposed U-Factor: from Table 402.1.3, with insulation layer on interior side of walls	As proposed As proposed As proposed, <u>assuming gaps/missing insulation equal to 5%, unless otherwise verified</u>
Above-grade floors	Type: wood frame Gross Area: same as proposed U-Factor: from Table 402.1.3	As proposed As proposed As proposed, <u>assuming gaps/missing insulation equal to 5%, unless otherwise verified</u>
Ceilings	Type: wood frame Gross Area: same as proposed U-Factor: from Table 402.1.3	As proposed As proposed As proposed, <u>assuming gaps/missing insulation equal to 5%, unless otherwise verified</u>

(Portions of table not shown remain unchanged)

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

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

Reason: This proposal recognizes that insulation must be installed per the manufacturer's specifications for it to perform as expected. EPA's ENERGY STAR Qualified New Homes program, RESNET, and others, have also recognized this distinction and incorporated requirements for insulation to be inspected to determine its level of performance. Similar to RESNET's requirements, this proposal requires that proposed homes assume decreased insulation performance equivalent to insulation gaps in 5% of the component surface area unless otherwise verified. Assuring proper installation of insulation is one of the most cost effective opportunities to improve the efficiency and comfort of new homes.

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

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

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

EC88–07/08
Table 404.5.2(1)

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

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	Specific Leakage Area (SLA)[d] = 0.00036 assuming no energy recovery.	For residences that are not tested, ~~the same as the standard reference design~~ <u>0.00060 SLA assuming no energy recovery</u> For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate [e] but not less than 0.35 ACH For residences with mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate [e] combined with the mechanical ventilation rate, [f] which shall not be less than 0.01 x CFA + 7.5 x (Nbr+1) where: CFA = conditioned floor area Nbr = number of bedrooms

(Portions of table and footnotes not shown remain unchanged)

Reason: This proposal dictates a higher default leakage level in the proposed home than the standard reference home, but does not make any changes to the standard reference design. This is one of two proposals addressing this subject; the second proposal also tightens the standard reference design.

The current code assumes that where residences are not tested, that the default air leakage level should be equal to the standard reference design. We believe that it is unreasonable to assume, with no proof, that every home meets the requirements of the standard reference design.

Prior to the 2004 IECC the equivalent specific leakage area used in energy analysis was approximately 0.00060, with an air change rate of 0.57 x W, the 2004 IECC set the first exact specific leakage area requirement at 0.00048, and then the 2006 IECC further reduced the specific leakage area to 0.00036. This proposal sets the proposed design default value at approximately equal to the previous infiltration air change rate of 0.57 x W, with a 0.00060.

If this proposal is adopted, builders using the performance path for compliance will be encouraged to tighten and test their homes to demonstrate savings over the current standard reference design. As currently adopted, the code provides no incentive for builders to test, because the proposed home dictates an extremely low level of infiltration by default. Therefore, builders are perversely encouraged to not test their home, because doing so would likely decrease the amount of savings that can be claimed.

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

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

EC89–07/08
Table 404.5.2(1)

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

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Air Exchange Rate	Specific Leakage Area (SLA)[d] = ~~0.00036 assuming no energy recovery~~ 0.00015 combined with the mechanical ventilation rate, which shall be 0.01 x CFA + 7.5 x (Nbr+1) where: CFA = conditioned floor area Nbr = number of bedrooms and assuming continuous balanced ventilation using a energy/heat recovery ventilator with a recovery efficiency of 76% [f]	For residences that are not tested, ~~the same as the standard reference design~~ 0.00060 SLA assuming no energy recovery For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate [e] but not less than 0.35 ACH For residences with mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate [e] combined with the mechanical ventilation rate, [f] which shall not be less than 0.01 x CFA + 7.5 x (Nbr+1) where: CFA = conditioned floor area Nbr = number of bedrooms

(Portions of table and footnotes not shown remain unchanged)

Reason: This proposal dictates a higher default leakage level in the proposed home than the reference home. In addition, it dictates a low infiltration value in the reference home and adds an active ventilation system with heat/energy recovery. This is the second, more stringent of two proposed alternative proposed for consideration related to air leakage.

The proposed configuration for the standard reference home represents a home that is "built tight, and ventilated right", a common objective of good building science. The low infiltration value represents achievable leakage by following the prescriptive guidance in this code.

The current code assumes that where residences are not tested, that the default air leakage level should be equal to the standard reference design. We believe that it is unreasonable to assume, with no proof, that every home meets the requirements of the standard reference design.

Prior to the 2004 IECC the equivalent specific leakage area used in energy analysis was approximately 0.00060, with an air change rate of 0.57 x W, the 2004 IECC set the first exact specific leakage area requirement at 0.00048, and then the 2006 IECC further reduced the specific leakage area to 0.00036. This proposal sets the proposed design default value at approximately equal to the previous infiltration air change rate of 0.57 x W, with a 0.00060.

If this proposed code modification is adopted, builders who use the performance path for compliance will be encouraged to tighten and test their homes to demonstrate savings. As currently adopted, the code provides no incentive for builders to test, because the proposed home dictates an extremely low level of infiltration by default. Therefore, builders are perversely encouraged to not test their home because doing so would likely decrease the amount of savings that can be claimed.

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

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

EC90–07/08
Table 404.5.2(1)

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

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems[h, i]	Fuel type: same as proposed design Efficiencies: Electric: air-source heat pump with ~~prevailing federal minimum~~ efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum. Nonelectric furnaces: natural gas furnace with ~~prevailing federal minimum~~ efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum Nonelectric boilers: natural gas boiler with ~~prevailing federal minimum~~ efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed As proposed As proposed As proposed As proposed
Cooling systems[h, j]	Fuel type: Electric Efficiency: as proposed, unless the proposed efficiency is greater than 15% above the ~~in accordance with~~ prevailing federal minimum ~~standards~~ efficiency, in which case it shall be 15% above the federal minimum. Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed As proposed As proposed
Service Water Heating[h, k]	Fuel type: same as proposed design Efficiency: as proposed, unless the proposed efficiency is greater than 15% above the ~~in accordance with~~ prevailing federal minimum ~~standards~~ efficiency, in which case it shall be 15% above the federal minimum. Use: ~~gal/day=30 + (10 x N_{br})~~ Same as proposed design	As proposed As proposed ~~Same as standard reference~~ Use: gal/day=30 + (10 x N_{br})

(Portions of table and footnotes not shown remain unchanged)

Reason: This proposed modification will enhance the performance path, improve its accuracy, and increase energy efficiency and stringency by eliminating a minimizing a compliance loophole. This is one of two alternative proposals intended to mitigate the harmful aspects of equipment trade-offs against other energy efficiency features. This proposal reduces the impact of equipment trade-offs by only allowing trade-offs to take credit for energy efficiency improvements more than 15% better than federal minimums.

Under the existing code, the Standard Reference Design references federal minimum standards for heating and cooling systems and service water heating, whereas the efficiencies of the proposed design are entered according to the actual mechanical equipment. The practical effect of specifying the federal minimum efficiencies in the performance path is that the proposed design receives trade-off credit for any upgrade to equipment, no matter how minor, even if the prevailing practice in a climate zone is to install more efficient equipment. At the same time, the ICC has little ability to set a higher standard reference design level to account for improvements because of federal legal preemption concerns.

Since the ICC does not control the federal minimums (which are, indeed, not referenced standards) and states generally cannot set higher values in the standard reference design (due to federal preemption concerns), these items should not have full trade-off against other items that the IECC can control.

Right now, in regions where higher-efficiency equipment is already likely to be installed, a home built under the prescriptive path (which does not allow equipment trade-offs) may be significantly more efficient than a home built under the performance path (which assumes a worst-case efficiency in the standard reference design for this equipment and then allows off-setting trade-offs elsewhere in the building). For example, in many northern states, furnace efficiencies above 90 AFUE are the norm, yet the performance path gives trade-off credit based on a 78 AFUE federal minimum furnace level established many years ago that may no longer even be available in that market. This can allow a 10% or more increase in heating and cooling energy use from the trade-off of other aspects of the energy efficiency of the home.

Moreover, equipment trade-offs, on their face, typically result in less efficiency. The useful life of HVAC or service water heating equipment is far shorter than envelope components such as insulation or windows. When equipment fails, it may very well be replaced with less efficient equipment.

This proposal is intended to promote high efficiency equipment without degrading the other components of the home. The current code approach allows residential buildings to trade off the quality of the buildings envelope for high efficiency equipment. The current trade-off hinders the quality and comfort of the home, along with increasing the size and cost of the equipment needed to meet the increased loads from the envelope.

This proposal requires only the minimum federal efficiency equipment, however, it only gives extra credit for equipment that is 15% better than federal minimum efficiencies. This would equate to 14.95 SEER, 89.7 AFUE, 8.86 HSPF, and a range of improved hot water efficiencies based on the storage capacity. As a result, this proposal would eliminate marginal equipment trade-offs while encouraging substantial improvements in equipment efficiency.

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

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

EC91–07/08

Table 404.5.2(1)

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

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Heating systems[h, i]	As Proposed ~~Fuel type: same as proposed design~~ ~~Efficiencies:~~ ~~Electric: air-source heat pump with prevailing federal minimum efficiency~~ ~~Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency~~ ~~Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency~~ Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As Proposed ~~As proposed~~ ~~As proposed~~ ~~As proposed~~ ~~As proposed~~ ~~As proposed~~
Cooling systems[h, j]	As Proposed ~~Fuel type: Electric~~ ~~Efficiency: in accordance with prevailing federal minimum standards~~ Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As Proposed ~~As proposed~~ ~~As proposed~~ ~~As proposed~~
Service Water Heating[h, k]	As Proposed ~~Fuel type: same as proposed design~~ ~~Efficiency: in accordance with prevailing federal minimum standards~~ Use: ~~gal/day=30 + (10 x N_{br})~~ Same as proposed design	As Proposed ~~As proposed~~ ~~As proposed~~ ~~Same as standard reference~~ Use: gal/day=30 + (10 x N_{br})

(Portions of table and footnotes not shown remain unchanged)

Reason: This proposed modification will enhance the performance path, improve its accuracy, and increase energy efficiency and stringency by eliminating a significant compliance loophole. This is one of two alternative proposals intended to mitigate the harmful aspects of equipment trade-offs against other energy efficiency features. The proposed change will set the standard reference design for heating, cooling and service water heating the same as the proposed equipment, thereby eliminating trade-offs of such equipment against other energy features of the home.

Under the existing code, the Standard Reference Design references federal minimum standards for heating and cooling systems and service water heating, whereas the efficiencies of the proposed design are entered according to the actual mechanical equipment. The practical effect of specifying the federal minimum efficiencies in the performance path is that the proposed design receives trade-off credit for any upgrade to equipment, no matter how minor, even if the prevailing practice in a climate zone is to install more efficient equipment. At the same time, the ICC has little ability to set a higher standard reference design level to account for improvements because of federal legal preemption concerns.

Since the ICC does not control the federal minimums (which are, indeed, not referenced standards) and states and local jurisdictions generally cannot set higher values in the standard reference design (due to federal preemption concerns), these items should not be included in the code as a basis to trade-off other items that the IECC can control. It simply does not make sense for the IECC to incorporate equipment efficiencies over which states have no control, especially where those efficiencies translate into lower energy efficiency elsewhere in the code. Right now, in regions where higher-efficiency equipment is already likely to be installed, a home built under the prescriptive path (which does not allow equipment trade-offs) may be significantly more efficient than a home built under the performance path (which assumes a worst-case efficiency in the standard reference design for this equipment and then allows off-setting trade-offs elsewhere in the building). For example, in many northern states, furnace efficiencies above 90 AFUE are the norm, yet the performance path gives trade-off credit based on a 78 AFUE federal minimum furnace level established many years ago that may no longer even be available in that market. This can allow a 10% or more increase in heating and cooling energy use from the trade-off of other aspects of the energy efficiency of the home.

Moreover, equipment trade-offs, on their face, typically result in less efficiency. The useful life of HVAC or service water heating equipment is far shorter than envelope components such as insulation or windows. When equipment fails, it may very well be replaced with less efficient equipment.

The solution for the IECC is to make the system efficiency in the standard reference design match the proposed design. More efficient equipment is regularly installed in many states, and should be encouraged, but the current equation in the performance path gives incentives to upgrade equipment at the expense of other efficiency measures, such as thermal envelope components. Unless DOE can suggest a solution that would allow states to require higher equipment efficiencies in the standard reference design, these standards should be removed from the equation.

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

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

EC92–07/08

Table 404.5.2(1)

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

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Glazing[a]	Total area[b] = (a) The proposed glazing area; where the proposed glazing area is less than ~~18%~~15% of the conditioned floor area (b) ~~18%~~15% of the conditioned floor area; where the proposed glazing area is ~~18%~~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 402.1.2	As proposed
	SHGC: From Table 402.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed
	Interior shade fraction: Summer (all hours when cooling is required) = 0.70 Winter (all hours when heating is required) = 0.85	Same as standard reference design[c]
	External shading: none	As proposed

(Portions of table and footnotes not shown remain unchanged)

Reason: This proposal brings the glazing area percentage in the Standard Reference Design closer to the average window area in homes and, as a result, will save energy for high-fenestration-area homes under the performance path. The current performance path compares the proposed design to a theoretical "standard reference design" home with the same glazing area when less than 18%, but uses 18% glazing area in the standard reference design where the proposed home has a higher glazing area percentage. The performance path is only as accurate as its fundamental assumptions, and based on DOE analysis presented to justify the rewrite of the IECC in 2004, 18% glazing is an artificially high assumption (PNNL concluded for DOE that the average was somewhere between 12% and 17%; this suggests that 15% is a reasonable choice for the performance baseline in the code). A more reasonable assumption of 15% glazing in the performance path will ensure that homes with above-average glazing area percentages meet a stringency level similar to that met by an average house that complies under the prescriptive path.

The performance path is designed so that homes with above-average glazing area must make up the difference elsewhere in the home, either through better windows, insulation, or other efficiency upgrades. The current assumption in the performance path is an 18% average. If that assumption is lowered to 15% (which is more in line with actual data presented by DOE) then homes with above-average (over 15%) glazing using the performance path will have to make up for the loss in efficiency in insulation, windows, or elsewhere in the home.

It is important to note that the proposed amendment to Table 404.5.2(1) does not reduce the actual glazing area of the home or require design changes, but rather, ensures that homes with above-average glazing areas meet the same overall efficiency of the average home built under the prescriptive path. For homes with less than 15% glazing, the standard reference design and proposed design are assumed to have identical glazing area, just as they are in the current performance path. As a result, this change will increase stringency for homes with above average glazing built under the performance path, but will not affect construction under the prescriptive path and/or homes built under the performance path with less than 15% window to wall area.

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

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

EC93–07/08
Table 404.5.2(1)

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

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Thermal distribution systems	A thermal distribution system efficiency (DSE) of ~~0.80~~ 0.88 shall be applied to both the heating and cooling system efficiencies	~~Same as standard reference design,~~ A thermal distribution system efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies, except as specified by Table 404.5.2(2)

(Portions of table and footnotes not shown remain unchanged)

Reason: This proposal increases stringency in the residential performance compliance path by establishing a reasonable distribution system efficiency (DSE) level in the standard reference design that can be met either by locating ducts in conditioned space or by installing a reduced leakage air distribution system when components are located in unconditioned space.

The distribution system efficiency currently found in the standard reference design is only 0.80, which is the same as the default value given in Table 404.5.2(2) for distribution system components located in unconditioned space. The practical effect of this "worst case" assumption in the performance path is that there is little incentive to undertake reasonable enhancements in DSE in the proposed design. The proposed modification addresses this problem by establishing a DSE of 0.88 in the standard reference design, which is the efficiency the code specifies for ducts in conditioned space or a reduced leakage air distribution system. If the user fails to adopt an approach to increase duct efficiency, the user is given the default of 0.80 from the present code.

It is unreasonable to assume inefficient ducts in the standard reference design since the IECC already requires that ducts, air handlers, filter boxes, etc. be "sealed." (403.2.2) It is more reasonable to assume that a modern, reasonably energy efficient home will have reasonably efficient ducts. A home with a DSE of 0.88 will produce substantial energy savings over one with a 0.80 DSE. This proposal still allows considerable flexibility in the performance path, because if a builder still does not wish to take any action on this front, the system will be given a default efficiency rating of 0.80 and the efficiency may be made up elsewhere in the building.

The actual cost impact will depend on which performance option the builder selects. Properly sealed ducts or ducts located entirely in conditioned space will not add cost to the building, but will increase the building's efficiency by a substantial amount.

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

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

EC94–07/08
Table 404.5.2(1)

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

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
~~Doors~~	~~Area: 40 ft^2~~ ~~Orientation: North~~ ~~*U*-Factor: same as fenestration from Table 402.1.3~~	~~As proposed~~ ~~As proposed~~ ~~As proposed~~
~~Glazing~~Fenestration[a]	Total area[b] = (a) The proposed ~~glazing~~fenestration area; where the proposed ~~glazing~~fenestration area is less than 18% of the conditioned floor area (b) 18% of the conditioned floor area; where the proposed ~~glazing~~fenestration area is 18% or more of the conditioned floor area Orientation: equally distributed to four cardinal compass orientations (N, E, S & W) U-Factor: from Table 402.1.1~~2~~ SHGC: For glazing, which shall equal the total area as defined above minus 40 ft^2, from Table 402.1.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used; for opaque doors, which shall equal 40 ft^2, SHGC = 0 for all climates, equally distributed to four cardinal compass orientations. Interior shade fraction: Summer (all hours when cooling is required) = 0.70 Winter (all hours when heating is required) = 0.85 External shading: none	As proposed As proposed As proposed As proposed Same as standard reference design[c] As proposed

(Portions of table and footnotes not shown remain unchanged)

Reason: The IECC defines fenestration (section 202) to include all windows, skylights and doors, whether glazed or opaque. Yet, table 404.5.2(1), treats “doors” a separate component. It is unclear how glazed and un-glazed doors are supposed to be treated under this approach (e.g., are glazed doors included in doors or glazing?). This proposal simplifies and tightens the performance path by including all fenestration—doors, vertical glazing, and skylights—in a single calculation. In order to do so, the proposal replaces the two terms “doors” and “glazing” with “fenestration,” and sets an SHGC in the standard reference design for both glazed and opaque doors.

This simplification has the potential to strengthen the code by ensuring that all fenestration is properly accounted for in the proposed design. The result will also be an increase in efficiency and energy savings, since it eliminates a separate assumption of 40 square feet of opaque doors in the standard reference design, instead including such doors in fenestration area, like all other fenestration. The proposal also corrects references to the appropriate U-factor and SHGC table.

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

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

EC95–07/08
202 (New), 404.1, 404.2, Table 404.5.2(1)

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

1. Add new definitions as follows:

SECTION 202
GENERAL DEFINITIONS

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

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

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

2. Revise as follows:

SECTION 404
ELECTRICAL POWER AND LIGHTING SYSTEMS

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

Exceptions:

1. Swimming pool lighting systems
2. Landscape lighting systems

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

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

(Renumber subsequent sections)

SECTION 404
SIMULATED PERFORMANCE ALTERNATIVE (Performance)

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

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Internal Gains	IGain = 17,900 + 23.8 x CFA + 4104 x Nbr + $\Delta IG_{lighting}$ (Btu/day per dwelling unit) Where $\Delta IG_{lighting}$ represents the reduced internal gains from efficient lighting as defined by the lighting building component.	~~Same as standard reference design,~~ IGain = 17,900 + 23.8 x CFA + 4104 x Nbr + $\Delta IG_{lighting}$ (Btu/day per dwelling unit) Where $\Delta IG_{lighting}$ represents the reduced internal gains from efficient lighting as defined by the lighting building component.
Lighting	kWh/yr = (455 + 0.80 * CFA) + □kWh/yr where: □kWh/yr = [29.5 – 0.5189*CFA *50% – 295.12*50% + 0.0519*CFA] Internal gains in the Standard Reference Design shall be reduced by 90% of the impact from efficient lighting, calculated in btu/day using the following equation: $\Delta IG_{lighting}$ = - 0.90 * ΔkWh/yr * 10^6 / 293 / 365	kWh/yr = (455 + 0.80 * CFA) + □kWh/yr where: □kWh/yr = [29.5 – 0.5189*CFA*FL% – 295.12*FL% + 0.0519*CFA] FL% = the ratio of Qualifying Light Fixtures to all light fixtures in Qualifying Light Fixture Locations. The Proposed Design shall not have FL% more than 50% from CFL. Internal gains in the Proposed Design shall be reduced by 90% of the impact from efficient lighting, calculated in btu/day using the following equation: $\Delta IG_{lighting}$ = 0.90 * ΔkWh/yr * 10^6 / 293 / 365

(Portions of table and footnotes not shown remain unchanged)

Reason: This proposal is intended to add on to the language that was added to the code in the 2007 IECC Supplement to include lighting as part of the energy efficiency code. This proposal gives a complete prescriptive and performance compliance path for lighting in residential buildings. The proposal includes new definitions, prescriptive requirements for interior and exterior lighting and a performance path that recognizes the standard reference design for having 50% of the lighting as high efficiency lighting. The performance compliance path integrates changes in lighting efficiency into the internal gains calculation used in energy modeling calculations.

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

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

EC96 –07/08

202 (New), 404.2; IRC N1104 (New), N1104.1 (New)

Proponent: Thomas D. Culp, Ph.D., Birch Point Consulting LLC

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

404.2 Automatic lighting shutoff. (Mandatory). Nonhabitable spaces shall be equipped with an automatic control device to shut off lighting in those areas. The automatic control device shall function on either an occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space, or a signal from another control or alarm system that indicates the area is unoccupied.

Exception: The following shall not require an automatic control device:

1. Lighting in spaces where patient care is directly provided.
2. Lighting in stairways or corridors that are elements of the means of egress.
3. Spaces where automatic shutoff would endanger occupant safety or security.

(Renumber subsequent sections)

PART II – IRC

Add new section as follows:

SECTION N1104
ELECTRICAL POWER AND LIGHTING SYSTEMS

N1104.1 Automatic lighting shutoff. Nonhabitable spaces shall be equipped with an automatic control device to shut off lighting in those areas. The automatic control device shall function on either an occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space, or a signal from another control or alarm system that indicates the area is unoccupied.

Exception: The following shall not require an automatic control device:

1. Lighting in spaces where patient care is directly provided.
2. Lighting in stairways or corridors that are elements of the means of egress.
3. Spaces where automatic shutoff would endanger occupant safety or security.

Reason: This proposal adds a new requirement for automatic lighting shutoff controls in residential buildings, adapted from similar language in IECC Chapter 5 for commercial buildings. Similar to highrise residential buildings, automatic shutoff controls also make sense for saving energy in lowrise residential buildings including apartments, dormitories, and assisted care facilities. These requirements would only apply to nonhabitable spaces such as garages, utility rooms, storage areas, bathrooms, and non-egress hallways. A typical motion sensor will add between $5-$15 per control, and costs would be expected to decrease with economies of scale.

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

PART I – IECC

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

PART II – IRC B/E

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

EC97–07/08

202, 404, 404.1, 404.2 (New); IRC R202 (New), N1104 (New), N1104.1 (New), N1104.2 (New)

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

THESE PROPOSALS ARE ON THE AGENDA OF THE IECC AND THE IRC B/E CODE DEVELOPMENT COMMITTEES AS 2 SEPARATE CODE CHANGES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES

PART I – IECC

1. Delete definition and substitute as follows:

~~**HIGH-EFFICACY LUMINAIRE. (Supp)** A lighting fixture that does not contain a medium screw base socket (E24/E26) and whose lamps have a minimum efficacy of:~~

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

HIGH-EFFICACY LAMPS: Compact florescent lamps, T-8 or smaller diameter linear florescent lamps, or lamps with a minimum efficacy of:

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

2. Revise section title as follows:

SECTION 404 (Mandatory) (Supp)
ELECTRICAL POWER AND LIGHTING SYSTEMS

3. Delete and substitute as follows:

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

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

404.1 Scope. This section applies to lighting equipment, related controls and electric circuits serving the interior spaces and exterior building facades of all residential buildings including accessory structures and garages.

4. Add new text as follows:

404.2 Lighting Equipment. A minimum of fifty percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps.

PART II – IRC

Add new text as follows:

SECTION R202
GENERAL DEFINITIONS

DEFINITION: HIGH-EFFICACY LAMPS: Compact florescent lamps, T-8 or smaller diameter linear florescent lamps, or lamps with a minimum efficacy of:

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

SECTION N1104 (Mandatory)
ELECTRICAL POWER AND LIGHTING SYSTEMS

N1104.1 Scope. This section applies to lighting equipment, related controls and electric circuits serving interior spaces and exterior building facades including accessory structures and garages.

N1104.2 Lighting equipment. A minimum of fifty percent of the lamps in permanently installed lighting fixtures shall be high efficacy lamps.

Reason: Incandescent lighting represents 10% of residential energy use yet has no code requirements, despite the now wide-spread availability of compact fluorescent lamps (CFLs), a cost-effective, much more efficient alternative. Consumer awareness and acceptance of CFLs has risen dramatically in the past few years. Replacements for almost all styles of incandescent lamps are now available.

Replacing a single 100-watt incandescent that is turned on 3 hours per day with a 25-watt CFL reduces energy use by 82 kWh per year. At 8¢/kWh, annual savings to the homeowner is $6.57 per year -- from one bulb that costs two dollars! Homeowners benefit even more because CFLs last five or more times longer than incandescents. CFLs can therefore pay for themselves based solely on the reduced replacement of bulbs. Initial costs of installing CFLs are paid back in a matter of months.

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

PART I – IECC

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

PART II – IRC B/E

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

EC98–07/08
404.3

Proponent: Ken Nittler, PE, Enercomp, Inc.

Revise as follows:

404.3 Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have an annual energy ~~cost~~ <u>use</u> that is less than or equal to the annual energy ~~cost~~ <u>use</u> of the standard reference design. ~~Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.~~ <u>The energy use shall be based on source energy expressed in Btu or Btu per square foot of conditioned floor area. The source energy multiplier for electricity shall be 3.16. The source energy multiplier for fuels other than electricity shall be 1.1.</u>

> ~~**Exception:** Jurisdictions that require site energy (1kWh = 3,413 Btu) rather than energy cost as the metric of comparison.~~

Reason: The purpose of this proposal is to base compliance on source energy use instead of cost and to eliminate the site energy exception. This is similar to a proposal from last year with more compact language and with a source multiplier for fuels included. Using cost has several major drawbacks:

- Using cost will be a liability to the homebuilder if homebuyers do not achieve the savings listed in the compliance documentation.
- It changes frequently. This means that a home that complies today may not comply a few months from now if costs change.
- It focuses attention on first year energy costs, which misses the point of an energy code where features that are generally life cycle cost effective to the homeowner are added to save energy and make homes more comfortable over the life of the home, not to reduce first cost
- The referenced to the *State Energy Price and Expenditure Report* is unclear on which cost figures should be used.

The source multipliers of 3.16 and 1.1 are from the 2002 *DOE Core Databook*. One way to think of this is that electric energy utilized at the site requires 3.16 times the source energy to produce at powerplants and distribute via power lines to homes. This is because the generating efficiency of power plants is much less than 100% and there are losses in transmission and distribution as well. Other fuels, such as natural gas and fuel oil have less source energy losses and a lower source energy multiplier.

Before the 2004 IECC Supplement, concerns about the choice between heating systems (e.g., electric versus natural gas) prevented the adoption of source or cost as the basis for comparison in the IECC. However, since the change in the 2004 supplement to cost has overcome this issue, substituting source energy will not greatly alter compliance as cost and source energy generally follows a similar pattern – on a Btu basis, electric energy generally costs a multiple of the cost of other fuels.

Note that the Las Vegas area, when it adopted the 2003 and 2006 IECC, added a local amendment requiring the use of source energy.

Site energy needs to be deleted because it is wrong anytime there are mixed fuel sources such as gas heating and electric cooling. Site energy only provides a meaningful comparison of energy use in cases where the same energy source is used for heating, cooling and water heating such as an all electric home. But in cases where a home has mixed energy sources, such as gas heating and electric cooling, adding together the site gas use (Btu) plus the air conditioner energy use (kWh * 3413) undervalues the electrical energy used for cooling because of the large generation and transmission losses of electricity compared to natural gas or other fuels. This leads to energy efficiency choices by builders that are flawed. In Phoenix for example, a builder might be encouraged to add a feature like a higher efficiency gas furnace to gain compliance with the IECC when the homeowner would be better served by having a more efficient air conditioner. It is important to note that removing this exception has no impact on the compliance results for cases like all electric homes because both the cost per kWh used in the old language and the source energy multiplier used in this proposal are both constants. If an all electric home complied under the site exception, it would continue to comply when using source energy.

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

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

EC99–07/08
404.3

Proponent: Ken Nittler, PE, Enercomp, Inc.

Revise as follows:

404.3 Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the standard reference design. Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

> **Exception:** ~~Jurisdictions that require site energy (1kWh = 3,413 Btu) rather than energy cost as the metric of comparison.~~ 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: If energy cost is going to remain the primary metric for compliance, the purpose of this proposal is to remove the exception for the use of site energy and to allow the use of source energy as an alternative to energy cost.

Adding source energy as an alternative to cost offers many benefits to compliance.

- Using cost will be a liability to the homebuilder if homebuyers do not achieve the savings listed in the compliance documentation.
- It changes frequently. This means that a home that complies today may not comply a few months from now if costs change.
- It focuses attention on first year energy costs, which misses the point of an energy code where features that are generally life cycle cost effective to the homeowner are added to save energy and make homes more comfortable over the life of the home, not to reduce first cost
- The referenced to the *State Energy Price and Expenditure Report* is unclear on which cost figures should be used.

The source multipliers of 3.16 and 1.1 are from the 2002 *DOE Core Databook*. One way to think of this is that electric energy utilized at the site requires 3.16 times the source energy to produce at powerplants and distribute via power lines to homes. This is because the efficiency of power plants is much less than 100% and there are losses in transmission and distribution as well. Other fuels, such as natural gas and fuel oil have less source energy losses and a lower source energy multiplier.

Note that the Las Vegas area, when it adopted the 2003 and 2006 IECC, added a local amendment requiring the use of source energy.

Site energy needs to be deleted because it is wrong anytime there are mixed fuel sources such as gas heating and electric cooling. Site energy only provides a meaningful comparison of energy use in cases where the same energy source is used for heating, cooling and water heating such as an all electric home. But in cases where a home has mixed energy sources, such as gas heating and electric cooling, adding together the site gas use (Btu) plus the air conditioner energy use (kWh * 3413) undervalues the electrical energy used for cooling because of the large generation and transmission losses of electricity compared to natural gas or other fuels. This leads to energy efficiency choices by builders that are flawed. In Phoenix for example, a builder might be encouraged to add a feature like a higher efficiency gas furnace to gain compliance with the IECC when the homeowner would be better served by having a more efficient air conditioner. It is important to note that removing this exception has no impact on the compliance results for cases like an all electric home where using either the cost comparison or the source comparison results in the heating, cooling and water heating energy all being multiplied by the same cost per kWh or the same source multiplier.

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

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

EC100–07/08
404.3

Proponent: Ken Nittler, PE, Enercomp, Inc.

Revise as follows:

404.3 Performance-based compliance. Compliance based on simulated energy performance requires that a proposed residence (proposed design) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the standard reference design. Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.

> ~~**Exception:** Jurisdictions that require site energy (1kWh = 3,413 Btu) rather than energy cost as the metric of comparison.~~

Reason: If energy cost is going to remain the primary metric for compliance and source energy is not going to be recognized, the purpose of this proposal is to remove the exception for the use of site energy.

Site energy needs to be deleted because it is wrong anytime there are mixed fuel sources such as gas heating and electric cooling. Site energy only provides a meaningful comparison of energy use in cases where the same energy source is used for heating, cooling and water heating such as an all electric home. But in cases where a home has mixed energy sources, such as gas heating and electric cooling, adding together the site gas use (Btu) plus the air conditioner energy use (kWh * 3413) undervalues the electrical energy used for cooling because of the large generation and transmission losses of electricity compared to natural gas or other fuels. This leads to energy efficiency choices by builders that are flawed. In Phoenix for example, a builder might be encouraged to add a feature like a higher efficiency gas furnace to gain compliance with the IECC when the homeowner would be better served by having a more efficient air conditioner. It is important to note that removing this exception has no impact on the compliance results for cases like an all electric home where using the cost comparison results in the heating, cooling and water heating energy all being multiplied by the same cost per kWh.

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

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

EC101 –07/08
404.4.3

Proponent: John R. Addario, PE, New York State Department of State Codes Division

Revise as follows:

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

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

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

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

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

EC102 –07/08
Table 404.5.2(1)

Proponents: Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America; David Duly, representing Pilkington North America

Revise table as follows:

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

Glazing[a]	Total Area[b] = (a) The proposed glazing area; where the proposed glazing area is less than 18% of the conditioned floor area (b) 18% of the conditioned floor area; where the proposed glazing area is 18% 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 402.1.2	As proposed
	SHGC: From Table 402.1 except that for climates with no requirement (NR) SHGC=0.40 shall be used	As proposed[c]
	Interior shade fraction: Summer (all hours when cooling is required) = 0.70 Winter (all hours when heating is required) = 0.85	Same as standard reference design[~~c~~d]
	External shading: none	As proposed

a. and b. (No change to current text)
c. <u>In Climate Zones 6, 7 and 8, alternative fenestration U-factor and SHGC values shall be permitted in the proposed design when based on the following equation: U-factor – 0.25 x SHGC = 0.25 (maximum).</u>
(Re-letter subsequent footnotes)

(Portions of table and footnotes not shown remain unchanged)

Reason: The purpose of this proposed code change is to provide an approved calculational method for the determination of U-factor and SHGC in proposed designs in climate zones 6, 7 and 8. Section 404.3 allows the use of a compliance software tool to perform energy calculations where the energy performance of the proposed design will have an annual energy cost that is less than or equal to the standard reference design.

The annual energy cost values are calculated using a performance analysis software tool recognized by DOE called REM/Design (V12.41). The equation [U-factor – 0.25 x SHGC = 0.25 (maximum)] represents equivalent annual energy cost for Climate Zones 6, 7 and 8 based on all specifications for the Proposed Design to be identical to the Standard Reference Design except for the fenestration properties. Substitution of the alternative fenestration U-factor and SHGC values for the Proposed Design was evaluated compared with the prescriptive U-factor = 0.35 Btu/hr-sf-F and SHGC = 0.40 for the Standard Reference Design.

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

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

EC103–07/08
501.1, 501.2, Chapter 6

Proponent: Larry Spielvogel, PE, Consulting Engineer, representing himself

1. Revise as follows:

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

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

> **Exception:** Buildings conforming to Section 506, provided Sections 502.4, 502.5, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied.

2. Delete without substitution from Chapter 6.

~~**IESNA**~~ ~~Illuminating Engineering Society of North America~~
~~120 Wall Street, 17th Floor~~
~~New York, NY 10005-4001~~

~~90.1-2004 Energy Standard for Buildings Except Low-rise Residential Buildings~~

Reason: This proposal should be adopted to delete optional provisions, simplify the Code, increase stringency, and the following:

1. ASHRAE/IESNA Standard 90.1 is no longer fair and no longer provides minimum criteria for the energy efficient design of buildings. It also no longer provides criteria and requirements that are economically justified and are economically consistent from section to section. Thus, users who follow the requirements of ASHRAE/IESNA Standard 90.1 will be required to install more expensive products and systems for the building envelope that will have much longer paybacks than the products and systems for HVAC, service water heating, and lighting. This is especially unfair and uneconomical in buildings whose heating and cooling requirements are predominantly for ventilation air and internal heat gains, such as schools, health care facilities, and retail establishments.
2. ASHRAE/IESNA Standard 90.1 is less stringent than IECC. With the current provisions in IECC, the requirements in ASHRAE/IESNA Standard 90.1 are often selected to circumvent comparable requirements in IECC and are often less stringent than IECC. Allowing users of the IECC to choose the ASHRAE/IESNA Standard 90.1 option can and will result in less stringent criteria than IECC. For example, the ASHRAE space-by-space method for lighting in Standard 90.1 Section 9.6 is less stringent than comparable requirements in IECC in virtually every type of occupancy. In addition, there are additional lighting power allowances in Section 9.6.2 of Standard 90.1 that do not exist in IECC, such as those for retail occupancies and that can more than double the amount of lighting compared with what is allowed in IECC. Every section of Standard 90.1 has many more options and exceptions than IECC, almost all of which are less stringent than IECC.
3. The building envelope portion of this current proposal was already approved by the IECC committee in EC82-06/07, to remove the option to use the envelope provisions of Standard 90.1 in lieu of complying with IECC Section 502. The proposal was withdrawn by the proponent for other reasons in the final hearings.
4. ASHRAE has not honored its commitment to publish updated versions of the Standard every 3 years by the deadline for submission to the IECC. Therefore, there is no certainty that a current version of the Standard will be available for this Code Cycle, or any future cycle. As of the deadline for this proposal, the 2007 version of ASHRAE/IESNA Standard 90.1 has not been published or approved by ANSI.
5. If ASHRAE does eventually publish a 2007 edition, and proposes to replace the currently referenced 2004 edition, it may not be an ANSI approved consensus standard, in violation of ICC requirements.
6. By not adopting this proposal, continuing to allow or require users of the IECC to use outdated sections of versions of the ASHRAE Standard is not consistent with the requirements or stringency of the IECC.
7. In June 2007, the ASHRAE Board of Directors passed a motion requiring and directing that: "Unregulated loads will be added to Standard 90.1, perhaps establishing a recommended level of *March 28, 2007* W/ft2." Thus, users of the IECC who elect the option to use Standard 90.1 will be required to comply with criteria that cannot be regulated by building officials at the time of design, construction, and occupancy, by ASHRAE's own admission.
8. The ASHRAE Board of Directors passed another motion directing the Standard 90.1 Committee to increase stringency without regard to following the technical and economic criteria used to date. Therefore, there is no assurance that future editions of the ASHRAE Standard will be consistent with the technical and economic criteria in IECC.
9. The resulting Standard 90.1 approved Work Plan requires: "That Standard 90.1-2010 is developed with the goal of achieving a 30% energy savings improvement compared to Standard 90.1-2004, per the direction of the ASHRAE Board of Directors motion." Thus, it is almost a certainty that ASHRAE/IESNA Standard 90.1 will no longer be a minimum set of criteria and requirements for the economical design and construction of energy efficient buildings.
10. The ASHRAE committee is no longer balanced. ASHRAE persists in not appointing, reappointing, and rejecting applications from prospective voting committee members who may not agree with the majority opinions or directions from ASHRAE management, such as prospective members who apply who are materially affected and interested persons. This includes builders, contractors, and members from associations representing building owners, such as the National Multi-Housing Council, National Association of Home Builders, and the National Apartment Association, despite those persons having the necessary technical qualifications.
11. HR 3221, passed by the U.S. House of Representatives on August 4, 2007, includes provisions that if ASHRAE 90.1 does not achieve a 30% reduction by 2010, and 50% reduction by 2020 (regardless of whether those reductions are technically or economically feasible), Section 304 of the bill requires the Secretary of Energy to "propose a modified code or standard that meets such targets." Then, each state shall "certify that it has achieved compliance with the certified building energy code." Such a government code or standard could supersede and preempt comparable private sector documents. This could render the IECC moot.
12. Finally, in Section 6, the reference to ASHRAE/IESNA Standard 90.1-2001 is no longer current or up-to-date and is not supported.

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

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

EC104–07/08
501.1, 501.2, 502.1.1, Table 502.2(2), Chapter 6

Proponent: Ron Nickson, National Multi Housing Council (NMHC)

1. Revise as follows:

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

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

> **Exception:** Buildings conforming to Section 506, provided Sections 502.4, 502.5, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied.

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

Table 502.2(2)
METAL BUILDING ASSEMBLY DESCRIPTION

ROOFS	DESCRIPTION	REFERENCE
R-19 + R-10	Filled cavity roof. Thermal blocks are a minimum, R-5 of rigid insulation, which extends 1 in. beyond the width of the purlin on each side, perpendicular to the purlin. This construction is R-10 insulation batts draped perpendicularly over the pulins, with enough looseness to allow R-19 batt to be laid above it, parallel to the pulins. Thermal blocks are then placed above the purlin/batt, and the roof deck is secured to the purlins. In the metal building industry, this is known as the “sag and bag” insulation system.	~~ASHRAE/IESNA 90.1 Table A2.3~~
R-19	Standing seam with single insulation layer. Thermal blocks are a minimum R-5 of rigid insulation, which extends 1 in. beyond the width of the purlin on each side, perpendicular to the purlin. This construction R-19 insulation batts draped perpendicular over the pulins. Thermal blocks are then placed above the purlin/batt, and the roof deck is secured to the purlins.	~~ASHRAE/IESNA 90.1 Table A2.3~~
Walls		
R-13	Single insulation layer The first layer of R-13 insulation batts is installed continuously perpendicular to the girts and is compressed as the metal skin is attached to the girts and is compressed as the metal skin is attached to the girts.	~~ASHRAE/IESNA 90.1 Table A2.3~~
R-13 + R-13	Double insulation layer The first layer of R-13 insulation batts is installed continuously perpendicular to the girts, and is compressed as the metal skin is attached to the girts. The second layer of R-13 insulation batts is installed within the framing cavity.	~~ASHRAE/IESNA 90.1 Table A2.3~~

For SI: 1 inch = 25.4 mm.

2. Delete without substitution from Chapter 6:

ASHRAE

~~90.1-2004 Energy Standard for Buildings Except Low-rise Residential Buildings (ANSI/ASHRAE/IESAN 90.1-2004)~~

~~**IESNA**~~

~~90.1-2001 Energy Standard for Buildings Except Low-rise Residential Buildings~~

Reason: The change is submitted to remove the reference to ASHRAE/IESNA 90.1 Energy Standard for Buildings Except Low-rise Residential Buildings. The IECC is a stand alone document setting minimum requirements for energy conservation in all type of buildings and the reference to ASHRAE/IESNA is not needed. The reference to ASHRAE/IESNA 90.1 is also in appropriate in that the standard is no longer a minimum standard,, but rather a standard with a directed purpose to increase energy stringency based on specific goals directed by the ASHRAE leadership.

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

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

EC105–07/08

501.2

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

Revise as follows:

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

> **Exception:** Buildings conforming to Section 506, provided Sections 502.4, 502.5, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied.

Reason: This proposal directs the permit applicant to apply either the IECC or ASHRAE/IESNA Standard 90.1 (90.1), not a mix of both. As written a mix of both codes is allowed on a single permit application. As written code review may require the use of two different energy code books to determine compliance. This proposal simplifies the process by limiting the applicant to a single energy code book.

Both the IECC and 90.1 were written to provide minimum energy code compliance without taking into account the base requirements, code compliance options and exceptions expressed in the other code. As a result, mixing and matching code sections may not result in a structure that achieves the energy efficiency targets of either code when applied individually.

Section 501.1 allows the code user to user to mix compliance approaches using either the provisions within 90.1 or IECC Chapter 5. As written, energy code compliance can be demonstrated using Chapter 5 for envelope compliance, 90.1 for the mechanical system and Chapter 5 for the lighting system. Typically the compliance approach that is used is selected because it offers the least restrictive method of compliance. For example, designers typically use 90.1 to demonstrate compliance with the energy code to eliminate the need to install a vestibule as required by Section 502.4.6. because 90.1 exempts buildings less that 4 stories from installing a vestibule.

The ability to "game" the system results in confusion from the jurisdictions in trying to enforce the energy code as they try to determine which compliance method each of energy using system must comply with. Also, 90.1 and Chapter 5 are designed to be used in its entirety to achieve the maximum energy savings. This code change proposal requires the energy code user to comply with either Chapter 5 in its entirety or 90.1 in its entirety and not allow the code user to select the least stringent compliance approach.

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

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

EC106–07/08

502.1.1, 502.1.2, Table 502.2(1), Table 502.1.2

Proponent: John Neff, Washington State Building Code Council

Revise as follows:

502.1.1 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Tables 502.2(1) and 502.3 based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the R-values from the "Group R" column of Table 502.2(1). Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the R-values from the "All other" column of Table 502.2(1). Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table 502.3 shall comply with the building envelope provisions of ASHRAE/IESNA 90.1.

502.1.2 (Supp) U-factor alternative. An assembly with a U-factor, C-factor, or F-factor equal or less than that specified in Table 502.1.2 shall be permitted as an alternative to the R-value in Table 502.2 (1). Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the U-factor, C-factor, or F-factor from the "Group R" column of Table 502.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the U-factor, C-factor, or F-factor from the "All other" column of Table 502.1.2.

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

	1		2		3		4 except Marine		5 and marine 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above deck	R-15ci	R-20ci	~~R-15ci~~ R-20ci	R-20ci	R-~~15ci~~ R-20ci	R-20ci	~~R-15ci~~ R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci
Metal buildings (with R-5 thermal blocks[a])[b]	R-19 + R-10	R-19 + R-10	R-19	R-19	R-19	R-19	R-19	R-19	R-19	R-19	R-19	R-19	R-19 + R-10	R-19 + R-10	R-19 + R-10	R-19 + R-10
Attic and other	R-30	R-38	R-~~30~~ 38	R-38	R-~~30~~ 38	R-38	R-~~30~~ 38	R-38	R-~~30~~ 38	R-38	R-~~30~~ 38	R-38	R-38	R-38	R-~~38~~ 49	R-49
Walls, Above Grade																
Mass	NR	R-5.7ci	~~NR~~ R-5.7ci	~~NR~~ R-7.6ci	~~R-5.7cic, e~~ R-7.6ci	R-9.5ci	R-~~5.7ci~~ R-9.5ci[c]	R-11.4ci	~~R-7.6ci~~ R-11.4ci	R-13.3 ci	~~R-9.5ci~~ R-13.3ci	R-15.2ci	~~R-11.4ci~~ R-15.2ci	R-15.2ci	~~R-13.3~~ R-25ci	R-25ci
Metal building[b]	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13
Metal framed	R-13	R-13	R-13	R-13+7.5ci	R-13 + R3.8ci	R-13 + R7.5ci	R-13 +7.5	R-13 + R7.5ci	R-13 + R-~~3.8~~ 7.5 ci	R-13 + R7.5ci	R-13 + R-~~3.8~~ 7.5ci	R-13 + R7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5 ci	R-13 + R-18.8ci
Wood framed and other	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13+ R-3.8ci	R-13 + R-3.8ci	R-13 +3.8	R-13 + 7.5	R-13 + R-7.5	R-13+ R-7.5ci	R-13 +7.5ci	R-13 + R-~~7.5~~ 15.6ci	R-13 +15.6ci
Walls, Below Grade																
Below grade wall[d]	NR	NR	NR	NR	NR	NR	NR	R-7.5ci	~~NR~~ R-7.5ci	R-7.5ci	NR R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-7.5ci	R-12.5ci
Floors																
Mass	NR	NR	~~R-5ci~~ R-6.3ci	R-8.3ci	R-~~5ci~~ R-6.3ci	R-8.3ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	~~R-10ci~~ R-12.5ci	R-14.6ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/Framing Steel/(Wood)	NR	NR	R-19	R-30	R-19	R-30	R-~~19~~ R-30	R-30	~~R-19~~ R-30	R-30	R-30	R-30[e]	R-30	R-30[e]	R-30[e]	R-30[e]

	1		2		3		4 except Marine		5 and marine 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	NR	R-10 for 24 in. below	NR	R-10 for 24 in. below	~~NR~~ R-10 for 24 in. below	R-15 for 24 in. below	~~NR~~ R-15 for 24 in. below	R-15 for 24 in. below	R-~~10~~ 15 for 24 in. below	R-20 for 24 in. below
Heated slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-~~7.5~~ 10 for ~~12~~ 24 in. below	10 24 in. below	R-~~7.5~~ 15 for ~~12~~ 24 in. below	R-15 for 24 in. below	R-~~10~~ 15 for 24 in. below	R-15 for 24 in. below	R-~~10~~ 15 for ~~36~~ 24 in. below	R-20 for 48 in. below	R-~~10~~ 20 for ~~36~~ 24in. below	R-20 for 48 in. below	R-~~10~~ 20 for 48 in. below	R-20 for 48 in. below
Opaque Doors																
Swinging	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.50	U – ~~0.70~~ 0.50	U – 0.50	U – 0.50	U – 0.50
Roll-up or sliding	U – 1.45	U – 1.45	U – 1.45	U – 1.45	U – 1.45	U – 1.45	U – ~~1.45~~ .50	U – 0.50	U – ~~1.45~~ 0.50	U – 0.50	U – 0.50	U – 0.50	U – 0.50	U – 0.50	U – 0.50	U – 0.50

For SI: 1 inch = 25.4 mm.

ci – Continuous Insulation NR – No Requirement

a. Thermal blocks are a minimum R-5 of rigid insulation, which extends 1-inch beyond the width of the purlin on each side, perpendicular to the purlin.

b. Assembly descriptions can be found in Table 502.2(2).

c. R-5.7 ci may be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 in. or less on center vertically and 48 in. or less on center horizontally, with ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu-in./h-f ^{2} F.

d. When heated slabs are placed below grade, below grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.

~~e. Insulation is not required for mass walls in Climate Zone 3A located below the "Warm-Humid" line, and in Zone 3B.~~ Steel floor joist systems shall be R-38

TABLE 502.1.2 (Supp)
BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMENT, MAXIMUM U-FACTORS

	1		2		3		4 except Marine		5 and Marine 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above deck	U-0.063	~~U-0.063~~ U-0.048	~~U-0.063~~ U-0.048	U-0.048	~~U-0.063~~ U-0.048	U-0.048	~~U-0.063~~ U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039
Metal buildings ~~(with R-5 thermal blocksa)b~~	U-0.052	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.052	U-0.052
Attic and other	U-0.034	U-0.027	~~U-0.034~~ U-.0270	U-.0270	~~U-0.034~~ U-.0270	U-0.027	~~U-0.034~~ U-.0270	U-0.027	~~U-0.034~~ U-.0270	U-0.027	~~U-0.034~~ U-.0270	U-0.027	~~U-0.034~~ U-.0270	U-0.027	U-.0270	U-.0270
Walls, Above Grade																
Mass	U-0.058	U-0.151	~~U-0.058~~ U-0.151	U-0.123	~~U-0.151~~ U-0.123	U-0.104	~~U-0.151~~ U-0.104	U-0.090	~~U-0.123~~ U-0.90	U-0.80	~~U-0.104~~ U-0.080	U-0.071	~~U-0.090~~ U-0.071	U-0.071	~~U-0.080~~ U-0.071	U-0.052
Metal building~~b~~	U-0.113	U-0.113	U-0.113	U-0.113	U-0.113	U-0.113	U-0.113	U-0.113	U-0.113	U-0.057	U-0.057	U-0.057	U-0.057	U-0.057	U-0.057	U-0.057
Metal framed	U-0.124	U-0.124	U-0.124	U-0.064	~~U-0.124~~ U-0.084	U-0.064	~~U-0.124~~ U-0.064	U-0.064	~~U-0.084~~ U-0.064	U-0.064	~~U-0.084~~ U-0.064	U-0.057	U-0.064	U-.052	U-0.064	U-0.037
Wood framed and other	U-0.089	U-0.089	U-0.089	U-0.089	U-0.089	U-0.089	U-0.089	U-0.064	~~U-0.089~~ U-0.064	U-0.051	~~U-0.089~~ U-0.051	U-0.051	~~U-0.089~~ U-0.051	U-0.051	~~U-0.051~~ U-0.036	U-0.036
Walls, Below Grade																
Below grade wall[a]	C-	C-	C-	C-	C-	C-	C-	C-0.119	~~C-1.140~~	C-0.119	~~C-1.140~~	C-0.119	~~C-1.140~~	C-0.092	C-0.119	C-0.075

	1		2		3		4 except Marine		5 and Marine 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
	1.140	1.140	1.140	1.140	1.140	1.140	1.140		C-0.119		C-0.119		C-0.119			
Floors																
Mass	U-0.322	U-0.322	~~U-0.123~~ U-0.107	U-0.087	~~U-0.123~~ U-0.107	U-0.087	~~U-0.076~~ U-0.087	U-0.074	~~U-0.076~~ U-0.074	U-0.064	~~U-0.076~~ U-.064	U-.057	~~U-0.055~~ U-0.064	U-0.051	~~U-0.076~~ U-0.057	U-0.051
Joist/Framing	~~U-0.350~~ U-0.282	U-0.282	U-.052	U-.052	~~U-.052~~ ~~U-.051~~	U-.033	~~U-.052~~ U-.033	U-.033	~~U-.052~~ U-.033	U-.033	~~U-.038~~ U-.033	U-.033	~~U-.052~~ U-.033	U-.033	~~U-.052~~ U-.033	U-.033
Slab-on-Grade Floors																
Unheated slabs	F-0.730	F-0.730	F-0.730	F-0.730	F-0.730	F-0.730	F-0.730	F-0.540	F-0.730	F-0.540	~~F-0.730~~ F-0.540	F-0.520	~~F-0.730~~ F-0.52	F-0.52	~~F-0.540~~ F-0.520	F-0.510
Heated slabs	F-1.020	F-1.020	F-1.020	F1.020	~~F-1.020~~ F-0.900	F-0.900	~~F-1.020~~	F-0.860	~~F-0.950~~ F-0.860	F-0.860	~~F-0.840~~ F-0.860	F-0.688	~~F-0.840~~ F-0.830	F-0.688	~~F-0.780~~ F-0.688	F-0.688

a. When heated slabs are placed below grade, below grade walls must meet the F-factor requirements for perimeter insulation according to the heated slab-on-grade construction.

Reason: The purpose of this proposal is to introduce specific building envelope criteria for commercial buildings that include Group R occupancies. This proposal has uses the R-values, U-factors, C-factors and F-factors from ANSI/ASHRAE/IESNA Standard 90.1-2004 addenda as[1], except when the existing values in this code are more stringent.

Loads for residential buildings have different space conditioning loads than commercial structures. For many years the analysis of loads conducted by the ANSI/ASHRAE/IESNA Standard 90.1 building envelope committee has resulted in the adoption of a separate set of criteria for commercial buildings that include group R occupancies, than for other commercial occupancies.

Because ANSI/ASHRAE/IESNA Standard 90.1 is an alternate standard to this code, it is prudent to include consistent application of building envelope standards between these two codes. The adoption of addenda as provides consistency between these two codes.

Bibliography

[1] BSR/ASHRAE Addenda as and at to ANSI/ASHRAE Standard 90.1-2004
http://www.ashrae.org/technology/page/132

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

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

EC107–07/08

502.1.3 (New), 502.1.3.1 (New), 502.1.3.2 (New), 502.1.3.3 (New)

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

Add new text as follows:

502.1.3 Total UA and total SHGCA alternative. The building envelope shall meet the requirements of this Section as an alternative to Section 502.1.1 or 502.1.2

502.1.3.1 Total UA. If the total proposed building thermal envelope UA (sum of *U*-factor times assembly area) is less than or equal to the total standard building UA resulting from using the equivalent assembly *U*-factors corresponding to the *R*-value and *U*-factor requirements in Tables 502.2(1) and 502.3, the building shall be considered in compliance with Tables 502.2(1) and 502.3. Assembly *U*-factor and UA calculations shall be done using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials.

502.1.3.2 Total SHGCA. If the total proposed building fenestration SHGCA (sum of SHGC times fenestration area for each vertical fenestration and skylight type) is less than or equal to the total standard building SHGCA resulting from using the fenestration SHGC in Table 502.3, the building shall be considered in compliance with Table 502.3.

502.1.3.3 Assembly areas for UA and SHGCA calculations. The assembly areas in the standard building shall be the same as in the proposed building, except the vertical fenestration and skylight area in the standard building shall not exceed the maximum area requirements of Section 502.3.1 and the corresponding opaque above-grade wall area and roof area shall be increased such that the total above-grade wall and roof areas of the standard building are the same as the proposed building.

Reason: This proposal provides a simple alternative compliance method for commercial buildings based on total UA and SHGCA of the envelope, similar to what already exists in Chapter 4 for residential buildings. A more complete envelope calculation would include *C*-factors and *F*-factors, or use the lengthy and detailed trade-off calculations in ASHRAE 90.1. We also support those options. However, if the committee and code body so choose, this proposal provides an option to leave Chapter 5 as a more simplified approach for commercial buildings with no new definitions or tables.

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

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

EC108 –07/08
502.1.3 (New), 502.1.3.1 (New), 502.1.3.2 (New), Table 502.1.2

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

1. Add new text as follows:

502.1.3 Total UA and total SHGCA alternative.

502.1.3.1 Total UA. If the total proposed building thermal envelope UA (sum of the U-factor or C-factor times each assembly area, plus the F-factor times the perimeter length for slab-on-grade floors) is less than or equal to the total standard building UA resulting from using the opaque assembly U-factors, C-factors and F-factors in Table 502.1.2, opaque door U-factors in Table 502.2(1), and fenestration U-factors in Table 502.3 the building shall be considered in compliance with Tables 502.2(1) and 502.3. Assembly U-factor calculations shall be done using a method consistent with the ASHRAE *Handbook of Fundamentals* and shall include the thermal bridging effects of framing materials.

For this calculation the standard building assembly areas shall be determined in accordance with the following:

1. If the proposed building vertical fenestration area does not exceed the maximum vertical fenestration area allowed in Table 502.3 and the skylight area does not exceed the maximum skylight area in Table 502.3, the standard assembly areas shall be the same as the proposed building assembly areas.
2. If the proposed building vertical fenestration exceeds the maximum vertical fenestration area allowed in Table 502.3, then the standard building shall use the maximum vertical fenestration area allowed in Table 502.3 and the opaque above grade wall assembly area shall be increased so that the gross above grade wall area (vertical fenestration area plus opaque door area) is the same as the proposed building.
3. If the proposed building skylight area exceeds the maximum skylight area allowed in Table 502.3, then the standard building shall use the maximum skylight area allowed in Table 502.3 and the opaque roof assembly area shall be increased so that the gross roof area (skylight area plus opaque roof area) is the same as the proposed building.)

502.1.3.2 Total SHGCA. If the total proposed building fenestration (vertical fenestration plus skylight) SHGCA (sum of SHGC times fenestration area for each fenestration type) is less than or equal to the total standard building SHGCA resulting from using the fenestration SHGC in Table 502.3, the building shall be considered in compliance with Tables 502.2(1) and 502.3.

For this calculation, the standard building fenestration areas shall be determined in accordance with the following:

1. If the proposed building vertical fenestration area does not exceed the maximum vertical fenestration area allowed in Table 502.3 and the skylight area does not exceed the maximum skylight area in Table 502.3, the standard assembly areas shall be the same as the proposed building assembly areas.
2. If the proposed vertical fenestration area exceeds the maximum vertical fenestration area allowed in Table 502.3, then the standard building shall use the maximum vertical fenestration area allowed in Table 502.3.
3. If the proposed building skylight area exceeds the maximum skylight area allowed in Table 502.3, then the standard building shall use the maximum skylight area allowed in Table 502.3.

2. Revise table title as follows:

TABLE 502.1.2 (Supp)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ELEMENT,
MAXIMUM U-FACTORS, C-FACTORS AND F-FACTORS

(No change to table entries)

Reason: This proposal brings the total UA alternate method of compliance which is already in Chapter 4 of the IECC for residential buildings into Chapter 5 for commercial buildings, and adds a similar provision for total SHGCA. The UA method applies to the entire building envelop, while the SHGCA only applies to the glazed portion of the building envelop.

Both methods permit compliance with the IECC to be achieved when the combination of components used achieves the same performance level as that prescribed by Chapter 5 of the IECC. This concept of establishing a target average U-factor for the building components was the basis of the original CABO Model Energy Code, which was the predecessor to the ICC International Energy Conservation Code. Through many iterations other methods of compliance have been added to the IECC, but this basic one has been lost and should be retained.

A similar proposal was submitted last cycle and approved by the IECC committee. The proponent, however, withdrew the proposal prior to Final Action in Rochester. The committee action on this previous proposal was valid and we ask that they once again approve extending this concept into the commercial provisions of the IECC.

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

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

EC109–07/08
502.2.1, 502.2.3, Table 502.2(1), Table 502.2(2)

Proponent: Brad Rowe, Thermal Design, Inc.

1. Revise as follows:

502.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table 502.2(1), based on construction materials used in the roof assembly.

Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25.4 mm) or less and where the area weighted *U*-factor is equivalent to the same assembly with the *R*-value specified in Table 502.2(1).
2. Metal buildings shall be as specified in Table 502.1.2.

502.2.3 Above-grade walls. The minimum thermal resistance (*R*-value) of the insulating material(s) installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Table 502.2(1), based on framing type and construction materials used in the wall assembly. The *R*-value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table 502.2(1). "Mass walls" shall include walls weighing at least (1) 35 pounds per square foot (170 kg/m$_2$) of wall surface area or (2) 25 pounds per square foot (120 kg/m$_2$) of wall surface area if the material weight is not more than 120 pounds per cubic foot (1,900 kg/m$_3$).

Exception: Metal building walls shall be as specified in Table 502.1.2.

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Roofs								
Metal buildings[d] (with R-5 thermal blocks[a])[b]	No change	No change	No change	No change	No change	No change	No change	No change
Walls, Above Grade								
Metal Building[b] [d]	No change	No change	No change	No change	No change	No change	No change	No change

(Portions of table not shown remain unchanged)

For SI: 1 inch = 25.4 mm.
ci – Continuous Insulation
NR – No Requirement

a. Thermal blocks are a minimum R-5 of rigid insulation, which extends 1-inch beyond the width of the purlin on each side, perpendicular to the purlin.
b. Assembly descriptions can be found in Table 502.2(2).
c a. R-5.7 ci maybe substituted with concrete block walls complying withASTMC90, ungrouted or partially grouted at 32 in. or less on center vertically and 48 in. or less on center horizontally, with ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu-in./h-f 2 F.
d b. When heated slabs are placed below grade, below grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.
e c. Insulation is not required for mass walls in Climate Zone 3A located below the “Warm-Humid” line, and in Zone 3B.
d. See TABLE 502.1.2 BUILDING ENVELOPE REQUIREMENTS – OPAQUE ELEMENT, MAXIMUM U-FACTORS.

2. Delete table without substitution:

TABLE 502.2(2)
METAL BUILDING ASSEMBLY DESCRIPTIONS

Reason: The prescriptive packages listed in Table 502.2(1) and Table 502.2(2) for metal building roofs and walls under typical installation conditions will not achieve the prescribed U-factors in Table 502.1.2.

Table 502.2(2) describes the metal building assembly descriptions and references AHRAE/IESNA 90.1 Table A2.3 and Table A3.2. The U-values that have appeared since ASHRAE 90.1-2001 Standard were provided by the North American Insulation Manufacturers Association (NAIMA) in a report entitled “Summary of Finite Element Modeling of NAIMA Roof Systems”. These U-values were calculated using finite element modeling with unrealistic assumptions for typical metal building insulation assemblies.. NAIMA has admitted that they do not know the installed thicknesses required to achieve these U-values contained in their report nor what it means to be “installed correctly” in order to achieve the U-value performances that NAIMA has published and ASHRAE has adopted.

The purpose of the proposed change is to clarify the code for insulating metal buildings. There is a lack of credible and conclusive information to link the R-values listed in Table 502.2(1), 502.2(2) with the U-values in Table 502.1.2 and thus making the code inadequate in reaching the maximum U-values. A contradicting report from Oak Ridge National Laboratory shows the roof packages listed in Table 502.2(2) is overstated by at least 20% after completing hot box testing (ASTM C 1363). Although the report contained information on one type of fabric liner system, there are numerous high performance insulation systems for metal buildings which have been available in the market for decades, this includes fabric liner systems and foam board systems. This will improve the code by not allowing inaccurate prescriptive paths to meet the true intentions of the code.

Bibliography:
Thomas W. Petrie, Research Engineer, Oak Ridge National Laboratory, “*Tests of Standing-Seam Metal Roof Assemblies”*, April 20th, 2007.

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

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

EC110–07/08
Table 502.2(1), Table 502.1.2, Table 502.3

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

Revise tables as follows:

Table 502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Roofs								
Insulation entirely above deck	R-15 ci	R-~~15~~20 ci	R-~~15~~20 ci	R-~~15~~20 ci	R-20 ci	R-20 ci	R-~~25~~20 ci	R-~~25~~20 ci
Metal buildings (with R-5 thermal blocks[a])[b]	R-19+ R-10	R-19	R-19	R-19	R-19	R-19	R-19 + R-10	R-19 + R-10
Attic and other	R-30	R-~~30~~38	R-~~30~~38	R-~~30~~38	R-~~30~~38	R-~~30~~38	R-38	R-~~38~~49
Walls, Above Grade								
Mass	NR	~~NR~~R-5.7 ci[c]	R-~~5.7~~7.6 ci[~~c,e~~]	R-~~5.7~~9.5 ci[e]	R-~~7.6~~11.4 ci	R-~~9.5~~ 13.3 ci	R-~~11.4~~15.2 ci	R-~~13.3~~15.2 ci
Metal building[b]	R-13	R-13	R-13	R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13
Metal framed	R-13	R-13	R-13 + R-3.8 ci	R-13 + R-7.5 ci	R-13 + R-~~3.8~~7.5 ci	R-13 + R-~~3.8~~7.5 ci	R-13+ R-7.5 ci	R-13+ R-7.5 ci
Wood framed and other	R-13	R-13	R-13	R-13	R-13 + R-3.8 ci	R-13 + R-7.5 ci	R-13 + R-7.5 ci	R-13+ R-~~7.5~~15.6 ci
Walls, Below Grade								
Below grade wall[d]	NR	NR	NR	NR	~~NR~~R-7.5 ci	~~NR~~R-7.5 ci	R-7.5 ci	R-7.5 ci
Floors								
Mass	NR	R-~~5~~6.3 ci	R-~~5~~6.3 ci	R-~~10~~8.3 ci	R-10.4 ci	R-~~10~~12.5 ci	R-~~15~~12.5 ci	R-~~15~~14.6 ci
Joist/Framing	NR	R-19	R-19	R-~~19~~30	R-~~19~~30	R-30	R-30	R-~~30~~38
Slab-on-Grade Floors								
Unheated slabs	NR	NR	NR	NR	NR	~~NR~~R-10 for 24 in. below	~~NR~~R-15 for 24 in. below	R-~~10~~15 for 24 in. below
Heated slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-~~7.5~~10 for ~~12~~24 in. below	R-~~7.5~~15 for ~~12~~24 in. below	R-~~7.5~~15 for ~~12~~24 in. below	R-~~10~~15 for ~~36~~24 in. below	R-~~10~~20 for ~~36~~24 in. below	R-~~10~~20 for 48 in. below
Opaque Doors								
Swinging	U-0.70	U-0.70	U-0.70	U-0.70	U-0.70	U-0.70	U-~~0.70~~0.50	U-0.50
Roll-up or sliding	U-1.45	U-1.45	U-1.45	U-~~1.45~~0.50	U-~~1.45~~0.50	U-0.50	U-0.50	U-0.50

For SI: 1 inch = 25.4 mm
ci – Continuous Insulation
NR – No Requirement

a. Thermal blocks are a minimum R-5 of rigid insulation, which extends 1-inch beyond the width of the purlin on each side, perpendicular to the purlin.
b. Assembly descriptions can be found in Table 502.2(2).
c. R-5.7 ci may be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 in. or less on center vertically and 48 in. or less on center horizontally, with ungrouted cores, filled with material having a maximum thermal conductivity of 0.44 Btu-in./h-ft^2 F.
d. When heated slabs are placed below grade, below grade walls must be meet exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.
~~e. Insulation is not required for mass walls in Climate Zone 3A located below the “Warm-Humid” line, and in Zone 3B.~~

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

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Roofs								
Insulation entirely above deck	U-0.063	~~U-0.063~~ U-0.048	~~U-0.063~~ U-0.048	~~U-0.063~~ U-0.048	U-0.048	U-0.048	~~U-0.039~~ U-0.048	~~U-0.039~~ U-0.048
Metal buildings (with R-5 thermal blocks[a])[b]	U-0.052	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.052	U-0.052
Attic and other	U-0.034	~~U-0.034~~ U-0.027	~~U-0.034~~ U-0.027	~~U-0.034~~ U-0.027	~~U-0.034~~ U-0.027	~~U-0.034~~ U-0.027	U-0.027	~~U-0.027~~ U-0.021
Walls, Above Grade								
Mass	U-0.580	~~U-0.580~~ U-0.151	~~U-0.151~~ U-0.123	~~U-0.151~~ U-0.104	~~U-0.123~~ U-0.090	~~U-0.104~~ U-0.080	~~U-0.090~~ U-0.071	~~U-0.080~~ U-0.071
Metal building[b]	U-0.113	U-0.113	U-0.113	U-0.113	U-0.057	U-0.057	U-0.057	U-0.057
Metal framed	U-0.124	U-0.124	~~U-0.124~~ U-0.084	~~U-0.124~~ U-0.064	~~U-0.084~~ U-0.064	~~U-0.084~~ U-0.064	U-0.064	U-0.064
Wood framed and other	U-0.089	U-0.089	U-0.089	U-0.089	~~U-0.089~~ U-0.064	~~U-0.089~~ U-0.051	~~U-0.089~~ U-0.051	~~U-0.051~~ U-0.036
Walls, Below Grade								
Below grade wall[d]	C-1.140	C-1.140	C-1.140	C-1.140	~~C-1.140~~ C-0.119	~~C-1.140~~ C-0.119	C-0.119	C-0.119
Floors								
Mass	U-0.322	~~U-0.123~~ U-0.107	~~U-0.123~~ U-0.107	~~U-0.076~~ U-0.087	~~U-0.076~~ U-0.074	~~U-0.076~~ U-0.064	~~U-0.055~~ U-0.064	~~U-0.055~~ U-0.057
Joist/Framing	U-0.350	U-0.052	U-0.052	~~U-0.052~~ U-0.038	~~U-0.052~~ U-0.038	U-0.038	U-0.038	~~U-0.038~~ U-0.032
Slab-on-Grade Floors								
Unheated slabs	F-0.730	F-0.730	F-0.730	F-0.730	F-0.730	~~F-0.730~~ F-0.540	~~F-0.730~~ F-0.520	~~F-0.540~~ F-0.520
Heated slabs	F-1.020	F-1.020	~~F-1.020~~ F-0.900	~~F-1.020~~ F-0.860	~~F-0.950~~ F-0.860	~~F-0.840~~ F-0.860	~~F-0.840~~ F-0.843	~~F-0.780~~ F-0.688

TABLE 502.3 (Supp)
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
***U*-Factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-Factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront *U*-Factor	1.0	0.70	0.60	0.50	0.45	0.45	~~0.45~~ 0.40	~~0.45~~ 0.40
Entrance Door *U*-Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other *U*-Factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	~~0.50~~ 0.45	~~0.50~~ 0.45
SHGC-All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	~~NR~~ 0.45	~~NR~~ 0.45
SHGC: 0.25 ≤ PF <0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
U-Factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.
PF = Projection factor (See Section 502.3.2)
a. All others include operable windows, fixed windows and non-entrance doors.

Reason: The proposed changes come from addenda "as" and "at" to ANSI/ASHRAE/IESNA Standard 90.1-2004. These addenda have been incorporated into ANSI/ASHRAE/IESNA Standard 90.1-2007. The revised criteria are based on 2006 construction costs and fuel prices and went through the ANSI/ASHRAE/IESNA Standard 90.1 public review process.

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

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

EC111–07/08
Table 502.2(1), Table 502.1.2

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

Revise tables as follows:

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Roofs								
Insulation entirely above deck	~~R-15 ci~~ R-20 ci	~~R-15 ci~~ R-20 ci	~~R-15 ci~~ R-20 ci	~~R-15 ci~~ R-20 ci	R-20 ci	R-20 ci	R-25 ci	R-25 ci
Metal buildings (with R-5 thermal blocks[a])[b]	R-19 + R-10	R-19	R-19	R-19	R-19	R-19	R-19 + R-10	R-19 + R-10
Attic and other	~~R-30~~ R-38	~~R-30~~ R-38	~~R-30~~ R-38	~~R-30~~ R-38	~~R-30~~ R-38	~~R-30~~ R-38	R-38	~~R-38~~ R-49
Walls, Above Grade								
Mass	~~NR~~ R-5.7 ci[c]	~~NR~~ R-7.6 ci	~~R-5.7 cic, e~~ R-9.5 ci	~~R-5.7 cic~~ R-11.4 ci	~~R-7.6 ci~~ R-13.3 ci	~~R-9.5 ci~~ R-15.2 ci	~~R-11.4 ci~~ R-15.2 ci	~~R-13.3ci~~ R-25 ci
Metal building[b]	R-13	R-13	R-13	R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-13 + R-13
Metal framed	R-13	R-13+ R-7.5 ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + ~~R-3.8 ci~~ R-7.5ci	R-13 + ~~R-3.8 ci~~ R-7.5ci	R-13 + ~~R-7.5 ci~~ R-15.6ci	R-13 + ~~R-7.5 ci~~ R-18.8ci
Wood framed and other	R-13	R-13	R-13	R-13 + R3.8ci	R-13 + R7.5ci	R-13 + R7.5ci	R-13 + R7.5ci	R-13 + ~~R-7.5 ci~~ R15.6ci
Walls, Below Grade								
Below grade wall[d]	NR	NR	NR	~~NR~~ R-7.5 ci	~~NR~~ R-7.5 ci	~~NR~~ R-7.5 ci	~~R-7.5 ci~~ R-10 ci	~~R-7.5 ci~~ R-12.5ci
Floors								
Mass	NR	~~R-5 ci~~ R-8.3ci	~~R-5 ci~~ R-8.3ci	~~R-10 ci~~ R-10.4ci	~~R-10 ci~~ R-12.5ci	~~R-10 ci~~ R-14.6ci	~~R-15 ci~~ R-16.7ci	~~R-15 ci~~ R-16.7ci
Joist/Framing	NR	R-19	~~R-19~~ R-30	~~R-19~~ R-30	~~R-19~~ R-30[e]	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors								
Unheated slabs	NR	NR	NR	~~NR~~ R-10 for 24 in. below	~~NR~~ R-10 for 24 in. below	~~NR~~ R-15 for 24 in. below	~~NR~~ R-15 for 24 in. below	~~R-10~~ R-20 for 24 in. below
Heated slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	~~R-7.5~~ R-10 for ~~12~~ 24 in. below	~~R-7.5~~ R-15 for ~~12~~ 24 in. below	~~R-7.5~~ R-15 for ~~12~~ 24 in. below	~~R-10~~ R-20 For ~~36~~ 48 in. below	~~R-10~~ R-20 For ~~36~~ 48 in. below	~~R-10~~ R-20 For 48 in. below
Opaque Doors								
Swinging	U – 0.70	U – 0.70	U – 0.70	~~U – 0.70~~ U-0.50	~~U – 0.70~~ U-0.50	~~U – 0.70~~ U-0.50	~~U – 0.70~~ U-0.50	U – 0.50
Roll-up or sliding	U – 1.45	~~U – 1.45~~ U-0.50	~~U – 1.45~~ U-0.50	~~U – 1.45~~ U-0.50	~~U – 1.45~~ U-0.50	U – 0.50	U – 0.50	U – 0.50

For SI: 1 inch = 25.4 mm. ci – Continuous Insulation NR – No Requirement

a. Thermal blocks are a minimum R-5 of rigid insulation, which extends 1-inch beyond the width of the purlin on each side, perpendicular to the purlin.
b. Assembly descriptions can be found in Table 502.2(2).
c. R-5.7 ci may be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 in. or less on center vertically and 48 in. or less on center horizontally, with ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu-in./h-f^2 F.
d. When heated slabs are placed below grade, below grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.
e. Insulation is not required for mass walls in Climate Zone 3A located below the “Warm-Humid” line, and in Zone 3B. Steel framed floors shall be R-38.

TABLE 502.1.2 (SUPP)
BUILDING ENVELOPE REQUIREMENTS OPAQUE ELEMENT, MAXIMUM U-FACTORS

	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Roof								
Insulation entirely above deck	~~U-0.063~~ U-0.048	~~U-0.063~~ U-0.048	~~U-0.063~~ U-0.048	~~U-0.063~~ U-0.048	U-0.048	U-0.048	U-0.039	U-0.039
Metal buildings ~~(with R-5 thermal block)~~	U-0.052	U-0.065	U-0.065	U-0.065	U-0.065	U-0.065	U-0.052	U-0.052
Attic and other	~~U-0.034~~ U-0.027	~~U-0.034~~ U-0.027	~~U-0.034~~ U-0.027	~~U-0.034~~ U-0.027	~~U-0.034~~ U-0.027	~~U-0.034~~ U-0.027	U-0.027	~~U-0.027~~ U-0.021
Walls, Above Grade								
Mass	~~U-0.580~~ U-0.151	~~U-0.580~~ U-0.123	~~U-0.151~~ U-0.104	~~U-0.151~~ U-0.090	~~U-0.123~~ U-0.080	~~U-0.104~~ U-0.071	~~U-0.090~~ U-0.071	~~U-0.080~~ U-0.052
Metal building	U-0.113	U-0.113	U-0.113	U-0.113	U-0.057	U-0.057	U-0.057	U-0.057
Metal framed	U-0.124	~~U-0.124~~ U-0.064	~~U-0.124~~ U-0.064	~~U-0.124~~ U-0.064	~~U-0.084~~ U-0.064	~~U-0.084~~ U-0.064	~~U-0.064~~ U-0.042	~~U-0.064~~ U-0.037
Wood framed and other	U-0.089	U-0.089	U-0.089	~~U-0.089~~ U-0.064	~~U-0.089~~ U-0.051	~~U-0.089~~ U-0.051	~~U-0.089~~ U-0.051	~~U-0.051~~ U-0.036
Walls, Below grade								
Below grade wall[d]	C-1.140	C-1.140	C-1.140	~~C-1.140~~ C-0.119	~~C-1.140~~ C-0.119	~~C-1.140~~ C-0.119	~~C-0.119~~ C-0.092	~~C-0.119~~ C-0.075
Floors								
Mass	U-0.322	~~U-0.123~~ U-0.087	~~U-0.123~~ U-0.087	~~U-0.076~~ U-0.074	~~U-0.076~~ U-0.064	~~U-0.076~~ U-0.057	~~U-0.055~~ U-0.051	~~U-0.055~~ U-0.051
Joist/Framing	~~U-0.350~~ U-0.282	~~U-0.052~~ U-0.033	~~U-0.052~~ U-0.033	~~U-0.052~~ U-0.033	~~U-0.052~~ U-0.033	~~U-0.038~~ U-0.033	~~U-0.038~~ U-0.033	~~U-0.038~~ U-0.033
Slab-on-Grade Floors								
Unheated Slabs	F-0.730	F-0.730	F-0.730	~~F-0.730~~ F-0.540	~~F-0.730~~ F-0.540	~~F-0.730~~ F-0.520	~~F-0.730~~ F-0.520	~~F-0.540~~ F-0.510
Heated Slabs	F-1.020	F-1.020	~~F-1.020~~ F-0.900	~~F-1.020~~ F-0.860	~~F-0.950~~ F-0.860	~~F-0.840~~ F-0.688	~~F-0.840~~ F-0.688	~~F-0.780~~ F-0.688

a. When heated slabs are placed below grade, below grade walls must meet the F-factor requirements for perimeter insulation according to the heated slab-on-grade construction.

Reason: The proposed building envelope standard will reduce energy use. The values have been chosen form ANSI/ASHRAE/IESNA Standard 90.1-2004 (90.1) Addenda as[1], except where the existing requirements are more stringent. 90.1 has three occupancy types for commercial buildings, each with a somewhat different building envelope standard. This includes commercial buildings housing nonresidential, residential, or semi-heated spaces. This proposal has adopted the residential requirements. In the last code cycle, the IECC committee expressed an interest in keeping the building envelope simple, with only a single set of standards for all commercial building envelopes. This proposal using a single standard to meet this request. If an applicant wishes to use the less stringent nonresidential standards, they may apply using 90.1.

The ASHRAE 90.1 building envelope committee has advanced the building envelope requirement in part in reaction to a substantial increase in the cost of energy. The current requirements in TABLE 502.2(1) were developed based on fuel cost from the late 1990's. Average national gas cost for commercial customers in 2000 was $6.56 per thousand cubic feet. For 2006 it was $11.58 per thousand cubic feet, a 76 percent increase[2]. For electricity, the price for the commercial sector has increased by 25%[2]. 71 percent of the commercial square foot is heated by gas[3] and have incurred the higher cost of fuel. This proposal provides savings and investments based on current cost of energy.

[1] ANSI/ASHRAE/IESNA Addenda as and at, to ANSI/ASHRAE/IESNA Standard 90.1-2004
http://www.ashrae.org/technology/page/132

[2] Energy Information Administration, Average Retail Price of Electricity to Ultimate Customers: Total by End-Use Sector
http://www.eia.doe.gov/cneaf/electricity/epm/table5_3.html

[3] Westphalen, Koszalinski Energy Consumption Characteristics of Commercial Building HVAC Systems Volume I: Chillers, Refrigerant Compressors, and Heating Systems for Office of Building Equipment, Office of Building Technology State and Community Programs U.S. Department of Energy, April 2001

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

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