3. An approved person shall conduct airtight testing and provide written results to the code official.
4. "Airtight residence" means leakage does not exceed 4 air changes per hour at 50 Pascals when tested as specified by ASTM E779-03.
5. "Airtight ducts" means duct and plenum leakage does not exceed 4 CFM per 100 ft^2 of conditioned floor area when tested at 25 Pascals as specified by ASTM E1554-2003. All ducts and HVAC within conditioned space meets the airtight duct requirement in an airtight residence.

PART II – IRC

Add new text as follows:

N1102.1.4 Insulation tradeoff. The insulation requirements in Table 402.1.4 shall be permitted as a tradeoff for the specified improvement.

TABLE N1102.1.4.
INSULATION TRADEOFFS

CLIMATE ZONE	IMPROVEMENT	INSULATION REQUIREMENT
4	Any ONE of the following: SEER 14 with AFUE 90 SEER 14 with HSPF 8.5 Ground source heat pump Airtight residence Airtight ducts	R-30 ceiling and R-19 floor
5	Any ONE of the following: AFUE 90 SEER 14 with HSPF 8.5 Ground source heat pump Airtight residence Airtight ducts	R-13 wall
5	Any TWO of the following: AFUE 90 SEER 14 with HSPF 8.5 Ground source heat pump Airtight residence Airtight ducts	R-30 ceiling, R-13 wall, and R-19 floor
6	Any ONE of the following: AFUE 90 Ground source heat pump Airtight residence Airtight ducts	R-13 wall
6	Any TWO of the following: AFUE 90 Ground source heat pump Airtight residence Airtight ducts	R-38 ceiling, R-13 wall, and R-19 floor

Notes:
1. Residences with electric furnaces, baseboard heating or gas-fired unvented room heaters are not eligible to use this table.
2. Oil boiler or oil furnace with AFUE 85 meets the AFUE requirement.
3. An approved person shall conduct airtight testing and provide written results to the code official.
4. "Airtight residence" means leakage does not exceed 4 air changes per hour at 50 Pascals when tested as specified by ASTM E779-03.
5. "Airtight ducts" means duct and plenum leakage does not exceed 4 CFM per 100 ft^2 of conditioned floor area when tested at 25 Pascals as specified by ASTM E1554-2003. All ducts and HVAC within conditioned space meets the airtight duct requirement in an airtight residence.

Reason: This table lists several optional energy efficiency improvements as "preapproved" prescriptive tradeoffs. By specifying common improvements that are at least the equivalent of the specified insulation tradeoff, the table eliminates calculations and promotes those energy efficiency improvements.

These tradeoffs are conservative. In some cases the optional improvement saves significantly more energy than the allowed tradeoff. Of course the code user is free to use the performance approach to attempt to lower the level of required improvement. More complicated tradeoffs, tradeoffs with lower requirements, and tradeoffs not listed in the table can still use the performance section of the IECC.

Several specifics in the tradeoff table deserve comment. The AFUE 90 furnace requirement represents a threshold for condensing furnaces. Heat pumps become less efficient (and less common) in northern climates, and therefore are not included in zone 6. The new Energy Star criteria also specifies a heat pump HSPF of 8.5 in zones 4 and 5, and requires a performance path (Section 404 in this code) in zones 6 and above. The airtightness of new homes varies considerably; however, a 4 ACH (under house airtightness testing pressure) would represent a tight home; in most situations it would exceed the airtightness required by Energy Star. Duct losses are often stated to be in the 15% to 25% range; therefore, moving the ducts indoor or testing ducts for airtightness can save substantial energy. Users are not eligible to use this table for residences with electric resistance furnaces and electric baseboard heating because of the poor efficiency of electric resistance heating. Users are not eligible to use this table for residences with gas-fired unvented room heaters because airtight residences are more vulnerable to the moisture unvented room heaters deposit in the residence. Oil boilers and furnaces are allowed to have a lower AFUE because the available AFUEs do not go as high as gas AFUEs. The airtightness tests for the house and the ducts are specified at the most commonly used pressures for those tests.

Inclusion of this "prescriptive" tradeoff table encourages the use of the efficiency improvements in the table. The table streamlines compliance with these tradeoffs. Overall, the table nets additional energy efficiency as code users choose the option of using energy efficiency improvements that may more than compensate for the insulation levels allowed.

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

PART I – IECC

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

PART II – IRC

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

EC38–06/07

Tables 402.1.1 and 402.1.3; IRC Tables N1102.1.1 and N1102.1.2

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise tables as follows:

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

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

a. R-Values are minimums. U-factors and SHGC are maximums. R-19 insulation shall be permitted to be compressed into a 2 x 6 cavity.
b. The fenestration U-factor column excludes skylights. The solar heat gain coefficient (SGHC) column applies to all glazed fenestration.
c. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
d. R-5 shall be added to the required slab edge R-values for heated slabs.
e. There are no solar heat gain coefficient (SHGC) requirements in the Marine Zone.
f. Or insulation sufficient to fill the framing cavity, R-19 minimum.
g. "13+~~5~~ 6" means R-13 cavity insulation plus R-~~5~~ 6 insulated sheathing. If structural sheathing covers 25% or less of the exterior, R-~~5~~ 6 insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

TABLE 402.13
EQUIVALENT U-FACTORS [a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.65	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	~~0.060~~ 0.057 [(b)]	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	~~0.060~~ 0.057 [(b)]	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.057[(b)]	0.057	0.033	0.059	0.065

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

PART II – IRC

Revise tables as follows:

TABLE N1102.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT [(a)]

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

a. R-Values are minimums. U-factors and SHGC are maximums. R-19 insulation shall be permitted to be compressed into a 2 x 6 cavity.
b. The fenestration U-factor column excludes skylights. The solar heat gain coefficient (SGHC) column applies to all glazed fenestration.
c. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
d. R-5 shall be added to the required slab edge R-values for heated slabs.
e. There are no solar heat gain coefficient (SHGC) requirements in the Marine Zone.
f. Or insulation sufficient to fill the framing cavity, R-19 minimum.
g. "13+~~5~~ 6" means R-13 cavity insulation plus R-~~5~~ 6 insulated sheathing. If structural sheathing covers 25% or less of the exterior, R-~~5~~ 6 insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

TABLE N1102.1.2
EQUIVALENT U-FACTORS [a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.65	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	~~0.060~~ 0.057 (b)	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	~~0.060~~ 0.057 (b)	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	0.057(b)	0.057	0.033	0.059	0.065

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

Reason: The purpose of this change is to increase the energy efficiency of home built using the International Energy Conservation Code. This change proposal is a slightly modified version of those the Committee has seen in the past. In an effort to make the change more attractive to the homebuilding industry and other insulation manufacturers we have only proposed the higher R-values in the colder climates where analysis have shown them to be very cost–effective.

The IECC Code Committee has twice approved the increased R-values that will benefit homeowners by providing of energy efficiency that will result from the increased R-values.

The increased R-values previously approved are justified by the fact that the new energy code provisions (in both the IECC and IRC) do not have any limitation on the percentage of glazing in homes. These modestly higher R-values are justified because without any limitation on glazing percentage or requirement to increase the energy efficiency of other building components in homes with more windows – slightly greater R-values are need to offset the unlimited glazing.

On March 24, 2006 the price of a barrel of crude oil was $64.26.
The Washington Times reported:
Policy-makers are beginning to pay attention to what industries have called "the other energy crisis" — the critical U.S. shortage in natural gas. According to Energy Secretary Spencer Abraham, natural gas storage levels are at their lowest levels in almost three decades and 42 percent below their five-year average. Meanwhile, natural gas prices have reportedly gone up by up to 700 percent since 2000.

The price of gas has more than doubled in the past year, to approximately $7 per million British thermal units, and had a peak price of $15 per MMBtu in December of 2005.

This change is designed to address the issue of product preference. Some manufacturers of competitive insulation products argue these higher R-values have put their materials at a market disadvantage. The R-21 insulation levels can be achieved using all types of insulation materials – some insulation materials, including R-19 fiber glass would require an additional R-2 sheet of continuous insulation to reach the required levels.

It is our belief that the Committee should simply consider the energy savings and related costs of achieving those savings and set an appropriate R-value. If R-values are set to permit all materials to be used, regardless of their R-values per inch, then the code requirements could never be advanced because the levels would be determined by the setting them to allow the lowest common denominator. Most commonly available materials will need an R-2 sheathing and there are many different wall configurations that can easily meet the 21 requirements. This additional sheathing will have the added energy efficiency benefit of reducing air infiltration and costs less than the common building practice.

Finally there is the issue of cost. Below are cost estimates using prices of competitive insulation materials obtained from the internet and a local building supply company. The estimated cost of adding ½ inch of expanded polystyrene to a 2000 SF home measuring 40 ft. by 50 ft. with 8 foot wall and a 1 ft. band board would be as follows:

area to be sheathed = (50+50+40+40) * 9 = 1620 SF
# of 4 ft. x 8 ft. sheets of EPS = 1620 / 32 = 51 + 3 (for waste) = 54 total sheets
cost per sheet = $5.99 [1]
total insulation sheathing materials cost = $5.99 [1] * 54 = $323

Assuming the home is already sheathed with a 1/8 in. cardboard bracing material there would not be any additional labor costs to install the R-2.16 EPS instead of the cardboard. A 4 ft. x 8 ft. sheet of 1/8 cardboard costs $8.24 at T.W. Perry a D.C. area building supply company. Substituting ½ in. thick EPS would actually reduce the total cost of the home. The cost of the cardboard sheathing materials would is $445 [2] ($8.24*54). This would reduce the total cost of sheathing by $122 when using to 1/2 in. thick EPS

If 7/16 in. OSB sheathing is being replaced with ½ in. EPS the builder would actually save a significant amount of money. The cost of the OSB would is approximately $13.88 for 4 ft. x 8 ft. sheet. So the cost of the OSB material would be $749 ($13.88*54). This would be a net savings $426($749 OSB - $323 EPS) to the builder if he used EPS instead of OSB for sheathing. The total labor costs when switching from OSB to EPS would be likely remain the same or even decrease. This is because the labor cost to install structural bracing (typically let-in corner bracing) would offset by the decreased cost to install EPS because it is lighter and easier to handle than OSB. Furthermore any additional material costs for structural bracing, jam extensions and fasteners.

This code change proposal will save the builder money up front and save the homeowners on their utility bills for the life of the building.

Attached are 2 DOE Building America case studies that show total cost for 2 homes built with insulating sheathing. One costs $25 less to build and the second cost $100 but the builder chose to use spray in cellulose insulation with likely increased the cost. If he had used the least costly insulation available it would probably have cost less. Additionally NAIMA has done 2 cost-benefit analyses one with the American Council for an Energy Efficient Economy and the second with ICF Consulting. In 2004 and 2005 both showed positive life-cycle costs for homes with the higher R-value and energy cost have risen significantly sine these analyses were completed.

Bibliography:
ACEEE report - *Impact Assessment of 2004 IECC Wall Criteria Changes*, February 2005
ICF report – *Review and Economic Analysis of Increased Wall Insulation Required by the 2004 IECC Supplement*, July 14, 2004

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

PART I – IECC

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

PART II – IRC

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

EC39–06/07

Table 402.1.1

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

Revise table as follows:

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

Climate Zone	Fenestration U-Factor	Skylight[(b)] U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement[(c)] Wall R-Value	Slab[(d)] R-Value & Depth	Crawl Space[(c)] Wall R-Value
1	1.20	0.75	~~0.40~~ 0.37	30	13	3	13	0	0	0
2	0.75	0.75	~~0.40~~ 0.37	30	13	4	13	0	0	0

(Portions of table not shown do not change)

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

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

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

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

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

EC40–06/07

Table 402.1.1

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

Revise table as follows:

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

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[h]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	~~0.40~~ 0.25	30	13	3	13	0	0	0
2	0.75	0.75	~~0.40~~ 0.25	30	13	4	13	0	0	0
3	0.65	0.65	0.40[c]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.
a. through g. (No change to current text)
h. Fenestration with a projection factor of ≥ 0.50 shall comply with the following SHGC requirements: Climate Zone 1- 0.38; Climate Zone 2- 0.38; Climate Zone 3 - 0.61. Projection factor shall be calculated using Equation 5-1.

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

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

Allowing flexibility in meeting the solar heat gain coefficient through the use of proven shading alternatives will increase the usability of the code for the building and design community while ensuring that the new fenestration is energy efficient. The use of these shading devices were previously allowed under the 2003 IECC and is currently allowed as a trade-off under the commercial provisions of the IECC.

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

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

EC41–06/07
Table 402.1.1; IRC Table N1102.1, Figure N1102.1, R202

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise table as follows:

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

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[h]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40[c]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.
a. through g. (No change to current text)
h. Fenestration with a projection factor of ≥ 0.50 shall comply with the following SHGC requirements: Climate Zone 1- 0.61; Climate Zone 2- 0.61; Climate Zone 3 - 0.61. Projection factor shall be calculated using Equation 5-1.

PART II – IRC

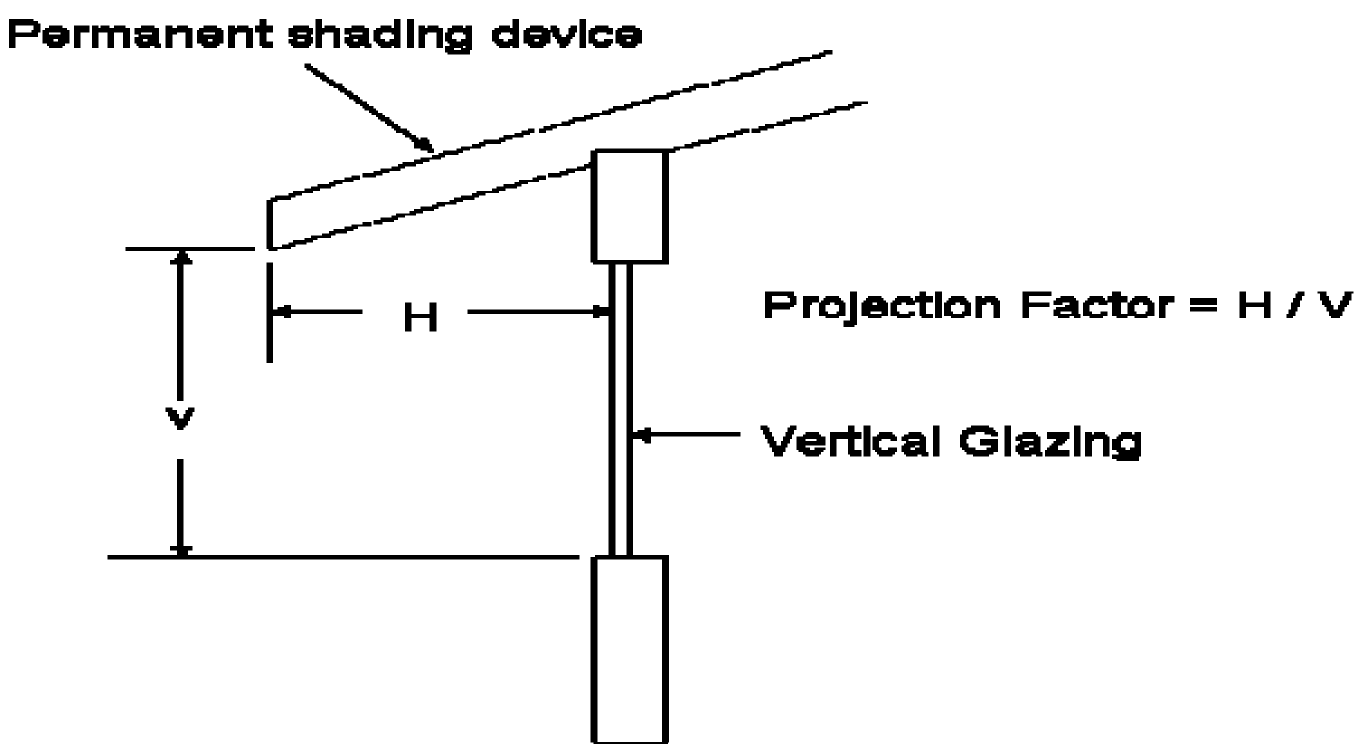
1. Revise table as follows:

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

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[h]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40[c]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	49	21	19	30[f]	10/13	10, 4 ft	10/13

For SI: 1 foot = 304.8mm
a. through g. (No change to current text)
h. Fenestration with a projection factor of ≥ 0.50 shall comply with the following SHGC requirements: Climate Zone 1- 0.61; Climate Zone 2- 0..61 Climate Zone 3 - 0.61.

3. Add new figure as follows:



3. Add new definitions as follows:

PROJECTION (FACTOR). The ratio of the horizontal depth of the external shading projection divided by the sum of the height of the fenestration and the distance from the top of the fenestration to the bottom of the furthest point of the external shading projection. The shading from projections used to calculate the projection factor is from an architectural feature such as a cornice, balcony, eave overhang, or a permanent shading device.

PERMANENT SHADING DEVICE. A commercially designed material or product, permanently attached, that reduces the directly transmitted solar heat gain entering a building area or space through the fenestration assembly.

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

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

Allowing flexibility in meeting the solar heat gain coefficient through the use of proven shading alternatives will increase the usability of the code for the building and design community while ensuring that the new fenestration is energy efficient. The use of these shading devices were previously allowed under the 2003 IECC and is currently allowed as a trade-off under the commercial provisions of the IECC.

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

PART I – IECC

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

PART II – IRC

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

EC42–06/07

Table 402.1.1; IRC Table N1102.1

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise table as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

Climate Zone	Fenestration U-Factor	Skylight(b) U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement(c) Wall R-Value	Slab(d) R-Value & Depth	Crawl Space(c) Wall R-Value
1	1.20	1.60	0.40	30	13	6	13	0	0	0
2	0.75	1.05	0.40	30	13	6	13	0	0	0
3	0.65	0.90	0.40(e)	30	13	6	19	~~0~~ 5/13	0	5/13
4 except Marine	0.40	0.60	NR	38	13	8	19	10 / 13	10, 2 ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5(g)	13	30(f)	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	19 or 13+5(g)	15	30(f)	10 / 13	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	21	30(f)	10 / 13	10, 4 ft	10 / 13

(Portions of table not shown do not change)

PART II – IRC

Revise table as follows:

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

Climate Zone	Fenestration U-Factor	Skylight[(b)] U-Factor	Glazed Fenestration SHGC	Ceiling R-Value	Wood Frame Wall R-Value	Mass Wall R-Value	Floor R-Value	Basement[(c)] Wall R-Value	Slab[(d)] R-Value & Depth	Crawl Space[(c)] Wall R-Value
1	1.20	1.60	0.40	30	13	6	13	0	0	0
2	0.75	1.05	0.40	30	13	6	13	0	0	0
3	0.65	0.90	0.40[(e)]	30	13	6	19	~~0~~ <u>5/13</u>	0	5/13
4 except Marine	0.40	0.60	NR	38	13	8	19	10 / 13	10, 2 ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[(g)]	13	30[(f)]	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	19 or 13+5[(g)]	15	30[(f)]	10 / 13	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	21	30[(f)]	10 / 13	10, 4 ft	10 / 13

(Portions of table not shown do not change)

Reason: The purpose of this proposal is to add basement wall insulation requirements for climate zone 3. Currently, no insulation is required for conditioned basements (floor insulation is required over unconditioned basements) in Zone 3. Though basements are uncommon in Zone 3, there are some and they tend to be in the colder parts of the zone where winter temperatures can reach as low as single digits. When basements are used as a conditioned living space, they often have furred in walls that allow space for insulation.

Energy simulation analyses shows that foundation wall insulation in cold climates is cost effective. For conditioned basements, the Building Foundation Design Handbook reports that R-5 insulation wall insulation 8 ft. deep saves 0.16 MBtu/lineal foot of foundation perimeter of heating energy use compared to an uninsulated wall in Atlanta. Assuming a house with a 130 ft. perimeter basement, this is 20.8 MBtus a year. Assuming $10/MBtu natural gas cost, this insulation will save $208 a year in heating costs. For example, with an estimated insulation cost of $900, the simple payback will be in less than five years in Atlanta. The lost floor space from insulating basement walls should be minimal as conditioned basements are normally finished, and exterior insulation is an option.

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

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

PART I – IECC

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

PART II – IRC

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

EC43–06/07

Table 402.1.1, Table 402.1.3; IRC Table N1102.1, Table N1102.2

Proponent: David Richmond, Environmental Community Consultants, Inc., representing himself

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise tables as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONES	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL RVALUE	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40(e)	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10 / 13	10, 2 ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	~~19 or 13+5~~ 22 or 13+7 (g h)	13	30(f)	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	~~19 or 13+5~~ 22 or 13+7 (g h)	15	30(f)	10 / 13	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	~~21~~ 22 or 13+7 (g h)	19	30(f)	10 / 13	10, 4 ft	10 / 13

a. R-Values are minimums. U-factors and SHGC are maximums. R-19 insulation shall be permitted to be compressed into a 2 x 6 cavity.
b. The fenestration U-factor column excludes skylights. The solar heat gain coefficient (SGHC) column applies to all glazed fenestration.
c. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.
d. R-5 shall be added to the required slab edge R-values for heated slabs.
e. There are no solar heat gain coefficient (SHGC) requirements in the Marine Zone. Or insulation sufficient to fill the framing cavity, R-19 minimum.
f. “13+~~5~~ 7” means R-13 cavity insulation plus R-~~5~~ 7 insulated sheathing. If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
h. In jurisdictions where wind or structural requirements do not permit the use of continuous insulated sheathing, the R-value shall be permitted to be reduced to R-19.

TABLE 402.1.3
EQUIVALENT U-FACTORS

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.65	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	~~0.057~~ 0.054 (b)	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	~~0.057~~ 0.054 (b)	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	~~0.057~~ 0.054 (b)	0.057	0.033	0.059	0.065

a. Non-fenestration U-factors shall be obtained from measurement, calculation or an approved source.
b. In jurisdictions where wind or structural requirements do not permit the use of continuous insulated sheathing, the U-factor shall be permitted to be increased to 0.57

PART II – IRC

Revise tables as follows:

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

CLIMATE ZONES	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL RVALUE	FLOOR R-VALUE	BASEMENT[C] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.2	0.75	0.40	30	13	3	13	0	0	0
2	0.75	0.75	0.40	30	13	4	13	0	0	0
3	0.65	0.65	0.40[(e)]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10 / 13	10, 2 ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	~~19 or 13+5~~ 22 or 13+7 [(g h)]	13	30[(f)]	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	~~19 or 13+5~~ 22 or 13+7 [(g h)]	15	30[(f)]	10 / 13	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	~~21~~ 22 or 13+7 [(g h)]	19	30[(f)]	10 / 13	10, 4 ft	10 / 13

a. R-Values are minimums. U-factors and SHGC are maximums. R-19 insulation shall be permitted to be compressed into a 2 x 6 cavity.
b. The fenestration U-factor column excludes skylights. The solar heat gain coefficient (SGHC) column applies to all glazed fenestration.
c. The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement. R-5 shall be added to the required slab edge R-values for heated slabs.
d. There are no solar heat gain coefficient (SHGC) requirements in the Marine Zone.
e. Or insulation sufficient to fill the framing cavity, R-19 minimum.
f. "13+~~5~~ 7" means R-13 cavity insulation plus R-~~5~~ 7 insulated sheathing. If structural sheathing covers 25% or less of the exterior, R-5 sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25% of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
h. In jurisdictions where wind or structural requirements do not permit the use of continuous insulated sheathing, the R-value shall be permitted to be reduced to R-19.

TABLE N1102.2
EQUIVALENT U-FACTORS[a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT U-FACTOR	CEILING U-FACTOR	FRAME WALL U-FACTOR	MASS WALL U-FACTOR	FLOOR U-FACTOR	BASEMENT WALL U-FACTOR	CRAWL SPACE WALL U-FACTOR
1	1.20	0.75	0.035	0.082	0.197	0.064	0.360	0.477
2	0.75	0.75	0.035	0.082	0.165	0.064	0.360	0.477
3	0.65	0.65	0.035	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	0.030	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	0.030	~~0.057~~ 0.054 [(b)]	0.082	0.033	0.059	0.065
6	0.35	0.60	0.026	~~0.057~~ 0.054 [(b)]	0.060	0.033	0.059	0.065
7 and 8	0.35	0.60	0.026	~~0.057~~ 0.054 [(b)]	0.057	0.033	0.059	0.065

a. Non-fenestration U-factors shall be obtained from measurement, calculation or an approved source.
b. In jurisdictions where wind or structural requirements do not permit the use of continuous insulated sheathing, the U-factor shall be permitted to be increased to 0.57

Reason: I am a former builder and have built numerous homes under the Building America criteria. Also, I have worked extensively with other builders that have successfully implemented the requested R Value change into their products without any substantial negative cost impact. Additionally, by providing continuous foam insulation on the exterior surface of the stud this has significantly reduced moisture problems. The cost of energy in the US continues to climb. Despite our mild winter many homeowners are paying record high utility bills.

It is easy and cost-effective to build more efficient homes. In fact, using insulative sheathing allows a builder to build a more energy efficient wall and save money. Even the Department of Energy advocates these building practices in their Building America program.

The IECC Committee approved changes that are similar to this during the last code cycle and those were reversed by the membership due to significant opposition from the homebuilding industry and some insulation manufacturers. I have revised this proposal in response to some of the opposition. First, I increased the R-value to R-22, which will require all types of cavity insulation used in 2x6 constructions to use continuous insulating sheathing, so it does not favor the fiber glass R-21 batt materials. Second, I have added footnote "h" to the R-value table which allows building departments high wind and seismic areas that choose not use insulation sheathing to reduce the requirement to the old R-19 requirements so they can use OSB or plywood.

It is critical that when a home is built the walls are built with good energy efficiency properties because they are rarely if ever upgraded. Even during major renovations I have done it is extremely costly insulate older walls. It is time to increase the code to reduce our use of energy, reduce monthly utility bills and save homeowners money.

The purpose of the code change proposal is to increase current prescriptive wall R-values and reduce the corresponding U-factors in the IECC.

There are 2 DOE Building America case studies that show total cost for 2 homes built with insulating sheathing. One costs $25 less to build and the second cost $100 but the builder chose to use spray in cellulose insulation with likely increased the cost. If he had used the least costly insulation available it would probably have cost less.

Bibliography: DOE Building America literature

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

PART I – IECC

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

PART II – IRC

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

EC44–06/07

Table 402.1.1; IRC Table N1102.1

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise table as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB *R*-VALUE & DEPTH	CRAWL SPACE[g] Wall *R*-value
1	1.20	0.75	Max 0.25 ~~0.40~~	30	13	3	13	0	0	0
2	0.75	0.75	Max 0.25 ~~0.40~~	30	13	4	13	0	0	0
3	0.65	0.65	Max 0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	Min 0.40 ~~NR~~	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	Min 0.40 ~~NR~~	49	21	19	30[f]	10/13	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

a. R-values are minimums. U-factors ~~and SHGC~~ are maximums. SHGC – Max = Maximum and Min = Minimum. R-l9 shall be permitted to be compressed into a 2 x 6 cavity.

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

PART II – IRC

Revise table as follows:

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

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB *R*-VALUE & DEPTH	CRAWL SPACE[g] Wall *R*-value
1	1.20	0.75	<u>Max 0.25</u> ~~0.40~~	30	13	3	13	0	0	0
2	0.75	0.75	<u>Max 0.25</u> ~~0.40~~	30	13	4	13	0	0	0
3	0.65	0.65	<u>Max</u> 0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	<u>Min 0.40</u> ~~NR~~	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	<u>Min 0.40</u> ~~NR~~	49	21	19	30[f]	10/13	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

a. R-values are minimums. U-factors ~~and SHGC~~ are maximums. <u>SHGC – Max = Maximum and Min = Minimum.</u> R-l9 shall be permitted to be compressed into a 2 x 6 cavity.

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

Reason: Energy efficient windows in the north require a different SHGC than energy efficient windows in the south. The north requires a higher SHGC to reduce heating loads while the south requires a lower SHGC to reduce cooling loads. The purpose of this proposal is to reduce window energy use by 29% in the north by prescribing a minimum SHGC of 0.40 in zones 6, 7 and 8 and to reduce window energy use by 10% in the south by lowering SHGC to 0.25 in zones 1 and 2. A companion, alternative proposal sets a minimum SHGC of 0.30 in zones 6, 7 and 8. The primary purpose of the companion proposal is to preclude the use of ultralow SHGC glazings in the north whereas this proposal not only does that but will also yield significant energy savings in both the north and the south.

Homes in zones 6, 7 or 8 using windows with a 0.35 *U*-factor and a 0.40 SHGC will experience a 29% window energy savings over the same home using windows with a 0.25 SHGC. Homes in zones 1 and 2 will experience a 10% window energy savings if ultralow 0.25 SHGC glazing is prescribed over the current 0.40 SHGC.

For clarity, each SHGC in the Table is denominated “Max” for “Maximum” or “Min” for “Minimum” and footnote “a” is modified accordingly.

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

PART I – IECC

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

PART II – IRC

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

EC45–06/07

Table 402.1.1; IRC Table N1102.1

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise table as follows:

TABLE 402.1.1
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB *R*-VALUE & DEPTH	CRAWL SPACE[g] Wall *R*-value
1	1.20	0.75	Max 0.25 ~~0.40~~	30	13	3	13	0	0	0
2	0.75	0.75	Max 0.25 ~~0.40~~	30	13	4	13	0	0	0
3	0.65	0.65	Max 0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	Min 0.30 ~~NR~~	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	Min 0.30 ~~NR~~	49	21	19	30[f]	10/13	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

a. R-values are minimums. U-factors ~~and SHGC~~ are maximums. SHGC – Max = Maximum and Min = Minimum. R-l9 shall be permitted to be compressed into a 2 x 6 cavity.
b. through g. (No change to current text)

PART II – IRC

Revise table as follows:

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

CLIMATE ZONE	**FENESTRATION *U*-FACTOR**	**SKYLIGHT[b] *U*-FACTOR**	**GLAZED FENESTRATION SHGC**	**CEILING *R*-VALUE**	**WOOD FRAME WALL *R*-VALUE**	**MASS WALL *R*-VALUE**	**FLOOR *R*-VALUE**	**BASEMENT[c] WALL *R*-VALUE**	**SLAB *R*-VALUE & DEPTH**	**CRAWL SPACE[g] Wall *R*-value**
1	1.20	0.75	Max 0.25 ~~0.40~~	30	13	3	13	0	0	0
2	0.75	0.75	Max 0.25 ~~0.40~~	30	13	4	13	0	0	0
3	0.65	0.65	Max 0.40[e]	30	13	5	19	0	0	5/13
4 except Marine	0.40	0.60	NR	38	13	5	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	38	19 or 13+5[g]	13	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	Min 0.30 ~~NR~~	49	19 or 13+5[g]	15	30[f]	10/13	10, 4 ft	10/13
7 and 8	0.35	0.60	Min 0.30 ~~NR~~	49	21	19	30[f]	10/13	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.
a. R-values are minimums. U-factors ~~and SHGC~~ are maximums. SHGC – Max = Maximum and Min = Minimum. R-l9 shall be permitted to be compressed into a 2 x 6 cavity.
b. through g. (No change to current text)

Reason: Today, windows can be made to allow more heat or less heat from the sun into a home. The use of low solar gain windows will let less sun in, which will save energy in the south by reducing cooling loads. Using higher solar gain windows will allow more sun in, saving energy in the north by reducing heating loads. The purpose of this proposal is to reduce cooling loads in the south (zones 1 and 2) by prescribing the use of ultra low solar gain windows having a 0.25 SHGC or less, while prescribing a minimum 0.30 SHGC to preclude the use of those same ultra low solar gain windows in the north (zones 6, 7 and 8).

Numerous ultra-low solar gain windows with 0.25 SHGC or less are available. If a maximum 0.25 SHGC is prescribed in zones 1 and 2, homes there will experience a 10% reduction in total heating and cooling loads associated with the windows. However, these reductions in energy consumption will be lost if these same, ultra low SHGC glazing products are used in the north where solar gain through the windows is needed to reduce heating loads. A window with a 0.35 U-factor and a 0.25 SHGC will use approximately 9% more energy than the same window with a 0.30

SHGC in zones 6, 7 or 8. To ensure that these ultra-low SHGC products are not inappropriately used in the north, a minimum SHGC of 0.30 is prescribed in zones 6, 7 and 8.

For clarity, each SHGC in the Table is denominated “Max” for “Maximum” or “Min” for “Minimum” and footnote “a” is modified accordingly.

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

PART I – IECC

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

PART II – IRC

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

EC46–06/07
Table 402.1.3

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

Revise table as follows:

TABLE 402.1.3
EQUIVALENT U-FACTORS[a]

CLIMATE ZONE	FENESTRATION *U*-FACTOR	SKYLIGHT *U*-FACTOR	CEILING *U*-FACTOR	FRAME WALL *U*-FACTOR	MASS WALL *U*-FACTOR	FLOOR *U*-FACTOR	BASEMENT WALL *U*-FACTOR	CRAWL SPACE WALL *U*-FACTOR
1	1.2	0.75	~~0.035~~ <u>0.030</u>	0.082	0.197	0.064	0.360	0.477
2	0.75	0.75	~~0.035~~ <u>0.030</u>	0.082	0.165	0.064	0.360	0.477
3	0.65	0.65	~~0.035~~ <u>0.030</u>	0.082	0.141	0.047	0.360	0.136
4 except Marine	0.40	0.60	~~0.030~~ <u>0.025</u>	0.082	0.141	0.047	0.059	0.065
5 and Marine 4	0.35	0.60	~~0.030~~ <u>0.025</u>	0.060	0.082	0.033	0.059	0.065
6	0.35	0.60	~~0.026~~ <u>0.020</u>	0.060	0.06	0.033	0.059	0.065
7 and 8	0.35	0.60	~~0.026~~ <u>0.020</u>	0.057	0.057	0.033	0.059	0.065

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

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

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

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

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

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

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

EC47–06/07
402.2; IRC N1102.2.2

Proponent: Craig Conner, Building Quality, representing himself

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

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) of ceiling area.~~

PART II – IRC

Revise as follows:

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 N1102.1 shall be limited to 500 ft2 (46 m2) of ceiling area~~.

Reason: Increased ceiling insulation is not cost-effective where it requires a potentially expensive increase in framing size. This change takes the code back to the original DOE proposal for this section of the code.

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

PART I – IECC

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

PART II – IRC

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

EC48–06/07
402.2.2 (New); IRC N1102.2.2 (New)

Proponent: Shirley Muns, C.B.O., Energy Systems Laboratory, Texas A&M University System

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

402.2.2 Attic access openings. Attic access openings that penetrate the building envelope shall be insulated to the minimum R-value of the building envelope. When the attic access is by way of a door assembly or pre-manufactured assembly having a U-factor rather than an R-value, said assembly shall meet the U-factor requirement in Section 402.1, in lieu of R-value.

(Renumber subsequent sections)

PART II – IRC

Add new text as follows:

N1102.2.2 Attic access openings. Attic access openings that penetrate the building envelope shall be durably sealed to limit infiltration and insulated to the minimum R-value of the building envelope. When the attic access is by way of a door assembly or pre-manufactured assembly having a U-factor rather than an R-value, said assembly shall meet the U-factor requirement in Section N1102.1, in lieu of R-value.

(Renumber subsequent sections)

Reason: Attic access openings should meet the same insulation and air leakage controls as doors, windows, recessed can lighting, etc, which penetrate the building envelope. This new section will provide clarification to the contractor and inspector as to how to achieve code compliance in an area that has been implied but never directly addressed.

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

PART I – IECC

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

PART II – IRC

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

EC49–06/07

402.2.3 (New); IRC N1102.2.3 (New)

Proponent: John Neff, Washington State Building Code Council

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

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

(Renumber subsequent sections)

PART II – IRC

Add new text as follows:

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

(Renumber subsequent sections)

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

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

PART I – IECC

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

PART II – IRC

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

EC50–06/07

402.2.3 (New), Table 402.2.3(1), Table 402.2.3(2) (New), Chapter 6 (New)

Proponent: W. Lee Shoemaker, P.E., Ph.D, Metal Building Manufacturers Association, Inc. (MBMA), representing Cool Metal Roofing Coalition

1. Add new text as follows:

402.2.3 High albedo roofs. For roofs where the exterior surface has the following:

1. A minimum total solar reflectance of 0.65 when tested in accordance with ASTM C1549, E903, or E1918, and
2. A minimum thermal emittance of 0.75 when tested in accordance with ASTM E408 or C1371, the R-value of the proposed ceiling shall comply with the values in Table 402.2.3(a) or the U-Factor of the proposed ceiling shall comply with the values in Table 402.2.3(b). The values for solar reflectance and thermal emittance shall be determined by a laboratory accredited by a nationally recognized organization, and shall be labeled and certified by the manufacturer.

(Renumber subsequent sections)

TABLE 402.2.3(1)
HIGH ALBEDO ROOF-CEILING INSULATION (R-VALUES)

ZONE	WOOD R-VALUE	STEEL R-VALUE
1	20	20
2	24	24
3	27	27

TABLE 402.2.3(2)
HIGH ALBEDO ROOF-CEILING INSULATION (U-VALUES)

ZONE	WOOD U-VALUE	STEEL U-VALUE
1	0.054	0.057
2	0.045	0.048
3	0.040	0.042

2. Add standards to Chapter 6 as follows:

ASTM

C1371- (04a)	Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
C1549-(04)	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
E408-(1971)	(Reapproved 2002) Standard Test Method for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
E903-(1996)	Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
E1918-(1997)	Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field

Reason: The proposal is to recognize high albedo roofs surfaces. In the IECC this benefit is only recognized in Section 501.1 where it references ASHRAE Standard 90.1 "Energy Standard for Buildings Except Low-Rise Residential Buildings." The residential chapter does not have a companion provision, and therefore residential buildings are not permitted to use this provision.

The purpose of this change is to account for the energy savings that is well established with a high albedo roof and offset this with a reduction in ceiling insulation.

In view of the fact that ASHRAE Standard 90.2 "Energy Efficient Design of Low-Rise Residential Buildings" contains provisions recognizing high albedo roof surfaces, this submission is proposed as an extract (Addenda "g" in 2005) from that standard for consideration into the IECC. The ASHRAE Standard 90.2 is an ANSI document, and the high albedo roof provisions have gone through a thorough review process. The Standard 90.2 provisions are based upon work by the Standing Standards Projection Committee 90.2 in conjunction with laboratory modeling by Lawrence Berkeley Laboratory. Additional research has been ongoing at the Oak Ridge National Laboratory and the Florida Solar Energy Center that demonstrated the benefits of high albedo roof surfaces.

Bibliography:

Akbari, H., Konopacki, S., Parker, D., "Updates on Revision to ASHRAE Standard 90.2: Including Roof Reflectivity for Residential Buildings," Lawrence Berkeley Laboratory, 2001.

Miller, W.A., Desjarlais, A., Akbari, H., Levenson, R., Berdahl, P., Scichili, R., Wiel, S., Loye, K., and Kriner, S., "Special Infrared Reflective Pigments Make a Dark Roof Reflect Almost Like A White Roof", Thermal Performance of the Exterior Envelopes of Buildings, IX, Proceedings of ASHRAE THERN IX, Clearwater, FL, Dec. 2004.

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

Analysis: Results of review of the proposed standard(s) will be posted on the ICC website by August 20, 2006.

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

EC51–06/07
402.2.5, N1102.2.5

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

402.2.5 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking. <u>Reflective insulation systems provide thermal resistance (R-value) using enclosed air spaces that are not in substantial contact with sub-flooring. Reflective insulation systems used below sub-flooring are not designed or intended to be installed in substantial contact with sub-flooring.</u>

PART II – IRC

Revise as follows:

N1102.2.5 Floors. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking. <u>Reflective insulation systems provide thermal resistance (R-value) using enclosed air spaces that are not in substantial contact with sub-flooring. Reflective insulation systems used below sub-flooring are not designed or intended to be installed in substantial contact with sub-flooring.</u>

Reason: Reflective insulation systems with air spaces from a fraction of an inch to several inches across provide thermal resistances (R-values) that are used in a variety of applications in the building envelope including below floors. Reflective insulation systems require air spaces and as a result are not designed to be installed in substantial contact with the subflooring. Reflective insulation systems are designed to be installed with air spaces having specific dimensions. Reflective insulation systems designed for installation below floors are water vapor retarders with measured water vapor transmission rates stated in perms. The proposed code change will allow use of this class of insulation.

The proposed change is a revision of a current code requirement that is needed because the code does not adequately include insulation systems that use enclosed air spaces with low-emittance surfaces to provide thermal resistance.

The performance of reflective air spaces is documented in Table 3 of Chapter 25 of the 2001 ASHRAE Handbook of Fundamentals and in all recent editions of the Handbook. The R-values in the ASHRAE Handbook are based on data from the United States National Bureau of Standards. The R-Values of specific product designs are provided.

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

PART I IECC

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

PART II IRC

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

EC52–06/07
402.3.3; IRC N1102.3.3

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. 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 <u>or up to 25 square feet (2.3 m^2) of glazed block</u> per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section 402.1.1.

PART II – IRC

Revise as follows:

N1102.3.3 Glazed fenestration exemption. Up to 15 $feet^2$ (1.4 m^2) of glazed fenestration <u>or up to 25 square feet (2.3 m^2) of glazed block</u> per dwelling unit shall be permitted to be exempt from *U*-factor and SHGC requirements in Section N1102.1.

Reason: In many neighborhoods, home security is one of the most important life safety considerations. Glazed block is often used in basement wells as an economical way to allow natural light into a basement while, at the same time, securing a home against break-ins. This application normally requires 25 square feet of glazed block. The low cost home security and natural lighting inherent in the use of this product outweighs any small increase in energy associated with the proposal.

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

PART I – IECC

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

PART II – IRC

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

EC53–06/07

402.3.7 (New); IRC N1102.3.7 (New)

Proponent: Craig Conner, Building Quality, representing himself

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.
PART I – IECC

Add new text as follows:

402.3.7 Energy Rating alternative. Fenestration with an Energy Rating (ER) of 21 or more shall be considered in compliance with Table 402.1.1 for climate zones 6, 7 and 8. The ER shall be computed as

ER = (57.76 x SHGC) – (124 x U-factor) – (10 x (air infiltration rate)) + 40

Fenestration U-factor, SHGC, and air infiltration rate shall be determined and labeled as specified in Sections 102.1.3 and 402.4.2. Fenestration complying under this alternative shall be labeled by the manufacturer to show the ER. Default values shall not be used to compute ER.

PART II – IRC

Add new text as follows:

N1102.3.7 Energy Rating alternative. Fenestration with an Energy Rating (ER) of 21 or more shall be considered in compliance with Table 402.1.1 for climate zones 6, 7 and 8. The ER shall be computed as

ER = (57.76 x SHGC) – (124 x U-factor) – (10 x (air infiltration rate)) + 40

Fenestration U-factor, SHGC, and air infiltration rate shall be determined and labeled as specified in Sections 102.1.3 and 402.4.2. Fenestration complying under this alternative shall be labeled by the manufacturer to show the ER. Default values shall not be used to compute ER.

Reason: The ER (Energy Rating) measures a window's suitability for residential use in a heating climate. ER combines the effects of U-factor, SHGC and air infiltration rate, which are all based on fenestration testing already specified in the IECC and IRC and should already be on the window's NFRC label. While a low SHGC (solar heat gain coefficient) is advantageous for cooling (hence the code requirement for a low SHGC in the south), a higher SHGC is advantageous for heating. The ER is only appropriate to a heating-dominated climate; therefore, the use of the ER alternative is limited to zones 6, 7, and 8. (A similar proposal last cycle also included zone 5.)

The ER concept has been used in Canada and is part of the Canadian Model National Energy Code for Houses and for the Canadian Energy Star program. Although not needed as a reference, the proposed equation comes from the Canadian ER (the CSA 440.2 Standard). Using the same ER in U.S. codes would encourage the use of windows designed for heating climates in the large northern US / Canadian market and thus encourage window sales across the U.S./Canadian border.

Because the minimum required ER never varies with the residential design, using the ER to show compliance is easy to enforce. A window with an ER of 21 or more complies. Consumers would also benefit from having a simple number that can be used to compare window options in northern climates.

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

PART I – IECC

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

PART II – IRC

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

EC54–06/07

402.3.7 (New), Table 402.3.7 (New); IRC N1102.3.7 (New), Table N1102.3.7 (New)

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text as follows:

402.3.7 Combined U-Factor and SHGC Alternative. In Zones 6 through 8, fenestration shall be permitted to meet the maximum *U*-factor requirement corresponding to the SHGC listed in Table 402.3.7. Fenestration meeting the requirements of Table 402.3.7 shall be considered in compliance with the fenestration requirements of Table 402.1.1

TABLE 402.3.7
ALTERNATIVE FENESTRATION *U*-FACTOR AND SHGC REQUIREMENTS IN ZONES 6 THROUGH 8

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

PART II – IRC

Add new text as follows:

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

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

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

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

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

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

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

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

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

PART I – IECC

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

PART II – IRC

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

EC55–06/07

402.4.1; IRC N1102.4.1

Proponent: Shirley Muns, Energy Systems Laboratory, Texas A&M University System

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

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

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

<u>10.</u> <u>Attic access openings.</u>

~~10.~~ <u>11.</u> Other sources of infiltration.

PART II – IRC

1102.4.1 Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:

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

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

Reason: Attic access openings should meet the same air leakage controls as other openings which penetrate the building envelope. Adding this new section will reinforce this fact and provide clarification to the contractor and inspector as to how to achieve code compliance in an area that has been implied but never directly addressed.

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

PART I – IECC

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

PART II -- IRC

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

EC56–06/07

402.4.3, 502.4.7; IRC N1102.4.3

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

1. Revise as follows:

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

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

2. Delete and substitute as follows:

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

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

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

PART II – IRC

Revise as follows:

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

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

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

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

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

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

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

PART I – IECC

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

PART II – IRC

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

EC57–06/07

402.2.11 (New), Table 402.2.11 (New), 404.2; IRC N1102.2.11 (New), Table N1102.2.11 (New)

Proponent: Charles Cottrell, North American Insulation Manufacturers Association (NAIMA), representing same

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Add new text and table as follows:

402.2.11 Minimum opaque envelope requirements. The minimum thermal requirements for opaque envelope components permitted using trade offs from section 402.1.3 or section 404 shall not be less than the requirements in Table 402.5.2.

TABLE 402.2.11
MANDATORY MINIMUM BUILDING ENVELOPE INSULATION R-VALUES

CLIMATE ZONES	CEILING	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	STEEL FRAME WALL CONTINUOUS R-VALUE (e)	FRAME FLOOR R-VALUE	BASEMENT WALL R-VALUE	SLAB R-VALUE & DEPTH	CRAWL SPACE WALL R-VALUE
Zone 1	30	13 (a)	0	3	13	0	0	0
Zone 2	30	13 (a)	0	3	13	0	0	0
Zones 3	30	13 (a)	0	3	13	0	0	0
Zone 4 except marine	30	13 (a)	0	3	13	0	0	0
Zone 5 and marine 4	30	13 (a)	3 (a)	5	19	0	0	3 (a, c)
Zones 6	38(b)	13 (a)	6 (a)	5	19	10/13 (a, c)	10, 2ft	6 (a, c)
Zones 7 and 8	38(b)	19 (a)	6 (a)	5	19	10/13 (a, c)	10, 2ft	6 (a, c)

a. The sum of the thermal resistance of cavity insulation plus insulating sheathing (if used) shall meet or exceed the required R-value in the table.
b. R-value for ceiling spaces without attics may be reduced to a minimum R-30 for areas not greater than 500 ft^2 per Section 402.2.2.
c. The first R-value applies to continuous insulation , the second to framing cavity insulation; either insulation condfiguation meets the requirement.
d. Cavity insulation R-value is listed first, followed by continuous insulation R-value.
e. Minimum R-value requirements for steel framing do not include cavity insulation values. See table 402.2.4

2. Revise as follows:

404.2 Mandatory requirements. This compliance with this Section requires that the criteria of sections 401, 402.4, 402.5 and 403 be met. The opaque building envelope components installed must meet the mandatory minimum insulation performance levels of Table 404.2

PART II – IRC

Add new text and table as follows:

N1102.2.11 Minimum opaque envelope requirements. The minimum thermal requirements for opaque envelope components permitted using trade offs from section N1102.1.3 shall not be less than the requirements in Table N1102.1.

TABLE N1102.2.11
MANDATORY BUILDING ENVELOPE INSULATION R-VALUES

CLIMATE ZONES	CEILING	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE	STEEL FRAME WALL CONTINUOUS R-VALUE (e)	FRAME FLOOR R-VALUE	BASEMENT WALL R-VALUE	SLAB R-VALUE & DEPTH	CRAWL SPACE WALL R-VALUE
Zone 1	30	13 (a)	0	3	13	0	0	0
Zone 2	30	13 (a)	0	3	13	0	0	0
Zones 3	30	13 (a)	0	3	13	0	0	0
Zone 4 except marine	30	13 (a)	0	3	13	0	0	0
Zone 5 and marine 4	30	13 (a)	3 (a)	5	19	0	0	3 (a, c)
Zones 6	38(b)	13 (a)	6 (a)	5	19	10/13 (a, c)	10, 2ft	6 (a, c)
Zones 7 and 8	38(b)	19 (a)	6 (a)	5	19	10/13 (a, c)	10, 2ft	6 (a, c)

a. The sum of the thermal resistance of cavity insulation plus insulating sheathing (if used) shall meet or exceed the required R-value in the table.
b. R-value for ceiling spaces without attics may be reduced to a minimum R-30 for areas not greater than 500 ft^2 per Section N1102.2.2
c. The first R-value applies to continuous insulation , the second to framing cavity insulation; either insulation condfiguation meets the requirement.
d. Cavity insulation R-value is listed first, followed by continuous insulation R-value.
e. Minimum R-value requirements for steel framing do not include cavity insulation values. See Table N1102.2.4.

Reason: The IECC and IRC allow the builder to trade-off efficiency of one envelope component against another as long as the resulting building uses no more energy than the prescribed level. While this principle may generally be good public policy, the IECC and IRC should set a reasonable minimum performance standard for essential components, particularly those in the building envelope. The IECC already does this for certain characteristics such as allowable air infiltration for windows and window U-values. Some individual jurisdictions have gone farther, setting minimum window and insulation performance levels that cannot be traded off. It is particularly important that such minimum standards be set for the building envelope, since the fundamental integrity of the envelope is so crucial to energy efficiency and satisfactory home occupancy. Moreover, unlike other measures (like equipment) that may be traded-off against the building envelope, the envelope often goes significantly unchanged for decades making the opportunity to get it right the first time particularly important. Unfortunately, this much longer life is not factored into trade-off calculations.

Minimum insulation levels for key components of the building envelope are important because of the important role insulation pays in ensuring energy efficiency in buildings. This proposal identifies reasonable, cost-effective, minimum levels of insulation for key areas of the building envelope. Establishing minimum insulation levels will also likely reduce construction costs, since some degree of uniformity in minimum performance will reduce complexity, improve construction practices, lead to economies of scale and reduce inventories. There is only one realistic opportunity to insulation the wall assembly so optimizing these values is important because once the building is finished there is virtually no opportunity to upgrade walls at a later date.

Similar code change proposals have been considered by the IECC committee during the 2 previous code change cycles and was favorably received. The change was revised to reflect the comments and concerns of the Committee and other affected industries.

The purpose of the code change proposal is to set minimum R-values for envelope components.

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

PART I – IECC

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

PART II – IRC

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

EC58–06/07
402.6; IRC N1102.5.1

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Delete without substitution:

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

PART II – IRC

Delete without substitution:

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

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

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

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

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

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

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

PART I – IECC

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

PART II – IRC

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

EC59–06/07

402.6; IRC N1102.5.1

Proponent: Craig Conner, Building Quality, representing himself

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Delete without substitution:

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

PART II – IRC

Delete without substitution:

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

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

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

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

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

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

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

PART I – IECC

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

PART II – IRC

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

EC60–06/07
402.6

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

Revise as follows:

~~402.6~~ 402.4 Maximum fenestration U-factor and SHGC. (Mandatory). The area weighted 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 excluding Marine Zone 3 shall be 0.50.

(Renumber subsequent sections)

Reason: The purpose of this proposal is to remove an inappropriate upper limit on solar heat gain for glazing in the marine climate zone. There is no prescriptive requirement for maximum SHGC in Marine zone 3 in Table 402.1.1 and there should be no mandatory limit either. Locations on and close to the Pacific coast often have very mild summers and high solar heat gains through glazing are desirable from both an energy efficiency and comfort standpoint. For example, Monterey, California, has far fewer cooling degree hours above 74 F than Fairbanks, Alaska, (137 compared to 752 according to ANSI/ASHRAE Standard 90.2-2001). Removing this limit would allow designers to select either high or low solar heat gain glazing as appropriate for the climate and building design.

This proposal also moves this section to follow the prescriptive requirements for fenestration. The organization of the code is improved by placing these two related sections adjacent to each other rather than being arbitrarily separated by other unrelated sections.

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

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

EC61–06/07
402.6

Proponent: Thomas S. Zaremba, Roetzel & Andress, representing Pilkington North America, Inc, and Pittsburg Corning Corporation

Revise as follows:

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~~ 0.55 in zones ~~4 and 5 and 0.40 in zones~~ 6 through 8 for vertical fenestration, and 0.75 in zones 4-8 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: The purpose of this proposal is to reduce the limitations imposed on vertical fenestration trade-offs when the performance based provisions of the code are used by adopting the *U*-factor limitations originally proposed by the Department of Energy in EC 48-03/04.

By definition, using trade-offs under the performance based provisions of the code (Section 404) means that no additional energy consumption is involved. The underlying premise of the performance based code is that if a less energy efficient product is used, it must be "traded-off" with other, more energy efficient products so that overall energy consumption is not compromised. The current code unduly restricts fenestration trade-offs with no energy saving justification. This proposal provides greater flexibility in trading off fenestration products with no reduction in energy efficiency.

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

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

EC62–06/07
403.2.1; IRC N1103.2.1

Proponent: Craig Conner, Building Quality, representing himself

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

403.2.1 Insulation. (Prescriptive) Supply ~~and return~~ ducts in attics shall be insulated to a minimum of R-8. All other ducts ~~Ducts~~ ~~in floor trusses~~ shall be insulated to a minimum of R-6.

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

PART II – IRC

N1103.2.1 Insulation. Supply ~~and return~~ ducts in attics shall be insulated to a minimum of R-8. <u>All other ducts</u> ~~Ducts in floor trusses~~ shall be insulated to a minimum of R-6.

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

Reason: There is an economic case for R-8 ducts in attics. However, there is clearly no economic case for R-8 return ducts or R-8 supply ducts in the basement. Outside the Northwest, it appears that many jurisdictions are simply not enforcing R-8 ducts. The latest Energy Star requirements are for R-6 ducts.

Duct insulation was not intended to be "mandatory" rather than "prescriptive" in the original DOE submission. Being "prescriptive" allows a code user to trade off the duct insulation.

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

PART I – IECC

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

PART II – IRC

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

EC63–06/07
403.2.1

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing himself

Revise as follows:

403.2.1 Insulation. Supply and return ducts shall be insulated to a minimum of R-8. Ducts in floor trusses shall be insulated to a minimum of R-6. <u>Underground ducts shall be enclosed with a minimum of R-8 insulation under, and on the sides of, the underground duct. The top of an underground duct is not required to have R-8 insulation if the space above the slab is a conditioned space. No insulation is required for underground ducts located in a heated slab on grade.</u>

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

Reason: The code is not clear on the minimum insulation, and the placement of insulation, as used with underground ducts. The proposed code change attempts to clarify the application of this code section.

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

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

EC64–06/07
403.2.2; IRC N1103.2.2

Proponent: Craig Conner, Building Quality, representing himself

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. 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 M1601.3.1 of the *International Residential Code*.

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

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 M1601.3.1.

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

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

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

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

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

PART I – IECC

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

PART II – IRC

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

EC65–06/07

403.2.2; IRC N1103.2.2

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IRC BUILDING/ENERGY CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

403.2.2 Sealing. All ducts, air handlers, filter boxes, or building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3.1 of the International Residential Code. Air handlers not located within the conditioned space shall be factory sealed to achieve a 2 percent or less leakage rate at 1-inch water gauge (250 Pascals) when all air inlets, air outlets and condensate drain port(s), when present, are sealed at an air pressure of 1-inch water gauge with no greater than 2-percent design cubic foot per minute discharge.

PART II – IRC

Revise as follows:

N1103.2.2 Sealing. All ducts, air handlers, filter boxes, or building cavities used as ducts shall be sealed. Joints and seams shall comply with Section M1601.3.1. Air handlers not located within the conditioned space shall be factory sealed to achieve a 2 percent or less leakage rate at 1-inch water gauge (250 Pascals) when all air inlets, air outlets and condensate drain port(s), when present, are sealed at an air pressure of 1-inch water gauge with no greater than 2-percent design cubic foot per minute discharge.

Reason: The purpose of this proposal is to provide specific requirements for the sealing of air handlers. The code already requires air handlers to be sealed—this proposal simply quantifies how proper sealing is to be determined. The text for this requirement is adapted from the 2004 Florida Building Code, Section 13-610.

Air handlers are often a major source of leakage that can result in significant energy loss. The Florida Solar Energy Center conducted leak testing on 69 air handlers in new Florida houses. The following information is taken from the report on that study. Leakage in the air handler cabinet averaged 20.4 Q_{25} in 69 air conditioning systems. Leakage at the return and supply plenum connections averaged 3.9 and 1.6 Q_{25}, respectively. Using the operating pressures in the air handler and at the plenum connections, these Q_{25} results convert to actual air leakage of 58.8 cfm on the return side (negative pressure side) and 9.3 cfm on the supply side (positive pressure side). The combined return and supply air leakage in the air handler and adjacent connections represents 5.3% of the system air flow (4.6% on the return side and 0.7% on the supply side). This is a concern, when one considers that a 4.6% return leak from a hot attic (peak conditions; 120°F and 30% RH) can produce a 16% reduction in cooling output and 20% increase in cooling energy use and this only from the air handler and adjacent connections. (source: http://www.fsec.ucf.edu/bldg/pubs/cr1357/index.htm)

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

PART I – IECC

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

PART II – IRC

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

EC66–06/07
403.7 (New)

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

Add new text as follows:

403.7 Systems serving multiple dwelling units. Systems serving multiple dwelling units shall comply with Sections 503 and 504 in lieu of Section 403.

Reason: The existing criteria in Section 403 primarily address stand-alone mechanical systems in single-family houses. However, Chapter 4 also includes apartment buildings up to three stories. Some of these building projects will have more complicated mechanical systems that may consist of a single system serving multiple dwelling units. Rather than repeating requirements here, references are made to Sections 503 and 504.

The purpose of the code change proposal is to provide specific instruction for single HVAC systems that serve multiple dwelling units.

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

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

EC67–06/07
403.7 (New)

Proponent: Shirley Muns, Energy Systems Laboratory, Texas A&M University System

Add new text as follows:

403.7 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 igntions 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. The additional cost of installing a pilotless gas water heater in lieu of standing pilot gas water heaters in new construction would be the difference in the price of the heater. The cost of the additional receptacle would be minimum in new construction. The use of such water heaters 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.

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

EC68–06/07
202 (New), 404 (New), 404.1 (New)

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

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

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

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

SECTION 404
ELECTRICAL POWER AND LIGHTING SYSTEMS

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

Exception: Dwelling units.

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

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

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

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

EC69–06/07
404.3

Proponent: Ken Nittler, 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~~ use that is less than or equal to the annual energy ~~cost~~ use of the standard reference design. ~~Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report*. Code officials shall be permitted to require time-of-use pricing in energy cost calculations.~~

1. The energy use shall be expressed in equivalent energy units using source energy.
2. The source energy multiplier for electricity shall be 3.16 (1 kWh = 3.16 * 3413 Btu).
3. The source energy multiplier for all other energy sources shall be 1.
4. The source energy shall be stated to two decimal places (example: 140.43) in thousands of Btus per square foot of conditioned floor area (kBtu/ft^2).

~~**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 or site energy. Using costs or site energy 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 *State Energy Price and Expenditure Report* is very difficult to understand and it is unclear which cost figures should be used.
- Site energy does not work as it improperly accounts for the true impact of fuel source, especially in climates where cooling is dominate. In a Las Vegas type climate for example, using site energy results in heating and cooling energy use values that are approximately equal. But homeowners in Las Vegas know that they pay far more for cooling than for heating.

The 3.16 electric source multiplier is 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. By contrast, non-electric furnaces consume the fuel at the site (that is, the source and the site are the same), requiring no adjustment to site energy usage.

Before the 2004 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.

Other approaches to this problem are possible. The Residential Energy Services Network, Inc. (RESNET) uses a method called normalized loads. This would also be a good method, although more complex and tougher to understand than source energy. One west coast state began to use source multipliers that depend on the day of the year and the time of day in 2005. On the balance, source energy captures the biggest concern over site energy that site does not properly account for the value of electricity while avoiding the problems with using cost.

Note that the Las Vegas area, when it adopted the 2003 IECC, added a local amendment requiring the use of 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

EC70–06/07
404.4.2

Proponent: Ken Nittler, Enercomp, Inc.

Revise as follows:

404.4.2 Compliance report. Compliance software tools shall generate a report that documents that the proposed design has annual energy costs less than or equal to the annual energy costs of the standard reference design. The compliance documentation shall include the following information:

1. Address <u>or other identification</u> of the residence;
2. An inspection checklist documenting the building component characteristics of the proposed design as listed in Table 404.5.2(1). The inspection checklist shall show the estimated annual energy cost for both the standard reference design and the proposed design;
3. Name of individual completing the compliance report; and
4. Name and version of the compliance software tool.

<u>**Exception:** Multiple Orientations. When an otherwise identical building model is offered in multiple orientations, compliance for any orientation shall be permitted by documenting that the building meets the performance requirements in each of the four cardinal (north, east, south and west) orientations.</u>

Reason: The purpose of this proposal is to restore useful language that allows calculations for the four cardinal orientations to demonstrate compliance for homes offered on multiple orientations.

- Similar language was in the 2003 IECC but was dropped from the 2004 IECC Supplement.
- This language is applicable to subdivisions where the same plan is often used repeatedly, with the only difference being the front orientation.
- Restoring this language will make documenting compliance for subdivisions less burdensome without sacrificing energy efficiency as it in effect requires that compliance be demonstrated for the worst orientation.
- The permit applicant retains the option of demonstrating compliance for every individual orientation with the proposed language.

The addition of the phrase "or other identification" to the address requirement was added because the exact address of a home is often not know at the time the compliance calculations are completed and submitted to the building department especially with subdivisions.

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

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

EC71–06/07
404.4.2

Proponent: Ken Nittler, Enercomp, Inc.

Revise as follows:

404.4.2 Compliance report. Compliance software tools shall generate a report that documents that the proposed design ~~has annual energy costs less than or equal to the annual energy costs of the standard reference design.~~ <u>complies in accordance with Section 404.3.</u> The compliance documentation shall include the following information:

1. Address of the residence;
2. An inspection checklist documenting the building component characteristics of the proposed design as listed in Table 404.5.2(1). The inspection checklist shall show ~~the estimated annual energy cost~~ <u>results</u> for both the standard reference design and the proposed design;
3. Name of individual completing the compliance report; and
4. Name and version of the compliance software tool.

Reason: The purpose of this proposal is to remove redundant language to reduce the change of inconsistencies between code sections without changing the intent or requirements in this code section. The requirements for performance based compliance are already fully described in Section 404.2 only a few paragraphs before this section. Repeating them here is unnecessary.

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

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

EC72–06/07
404.4.2

Proponent: Ken Nittler, Enercomp, Inc.

Revise as follows:

404.4.2 Compliance report. Compliance software tools shall generate a report that documents that the proposed design has annual energy costs less than or equal to the annual energy costs of the standard reference design. The compliance documentation shall include the following information:

1. Address of the residence;
2. An inspection checklist documenting the building component characteristics of the proposed design as listed in Table 404.5.2(1). The inspection checklist shall show the estimated annual energy cost for both the standard reference design and the proposed design~~;~~, and shall document all inputs entered by the user necessary to reproduce the results.
3. Name of individual completing the compliance report; and
4. Name and version of the compliance software tool.

Reason: The purpose of this proposal is to ensure that the building official can reliably check all computer software inputs entered by the user when desired. Depending on interpretation, the current language may or may not require that the checklist include such important factors as the areas and orientations of walls and windows for example. Adding this language is based on years of experience in states where the performance approach is frequently used in energy codes. Stated another way, a building official or other user should be able to take the inspection checklist and reconstruct the inputs used to generate the compliance calculations. Any standard less than this allows for the gaming of the system by documentation authors.

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

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

EC73–06/07
404.4.3

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

Revise as follows:

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

1. Documentation of the building component characteristics of the standard reference design.
2. A certification signed by the builder providing the building component characteristics of the proposed design as given in Table 404.5.2(1).
3. 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 proper documentation is provided.

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

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

EC74–06/07
Table 404.5.2(1)

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

Revise table as follows:

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

Glazing:[a]	Total area[b]= (a.) The proposed glazing area; where the proposed glazing area is less than 18% of the conditioned floor area. (b.) 18% of the conditioned floor area; where proposed glazing area is 18% or more of conditioned floor area.	As proposed
	Orientation: equally distributed to four (4) cardinal compass orientations (N, E, S, &W)	As proposed
	U-factor: from Table 402.1..1	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~~ same as proposed	As proposed

(Portions of table not shown do not change)

Reason: The IECC currently assumes the reference design in the Simulated Performance Alternative has no external shading of any type. However, many new residential buildings have exterior shading from overhangs, nearby trees, and adjacent buildings. Often this shading is not a result of an alteration of the design to improve energy efficiency. For example, roof overhangs are standard practice in much of Florida and have been for decades. Setting the exterior shading to be equal in the proposed and reference design will prevent unjustified exploitation of exterior shading to allow reductions in other energy efficiency measures to below-code levels. This proposed change would not discourage or penalize the effective use of exterior shading in any way. Passive solar design can still receive credit in the performance path because of improved glazing orientation and thermal mass.

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

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

EC75–06/07
Table 404.5.2(1)

Proponent: Shirley Muns, Energy Systems Laboratory, Texas A&M University System

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Service Water Heating[h,k]	Fuel type: same as proposed design Efficiency: in accordance with prevailing federal minimum standards Use: gal/day=30 + (10 x N_{br})	(No Change)

Reason: Adding the parenthesis to the 10 x N_{br} clarifies the equation. It ensures the number of bedrooms are multiplied by 10 gallons and not by 40 gallons.

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

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

EC76–06/07
Table 404.5.2(1)

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

Revise table as follows:

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

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

(Portions of table and notes not shown do not change)

Reason: The purpose of this code change is to modify the cooling and heating temperature set points to 75°F and 70°F respectively in the performance path to reflect more reasonable values.

There is no persuasive evidence as to the typical thermostat set points utilized in well-constructed new homes reflecting *IECC* energy efficiency levels. Obviously, these values vary substantially by individual homeowner and by climate. As a result, it is impossible to set accurate values for these set points. Nonetheless, these set points are very important because they determine the relative levels of heating and cooling energy utilized by the home, and depending on the values, can drive compliance investment decisions in favor of compliance choices that focus on either reducing cooling energy or reducing heating energy (and may even increase the other).

Given the concerns above, the best approach is to set these set point values for purposes of code compliance performance analysis consistent with other design considerations and with reasonable occupant comfort. This proposal adopts this approach by setting the new values at more reasonable levels while taking these issues into consideration. The proposed levels of 70°F winter/75°F summer are the same as those used for HVAC sizing and are consistent with comfort considerations.

ACCA Manual J recommends 70°F for heating and 75°F for cooling as the standard for temperature set points for load calculations for HVAC sizing. *ACCA Manual J* is already indirectly referenced by the *IECC* as the standard for such sizing (see IECC section 403.6, which references IRC section M1401.3, which references Manual J).

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

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

EC77–06/07
Table 404.5.2(1)

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

Revise table as follows:

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

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Glazing[a]	Total area[b] = (a) The proposed glazing area; where 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 402.1.1	As proposed
	SHGC: From Table 402.1.1 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~~ 0.85 Winter (all hours when heating is required) = 0.85	Same as standard reference design[c]
	External shading: none	As proposed

(Portions of table and notes not shown do not change)

Reason: The purpose of this proposal is to remove the existing bias in the Standard Reference Design (for the performance compliance path) in favor of options that reduce heating energy over reducing cooling energy by making the shade fraction for summer and winter equal, thereby assuming the same use of shades each hour throughout the year. This proposal also reflects the fact that shade usage varies enormously by individual homeowner.

The existing Standard Reference Design assumes that interior shading is deployed twice as much of the time in the summer as in the winter. The effect of this approach is to favor compliance measures that reduce heating energy as compared to cooling energy (since assuming increased shading in summer results in less summer cooling energy to save when compared to winter heating energy). The existing approach is also biased in favor of winter passive solar design (allowing more gain in the winter) when compared with summer solar control (blocking more gain through shading and reducing the apparent effectiveness of solar control through fenestration). This proposal removes that bias by assuming that shades are used uniformly year-round. Another option would be to remove this provision entirely and assume no shade use at all in either summer or winter, just as the code assumes no exterior shading.

While some may be argue that using interior shades more in the summer and less in the winter is advisable behavior from an energy use standpoint under certain circumstances, there is no persuasive evidence that this actually occurs – further, it could easily be argued that shades are used more in winter for their insulating effects. In fact, how shades are used vary by each individual homeowner and by climate. Some homeowners may choose to leave shades primarily closed throughout the year for privacy and security. Other homeowners may choose to leave shades primarily open throughout the year for daylighting and views (after all, why have windows if you are going to cover them?). Others may react to issues like glare or comfort. In short, shade usage behavior is unpredictable and therefore should not be biased in favor of one type of energy use (heating) over another (cooling). Finally, the effect of shades, even if used, varies depending on the type of shade.

One reason that this pattern of use may have been assumed in the past is the assumption that some folks may use shades more the in the summer to block unwanted heat gain (ignoring the fact that they might use shades in winter to provide greater insulating effects). However, even if this assumption were valid in the past, it would no longer be valid with modern window technology, which already substantially controls solar heat gain. With this technology, any comfort or energy savings reasons for such shade use are diminished.

Given the lack of valid evidence supporting the bias in favor of summer shading, the bias should be removed. Otherwise, the code will send inconsistent signals by discouraging measures under the performance path, like low solar gain windows, that are encouraged under the prescriptive path. Given the importance of these measures to peak control, HVAC sizing, comfort and energy savings, such artificial disincentives should be eliminated. In sum, it is not reasonable to simply assume that 30% of the solar gain in the summer has already been blocked by shade use, while only 15% is blocked in the winter.

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

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

EC78–06/07

403, 404.2, Table 404.5.2(2)

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

Revise as follows:

SECTION 403
SYSTEMS (MANDATORY)

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

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

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

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

Notes:

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

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

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

c. Entire system in conditioned space shall mean that no component of the distribution system, including the air handler unit, is located outside of the conditioned space.
d. Proposed "reduced leakage" shall mean leakage to outdoors not greater than 3 cfm per 100 ft^2 of conditioned floor area and total leakage not greater than 9 cfm per 100 ft^2 of conditioned floor area at a pressure differential of 0.02 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure. Total leakage of not greater than 3 cfm per 100 ft^2 of conditioned floor area at a pressure difference of 0.02 inches w.g. (25 Pa) across the entire system, including the manufacturer's air handler enclosure, shall be deemed to meet this requirement without measurement of leakage to outdoors. This performance shall be specified as required in the construction documents and confirmed through field-testing of installed systems as documented by an approved independent party.
e. Ductless systems may have forced airflow across a coil but shall not have any ducted airflows external to the manufacturer's air handler enclosure.

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

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

Bibliography:

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

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

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

EC79–06/07

Table 404.5.2(1), Chapter 6

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

1. Revise table as follows:

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

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

(Portions of table not shown do not change)

2. Add standard to Chapter 6 as follows:

ASHRAE

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

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

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

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

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

Analysis: Results of review of the proposed standard(s) will be posted on the ICC website by August 20, 2006.

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

EC80–06/07

Table 404.5.2(1)

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

Revise table as follows:

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

Glazing:[a]	Total area[b]= (a.) The proposed glazing area; where the proposed glazing area is less than 18% of the conditioned floor area. (b.) 18% of the conditioned floor area; where proposed glazing area is 18% or more of conditioned floor area.	As proposed
	Orientation: equally distributed to four (4) cardinal compass orientations (N, E, S, &W)	As proposed
	U-factor: from Table 402.1.2	As proposed
	SHGC: Zones 1-3: 0.30 if proposed level is equal to or less than 0.30. Same as proposed if proposed level is between 0.30 and the value in Table 402.1.1. From Table 402.1.1 if proposed is higher than the value in Table 402.1.1. Zones 4-8: 0.40 ~~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 not shown do not change)

Reason: The purpose of this code change is to set a more appropriate solar heat gain for glazing in the simulated performance alternative. Currently, the reference design solar heat gain coefficient (SHGC) matches the prescriptive code requirement from Table 402.1.1 (0.40 SHGC) for all climate zones. The reference design is a hypothetical building intended to represent a typical design that meets the minimum code requirements. However, the code SHGC requirement of 0.40 in zones 1-3 does not represent a typical glazing product but rather sets an upper limit for low solar gain glazing. DOE believes that Low-E glass is by far the most popular method of achieving low solar heat gain in glazed fenestration due to its modest cost, high visible light transmittance, and excellent energy efficiency characteristics. In fact, approximately 60% of new residential windows nationwide are low-E (Door and Window Maker Magazine, April 2005). Data from the National Fenestration Ratings Council ratings indicate only 2% of all double-glaze "soft-coat" low-E horizontal slider products in the NFRC have a SHGC above 0.40. Therefore 0.40 does not represent a typical value but a worst case. The 0.30 SHGC proposed here is the value provided for double-glazed low-solar low-E windows with a wood or vinyl frame from the Efficient Windows Collaborative website (http://www.efficientwindows.org/glazing_.cfm?id=8). Sixty percent of the horizontal sliders in the NFRC database are at 0.30 SHGC or lower.

The performance alternative reference design often sets the baseline for beyond-code programs such as Energy Star Homes; therefore, this proposal has implications for future updates of these beyond-code programs. The current baseline of 0.40 SHGC in Zones 1-3 allows an easy credit that undercuts the leading-edge nature of Energy Star. For example, REM-Design 12.0 indicates a reduction of SHGC from 0.40 to 0.30 achieves 30% of the improvement beyond IECC code levels needed to qualify for Energy Star for a typical house in Orlando (2000 ft^2 floor area, 360 ft^2 windows, equally on north, south, east, and west).

This proposal leaves the prescriptive requirement at 0.40 to allow for less common low solar gain product types that may have SHGC values above 0.30 (examples may include tinted and reflective glass, and aluminum framed windows). DOE is not opposed to lowering the prescriptive requirement, but considers that a lower priority because of the scarcity of products that would be affected by reducing the prescriptive level. On the other hand, lowering the reference design SHGC requirement applies to all designs when the simulated performance alternative is used in the affected climate zones.

Although this proposal may appear to create a mismatch between the stringency of the prescriptive and simulation approaches, this is not the case. The proposed requirement is in no way more stringent in the performance path compared to the prescriptive path and in fact allows credit not available in the prescriptive approach. The minor differences created by this proposal are similar to other performance path departures from the prescriptive path such as the exemptions of one door and 15 sq. ft. of glass that are not carried into the reference design.

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

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

EC81–06/07

Table 404.5.2(1), Table 404.5.2(3) (New)

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

1. Revise table as follows:

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

Roofs	Type: composition shingle on wood sheathing	As proposed
	Gross area: same as proposed	As proposed
	Solar absorptance = 0.75	~~As proposed~~ As specified in Table 404.5.2(3) or determined by specific test data for the roof surface in accordance with ASTM Standard E-903. If specific roof type is unknown the default value shall be that of standard dark composition shingles (0.92).
	Emittance = 0.90	As proposed

(Portions of table not shown do not change)

2. Add new table as follows:

TABLE 404.5.2(3)
DEFAULT SOLAR ABSORPTANCES FOR ROOFING SURFACES

ROOF MATERIAL	ABSORPTANCE	ROOF MATERIAL	ABSORPTANCE
Composition Shingles		Wood Shingles	
Dark	0.92	Dark	0.90
Medium	0.85	Medium	0.80
Light	0.75		
		Concrete/Cement	
Tile/Slate		Dark	0.90
Dark	0.90	Medium	0.75
Medium	0.75	Light	0.60
Terra cotta	0.65	White	0.30
Light	0.60		
White	0.30	Membrane	
		Dark	0.90
Metal		Medium	0.75
Dark	0.90	Light	0.60
Medium	0.75	White	0.30
Galvanized, unfinished	0.70		
Light	0.60	Built-up (gravel surface)	
Galvalum, unfinished	0.35	Dark	0.92
White	0.30	Medium	0.85
		Light	0.75

3. Add standard to Chapter 6 as follows:

ASTM

E-903-1996 Standard Test Method for Solar Absorptance, Reflectance and Transmittance of Materials Using Integrating Spheres

Reason: The current provisions give no guidance on how to estimate or otherwise determine the absorptance of various roofing materials.

The purpose of the proposed change is to allow compliance credit in the performance path for "cool roofs" (low solar absorptance).

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

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

Analysis: Results of review of the proposed standard(s) will be posted on the ICC website by August 20, 2006.

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

EC82–06/07

501.1, 501.2, 502.1.1, 502.1.2 (New), 502.1.3 through 502.1.3.2 (New)

Proponent: John Neff, Washington State Building Code Council

1. Revise as follows:

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

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

Exceptions:

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

SECTION 502
BUILDING ENVELOPE REQUIREMENTS

502.1 General. (Prescriptive).

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

2. Add new text as follows:

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

502.1.3 Total UA and total SHGCA alternative.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

EC83-06/07

502.1.1

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing himself

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. 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.

> **Exception:** Glazed structures or glazed portions of buildings used for the production of plant life or for maintaining plant life as the primary purposes of the structure are exempt from the building envelope requirements. When the glazed areas are attached to a building with a different occupancy, use, or construction type, these glazed areas shall be separated from the remainder of the building with construction material complying with the building envelope requirements of Section 502.2.

Reason: Some greenhouses are constructed specifically for agricultural purposes, and thus may be exempt from the code. Others, however, may be constructed for research purposes, while others may be used for general plant growth in a mercantile setting for future public purchase. The later two situations are not clearly addressed in ASHRAE/IESNA 90.1, thus the reason for the proposed code change. The reason for use of the wording "…buildings used for…maintaining plant life as the primary purposes of the structure…" was to address those situations involving plant growth in a mercantile setting. The word, "Primary", is to address the fact of at least 51% of the floor area is to be for plant growth, and not for sales of pots, potting soil, gardening tools, fertilizers, etc. Since these types of glazed structures are typically not of the same construction type of the adjacent building construction, nor are they of the same occupancy or use, they need to be separated from the adjacent spaces. These glazed areas are typically not excessively cooled to cold temperatures in warmer climates. Due to this type of action, an insulated assembly, per IECC 502.2, is required in the proposal so as to minimize heat loss/heat gain from the glazed area to the rest of the building.

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

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

EC84–06/07

202 (New), 502.1.2 (New), Table 502.1.2 (New)

Proponents: Steven Ferguson, ASHRAE, representing the American Society of Heating Refrigeration and Air-Conditioning Engineers; Chuck Murray, Washington State University, representing Northwest Energy Code Group; Martha G. VanGeem, CTL Group

Add new text as follows:

C-FACTOR (THERMAL CONDUCTANCE). The coefficient of heat transmission (surface to surface) through a building component or assembly, equal to the time rate of heat flow per unit area and the unit temperature difference between the warm side and cold side surfaces (Btu/h·ft^2·°F) [W/(m^2·K)].

F-FACTOR. The perimeter heat loss factor for slab-on-grade floors (Btu/h·ft·°F) [W/(m·K)].

502.1.2 U-factor alternative. An assembly with a U-factor, C-factor, or F-Factor equal or less than that specified in Table 502.1.2 shall be permitted as an alternative to the R-value in Table 502.2 (1).

TABLE 502.1.2
BUILDING ENVELOPE REQUIREMENTS-OPAQUE ASSEMBLIES, MAXIMUM U-FACTORS

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

Reason: (Ferguson) This proposal is to add U factors as a prescriptive option to the R-values in Table 502.2 (1). Currently, the commercial portion (Chapter 5) has only an added R value prescriptive requirement for nonresidential buildings. However, the residential portion (Chapter 4) allows either U factors or R values for compliance. This proposal is intended to provide the same flexibility as in Chapter 4. *ASHRAE Standard 90.1-2004, Energy Standard for Buildings Except Low-Rise Residential Buildings* also allows prescriptive compliance using either U factors or R values for compliance. The U factors shown for compliance are for the assembly and correspond to the added R-values in Table 502.2 (1). The method for calculating these values is taken directly from ASHRAE 90.1-2004

(Murray) Currently, the commercial portion (Chapter 5) has only an added R value prescriptive requirement for nonresidential buildings. However, the residential portion (Chapter 4) allows either U factors or R values for compliance. This proposal is intended to provide the same flexibility as in Chapter 4. *ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings* also allows prescriptive compliance using either U factors or R values for compliance. The U factors shown for compliance are for the assembly and correspond to the added R-values in Table 502.2 (1). They are taken directly from ASHRAE 90.1.

This proposal is to add U factors as a prescriptive option to the R-values in Table 502.2 (1).

(VanGeem) Currently, the commercial portion (Chapter 5) has only an added R-value prescriptive requirement for nonresidential buildings. However, the residential portion (Chapter 4) allows either U-factors or R-values for compliance. This proposal is intended to provide the same flexibility as in Chapter 4. *ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings* also allows prescriptive compliance using either U factors or R values for compliance.

The purpose of this proposal is to add U-factors, C-factors (below grade), and F-factors (slab-on-grade) as a prescriptive option to the R-values in Table 502.2(1). A table and definitions are provided.

The U-factors and other factors shown for compliance are for the assembly and correspond to the added R-values in Table 502.2 (1). They are taken directly from ASHRAE 90.1-2004.

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

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

EC85–06/07
202 (New), 502.1.2 (New), Table 502.1.2(1) (New), Table 502.1.2(2) (New)

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

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

C-FACTOR (THERMAL CONDUCTANCE). The coefficient of heat transmission (surface to surface) through a building component or assembly, equal to the time rate of heat flow per unit area and the unit temperature difference between the warm side and cold side surfaces (Btu/h·ft^2·°F) [W/(m^2·K)].

F-FACTOR. the perimeter heat loss factor for slab-on-grade floors (Btu/h·ft·°F) [W/(m·K)].

502.1.2 U-factor alternative. For nonresidential buildings, an assembly with a U-factor, C-factor, or F-factor equal or less than that specified in Table 502.1.2(1) shall be permitted as an alternative to the R-value in Table 502.2(1). For residential buildings except low-rise residential buildings, an assembly with a U-factor, C-factor, or F-factor equal or less than that specified in Table 502.1.2(2) shall be permitted as an alternative to the R-value in Table 502.2(3).

TABLE 502.1.2(1)
NONRESIDENTIAL BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES, MAXIMUM U-FACTORS, C-FACTORS, AND F-FACTORS

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

TABLE 502.1.2(2)
RESIDENTIAL EXCEPT LOW-RISE RESIDENTIAL
BUILDING ENVELOPE REQUIREMENTS –OPAQUE ASSEMBLIES,
MAXIMUM U-FACTORS, C-FACTORS, AND F-FACTORS

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Roof	-	-	-	-	-	-	-	-
Insulation entirely above deck	U-0.063	U-0.063	U-0.063	U-0.063	U-0.048	U-0.048	U-0.039	U-0.039
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027
Walls, Above Grade	-	-	-	-	-	-	-	-
Mass	U-0.151	U-0.151	U-0.123	U-0.104	U-0.090	U-0.090	U-0.080	U-0.071
Metal framed	U-0.124	U-0.124	U-0.084	U-0.064	U-0.064	U-0.064	U-0.064	U-0.055
Wood framed and other	U-0.089	U-0.089	U-0.089	U-0.089	U-0.089	U-0.064	U-0.051	U-0.051
Walls, Below grade	-	-	-	-	-	-	-	-
Below grade wall	C-1.140	C-1.140	C-1.140	C-1.140	C-1.140	C-0.119	C-0.119	C-0.119
Floors	-	-	-	-	-	-	-	-
Mass	U-0.322	U-0.123	U-0.076	U-0.076	U-0.076	U-0.055	U-0.055	U-0.055
Joist/Framing	U-0.350	U-0.052	U-0.038	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-0.520
Heated Slabs	F-1.020	F-1.020	F-1.020	F-0.840	F-0.840	F-0.780	F-0.780	F-0.780

Reason: Currently, Chapter 5 has only an added R-value prescriptive requirement. However, Chapter 4 allows either U-factors or R-values for compliance. This proposal is intended to provide the same flexibility as in Chapter 4. The use of U-factors is available in many codes including *ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings.* The U factors shown for compliance are for the assembly and correspond to the added R-values in Tables 502.2(1) and 502.2(3). They were developed by ASHRAE.
This proposal also includes U-factors for Residential Except Low-Rise Residential buildings, and is a companion to the R-value table proposed for this type of construction.
This proposal is to add U-factors as a prescriptive option to the R-values in Tables 502.2(1) and 502.2(3).

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

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

EC86–06/07
502.1.3 through 502.1.3.3 (New)

Proponent: Craig Conner, Building Quality, representing himself

Add new text as follows:

502.1.3 Overall UA and SHGC compliance. Compliance with the requirements for U-factor, SHGC, or both shall be permitted to be based on the overall building.

502.1.3.1 Total UA. If the total proposed building thermal envelope UA is less than or equal to the total standard building UA resulting from using Tables 502.1.2 and 502.3, then the building shall be considered in compliance with the U-factor requirements in Section 502.1.1. The total UA is the sum of the U-factor and C-factor times the assembly areas, plus the F-factor times the perimeter lengths.

502.1.3.2 Total SHGC. If the total proposed building fenestration SHGC for vertical fenestration and skylights is less than or equal the total SHGC for the standard building, the building shall be considered in compliance with the SHGC requirements in Table 502.3. The total SHGC is the sum of SHGC times the assembly areas.

502.1.3.3 Assembly areas for calculations. The assembly areas shall be the actual proposed assembly areas in both the proposed and standard building calculations, except as noted. If the proposed vertical fenestration area exceeds 40% of the above-grade wall area, then the standard vertical fenestration area shall be assumed to be 40% of the above-grade wall area. If the proposed skylight area exceeds 3% of the roof area, then the standard skylight area shall be assumed to be 3% of the roof area.

Reason: This adds simple UA and SHGC methods of compliance for commercial buildings. It is meant to be similar to the existing UA and SHGC approaches in the residential IECC.

[This code change anticipates a U-factor table, new Table 502.1.2, being submitted by Chuck Murray]

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

Analysis: Chuck Murray has submitted 2 code change proposals containing this new table.

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

EC87–06/07

Table 502.2(1)

Proponent: John Neff, Washington State Building Code Council, representing same

Revise table as follows:

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

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

For SI: 1 inch = 25.4 mm
ci — Continuous Insulation
NR – No Requirement

a. Thermal blocks are a minimum R-5 of rigid insulation, which extends 1-inch beyond the width of the purlin on each side, perpendicular to the purlin.
b. Assembly descriptions can be found in Table 502.2(2)
c. R-5.7 ci may be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 in. or less on center vertically and 48 in. or less on center horizontally, with ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu-in./h-f^2 F.
d. When heated slabs are placed below grade, below grade walls must meet the exterior insulation requirements for perimeter insulation according to the heated slab-on-grade construction.
e. Insulation is not required for mass walls in Climate Zone 3A located below the “Warm-Humid” line, and in Zone 3B.

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

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

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

EC88–06/07
Table 502.2(1)

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

Revise table as follows:

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

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

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

(Portions of table and footnotes not shown do not change)

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

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

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

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

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

EC89–06/07
Table 502.2(2)

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

Revise table as follows:

TABLE 502.2(2)
METAL BUILDING ASSEMBLY DESCRIPTIONS

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

(Portions of table now shown do not change)

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

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

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

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

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

EC90–06/07

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

Proponents: Julie Ruth, JRuth Code Consulting, representing the American Architectural Manufacturers Association
Charlie Curcija, Carlie, Inc., representing the American Architectural Manufacturers Association

1. Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

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

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

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

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

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

2. Revise as follows:

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

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

3. Add new text as follows:

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

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

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

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

4. Revise as follows:

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

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

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

where:

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

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

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

5. Add new text as follows:

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

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

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

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

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

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

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

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

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

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

Energy Cost Savings (in percent)

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

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

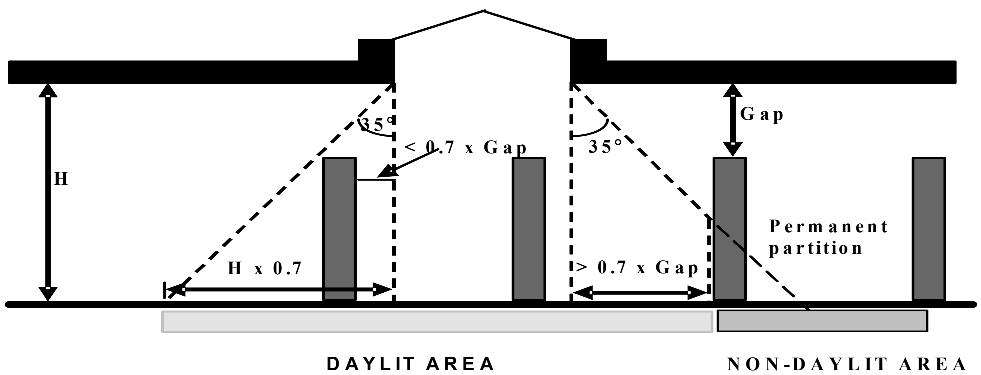


FIGURE 1: DAYLIT AREA UNDER SKYLIGHT

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

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

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

Analysis: Results of review of the proposed standard(s) will be posted on the ICC website by August 20, 2006.

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

EC91–06/07
Table 502.3

Proponent: Michael D. Fischer, The Kellen Company, representing The Window and Door Manufacturers Association

Revise table as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
***U*- Factor**								
~~**Framing materials other than metal with or without metal reinforcement or cladding**~~								
Entrance Door *U*- Factor	1.2	1.1	0.9	0.85	0.8	0.8	0.8	0.8
Vertical fenestration (other than entrance doors) [a.]								
~~*U* -Factor~~ 40% Glazing	1.05 ~~1.20~~	0.60 ~~0.75~~	0.55 ~~0.65~~	0.4	0.35	0.35	0.35	0.35
~~**Metal framing with or without thermal break**~~								
~~Curtain Wall/Storefront~~ ~~*U* -Factor~~ 35% Glazing	1.2	0.7	0.6	0.5	0.45	0.45	0.45	0.45
~~Entrance Door *U*- Factor~~	~~1.2~~	~~1.1~~	~~0.9~~	~~0.85~~	~~0.8~~	~~0.8~~	~~0.8~~	~~0.8~~
~~All Other *U*- Factor~~ 30% Glazing	1.40 ~~1.20~~	0.80 ~~0.75~~	0.70 ~~0.65~~	0.55	~~0.55~~ 0.5	~~0.55~~ 0.5	0.5	0.5
SHGC Vertical Fenestration-~~All Frame Types~~								
SHGC: PF < 0.25	0.25	0.25	0.25	0.4	0.4	0.4	NR	NR
SHGC: 0.25 ~ PF <0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ~ 0.5	0.4	0.4	0.4	NR	NR	NR	NR	NR
Skylights (3% maximum)								
Glass								
U -Factor	1.6	1.05	0.9	0.6	0.6	0.6	0.6	0.6
SHGC	0.4	0.4	0.4	0.4	0.4	0.4	NR	NR
Plastic								
U -Factor	1.9	1.9	1.3	1.3	1.3	0.9	0.9	0.6
SHGC	0.35	0.35	0.35	0.62	0.62	0.62	NR	NR

NR = No requirement.
PF = Projection factor (See Section 502.3.2)
a. ~~All others includes operable windows, fixed windows and non-entrance doors.~~ User shall select the 40% Glazing, 35% Glazing or 30% Glazing requirements based on the overall percentage of vertical fenestration to above-grade wall. These requirements shall apply to all vertical fenestration including fixed and operable windows, curtain wall, storefront glazing and doors other than entrance doors. Entrance door glazing area shall be included in the vertical fenestration area used to determine the appropriate fenestration U-factors.

Reason: The purpose for this change is to convert the vertical fenestration requirements of this table from material specific requirements to material neutral requirements. The current IECC requirements contain a material bias base upon the type of frame selected by the designer. The proponents believe that the energy efficiency requirements for fenestration should be more appropriately based solely upon product performance. In order to achieve the stated goal of material neutrality with basically the same level of stringency of energy efficiency requirements, this proposal recommends a limited reintroduction of window/glazing area into the commercial prescriptive fenestration requirements. It is important to remember that the PNNL and DOE study of window to wall ratio was based upon residential construction. While the proponents believe that some level of simplicity in the prescriptive tables will streamline code interpretation and facilitate compliance, the tremendous variety of glazing features and quantities across the spectrum of commercial construction does merit at least a limited consideration of the amount of glazing within these prescriptive values.

The existing table sets different levels of stringency for different framing material types. As a result, a building constructed with fenestration with non-metal frames would be considerably more efficient than a building constructed with metal frame fenestration. The reason given for this lack of material neutrality, which was adopted in the last code cycle, is that metal frame products could not meet the more stringent requirements established in the 2004 version of the code for all fenestration. Although the committee could have adopted the less stringent requirements for all frame types, the committee elected to adopt this discriminating treatment, with the expressed hope by many that a material neutral solution could be offered in the future. After considerable thought and consideration, WDMA determined that the most reasonable approach to maintain similar stringency, yet move to material neutrality, would be to reintroduce, on a limited basis, U-factor requirements that vary by glazing area.

In order to determine the values proposed above, the present requirements for curtain wall and storefront applications were set as a baseline for the 35% glazing level. Then the 40% and 30% levels were calculated by use of a simple ratio to increase or decrease values appropriately. Then the values were rounded down for conservative results.

This proposal results in eliminating material discrimination while permitting all frame types to be used. While the window area of projects using higher U-factors will be more limited, this is appropriate since such products are less energy efficient. If a designer wished to select such a product, then compliance using the methods in ASHRAE 90.1 remain as a solution to overall building performance.

In summary, the text below is drawn from the preface to the IECC:

> *"This code is founded on principles intended to establish provisions consistent with the scope of an energy conservation code that adequately conserves energy; provisions that do not unnecessarily increase construction costs; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction."*

The current IECC requirements are in direct conflict with this stated intent of the IECC by allowing different levels of energy efficiency for different window frame materials. This proposal solves that conflict while maintaining current levels of efficiency.

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

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

EC92–06/07
Table 502.3

Proponent: Michael D. Fischer, The Kellen Company, representing The Window and Door Manufacturers Association

Revise table as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 except Marine	5 and Marine 4	6	7	8
(No changes to vertical fenestration section of the table)								
Skylights (3% maximum)								
~~Glass~~								
~~*U*-Factor~~	~~1.6~~	~~1.05~~	~~0.9~~	~~0.6~~	~~0.6~~	~~0.6~~	~~0.6~~	~~0.6~~
~~SHGC~~	~~0.4~~	~~0.4~~	~~0.4~~	~~0.4~~	~~0.4~~	~~0.4~~	~~NR~~	~~NR~~
~~Plastic~~								
U-Factor	1.9	1.9	1.3	1.3	1.3	0.9	0.9	0.6

NR = No requirement.
PF = Projection factor (See Section 502.3.2)
a. All others includes operable windows, fixed windows and non-entrance doors.

Reason: The purpose for this change is to convert the skylight fenestration U-Factor and SHGC requirements of this table from material specific requirements to material neutral requirements. The current IECC requirements contain a material bias base upon the type of glazing material selected by the designer. The proponents believe that the energy efficiency requirements for skylights should be more appropriately based solely upon product performance.

This proposal results in eliminating material discrimination while permitting all glazing types to be used. In the previous code cycle, WDMA worked with other stakeholders to remove material biases from the energy code requirements, and did achieve some success. We made no secret of our goal to help develop an energy code that provides for the development of energy efficient products without any discrimination based upon the materials used.

In preparing this proposal, we were left with several choices. One would have been to remove the values currently assigned to plastic skylights, and require all products, regardless of glazing materials, to meet the glass values. That approach, while more energy efficient and certainly acceptable to the glass skylight manufacturers, would no doubt receive substantial opposition from other industry segments. The committee, then, is left with the problem. The ICC is in agreement with WDMA in its stated intentions regarding material neutrality as outlined below. The proponent asks the committee to carefully consider the available options to achieve that common goal, and select the best solution.

In summary, the text below is drawn from the preface to the IECC:

> "This code is founded on principles intended to establish provisions consistent with the scope of an energy conservation code that adequately conserves energy; provisions that do not unnecessarily increase construction costs; provisions that do not restrict the use of new materials, products or methods of construction; and provisions that do not give preferential treatment to particular types or classes of materials, products or methods of construction."

The current IECC requirements are in direct conflict with this stated intent of the IECC by allowing different levels of energy efficiency for different glazing materials. This proposal solves that conflict while maintaining current *minimum* levels of efficiency.

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

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

EC93–06/07
Table 502.3

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

Revise table as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
***U*-Factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-Factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront *U*-Factor	1.20	0.70	0.60	0.50	0.45	0.45	0.45	0.45
Entrance Door *U*-Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other *U*-Factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.50	0.50
SHGC-All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	NR	NR
SHGC: 0.25 ≤ PF < 0.5	<u>0.27</u> ~~0.33~~	<u>0.27</u> ~~0.33~~	<u>0.27</u> ~~0.33~~	<u>0.44</u> ~~NR~~	<u>0.44</u> ~~NR~~	<u>0.44</u> ~~NR~~	NR	NR
SHGC: PF ≥ 0.5	<u>0.30</u> ~~0.40~~	<u>0.30</u> ~~0.40~~	<u>0.30</u> ~~0.40~~	<u>0.48</u> ~~NR~~	<u>0.48</u> ~~NR~~	<u>0.48</u> ~~NR~~	NR	NR
Skylights (3% maximum)								
Glass								
U-Factor	1.60	1.05	0.90	0.60	0.60	0.60	0.60	0.60
SHGC	0.40	0.40	0.40	0.40	0.40	0.40	NR	NR
Plastic								
U-Factor	1.90	1.90	1.30	1.30	1.30	0.90	0.90	0.60
SHGC	0.35	0.35	0.35	0.62	0.62	0.62	NR	NR

NR = No requirement.
PF = Projection factor (See Section 502.3.2). <u>Where the user elects not to calculate the PF, the SHGC values for PF<0.25 shall be used.</u>
a. All others includes operable windows, fixed windows and non-entrance doors.

Reason: The purpose of this proposal is to modify the commercial fenestration SHGC requirements by projection factor to reflect a uniform method of determining such requirements. At present, in zones 4-6, there are no SHGC requirements with projection factors above 0.25. This approach is inconsistent with the approach to zones 1-3 and does not accurately reflect the effects of higher projection factors, which serve to increase, but not eliminate, the allowable SHGC.

Projection factors (PFs) reflect the effect of external permanent shading (overhangs) on the overall solar heat gain transmitted through glazing. The greater the PF, the lower the solar gain transmitted through the window. As a result, higher PFs permit the user to use higher SHGC glazing with the same overall building energy impact as a lower SHGC window with no overhang. In zones 1-3, Table 502.3 recognizes this effect by allowing maximum glazing SHGC value increases with increases in PF. Unfortunately, this principle was not applied to zones 4-6, where there is no requirement for situations with a PF above 0.25. This proposed code change is intended to correct this problem and make the glazing SHGC requirements accompanied by higher PFs in zones 4-6 of at least equal stringency to the SHGC requirement for a PF of less than 0.25. Without this correction, glazing with PFs above 0.25 will permit more overall heat gain than buildings with glazing less than a 0.25 PF.

There are two reasonable options to address this concern. A simple approach would be to assume the differentials used for zones 1-3 are reasonable and use the same differentials for zones 4-6. Using this approach would produce a 0.48 SHGC for 0.25≤PF<0.50 and 0.55 SHGC for PF≥0.50 in zones 4-6. At a minimum, the committee should adopt this approach. This approach has been utilized to develop a separate code change as an alternative for the committee to consider on this subject.

A more sophisticated and precise approach would be to adjust the values based on the SHGC multipliers from ASHRAE 90.1. Table 5.5.4.4.1 in ASHRAE 90.1 displays the SHGC multipliers for various projection factors for commercial buildings. According to this table, the multipliers vary depending on the orientation. Using these multipliers, one can determine the equivalent SHGC for each projection factor for each orientation. Since the simplified IECC table does not vary projection factor by orientation, it seems appropriate to use the most stringent value/orientation to ensure equivalence no matter what the actual orientation of the glazing. The most stringent value for a 25% projection factor is a multiplier of 0.91; for 50% the multiplier is 0.84. Accordingly, an equivalent SHGC to 0.40 (the baseline in zones 4-6) for a PF of 25% is 0.44 (0.40/0.91) and for a PF of 50% is 0.48 (0.40/0.84). (For the less stringent orientations, the SHGC values would be 0.49 and 0.60, respectively.) With this approach, the values for zones 1-3 should also be adjusted. Using 0.25 SHGC as a baseline, a PF of 25% would have an SHGC of 0.27 (0.25/0.91) and a PF of 50% would have an SHGC of 0.30 (0.25/0.91). This more precise approach is incorporated into this proposal.

A final option would be to further simplify the table by eliminating PF as a variable and simply using the baseline values (<0.25) as the values. Under this approach, those who wish to take credit for PF would use the performance path. This would eliminate the need for PF adjusted values. Finally, the note defining PF at the end of table should be revised to clarify that the user need not calculate the PF if their fenestration already meets the most stringent SHGC values. The following additional language is proposed "where the user elects not to calculate the PF, the SHGC values for PF<0.25 shall be used."

Given how critical solar control is for most commercial buildings, this correction is important for energy efficient construction. In J. Carmody, *et. al*., *Window Systems for High-Performance Buildings* (2004), the authors stress that commercial buildings will "typically have high cooling and low heating energy use requirements" because of the way they are designed and used (page 31). For example, the book analyzes a commercial building in Chicago (IECC climate zone 5) and notes that "[e]lectricity use increases as the SHGC increases" and "lower electricity use for cooling corresponds to windows with lower SHGC" (pages 27 and 33). Also, "[i]mproving the SHGC and U-factor of the window has the largest impact on reducing peak demand. . . . Even though higher-performance windows . . . may cost more initially, they may be offset by reduced costs for mechanical system components and the elimination of perimeter heating. In addition, operating costs will be less and people are likely to be more comfortable and productive" (page 39). These are just a few citations from the book highlighting the importance of low SHGCs for commercial buildings in all climate zones.

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

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

EC94–06/07
Table 502.3

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

Revise table as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
***U*-Factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-Factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront *U*-Factor	1.20	0.70	0.60	0.50	0.45	0.45	0.45	0.45
Entrance Door *U*-Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other *U*-Factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.50	0.50
SHGC-All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	NR	NR
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	0.48 ~~NR~~	0.48 ~~NR~~	0.48 ~~NR~~	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	0.55 ~~NR~~	0.55 ~~NR~~	0.55 ~~NR~~	NR	NR
Skylights (3% maximum)								
Glass								
U-Factor	1.60	1.05	0.90	0.60	0.60	0.60	0.60	0.60
SHGC	0.40	0.40	0.40	0.40	0.40	0.40	NR	NR
Plastic								
U-Factor	1.90	1.90	1.30	1.30	1.30	0.90	0.90	0.60
SHGC	0.35	0.35	0.35	0.62	0.62	0.62	NR	NR

NR = No requirement.
PF = Projection factor (See Section 502.3.2). Where the user elects not to calculate the PF, the SHGC values for PF<0.25 should be used.
a. All others includes operable windows, fixed windows and non-entrance doors.

Reason: The purpose of this proposal is to modify the commercial fenestration SHGC requirements by projection factor to reflect a uniform method of determining such requirements. At present, in zones 4-6, there are no SHGC requirements with projection factors above 0.25. This approach is inconsistent with the approach to zones 1-3 and does not accurately reflect the effects of higher projection factors, which serve to increase, but not eliminate, the allowable SHGC.

Projection factors (PFs) reflect the effect of external permanent shading (overhangs) on the overall solar heat gain transmitted through glazing. The greater the PF, the lower the solar gain transmitted through the window. As a result, higher PFs permit the user to use higher SHGC glazing with the same overall building energy impact as a lower SHGC window with no overhang. In zones 1-3, Table 502.3 recognizes this effect by allowing maximum glazing SHGC value increases with increases in PF. Unfortunately, this principle was not applied to zones 4-6, where there is no requirement for situations with a PF above 0.25. This proposed code change is intended to correct this problem and make the glazing SHGC requirements accompanied by higher PFs in zones 4-6 of at least equal stringency to the SHGC requirement for a PF of less than 0.25. Without this correction, glazing with PFs above 0.25 will permit more overall heat gain than buildings with glazing with less than a 0.25 PF.

There are two reasonable options to address this concern. A simple approach would be to assume the differentials used for zones 1-3 are reasonable and use the same differentials for zones 4-6. Using this approach would produce a 0.48 SHGC for 0.25 ≤ PF<0.50 and 0.55 SHGC for PF≥0.50 in zones 4-6. At a minimum, the committee should adopt this approach. This approach has been utilized to develop this proposal.

A more sophisticated and precise approach would be to adjust the values based on the SHGC multipliers from ASHRAE 90.1. Table 5.5.4.4.1 in ASHRAE 90.1 displays the SHGC multipliers for various projection factors for commercial buildings. According to this table, the multipliers vary depending on the orientation. Using these multipliers, one can determine the equivalent SHGC for each projection factor for each orientation. Since the simplified IECC table does not vary projection factor by orientation, it seems appropriate to use the most stringent value/orientation to ensure equivalence no matter what the actual orientation of the glazing. The most stringent value for a 25% projection factor is a multiplier of 0.91; for 50% the multiplier is 0.84. Accordingly, an equivalent SHGC to 0.40 (the baseline in zones 4-6) for a PF of 25% is 0.44 (0.40/0.91) and for a PF of 50% is 0.48 (0.40/0.84). (For the less stringent orientations, the SHGC values would be 0.49 and 0.60, respectively.) With this approach, the values for zones 1-3 should also be adjusted. Using 0.25 SHGC as a baseline, a PF of 25% would have an SHGC of 0.27 (0.25/0.91) and a PF of 50% would have an SHGC of 0.30 (0.25/0.91). We have offered this approach as an alternative in a separate proposed code change.

A final option would be to further simplify the table by eliminating PF as a variable and simply using the baseline values (<0.25) as the values. Under this approach, those who wish to take credit for PF would use the performance path. This would eliminate the need for PF adjusted values. Finally, the note defining PF at the end of table should be revised to clarify that the user need not calculate the PF if their fenestration already meets the most stringent SHGC values. The following additional language is proposed "where the user elects not to calculate the PF, the SHGC values for PF<0.25 should be used."

Given how critical solar control is for most commercial buildings, this correction is important for energy efficient construction. In J. Carmody, *et. al*., *Window Systems for High-Performance Buildings* (2004), the authors stress that commercial buildings will "typically have high cooling and low heating energy use requirements" because of the way they are designed and used (page 31). For example, the book analyzes a commercial building in Chicago (IECC climate zone 5) and notes that "[e]lectricity use increases as the SHGC increases" and "lower electricity use for cooling corresponds to windows with lower SHGC" (pages 27 and 33). Also, "[i]mproving the SHGC and U-factor of the window has the largest impact on reducing peak demand. . . . Even though higher-performance windows . . . may cost more initially, they may be offset by reduced costs for mechanical system components and the elimination of perimeter heating. In addition, operating costs will be less and people are likely to be more comfortable and productive" (page 39). These are just a few citations from the book highlighting the importance of low SHGCs for commercial buildings in all climate zones.

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

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

EC95–06/07
Table 502.3

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

Revise table as follows:

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
***U*-Factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-Factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront *U*-Factor	1.20	0.70	0.60	0.50	0.45	0.45	0.45	0.45
Entrance Door *U*-Factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All Other *U*-Factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.50	0.50
SHGC-All Frame Types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	NR	NR
SHGC: 0.25 ≤ PF <0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
~~Glass~~								
U-Factor	0.75 ~~1.60~~	0.75 ~~1.05~~	0.65 ~~0.90~~	0.60	0.60	0.60	0.60	0.60
SHGC	0.40	0.40	0.40	0.40	0.40	0.40	NR	NR
~~Plastic~~								
~~*U*-Factor~~	~~1.90~~	~~1.90~~	~~1.30~~	~~1.30~~	~~1.30~~	~~0.90~~	~~0.90~~	~~0.60~~
~~SHGC~~	~~0.35~~	~~0.35~~	~~0.35~~	~~0.62~~	~~0.62~~	~~0.62~~	~~NR~~	~~NR~~

NR = No requirement.
PF = Projection factor (See Section 502.3.2).
a. All others includes operable windows, fixed windows and non-entrance doors.

Reason: The purpose of this proposal is to eliminate the plastic and glass categories of skylights in the simplified prescriptive path and establish a single set of prescriptive values, in order to ensure consistent stringency regardless of the type of skylights chosen. This proposal establishes a single set of values by eliminating the less stringent plastic values and modifying the glass U-factors (they are presently different in climate zones 1-3) to reflect the same values as set for residential skylights. As a result, this proposal will ensure more energy efficient buildings.

As discussed in previous code cycles, material-neutral prescriptive requirements are an important objective. This can only be achieved if a single set of skylight values is adopted.

In essence, skylights are holes in what are otherwise highly insulated roofs. While there are certainly legitimate reasons for installing skylights, those reasons do not negate the need for requiring a reasonable level of energy efficiency for such products. There is no legitimate justification for different performance requirements for glass versus plastic skylights. Amazingly, the table presently allows plastic skylights that in some cases have energy losses more than twice the losses of glass skylights, and in some cases have solar heat gains more than 50% greater than glass skylights. This cannot be justified.

If plastic skylights cannot perform to a reasonable level, then the energy lost should be offset by energy gained through some other improved envelope component. This can only be done if more poorly performing skylights (whatever material they are constructed from) are required to use a trade-off path (e.g., ASHRAE 90.1 or COMCHECK) rather than the prescriptive path.

Some might argue for daylighting benefits from skylights. We agree that such benefits can occur. However, nothing in this 3% skylight exception suggests that such benefits can be obtained only by allowing poorer performing skylights from a U-factor and/or SHGC standpoint, particularly without requirements to ensure such daylighting benefits.

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

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

EC96–06/07
104.2, 202, 502.4.3, Chapter 6

Proponent: Wagdy Anis, AIA, Shepley Bulfinch Richardson and Abbott, Architects, representing same

1. Revise as follows:

104.2 Information on construction documents. Construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when approved by the code official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to, insulation materials and their R-values; fenestration U-factors and SHGCs; system and equipment efficiencies, types, sizes and controls; duct sealing, insulation and locations~~; and air sealing details~~. Air barrier components of each envelope assembly shall be clearly identified on construction documents and the joints, interconnections and penetrations of the air barrier components shall be detailed.

2. Add new text as follows:

AIR BARRIER. The combination of interconnected materials, assemblies, flexible sealed joints and components of the thermal building envelope that provide airtightness and controls infiltration.

3. Revise as follows:

502.4.3 Sealing of the building envelope. The building thermal envelope's opaque assemblies shall include an air barrier that shall control infiltration by:

1. Using materials that have an air permeance not exceeding 0.004 cfm/ft^2 at 0.3" w.g. (1.57psf) (0.02 L/s.m2 @ 75 Pa) in accordance with ASTM E 2178 or other approved method; or:
2. Using assemblies of materials and components that have an average air leakage not to exceed 0.04 cfm/ft^2 at 0.3" w.g. (1.57psf) (0.2 L/s.m^2 @ 75 Pa) in accordance with ASTM E 2357 or ASTM E 1677 or other approved method; or:
3. Testing the completed building and demonstrating that the air leakage rate does not exceed 0.40 cfm/ft^2 at 0.3" w.g. (1.57 psf) (2.0 L/s.m^2 @ 75 Pa) in accordance with ASTM E 779, or other approved method.

Openings and penetrations in the ~~building envelope~~ air barrier shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of construction materials.

4. Add standards to Chapter 6 as follows:

ASTM

E 2178-03	Standard Test Method for Air Permeance of Building Materials
E 2357-05	Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
E 1677-95 2000)	Standard Specification for an Air Retarder (AR) Material or System for Low-Rise Framed Building Walls
E 779-03	Standard for Test Method for Determining Air Leakage Rate by Fan Pressurization

Reason: Although the current code language addresses air sealing the end result is uncertain because there are no performance requirements to meet. The additional language ensures better attention will be given to achieving a tight envelope.

According to DOE and Oakridge National Labs studies air leakage accounts for up to 40% of energy loss. At the time when energy costs are rising at a rapid rate it is imperative to take every possible measure to conserve energy. This proposal enhances measures already adopted by the IECC. It defines and specifies the performance requirements of opaque assemblies. Studies of the air leakage of completed buildings, indicate that they are very leaky (See NIST report), and therefore more attention and accountability is needed to achieve a sealed envelope.

The most recent and perhaps most comprehensive study conducted by NIST titled "Investigation Of The Impact Of Commercial Building Envelope Air Tightness On HVAC Energy Use" summarizes the energy conservation potential well.

Bibliography: NISTIR 7238 "Investigation Of The Impact Of Commercial Building Envelope Air Tightness On HVAC Energy Use" by Stephen J Emmerich, Tim McDowell, Wagdy Anis Printed by National Institute Of Standards And Technology, US Department of Commerce.
Although the NIST report referenced above suggests that mass masonry walls in climate zones 1 and 2 may not be airtightened cost-effectively, subsequent information (EPA/Ruppelsberger test data) revealed that painting the block can achieve the airtightness required by the assembly air leakage under (b) above, which is cost effective.
http://fire.nist.gov/bfrlpubs/build05/art007.html

Cost Impact: Easily recoverable in the form of saved energy in a short period. See NIST report.

Analysis: Results of review of the proposed standard(s) will be posted on the ICC website by August 20, 2006.

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

EC97–06/07

104.2, 202, 502.4.3, 502.4.3.1 (New), 502.4.3.1.1 (New), Chapter 6

Proponent: Wagdy Anis, AIA, Shepley Bulfinch Richardson and Abbott, Architects, representing same

1. Revise as follows:

104.2 Information on construction documents. Construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when approved by the code official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to, insulation materials and their R-values; fenestration U-factors and SHGCs; system and equipment efficiencies, types, sizes and controls; duct sealing, insulation and locations~~; and air sealing details~~. Air barrier components of each envelope assembly shall be clearly identified on construction documents and the joints, interconnections and penetrations of the air barrier components shall be detailed.

2. Add new text as follows:

AIR BARRIER. The combination of interconnected materials, assemblies, flexible sealed joints and components of the thermal building envelope that provide airtightness and control infiltration.

3. Revise as follows:

502.4.3 Sealing of the building envelope. The building thermal envelope's opaque assemblies shall include an air barrier to control infiltration. Openings and penetrations in the ~~building envelope~~ air barrier shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of construction materials.

4. Add new text as follows:

502.4.3.1 Testing required. When the air barrier work is complete and the building sealed, an accredited testing agency shall test the building to demonstrate that the air leakage rate of the thermal building envelope does not exceed 0.40 cfm/ft^2 at 1.57 psf (2.0 L/s.m^2 @ 75 Pa) in accordance with ASTM E 779, or other approved method.

504.4.3.1.1 Remedial work and retesting. In the period up to January 1, 2010, in the event that initial test results are unsatisfactory, remedial work shall be performed, and the building shall be retested, showing an improvement of 75% of the difference between the initial test result and the target of 0.4 cfm/ft^2 at 1.57 lb/ft^2.

5. Add standard to Chapter 6 as follows:

ASTM

E 779-03 Standard for Test Method for Determining Air Leakage Rate by Fan Pressurization

Reason: Although the current code language addresses air sealing the end result is uncertain because there are no performance requirements to meet. The additional language ensures better attention will be given to achieving a tight envelope.

According to DOE and Oakridge National Labs studies air leakage accounts for up to 40% of energy loss. At the time when energy costs are rising at a rapid rate it is imperative to take every possible measure to conserve energy. This proposal enhances measures already adopted by the IECC. It defines and specifies the performance requirements of opaque assemblies. Studies of the air leakage of completed buildings, indicate that they are very leaky (See NIST report referenced below), and therefore more attention and accountability is needed to achieve a sealed envelope. This proposal has been substantially modified from the previous code development cycle, where the committee appreciated the importance of air tightening. It is more simplified and follows the committee's comments and observations, and provides a definitive method for proving compliance. The cost of testing varies from $1000 from a simple building to $10,000 for a major facility.

The most recent and perhaps most comprehensive study conducted by NIST titled "Investigation Of The Impact Of Commercial Building Envelope Air Tightness On HVAC Energy Use" summarizes the energy conservation potential well.

Bibliography: NISTIR 7238 "Investigation Of The Impact Of Commercial Building Envelope Air Tightness On HVAC Energy Use" by Stephen J Emmerich, Tim McDowell, Wagdy Anis Printed by National Institute Of Standards And Technology, US Department of Commerce.
Although the NIST report referenced above suggests that mass masonry walls in climate zones 1 and 2 may not be airtightened cost-effectively, subsequent information (EPA/Ruppelsberger test data) revealed that painting the block can achieve the airtightness required by the assembly air leakage under (b) above, which is cost effective.
http://fire.nist.gov/bfrlpubs/build05/art007.html

Cost Impact: Easily recoverable in the form of saved energy in a short period.

Analysis: Results of review of the proposed standard(s) will be posted on the ICC website by August 20, 2006.

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

EC98–06/07

502.4.4 (New), Table 502.4.4 (New)

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

Add new text as follows:

502.4.4 Hot gas bypass limitation. Cooling systems shall not use hot gas bypass or other evaporator pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation. The capacity of the hot gas bypass shall be limited as indicated below.

> **Exception:** Unitary packaged systems with cooling capacities not greater than 90,000 Btu/h

TABLE 502.4.4
MAXIMUM HOT GAS BYPASS CAPACITY

RATED CAPACITY	MAXIMUM HOT GAS BYPASS CAPACITY (% of Total Capacity)
≤ 240,000 Btu/h	50%
> 240,000 Btu/h	25%

(Renumber subsequent sections)

Reason: This proposal addresses hot gas bypass. While hot gas bypass is a somewhat technical concept, explanation of it is simple and enforcement should be simple as well. Hot gas bypass is simply a control strategy used in commercial cooling and refrigeration equipment that allows cooling compressors to remain online at low load and in colder weather by raising the condenser pressure. However, to accomplish this, this type of system does waste energy. Many new commercial cooling units do not use hot gas bypass, but those that do waste a lot of energy unless they also have capacity to modulate or unload capacity. Enforcement of this requirement would be limited to review of design specifications and HVAC system control information as required in Section 503.2.9.3, Manuals.

This proposal makes consistent (to the extent possible) the prescriptive text of the IECC and the corresponding text of the commercial reference standard – ASHRAE/IESNA Standard 90.1. The reference sections for ASHRAE/IESNA Standard 90.1 are taken from ANSI/ASHRAE/IESNA Standard 90.1-2004.

Cost Impact: The code change proposal may result in a slight cost increase for those commercial cooling systems that do not already employ these capacity modulation devices.

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

EC99–06/07

202 (New), 502.4.6

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

1. Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

BUILDING ENTRANCE. any doorway, set of doors, turnstiles, vestibules or other form of portal that is ordinarily used to gain access to the building by its users and occupants.

ENCLOSED SPACE. A volume substantially surrounded by solid surfaces such as walls, floors, roofs, and openable devices such as doors.

2. Revise as follows:

502.4.6 Vestibules. Building entrances ~~A door~~ that separate~~s~~ conditioned spaces from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through, it is not necessary for the interior and exterior doors to open at the same time. The exterior envelope of conditioned vestibules shall comply with the requirements for a conditioned space.The interior envelope of unconditioned vestibules shall comply with the requirements for a conditioned space.

Exceptions:

1. Buildings in Climate Zones 1 and 2 as indicated in Figure 301.1 and Table 301.1.
2. Building entrances in buildings that are located in Climate Zones 3 or 4, that are less than four stories above grade and less than 10,000 ft^2 (929 m^2) in area.
3. Building entrances in buildings that are located in Climate Zones 5, 6, 7 or 8 that are less than 1000 ft^2 (929 m^2) in area.
4. Doors not intended to be used as a building entrance door, ~~such as doors to mechanical or electrical equipment rooms.~~
5. Doors opening directly from a sleeping unit or dwelling unit.
6. Doors that open directly from an enclosed space less than 3,000 square feet (298 m^2) in area and is separate from the building entrance. The area of an enclosed space shall include the area of an adjacent space if the total opening between the two spaces is 25 square feet (2.3 m^2) or 8% of the floor area of the interior space, whichever is greater.
7. Building entrances with revolving doors.
8. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

Reason: The current language in IECC Section 502.4.6 is difficult to implement and does not provide adequate direction to either the designer or the enforcement agencies on when a vestibule is or is not required. Jurisdictions in the Las Vegas/Southern Nevada region and in Idaho have had difficulty implementing this requirement due to the lack of clear direction. The U.S. Department of Energy has deployed a “webcast” specifically on vestibules to help provide clarity. ASHRAE has re-evaluated the vestibule requirement for ASHRAE Standard 90.1-2004 and has issued Addenda C. The new language that is proposed is this code change makes the vestibule requirement consistent with the requirement in Addenda C.

Exemption 6 was added to help define a space. The current code does not define a space nor does it provide guidance on what to include in the 3,000 ft^2 if one space is connected to another space with an opening between the two. Exemption 6 takes language from the International Building Code that defines when an interior space can make use of natural ventilation from an exterior space due to air transfer between the two spaces. If ventilation transfer is found to be adequate then heat and cool transfer should also be adequate.

The addition of Enclosed Space and Building Entrance will also help clarify the requirement. These definitions will help enforcement personnel and designers determine which door will need a vestibule and also define what a space is.

The purpose of the proposed code change is to clarify the requirements for vestibules.

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

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

EC100–06/07
502.5

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing himself

Revise as follows:

502.5 Moisture control. (Mandatory). The building design shall not create conditions of accelerated deterioration from moisture condensation. All framed walls, floors and ceilings not ventilated to allow moisture to escape shall be provided with an approved vapor retarder having a permeance rating of 1 perm (5.7 × 10 –11 kg/Pa · s · m2) or less, when tested in accordance with the dessicant method using Procedure A of ASTM E 96. The vapor retarder shall be installed on the warm-in-winter side of the insulation.

Exceptions:

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

Reason: The current wording does not match with IECC 402.5. The proposed change, which involves a single sentence, will provide consistent language between IECC Chapters 4 and 5.

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

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

EC101–06/07

Tables 503.2.3(1)-(2)-(4)-(5), Table 504.2, 506.4.1

Proponent: Craig Conner, Building Quality, representing himself

Revise tables as follows:

TABLE 503.2.3(1)
UNITARY AIR CONDITIONING AND CONDENSING UNITS, ELECTRICALLY OPERATED MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air conditioners, Air cooled	~~<65,000 Btu/h~~[d]	~~Split System~~	~~10.0 SEER~~	ARI 210/240
		~~Single System~~	~~9.7 SEER~~	

~~d. Single-phase air-cooled air conditioners < 65,000 Btu/h are regulated by the National Appliance Energy Conservation Act of 1987 (NAECA), SEER values are those set by NAECA.~~

(Portions of table and footnotes not shown do not change)

TABLE 503.2.3(2)
UNITARY AND APPLIED HEAT PUMPS, ELECTRICALLY OPERATED MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air cooled (Cooling mode)	~~<65,000 Btu/h~~[d]	~~Split System~~	~~10.0 SEER~~	ARI 210/240
		~~Single System~~	~~9.7 SEER~~	
Air cooled (Heating mode)	~~<65,000 Btu/h~~[d]	~~Split System~~	~~6.8 HSPF~~	ARI 210/240
		~~Single System~~	~~6.6 HSPF~~	

~~d. Single-phase air-cooled heat pumps < 65,000 Btu/h are regulated by the National Appliance Energy Conservation Act of 1987 (NAECA), SEER and HSPF values are those set by NAECA.~~

(Portions of table and footnotes not shown do not change)

TABLE 503.2.3(4)
WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Warm air furnaces, gas fired	~~<225,000 Btu/h~~		~~78% AFUE~~ ~~or~~ 80% E_t[c]	~~DOE 10 CFR Part 430~~ or ANSI Z21.47
Warm air furnaces, oil fired	~~<225,000 Btu/h~~		~~78% AFUE~~ ~~or~~ 80% E_t[c]	~~DOE 10 CFR Part 430~~ or ANSI Z21.47

(Portions of table and footnotes not shown do not change)

TABLE 503.2.3(5)
BOILER, GAS- AND OIL-FIRED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Boiler, Gas fired	~~<300,000 Btu/h~~	~~Hot Water~~	~~80% AFUE~~	~~DOE 10 CFR Part 430~~
		~~Steam~~	~~75% AFUE~~	
Boiler, oil fired	~~<300,000 Btu/h~~		~~80% AFUE~~	~~DOE 10 CFR Part 430~~

(Portions of table and footnotes not shown do not change)

TABLE 504.2
MINIMUM PERFORMANCE OF WATER HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY (Input)	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED~~[a,b]~~	TEST PROCEDURE
Water heaters, Electric	~~< 12 W~~	~~Resistance~~	~~0.93–0.00132V, EF~~	~~DOE 10 CFR Part 430~~
	~~< 24 amps and < 250 volts~~	~~Heat pump~~	~~0.93–0.00132V, EF~~	~~DOE 10 CFR Part 430~~
Storage water heaters, Gas	~~<75,000 Btu/h~~	~~> 20 gal~~	~~0.93–0.00132V, EF~~	~~DOE 10 CFR Part 430~~
Instantaneous water heaters, Gas	~~>50,000 Btu/h and < 200,000 Btu/h[c]~~	~~> 4,000 (Btu/h)/gal and < 2 gal~~	~~0.62–0.0019V, EF~~	~~DOE 10 CFR Part 430~~
Storage water heaters, Oil	~~<105,000 Btu/h~~	~~> 20 gal~~	~~0.59–0.0019V, EF~~	~~DOE 10 CFR Part 430~~
Instantaneous water heaters, Oil	~~<210,000 Btu/h~~	~~> 4,000 (Btu/h)/gal and < 2 gal~~	~~0.59–0.0019V, EF~~	~~DOE 10 CFR Part 430~~

a. ~~Energy Factor (EF) and t~~Thermal efficiency (E_t) ~~are~~ is a minimum requirement~~s~~. ~~In the EF equation, V is rated volume in gallons.~~

(Portions of table and footnotes not shown do not change)

506.4.1 Equipment efficiency. The space-heating, space-cooling, service water-heating, and ventilation systems and equipment shall meet, but not exceed, the minimum efficiency requirements of Sections 503 and 504. For equipment regulated preemptively by Federal law, the assumed equipment efficiency shall be the prevailing Federal requirement.

Reason: This proposal deletes references to Federally mandated equipment efficiencies that are regulated by NAECA (National Appliance Energy Conservation Act). Such references can either be redundant (if current), or wrong (after Federal requirements change). Now that the 2006 Federal requirements have changed for SEER, the 2006 and earlier IECC requirement for air conditioner SEER will be incorrect and therefore overridden by Federal law (NAECA). Best to simply eliminate this confusion by removing the attempted repetition of Federal law.

The Equipment Efficiency Section of the performance method (Section 506.4.1) states that the user must use the efficiencies exactly as listed in Sections 503 and 504 for the standard design. The same section in the 2006 IECC would seem to mandate the use of 10 SEER air conditioners, even after Federal law requires the minimum of 13 SEER in 2006. However, the statement in the 2003 IECC and any future version is preemptively overridden by Federal law (NAECA) and therefore just invalid and confusing.

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

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

EC102–06/07
Tables 503.2.3(1), 503.2.3(2), 503.2.3(5), Chapter 6

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

1. Revise tables as follows:

TABLE 503.2.3(1)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUB-CATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[B]	TEST PROCEDURE[A]
Air Conditioners, Air Cooled	< 65,000 Btu/h[d]	Split System	~~10.0 SEER~~ 13.0 SEER	ARI 210/240
		Single Package	~~9.7 SEER~~ 13.0 SEER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split System and Single Package	10.3 EER[c] (before Jan 1, 2010) 11.0 EER[c] (as of Jan 1, 2010)	
	≥135,000 Btu/h and < 240,000 Btu/h	Split System and Single Package	9.7 EER[c] (before Jan 1, 2010) 11.0 EER[c] (as of Jan 1, 2010)	ARI 340/360
	≥ 240,000 Btu/h and <760,000 Btu/h	Split System and Single Package	9.5 EER[c] 9.7 IPLV[c] (before Jan 1, 2010) 10.0 EER[c] (as of Jan 1, 2010)	
	≥760,000 Btu/h	Split System and Single Package	9.2 EER[c] 9.4 IPLV[c] (before Jan 1, 2010) 9.7 EER[c] 9.4 IPLV[c] (as of Jan 1, 2010)	
Through-the-Wall, Air Cooled	<30,000 Btu/h[d]	Split System	10.9 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	ARI 210/240
		Single Package	10.6 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	
Air Conditioners, Water and Evaporatively Cooled	< 65,000 Btu/h	Split System and Single Package	12.1 EER	ARI 210/240
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split System and Single Package	11.5 EER[c]	
	≥135,000 Btu/h and <240,000 Btu/h	Split System and Single Package	11.0 EER[c]	ARI 340/360
	≥ 240,000 Btu/h	Split System and Single Package	11.0 EER[c] 10.3 IPLV[c]	

(No change to current footnotes)

TABLE 503.2.3(2)
UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY	SUB-CATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[B]	TEST PROCEDURE[A]
Air Cooled, (Cooling Mode)	< 65,000 Btu/h[d]	Split System	~~10.0 SEER~~ 13.0 SEER	ARI 210/240
		Single Package	~~9.7 SEER~~ 13.0 SEER	
	≥65,000 Btu/h and < 135,000 Btu/h	Split System and Single Package	10.1 EER[c] (before Jan 1, 2010) 11.0 EER[c] (as of Jan 1, 2010)	
	≥135,000 Btu/h and <240,000 Btu/h	Split System and Single Package	9.3 EER[c] (before Jan 1, 2010) 10.6 EER[c] (as of Jan 1, 2010)	ARI 340/360
	≥ 240,000 Btu/h	Split System and Single Package	9.0 EER[c] 9.2 IPLV[c] (before Jan 1, 2010) 9.5 EER[c] 9.2 IPLV[c] (as of Jan 1, 2010)	
Through-the-Wall (Air Cooled, Cooling Mode)	<30,000 Btu/h[d]	Split System	10.9 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	ARI 210/240
		Single Package	10.6 SEER (before Jan 23, 2010) 12.0 SEER (as of Jan 23, 2010)	
Water-Source (Cooling Mode)	< 17,000 Btu/h	86°F Entering Water	11.2 EER	ARI/ASHRAE-13256-1
	≥ 17,000 Btu/h and < 135,000 Btu/h	86°F Entering Water	12.0 EER	ARI/ASHRAE-13256-1
Groundwater-Source (Cooling Mode)	< 135,000 Btu/h	59°F Entering Water	16.2 EER	ARI/ASHRAE-13256-1
Ground Source (Cooling Mode)	< 135,000 Btu/h	77°F Entering Water	13.4 EER	ARI/ASHRAE-13256-1
Air Cooled (Heating Mode)	< 65,000 Btu/h[d] (Cooling Capacity)	Split System	~~6.8 HSPF~~ 7.7 HSPF	ARI 210/240
		Single Package	~~6.6 HSPF~~ 7.7 HSPF	
	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling Capacity)	47°F db/43°F wb Outdoor Air	3.2 COP	
	≥ 135,000 Btu/h (Cooling Capacity)	47°F db/43°F wb Outdoor Air	3.1 COP	ARI 340/360
Through-the-Wall (Air Cooled, Heating Mode)	< 30,000 Btu/h[2]	Split System	7.1 HSPE (before Jan 23, 2010 7.4 HSPF (as of Jan 23, 2010)	ARI 210/240
		Single Package	7.0 HSPF (before Jan 23, 2010) 7.4 HSPF (as of Jan 23, 2010)	

(Portions of table and footnotes not shown do not change)

TABLE 503.2.3(5)
BOILERS, GAS- AND OIL-FIRED, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE[F]	SIZE CATEGORY	SUB-CATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY[B]	TEST PROCEDURE
Boilers, Gas-Fired	< 300,000 Btu/h	Hot Water	80% AFUE	DOE 10 CFR Part 430
		Steam	75% AFUE	
	≥300,000 Btu/h and ≤ 2,500,000 Btu/h	Minimum Capacity[b]	75% E_t <ins>and 80% E_c</ins>	~~H.I.HBS~~ <ins>DOE 10 CFR Part 431</ins>
	> 2,500,000 Btu/h[f]	Hot Water	80% E_c	
		Steam	80% E_c	
Boilers, Oil-Fired	< 300,000 Btu/h	--------	80% AFUE	DOE 10 CFR Part 430
	≥300,000 Btu/h and ≤ 2,500,000 Btu/h	Minimum Capacity[b]	78% E_t <ins>and 83% E_c</ins>	~~H.I.HBS~~ <ins>DOE 10 CFR Part 431</ins>
	> 2,500,000 Btu/h[a]	Hot Water	83% E_c	
		Steam	83% E_c	
Boilers Oil-Fired (Residual)	≥300,000 Btu/h and ≤2,500,000 Btu/h	Miniimum Capacity[b]	78% E_t <ins>and 83% E_c</ins>	~~H.I.HBS~~ <ins>DOE 10 CFR Part 431</ins>
	> 2,500,000 Btu/h[a]	Hot Water	83% E_c	
		Steam	83% E_c	

(No change to current footnotes)

2. Revise standards in Chapter 6 as follows:

ARI 340/360-~~2000~~ <ins>2004</ins> Commercial and Unitary Air-conditioning and Heat Pump Equipment

<ins>DOE 10 CFR Part 431, Subpart E (2004) Test Procedures and Efficiency Standards for Commercial Packaged Boilers Table 503.2.3(5)</ins>

~~**HI** Hydronics Institute, Division of the Gas Appliance Manufacturers Association.~~
~~P.O. Box 218~~
~~Berkeley Heights, NJ 07054~~
~~Standard Referenced~~
~~HBS I=B=R - Testing and Rating Standard for Heating Boilers, 1989 Ed . . . Table 503.2.2(5)~~

Reason: Update requirements per 2005 Federal Energy Policy Act (EPAct) and per national standard ASHRAE/IESNA Standard 90.1-2004.

- Table 503.2.3(1), (air conditioners): delete outdated material, update requirements per 2005 EPAct and per national standard ASHRAE/IESNA Standard 90.1-2004 addendum f and addendum g.
- Table 503.2.3(1), (through-the-wall air conditioners): update requirements per national standard ASHRAE/IESNA Standard 90.1-2004.
- Table 503.2.3(2), (heat pumps): delete outdated material, update requirements per 2005 EPAct and per national standard ASHRAE/IESNA Standard 90.1-2004 addendum f and addendum g.
  Table 503.2.3(5), (boilers): update requirements per national standard ASHRAE/IESNA Standard 90.1-2004 addendum t.
  The purpose of the code change proposal is to update equipment requirements to match federal standards.

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

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

EC103–06/07

Tables 503.2.3(7) through (10), Tables 503.2.3(11) through (14) (New)

Proponents: Harry Misuriello, representing the Alliance to Save Energy, American Council for an Energy-Efficient Economy; Steven Nadel, American Council for an Energy-Efficient Economy, representing the Alliance to Save Energy, American Council for an Energy-Efficient Economy; Mark Frankel, new Buildings Institute, representing the Alliance to Save Energy, American Council for an Energy-Efficient Economy

1. Delete tables and substitute as follows:

~~TABLE 503.2.3(7)~~
~~WATER CHILLING PACKAGES, MINIMUM EFFICIENCY REQUIREMENTS~~

~~TABLE 503.2.3(8)~~
~~COPs AND IPLVs FOR NONSTANDARD CENTRIFUGAL CHILLERS < 150 TONS~~

~~TABLE 503.2.3(9)~~
~~COPs AND IPLVs FOR NONSTANDARD CENTRIFUGAL CHILLERS ≥ 150 TONS, ≤ 300 TONS~~

~~TABLE 503.2.3(10)~~
~~COPs AND IPLVs FOR NONSTANDARD CENTRIFUGAL CHILLERS > 300 TONS~~

TABLE 503.2.3(7)
WATER CHILLING PACKAGES, MINIMUM EFFICIENCY REQUIREMENTS

(UNDERLINING OMITTED FOR CLARITY)

Equipment Type Electrically-Operated Chillers	**Size Category**	**PATH A Required Efficiency-chillers with ASDs or without ASDs (See note g.)**		**PATH B Required Efficiency-Chillers with ASDs optional compliance path (See note g.)**	
		Full Load (kW/ton)	IPLV (kW/ton)	Full Load (kW/ton)	IPLV (kW/ton)
Air cooled w/ condenser	All	1.2	1.0	N/A	N/A
Air cooled w/o condenser	All	1.08	1.08	N/A	N/A
Water cooled, reciprocating	All	0.840	0.630	N/A	N/A
Water cooled, rotary screw and scroll (positive displacement)	< 100 tons	0.780	0.600	N/A	N/A
	≥100 tons and < 150 tons	0.730	0.550	N/A	N/A
	≥150 tons and ≤ 300 tons	0.610	0.510	N/A	N/A
	> 300 tons	0.600	0.490	N/A	N/A
Water cooled, centrifugal	< 150 tons	0.610	0.620	0.630	0.410
	≥150 tons and ≤ 300 tons	0.590	0.560	0.610	0.410
	> 300 tons and ≤ 600 tons	0.570	0.510	0.590	0.400
	> 600 tons	0.550	0.510	0.570	0.400
Equipment Type Absorption Chillers	Size Category	Required Efficiency Full load COP (IPLV) (See note g.)			
Air cooled, single effect	All Capacities	0.60, but only allowed in heat recovery applications			
Water cooled, single effect	All Capacities	0.70, but only allowed in heat recovery applications			
Double effect – direct fired	All Capacities	1.0(1.05)			
Double effect – indirect fired	All Capacities	1.20			

a. Compliance with full load efficiency numbers and IPLV numbers are both required.
b. Systems with single chillers that operate on 460/480V require ASDs. ASDs are optional in multiple chiller systems.
c. Electrically-operated chiller packages shall be tested in accordance with ARI Standard 550/590
d. Absorption chillers shall be tested in accordance with ARI Standard 560
e. Chapter 6 contains a complete specification of the referenced test procedures, including the referenced year version of the test procedure.
f. Water-cooled centrifugal water-chilling packages that are not designed for operation at ARI Standard 550/590 test conditions (and thus cannot be tested to meet the requirements of Table 503.2.3(7)) of 44 degrees F leaving chilled water temperature and 85 degrees F entering condenser water temperature shall meet the applicable full load and IPLV/NPLV requirements in Tables 503.2.3(8) through 503.2.3(15) for "Path A" and in Tables 503.2.3(16 through 503..2.3(21) for "Path B."
g. The chiller equipment requirements do not apply for chillers used in low temperature applications where the design leaving fluid temperature in less than or equal to 40 degrees F.

TABLE 503.2.3(8)
PATH A - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.49	0.47	0.46	0.44	0.42	0.41
45	75	30	0.50	0.48	0.47	0.45	0.43	0.42
44	75	31	0.51	0.49	0.47	0.46	0.44	0.43
43	75	32	0.52	0.50	0.48	0.46	0.45	0.44
42	75	33	0.52	0.50	0.49	0.47	0.46	0.45
41	75	34	0.53	0.51	0.50	0.48	0.47	0.46
46	80	34	0.53	0.51	0.50	0.48	0.47	0.46
40	75	35	0.54	0.52	0.50	0.49	0.48	0.47
45	80	35	0.54	0.52	0.50	0.49	0.48	0.47
44	80	36	0.55	0.53	0.51	0.49	0.48	0.48
43	80	37	0.56	0.53	0.52	0.50	0.49	0.48
42	80	38	0.57	0.54	0.53	0.51	0.50	0.49
41	80	39	0.58	0.55	0.53	0.52	0.51	0.50
46	85	39	0.58	0.55	0.53	0.52	0.51	0.50
40	80	40	0.60	0.56	0.54	0.52	0.51	0.51
45	85	40	0.60	0.56	0.54	0.52	0.51	0.51
44	85	41	0.62	0.57	**0.55**	0.53	0.52	0.51
43	85	42	0.64	0.59	0.56	0.54	0.53	0.52
42	85	43	0.66	0.60	0.57	0.55	0.54	0.53
41	85	44	0.69	0.62	0.59	0.56	0.55	0.54
40	85	45	0.72	0.64	0.60	0.57	0.55	0.55
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

The following applies to the above table and all the following tables :

- LIFT = Entering Condenser Water Temperature - Leaving Chilled Water Temperature
- Cond DT = Leaving Condenser Water Temperature(F) - Entering Condenser Water Temperature(F)
- Kadj = 6.1507 - 0.30244(X) + 0.0062692(X)2 - 0.000045595(X)3 where X = Cond DT + LIFT
- kW/ton adj = kW/tonstd / Kadj

TABLE 503.2.3(9)
PATH A - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 300 Tons < 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.51	0.49	0.47	0.45	0.44	0.43
45	75	30	0.52	0.50	0.48	0.46	0.45	0.44
44	75	31	0.53	0.51	0.49	0.47	0.46	0.45
43	75	32	0.53	0.51	0.50	0.48	0.47	0.46
42	75	33	0.54	0.52	0.51	0.49	0.48	0.47
41	75	34	0.55	0.53	0.52	0.50	0.49	0.48
46	80	34	0.55	0.53	0.52	0.50	0.49	0.48
40	75	35	0.56	0.54	0.52	0.51	0.49	0.49
45	80	35	0.56	0.54	0.52	0.51	0.49	0.49
44	80	36	0.57	0.54	0.53	0.51	0.50	0.49
43	80	37	0.58	0.55	0.54	0.52	0.51	0.50
42	80	38	0.59	0.56	0.55	0.53	0.52	0.51
41	80	39	0.60	0.57	0.55	0.53	0.52	0.52
46	85	39	0.60	0.57	0.55	0.53	0.52	0.52
40	80	40	0.62	0.58	0.56	0.54	0.53	0.52
45	85	40	0.62	0.58	0.56	0.54	0.53	0.52
44	85	41	0.64	0.59	**0.57**	0.55	0.54	0.53
43	85	42	0.66	0.61	0.58	0.56	0.55	0.54
42	85	43	0.68	0.62	0.60	0.57	0.56	0.55
41	85	44	0.71	0.64	0.61	0.58	0.56	0.56
40	85	45	0.75	0.66	0.63	0.59	0.57	0.57
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(10)
PATH A - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 150 Tons < 300 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.53	0.51	0.49	0.47	0.45	0.44
45	75	30	0.54	0.52	0.50	0.48	0.46	0.45
44	75	31	0.55	0.52	0.51	0.49	0.47	0.46
43	75	32	0.55	0.53	0.52	0.50	0.48	0.48
42	75	33	0.56	0.54	0.53	0.51	0.49	0.49
41	75	34	0.57	0.55	0.53	0.51	0.50	0.49
46	80	34	0.57	0.55	0.53	0.51	0.50	0.49
40	75	35	0.58	0.56	0.54	0.52	0.51	0.50
45	80	35	0.58	0.56	0.54	0.52	0.51	0.50
44	80	36	0.59	0.56	0.55	0.53	0.52	0.51
43	80	37	0.60	0.57	0.56	0.54	0.53	0.52
42	80	38	0.61	0.58	0.56	0.55	0.54	0.53
41	80	39	0.63	0.59	0.57	0.55	0.54	0.54
46	85	39	0.63	0.59	0.57	0.55	0.54	0.54
40	80	40	0.64	0.60	0.58	0.56	0.55	0.54
45	85	40	0.64	0.60	0.58	0.56	0.55	0.54
44	85	41	0.66	0.61	0.59	0.57	0.56	0.55
43	85	42	0.68	0.63	0.60	0.58	0.57	0.56
42	85	43	0.71	0.65	0.62	0.59	0.58	0.57
41	85	44	0.74	0.66	0.63	0.60	0.58	0.58
40	85	45	0.77	0.69	0.65	0.61	0.60	0.59
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(11)
PATH A - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS < 150 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.55	0.53	0.51	0.48	0.47	0.46
45	75	30	0.56	0.53	0.52	0.49	0.48	0.47
44	75	31	0.56	0.54	0.53	0.50	0.49	0.48
43	75	32	0.57	0.55	0.53	0.51	0.50	0.49
42	75	33	0.58	0.56	0.54	0.52	0.51	0.50
41	75	34	0.59	0.57	0.55	0.53	0.52	0.51
46	80	34	0.59	0.57	0.55	0.53	0.52	0.51
40	75	35	0.60	0.57	0.56	0.54	0.53	0.52
45	80	35	0.60	0.57	0.56	0.54	0.53	0.52
44	80	36	0.61	0.58	0.57	0.55	0.54	0.53
43	80	37	0.62	0.59	0.58	0.56	0.55	0.54
42	80	38	0.63	0.60	0.58	0.56	0.55	0.55
41	80	39	0.65	0.61	0.59	0.57	0.56	0.55
46	85	39	0.65	0.61	0.59	0.57	0.56	0.55
40	80	40	0.66	0.62	0.60	0.58	0.57	0.56
45	85	40	0.66	0.62	0.60	0.58	0.57	0.56
44	85	41	0.68	0.64	0.61	0.59	0.58	0.57
43	85	42	0.70	0.65	0.62	0.60	0.59	0.58
42	85	43	0.73	0.67	0.64	0.61	0.59	0.59
41	85	44	0.76	0.69	0.65	0.62	0.60	0.60
40	85	45	0.80	0.71	0.67	0.63	0.62	0.61
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

2. Add new tables as follows:

TABLE 503.2.3(12)
PATH A - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.51	0.49	0.47	0.45	0.44	0.43
45	75	30	0.52	0.50	0.48	0.46	0.45	0.44
44	75	31	0.53	0.51	0.49	0.47	0.46	0.45
43	75	32	0.53	0.51	0.50	0.48	0.47	0.46
42	75	33	0.54	0.52	0.51	0.49	0.48	0.47
41	75	34	0.55	0.53	0.52	0.50	0.49	0.48
46	80	34	0.55	0.53	0.52	0.50	0.49	0.48
40	75	35	0.56	0.54	0.52	0.51	0.49	0.49
45	80	35	0.56	0.54	0.52	0.51	0.49	0.49
44	80	36	0.57	0.54	0.53	0.51	0.50	0.49
43	80	37	0.58	0.55	0.54	0.52	0.51	0.50
42	80	38	0.59	0.56	0.55	0.53	0.52	0.51
41	80	39	0.60	0.57	0.55	0.53	0.52	0.52
46	85	39	0.60	0.57	0.55	0.53	0.52	0.52
40	80	40	0.62	0.58	0.56	0.54	0.53	0.52
45	85	40	0.62	0.58	0.56	0.54	0.53	0.52
44	85	41	0.64	0.59	**0.57**	0.55	0.54	0.53
43	85	42	0.66	0.61	0.58	0.56	0.55	0.54
42	85	43	0.68	0.62	0.60	0.57	0.56	0.55
41	85	44	0.71	0.64	0.61	0.58	0.56	0.56
40	85	45	0.75	0.66	0.63	0.59	0.57	0.57
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(13)
PATH A - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 300 TONS AND < 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.46	0.44	0.42	0.40	0.39	0.38
45	75	30	0.47	0.45	0.43	0.41	0.40	0.39
44	75	31	0.47	0.45	0.44	0.42	0.41	0.40
43	75	32	0.48	0.46	0.45	0.43	0.42	0.41
42	75	33	0.49	0.47	0.45	0.44	0.43	0.42
41	75	34	0.49	0.47	0.46	0.44	0.43	0.43
46	80	34	0.49	0.47	0.46	0.44	0.43	0.43
40	75	35	0.50	0.48	0.47	0.45	0.44	0.44
45	80	35	0.50	0.48	0.47	0.45	0.44	0.44
44	80	36	0.51	0.49	0.47	0.46	0.45	0.44
43	80	37	0.52	0.49	0.48	0.47	0.46	0.45
42	80	38	0.53	0.50	0.49	0.47	0.46	0.46
41	80	39	0.54	0.51	0.50	0.48	0.47	0.46
46	85	39	0.54	0.51	0.50	0.48	0.47	0.46
40	80	40	0.55	0.52	0.50	0.49	0.48	0.47
45	85	40	0.55	0.52	0.50	0.49	0.48	0.47
44	85	41	0.57	0.53	**0.51**	0.49	0.48	0.48
43	85	42	0.59	0.54	0.52	0.50	0.49	0.48
42	85	43	0.61	0.56	0.53	0.51	0.50	0.49
41	85	44	0.64	0.57	0.55	0.52	0.51	0.50
40	85	45	0.67	0.59	0.56	0.53	0.51	0.51
Condenser ∆T			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(14)
PATH A - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 150 TONS < 300

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.50	0.48	0.47	0.44	0.43	0.42
45	75	30	0.51	0.49	0.48	0.45	0.44	0.43
44	75	31	0.52	0.50	0.48	0.46	0.45	0.44
43	75	32	0.53	0.51	0.49	0.47	0.46	0.45
42	75	33	0.53	0.51	0.50	0.48	0.47	0.46
41	75	34	0.54	0.52	0.51	0.49	0.48	0.47
46	80	34	0.54	0.52	0.51	0.49	0.48	0.47
40	75	35	0.55	0.53	0.51	0.50	0.49	0.48
45	80	35	0.55	0.53	0.51	0.50	0.49	0.48
44	80	36	0.56	0.53	0.52	0.50	0.49	0.49
43	80	37	0.57	0.54	0.53	0.51	0.50	0.49
42	80	38	0.58	0.55	0.54	0.52	0.51	0.50
41	80	39	0.59	0.56	0.54	0.53	0.52	0.51
46	85	39	0.59	0.56	0.54	0.53	0.52	0.51
40	80	40	0.61	0.57	0.55	0.53	0.52	0.52
45	85	40	0.61	0.57	0.55	0.53	0.52	0.52
44	85	41	0.63	0.58	0.56	0.54	0.53	0.52
43	85	42	0.65	0.60	0.57	0.55	0.54	0.53
42	85	43	0.67	0.61	0.58	0.56	0.55	0.54
41	85	44	0.70	0.63	0.60	0.57	0.56	0.55
40	85	45	0.73	0.65	0.61	0.58	0.56	0.56
Condenser ∆T			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(15)
PATH A - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS < 150 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.56	0.53	0.52	0.49	0.48	0.46
45	75	30	0.57	0.54	0.53	0.50	0.49	0.48
44	75	31	0.57	0.55	0.54	0.51	0.50	0.49
43	75	32	0.58	0.56	0.54	0.52	0.51	0.50
42	75	33	0.59	0.57	0.55	0.53	0.52	0.51
41	75	34	0.60	0.58	0.56	0.54	0.53	0.52
46	80	34	0.60	0.58	0.56	0.54	0.53	0.52
40	75	35	0.61	0.58	0.57	0.55	0.54	0.53
45	80	35	0.61	0.58	0.57	0.55	0.54	0.53
44	80	36	0.62	0.59	0.58	0.56	0.55	0.54
43	80	37	0.63	0.60	0.58	0.57	0.55	0.55
42	80	38	0.64	0.61	0.59	0.57	0.56	0.55
41	80	39	0.66	0.62	0.60	0.58	0.57	0.56
46	85	39	0.66	0.62	0.60	0.58	0.57	0.56
40	80	40	0.67	0.63	0.61	0.59	0.58	0.57
45	85	40	0.67	0.63	0.61	0.59	0.58	0.57
44	85	41	0.69	0.65	0.62	0.60	0.59	0.58
43	85	42	0.72	0.66	0.63	0.61	0.60	0.59
42	85	43	0.74	0.68	0.65	0.62	0.60	0.60
41	85	44	0.77	0.70	0.66	0.63	0.61	0.61
40	85	45	0.81	0.72	0.68	0.64	0.63	0.62
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(16)
PATH B - FULL LOAD-EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.51	0.49	0.47	0.45	0.44	0.43
45	75	30	0.52	0.50	0.48	0.46	0.45	0.44
44	75	31	0.53	0.51	0.49	0.47	0.46	0.45
43	75	32	0.53	0.51	0.50	0.48	0.47	0.46
42	75	33	0.54	0.52	0.51	0.49	0.48	0.47
41	75	34	0.55	0.53	0.52	0.50	0.49	0.48
46	80	34	0.55	0.53	0.52	0.50	0.49	0.48
40	75	35	0.56	0.54	0.52	0.51	0.49	0.49
45	80	35	0.56	0.54	0.52	0.51	0.49	0.49
44	80	36	0.57	0.54	0.53	0.51	0.50	0.49
43	80	37	0.58	0.55	0.54	0.52	0.51	0.50
42	80	38	0.59	0.56	0.55	0.53	0.52	0.51
41	80	39	0.60	0.57	0.55	0.53	0.52	0.52
46	85	39	0.60	0.57	0.55	0.53	0.52	0.52
40	80	40	0.62	0.58	0.56	0.54	0.53	0.52
45	85	40	0.62	0.58	0.56	0.54	0.53	0.52
44	85	41	0.64	0.59	**0.57**	0.55	0.54	0.53
43	85	42	0.66	0.61	0.58	0.56	0.55	0.54
42	85	43	0.68	0.62	0.60	0.57	0.56	0.55
41	85	44	0.71	0.64	0.61	0.58	0.56	0.56
40	85	45	0.75	0.66	0.63	0.59	0.57	0.57
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(17)
PATH B - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 300 TONS < 600 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.53	0.51	0.49	0.47	0.45	0.44
45	75	30	0.54	0.52	0.50	0.48	0.46	0.45
44	75	31	0.55	0.52	0.51	0.49	0.47	0.46
43	75	32	0.55	0.53	0.52	0.50	0.48	0.48
42	75	33	0.56	0.54	0.53	0.51	0.49	0.49
41	75	34	0.57	0.55	0.53	0.51	0.50	0.49
46	80	34	0.57	0.55	0.53	0.51	0.50	0.49
40	75	35	0.58	0.56	0.54	0.52	0.51	0.50
45	80	35	0.58	0.56	0.54	0.52	0.51	0.50
44	80	36	0.59	0.56	0.55	0.53	0.52	0.51
43	80	37	0.60	0.57	0.56	0.54	0.53	0.52
42	80	38	0.61	0.58	0.56	0.55	0.54	0.53
41	80	39	0.63	0.59	0.57	0.55	0.54	0.54
46	85	39	0.63	0.59	0.57	0.55	0.54	0.54
40	80	40	0.64	0.60	0.58	0.56	0.55	0.54
45	85	40	0.64	0.60	0.58	0.56	0.55	0.54
44	85	41	0.66	0.61	**0.59**	0.57	0.56	0.55
43	85	42	0.68	0.63	0.60	0.58	0.57	0.56
42	85	43	0.71	0.65	0.62	0.59	0.58	0.57
41	85	44	0.74	0.66	0.63	0.60	0.58	0.58
40	85	45	0.77	0.69	0.65	0.61	0.60	0.59
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(18)
PATH B - FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS ≥ 150 TONS < 300 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.55	0.53	0.51	0.48	0.47	0.46
45	75	30	0.56	0.53	0.52	0.49	0.48	0.47
44	75	31	0.56	0.54	0.53	0.50	0.49	0.48
43	75	32	0.57	0.55	0.53	0.51	0.50	0.49
42	75	33	0.58	0.56	0.54	0.52	0.51	0.50
41	75	34	0.59	0.57	0.55	0.53	0.52	0.51
46	80	34	0.59	0.57	0.55	0.53	0.52	0.51
40	75	35	0.60	0.57	0.56	0.54	0.53	0.52
45	80	35	0.60	0.57	0.56	0.54	0.53	0.52
44	80	36	0.61	0.58	0.57	0.55	0.54	0.53
43	80	37	0.62	0.59	0.58	0.56	0.55	0.54
42	80	38	0.63	0.60	0.58	0.56	0.55	0.55
41	80	39	0.65	0.61	0.59	0.57	0.56	0.55
46	85	39	0.65	0.61	0.59	0.57	0.56	0.55
40	80	40	0.66	0.62	0.60	0.58	0.57	0.56
45	85	40	0.66	0.62	0.60	0.58	0.57	0.56
44	85	41	0.68	0.64	0.61	0.59	0.58	0.57
43	85	42	0.70	0.65	0.62	0.60	0.59	0.58
42	85	43	0.73	0.67	0.64	0.61	0.59	0.59
41	85	44	0.76	0.69	0.65	0.62	0.60	0.60
40	85	45	0.80	0.71	0.67	0.63	0.62	0.61
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(19)
PATH B – FULL-LOAD EFFICIENCY FOR NON-STANDARD CENTRIFUGAL CHILLERS < 150 TONS

Leaving Chilled Water Temperature(F)	**Entering Condenser Water Temperature(F)**	**Lift[a]**	**Condenser Flow Rate**					
			2 gpm/ton	**2.5 gpm/ton**	**3 gpm/ton**	**4 gpm/ton**	**5 gpm/ton**	**6 gpm/ton**
			Required kW/ton					
46	75	29	0.57	0.54	0.52	0.50	0.48	0.47
45	75	30	0.57	0.55	0.53	0.51	0.50	0.48
44	75	31	0.58	0.56	0.54	0.52	0.51	0.50
43	75	32	0.59	0.57	0.55	0.53	0.52	0.51
42	75	33	0.60	0.58	0.56	0.54	0.53	0.52
41	75	34	0.61	0.58	0.57	0.55	0.54	0.53
46	80	34	0.61	0.58	0.57	0.55	0.54	0.53
40	75	35	0.62	0.59	0.58	0.56	0.55	0.54
45	80	35	0.62	0.59	0.58	0.56	0.55	0.54
44	80	36	0.63	0.60	0.59	0.57	0.55	0.55
43	80	37	0.64	0.61	0.59	0.57	0.56	0.56
42	80	38	0.65	0.62	0.60	0.58	0.57	0.56
41	80	39	0.67	0.63	0.61	0.59	0.58	0.57
46	85	39	0.67	0.63	0.61	0.59	0.58	0.57
40	80	40	0.69	0.64	0.62	0.60	0.59	0.58
45	85	40	0.69	0.64	0.62	0.60	0.59	0.58
44	85	41	0.70	0.66	0.63	0.61	0.60	0.59
43	85	42	0.73	0.67	0.64	0.62	0.60	0.60
42	85	43	0.75	0.69	0.66	0.63	0.61	0.61
41	85	44	0.79	0.71	0.67	0.64	0.62	0.61
40	85	45	0.82	0.73	0.69	0.65	0.64	0.63
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(20)
PATH B - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS > 300 TONS

Leaving Chilled Water Temperature(F)	**Entering Condenser Water Temperature(F)**	**Lift[a]**	**Condenser Flow Rate**					
			2 gpm/ton	**2.5 gpm/ton**	**3 gpm/ton**	**4 gpm/ton**	**5 gpm/ton**	**6 gpm/ton**
			Required kW/ton					
46	75	29	0.36	0.34	0.33	0.32	0.31	0.30
45	75	30	0.36	0.35	0.34	0.32	0.31	0.31
44	75	31	0.37	0.3 6	0.35	0.33	0.32	0.32
43	75	32	0.38	0.36	0.35	0.34	0.33	0.32
42	75	33	0.38	0.37	0.36	0.34	0.33	0.33
41	75	34	0.39	0.37	0.36	0.35	0.34	0.34
46	80	34	0.39	0.37	0.36	0.35	0.34	0.34
40	75	35	0.39	0.38	0.37	0.35	0.35	0.34
45	80	35	0.39	0.38	0.37	0.35	0.35	0.34
44	80	36	0.40	0.38	0.37	0.36	0.35	0.35
43	80	37	0.41	0.39	0.38	0.36	0.36	0.35
42	80	38	0.41	0.39	0.38	0.37	0.36	0.36
41	80	39	0.42	0.40	0.39	0.38	0.37	0.36
46	85	39	0.42	0.40	0.39	0.38	0.37	0.36
40	80	40	0.44	0.41	0.39	0.38	0.37	0.37
45	85	40	0.44	0.41	0.39	0.38	0.37	0.37
44	85	41	0.45	0.42	**0.40**	0.39	0.38	0.37
43	85	42	0.46	0.43	0.41	0.39	0.38	0.38
42	85	43	0.48	0.44	0.42	0.40	0.39	0.38
41	85	44	0.50	0.45	0.43	0.41	0.40	0.39
40	85	45	0.52	0.47	0.44	0.41	0.40	0.40
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

TABLE 503.2.3(21)
PATH B - IPLV/NPLV FOR NON-STANDARD CENTRIFUGAL CHILLERS < 300 TONS

Leaving Chilled Water Temperature(F)	Entering Condenser Water Temperature(F)	Lift[a]	Condenser Flow Rate					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
			Required kW/ton					
46	75	29	0.37	0.35	0.34	0.33	0.31	0.31
45	75	30	0.37	0.36	0.35	0.33	0.32	0.32
44	75	31	0.38	0.36	0.35	0.34	0.33	0.32
43	75	32	0.38	0.37	0.36	0.35	0.34	0.33
42	75	33	0.39	0.38	0.37	0.35	0.34	0.34
41	75	34	0.40	0.38	0.37	0.36	0.35	0.34
46	80	34	0.40	0.38	0.37	0.36	0.35	0.34
40	75	35	0.40	0.39	0.38	0.36	0.36	0.35
45	80	35	0.40	0.39	0.38	0.36	0.36	0.35
44	80	36	0.41	0.39	0.38	0.37	0.36	0.36
43	80	37	0.42	0.40	0.39	0.37	0.37	0.36
42	80	38	0.43	0.40	0.39	0.38	0.37	0.37
41	80	39	0.43	0.41	0.40	0.38	0.38	0.37
46	85	39	0.43	0.41	0.40	0.38	0.38	0.37
40	80	40	0.45	0.42	0.40	0.39	0.38	0.38
45	85	40	0.45	0.42	0.40	0.39	0.38	0.38
44	85	41	0.46	0.43	0.41	0.40	0.39	0.38
43	85	42	0.47	0.44	0.42	0.40	0.39	0.39
42	85	43	0.49	0.45	0.43	0.41	0.40	0.39
41	85	44	0.51	0.46	0.44	0.42	0.41	0.40
40	85	45	0.54	0.48	0.45	0.43	0.41	0.41
Condenser ΔT			14.04	11.23	9.36	7.02	5.62	4.68

(Renumber subsequent Table 503.2.3(11) to 503.2.3(22)

Reason: The current minimum efficiency requirements for electrically-operated chillers in Chapter 5 of the 2006 IECC are less stringent than those contained in ASHRAE Standard 90.1-2004 which is referenced in Section 501 of the IECC. The ASHRAE Standard 90.1, in turn, contains minimum chiller efficiency requirements that are essentially unchanged since the 1999 version of the standard. The underlying data used to set the 1999 ASHRAE Standard dates back to 1993. Thus, in late 2007 when the Supplement to the 2006 IECC is issued, the data and analyses underlying the chiller efficiency requirements will be almost 15 years old.

Advances in cost-effective energy-efficient chiller performance since 1993, widespread marketing of chillers with adjustable speed drives (ASDs), and historic and dramatic increases in energy costs in recent years, coupled with equipment lifetimes of more than 20 years, require this code proposal change. According to some manufacturers, the most efficient chiller available in 1993 was rated at 0.52 kW per ton of full-load cooling capacity. Today the most efficient models are rated at about 0.47 kW per ton—about a 10% increase. In addition, some manufacturers believe that the performance of the average chiller sold in the marketplace has increased by the same amount. Yet, the minimum efficiency requirements for chillers have not risen at all. The proponents believe that now is the time to increase the minimum efficiency requirements for electrically-operated chillers.

Purpose: The purpose of this code change proposal is to update the minimum efficiency requirements for electrically-operated water chiller packages in Section 5 of the 2006 IECC. Specifically, we propose to strengthen efficiency requirements, add an explicit path for chillers with adjustable speed drives (ASDs), and change the units of measurement to that which is most widely used in the industry.

Substantiation: The basis for this code change proposal are the chiller performance criteria recommended in the New Buildings Institute publication ***Advanced Buildings Benchmark Version 1.1*** ("Benchmark".) Version 1.0 of the Benchmark was published in October 2003. A national committee consisting of manufacturers, contractors, building owners, designers, property managers, government representatives, efficiency experts and members of the public was involved in Benchmark's rigorous, year-long development and review process. The development process was modeled after the policies and procedures on the American National Standards Institute (ANSI) and included a Criteria Review Committee to serve as a "consensus body". Version 1.1 of the Benchmark was published in January 2005.

The Benchmark document is intended to provide comprehensive "whole building" design guidance for envelope, lighting and mechanical systems as well as commissioning recommendations. The Benchmark is recognized by the US Green Buildings Council for prescriptive use in the LEED process. For this code change proposal we have adapted the chiller performance recommendations of the Benchmark because of the open development process, rigorous technical analysis and its ANSI-based consensus approach. However, while we have largely used the Benchmark values to develop this proposal, in the case of centrifugal chillers with ASDs, we have modestly loosened the full-load performance values in order to make these easier to meet. Specifically, we have made the full load efficiencies 0.02 kW/ton higher for systems with ASDs than without in order to allow for ASD losses. Also, we have increased the IPLV for centrifugal chillers of 300 tons or less from 0.40 to 0.41 in order to allow some additional manufacturers and products to comply.

Adoption of this code change proposal will bring important improvements to the IECC commercial building requirements. To assist reviewers, we have provided a table which compares the current IECC and ASHRAE requirements to the code change proposal. As shown in the table, the 2006 IECC lags ASHRAE 90.1-2004 slightly on full-load performance and also in the important criterion of integrated part-load value (IPLV) ratings. On average, the 2006 IECC is about 9.3% less stringent than the current ASHRAE standard for IPLV. With this code change proposal the IECC can improve full-load chiller performance by about 6.6% and improve IPLV by about 18.3% across all chiller types. If adopted, the IECC will require better chiller performance than the ASHRAE standard.

According to a 2001 study prepared for DOE, chillers account for about 31% of commercial building cooling energy use, or about 42 billion kWh of electricity use each year. An 18.3% average improvement in IPLV means that more than 7 billion kWh will be saved annually once the existing chiller stock turns over, not to mention additional savings from more efficient chillers in new buildings. Based on these electricity savings figures, the average peak load and IPLV improvements discussed above, and the full load equivalent operating hours for chillers assumed by ASHRAE 90.1, once the stock turns over, these chiller standards will reduce peak electric generating requirements by about 1800 MW, equivalent to six power plants of 300 MW each.

The code change proposal also offers more flexibility to manufacturers, design engineers and building owners in selecting the best chiller for a particular application. There are two compliance paths to demonstrate minimum chiller efficiency. The first set of criteria (Path A) applies to chillers with or without adjustable speed drives or ASDs. A second optional compliance path (Path B) includes slightly less stringent full-load requirements for chillers equipped with ASDs. The optional compliance path offers cost flexibility to all parties. In particular, this path was developed by NBI in order to permit all current chiller manufacturers to meet the standard, irregardless of which refrigerant they use. As of 2002 when NBI did its analysis, each of the chiller efficiency values could be met by at least two manufacturers, and at least three manufacturers in most cases. Since then, additional equipment has been introduced to the market. In addition, the modest easing we propose to the NBI full-load efficiencies for chillers with ASDs will also increase the number of existing products that comply. Furthermore, since chillers are generally custom engineered and built for each site, manufacturers will generally have the option of adding additional heat exchange area to a chiller in order to reach an efficiency level that current equipment may just miss.

When NBI developed the Benchmark, the economics of all requirements were examined and each requirement needed to provide positive discounted lifecycle cost savings to building owners. Since then, electricity costs have increased significantly (e.g. commercial average electricity prices are up 15% comparing Dec. 2005 to Dec. 2002), improving the economics of the Benchmark chiller efficiency requirements.

Normally, we would bring a proposal to improve chiller efficiency to ASHRAE first before approaching the ICC. However, the chiller industry has been in a multiyear controversy over chiller refrigerants, with the largest manufacturer preferring one refrigerant and several manufacturers preferring another refrigerant. ASHRAE has attempted to develop a consensus on new chiller efficiency values for more than two years but has been unsuccessful due to this controversy over refrigerants. The Air-Conditioning and Refrigeration Institute (ARI), the chiller industry trade association, has set up a process to try to broker a compromise, but this process is moving very slowly. In the face of inaction by both ASHRAE and ARI, we are making this proposal to the ICC. Our proposal is a compromise that provides efficiency levels that can be met with both refrigerants, provided manufacturers use best practices.

The code change proposal also changes the basic units describing minimum chiller performance in an energy code. Instead of the traditional Coefficient of Performance (COP) metric, we are proposing to use the more industry-standard term of kilowatts per ton of cooling capacity.

Supplemental Information

Chiller Performance Requirements Comparison for IECC Code Change Proposal

Equipment Type and Capacity		COP Comparisons				kW per Ton Comparisons					
Equipment Type	**Size Category**	**Units**	**ASHRAE Standard 90.1-2004 Table 6.8.1C**	**2006 IECC Table 503.2.3(7)**	**IECC compared to ASHRAE (Percent Below)**	**Units**	**ASHRAE Standard 90.1-2004 Table 6.8.1C**	**2006 IECC Table 503.2.3(7)**	**Code Change Proposal (NBI-based)**	**Code Change Proposal compared to ASHRAE (Percent Better)**	**Code Change Proposal compared to IECC (Percent Better)**
Air cooled w/ condenser	<150 tons	COP	2.80	2.80	0.0%	Full Load	1.256	1.256	**1.200**	4.4%	4.4%
		IPLV	3.05	2.80	-8.2%	IPLV	1.153	1.256	**1.000**	13.3%	20.4%
	>150 tons	COP	2.80	2.50	-10.7%	Full Load	1.256	1.406	**1.200**	4.4%	14.7%
		IPLV	3.05	2.50	-18.0%	IPLV	1.153	1.406	**1.000**	13.3%	28.9%
Air cooled w/o condenser	All	COP	3.10	3.10	0.0%	Full Load	1.134	1.134	**1.080**	4.8%	4.8%
		IPLV	3.45	3.10	-10.1%	IPLV	1.019	1.134	**1.080**	-6.0%	4.8%
Water cooled, reciprocating	All	COP	4.20	4.20	0.0%	Full Load	0.837	0.837	**0.840**	-0.3%	-0.3%
		IPLV	5.05	4.65	-7.9%	IPLV	0.696	0.756	**0.630**	9.5%	16.7%
Water cooled, rotary screw and scroll (positive displacement)	< 100 tons	COP	4.45	4.45	0.0%	Full Load	0.790	0.790	**0.780**	1.3%	1.3%
		IPLV	5.20	4.50	-13.5%	IPLV	0.676	0.781	**0.600**	11.3%	23.2%
	100 tons and <150 tons	COP	4.45	4.45	0.0%	Full Load	0.790	0.790	**0.730**	7.6%	7.6%
		IPLV	5.20	4.50	-13.5%	IPLV	0.676	0.781	**0.550**	18.7%	29.6%
	150 tons and <300 tons	COP	4.90	4.90	0.0%	Full Load	0.718	0.718	**0.610**	15.0%	15.0%
		IPLV	5.60	4.95	-11.6%	IPLV	0.628	0.710	**0.510**	18.8%	28.2%
	> 300 tons	COP	5.50	5.50	10.9%	Full Load	0.639	0.576	**0.600**	6.1%	6.1%
		IPLV	6.15	5.60	-0.8%	IPLV	0.572	0.576	**0.490**	14.3%	22.0%
Water cooled, centrifugal	< 150 tons	COP	5.00	5.00	0.0%	Full Load	0.703	0.703	**0.610**	13.3%	13.3%
		IPLV	5.25	5.00	-4.8%	IPLV	0.670	0.703	**0.620**	7.4%	11.8%
	150 tons and 300 tons	COP	5.55	5.55	0.0%	Full Load	0.634	0.634	**0.590**	6.9%	6.9%
		IPLV	5.90	5.55	-5.9%	IPLV	0.596	0.634	**0.560**	6.0%	11.6%
	>300 tons and <600 tons	COP	6.10	6.10	0.0%	Full Load	0.576	0.576	**0.570**	1.1%	1.1%
		IPLV	6.40	6.10	-4.7%	IPLV	0.549	0.576	**0.510**	7.2%	11.5%
	> 600 tons	COP	6.10	6.10	0.0%	Full Load	0.576	0.576	**0.550**	4.6%	4.6%
		IPLV	6.40	6.10	-4.7%	IPLV	0.549	0.576	**0.510**	7.2%	11.5%
		Average Differences		COP	-0.9%	Average Differences			Full Load	5.8%	6.6%
				IPLV	-9.3%				IPLV	10.1%	18.3%

Bibliography: New Buildings Institute ***Advanced Buildings Benchmark Version 1.1*** is available for viewing at: http://www.poweryourdesign.com/benchmark.htm

More information on the Benchmark is available at: http://www.newbuildings.org

Cost Impact: The code change proposal will increase the cost of construction. Note that the proponents believe that any cost increases will be modest with respect to these changes to minimum efficiency requirements.

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

EC104–06/07
202 (New), 503.2.5.1 (New).

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

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

DEMAND CONTROL VENTILATION (DCV). A ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy.

503.2.5.1 Demand controlled ventilation. Demand control ventilation (DCV) is required for spaces larger than 500 ft^2 (50 m^2) and with an average occupant load of 40 people per 1000 ft^2 (100 m^2) of floor area (as established in Table 403.3 of the *International Mechanical Code*) and served by systems with one or more of the following:

1. An air-side economizer
2. Automatic modulating control of the outdoor air damper, or
3. A design outdoor airflow greater than 3000 CFM (1,400 L/s)

Exceptions:

1. Systems with energy recovery complying with section 503.2.6
2. Multiple-zone systems without direct-digital control of individual zones communicating with a central control panel.
3. System with a design outdoor airflow less than 1,200 CFM (600 L/s)
4. Spaces where the supply air flow rate minus any make up or outgoing transfer air requirement is less than 1,200 CFM (600 L/s)

Reason: Currently spaces with high occupant densities are permitted to continually provide ventilation for design levels of occupancy. In most instances average occupant load in these spaces is much less than design levels, resulting in the wasteful supply of excess outside air. This change requires HVAC systems serving large densely occupied spaces to include a means to automatically reduce outside air intake below design rates when spaces are partially occupied. This saves energy without compromising indoor air quality. Technologies (such as CO2 based control) currently exist making demand controlled ventilation reliable, practical, and easily implemented. The change is based on language approved for publication in ASHRAE Standard 90.1.

The purpose of the proposed code change is to require automatic ventilation controls based on occupancy loads in high occupancy spaces.

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

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

EC105–06/07
503.2.6

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

Revise as follows:

503.2.6 Energy recovery ventilation systems. Individual fan systems that have both a design supply air capacity of 5,000 cfm (2.36 m^3/s) or greater and a minimum outside air supply of 70 percent or greater of the design supply air quantity shall have an energy recovery system that provides a change in the enthalpy of the outdoor air supply of 50 percent or more of the difference between the outdoor air and return air at design conditions. Provision shall be made to bypass or control the energy recovery system to permit cooling with outdoor air where cooling with outdoor air is required.

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are prohibited by the *International Mechanical Code*.
~~2. Laboratory fume hood systems with a total exhaust rate of 15,000 cfm (7.08 m³/s) or less.~~
~~3~~ 2. Laboratory fume hood systems ~~with a total exhaust rate greater than 15,000 cfm (7.08 m³/s)~~ that include at least one of the following features:

~~3~~2.1. Variable-air-volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of design values.

~~3~~2.2. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (1.1°C) below room set point, cooled to no cooler than 3 °F (1.7°C) above room set point, no humidification added, and no simultaneous heating and cooling used for dehumidification control.

~~4~~ 3. Systems serving spaces that are not cooled and are heated to less than 60°F (15.5°C).

~~5~~ 4. Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.

~~6.~~ 5. Heating systems in climates with less than 3600 HDD.

~~7.~~ 6. Cooling systems in climates with a 1 percent cooling design wet-bulb temperature less than 64 °F (17.7°C).

~~8.~~ 7. Systems requiring dehumidification that employ series-style energy recovery coils wrapped around the cooling coil.

Reason: There is no good justification for having a higher threshold for laboratories than for other high percentage outdoor air systems. Labs21 (USDOE sponsored program) has conducted a study analyzing the effects of efficiency measures such as VAV and energy recovery in several locations. The study concluded that at 5,000 CFM VAV makes economic sense for all types of laboratory buildings in all locations and energy recovery makes economic sense in most locations.

The purpose of the code change proposal is to require the use of energy recovery ventilation systems with laboratory fume hoods.

Bibliography: Laboratories for the 21 Century:Energy Analysis, Prepared for Laboratories for the 21Century a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy Federal Energy Management Program Prepared By Enermodal Engineering, Inc. And the National Renewable Energy Laboratory A DOE national laboratory, 2003. http://www.labs21century.gov/pdf/cs_energyanalysis_508.pdf

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

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

EC106–06/07

503.2.6; IMC 514.2

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

THIS PROPOSAL IS ON THE AGENDA OF THE IECC AND THE IMC CODE DEVELOPMENT COMMITTEES. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

PART I – IECC

Revise as follows:

503.2.6 Energy recovery ventilation systems. Individual fan systems that have both a design supply air capacity of 5,000 cfm (2.36 m3/s) or greater and a minimum outside air supply of 70 percent or greater of the design supply air quantity shall have an energy recovery system that provides a change in the enthalpy of the outdoor air supply of 50 percent or more of the difference between the outdoor air and return air at design conditions. Provision shall be made to bypass or control the energy recovery system to permit cooling with outdoor air where cooling with outdoor air is required.

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are prohibited by the *International Mechanical Code*.
2. Laboratory fume hood systems with a total exhaust rate of 15,000 cfm (7.08 m^3/s) or less.
3. Laboratory fume hood systems with a total exhaust rate greater than 15,000 cfm (7.08 m^3/s) that include at least one of the following features:
   - 3.1. Variable-air-volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of design values.
   - 3.2. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2_F (1.1_C) below room set point, cooled to no cooler than 3◦F (1.7◦C) above room set point, no humidification
4. Hazardous exhaust systems covered in *International Mechanical Code* Section 510.
5. Commercial kitchen exhaust systems serving Type I hoods.
6. Clothes dryer exhaust systems covered in *International Mechanical Code* Section 504.

PART II – IMC

Revise as follows:

SECTION 514
ENERGY RECOVERY VENTILATION SYSTEMS

514.1 General. Energy recovery ventilation systems shall be installed in accordance with this section. Where required for purposes of energy conservation, energy recovery ventilation systems shall also comply with the *International Energy Conservation Code*.

514.2 Prohibited applications. Energy recovery ventilation systems shall not be used in the following systems.

~~1. Hazardous exhaust systems covered in Section 510.~~
~~2.~~ 1. Dust, stock and refuse systems that convey explosive or flammable vapors, fumes or dust.
~~3.~~ 2. Smoke control systems covered in Section 513.
~~4. Commercial kitchen exhaust systems serving Type I and Type II hoods.~~
~~5. Clothes dryer exhaust systems covered in Section 504.~~

514.3 Access. A means of access shall be provided to the heat exchanger and other components of the system as required for service, maintenance, repair or replacement.

Reason: (IECC) Application of energy recovery ventilation should not be prohibited outright for applications to hazardous exhaust systems, Type I hoods, or Clothes Dryer Exhaust. Specialty equipment is available for the listed applications and can be safely applied when properly designed and maintained.

This proposal would allow the use of energy recovery ventilation for hazardous exhaust systems, type I and II hoods, and clothes dryers. To allow the utilization of energy recovery ventilation in more cases, without requiring it, changes to both the IECC and IMC are required.

There are many type of specialized equipment designed to deal with issues of subsections 1, 4, and 5. Examples of acceptable systems are runaround loops for laboratories, special filtration and warning lights for clothes dryers, and scrubbers for Type I hood are among equipment that have been successfully installed.

In the state of Oregon prison system, for the past several years, we have installed energy recovery on the clothes dryer exhaust for the prison's laundry. We have spoke with engineers that provided energy recovery for Type II hood with specific scrubbing mechanisms for that purpose with no repercussions.

Prohibiting energy recovery ventilation from Type II hoods does not pass the laugh test from engineers polled. Moisture-laden exhaust air is an ideal opportunity for energy recovery. Recovery ventilation equipment is made to deal with condensation, which occurs within the units.

(IMC) Application of energy recovery ventilation should not be prohibited outright for applications to hazardous exhaust systems, Type I hoods, or Clothes Dryer Exhaust. Specialty equipment is available for the listed applications and can be safely applied when properly designed and maintained.

Current code is overly restrictive. This proposal expands the applications where energy recovery ventilation is allowed, without requiring it. Modifications to both the IMC and IECC are required to make this a viable proposal.

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

PART I – IECC

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

PART II – IMC

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

EC107–06/07
503.2.7

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

Revise as follows:

503.2.7 Duct and plenum insulation and sealing. All supply and return air ducts and plenums shall be insulated with a minimum of R-5 insulation when located in unconditioned spaces and with a minimum of R-8 insulation when located outside the building. When located within a building envelope assembly, the duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation.

Exceptions:

1. When located within equipment.
2. When the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8°C).

~~All joints, longitudinal and transverse seams and connections in ductwork, shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems or tapes. Tapes and mastics used to seal ductwork shall be listed and labeled in accordance with UL 181A and shall be marked "181A-P" for pressure-sensitive tape, "181A-M" for mastic or "181A-H" for heat-sensitive tape. Tapes and mastics used to seal flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181B-FX" for pressure-sensitive tape or "181B-M" for mastic. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Unlisted duct tape is not permitted as a sealant on any ducts.~~

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

Reason: The purpose of this proposal is to provide a set of uniform codes. The *International Mechanical Code* already has requirements for duct sealing. The requirements found in the IMC are slightly different from what is found in the IECC, which is a source of confusion. The IMC is written more accurately as it relates to the references of listed products and there application. Also, Chapter 4 of the IECC now references the mechanical section of the IRC for sealing of ducts, the proposed language was lifted from that section, for consistency and revised to reference the IMC. Therefore this proposal would provide consistency within the I-Codes, eliminate duplicate but slightly different section within two different I-Codes and provide for an easier maintainable set of codes.

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

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

EC108–06/07
503.2.8, Chapter 6

Proponent: Patrick A. McLaughlin, McLaughlin & Associates, representing Air Conditioning and Refrigeration Institute

1. Revise as follows:

503.2.8 Piping insulation. All piping serving as part of a heating or cooling system shall be thermally insulated in accordance with Table 503.2.8.

Exceptions:

1. Factory-installed piping within HVAC equipment tested and rated in accordance with a test procedure referenced by this code.
<u>2.</u> <u>Factory-installed piping within room fan-coils and unit ventilators tested and rated according to ARI standards 440 and 840 respectively.</u>
~~2.~~ <u>3.</u> Piping that conveys fluids that have a design operating temperature range between 55°F (13°C) and 105°F 41°C).
~~3.~~ <u>4.</u> Piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.
~~4.~~ <u>5.</u> Runout piping not exceeding 4 feet (1219 mm) in length and 1 inch (25 mm)in diameter between the control valve and HVAC coil.

2. Add standards to Chapter 6 as follows:

ARI

<u>ARI 440-2005</u> <u>Room Fan-Coil</u>
<u>ARI 840-1998</u> <u>Unit Ventilators</u>

Reason: The proposal exempts room fan-coils and unit ventilators which are tested and rated according to ARI standards 440 and 840 from the piping insulation requirements. Room fan-coils and unit ventilators are HVAC equipment for which Exception 1 of Section 503.2.8 does not apply because the test procedures used to rate and test these products are not currently referenced in the IECC. However, as with other HVAC equipment referenced in the IECC, the performance of room fan-coils and unit ventilators, including energy consumption and/or energy efficiency, is tested and rated according to ARI standards 440 and 840 respectively. The performance ratings of these products are also verified by an independent third party certification program. A similar proposal was disapproved last code cycle because it did not reference a specific standard and thus would be difficult to enforce. It was then ruled out of order as a challenge because it introduced new standards which the Code Development Committee had not reviewed. This proposal corrects those deficiencies. ARI standards, including 440 and 840, are available free on the ARI web site at www.ari.org.

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

Analysis: Results of review of the proposed standard(s) will be posted on the ICC website by August 20, 2006.

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

EC109–06/07
503.2.9.1

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

Revise as follows:

503.2.9.1 Air system balancing. Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International Mechanical Code*. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors ~~25~~ 10 hp (7.5 kW) and larger.

Reason: This change is to be consistent with Section 503.4.2 requiring variable speed drives for VAV fans of 10 hp or greater. When Section 503.4.2 was changed, this section also should have been changed.

The purpose of the code change proposal is to reduce threshold for air system balancing.

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

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

EC110–06/07
503.2.9 through 503.2.9.3.2 (New)

Proponent: John Neff, Washington State Building Code Council, representing same

Delete and substitute as follows:

~~**503.2.9 HVAC system completion.** Prior to the issuance of a certificate of occupancy, the design professional shall provide evidence of system completion in accordance with Sections 503.2.9.1 through 503.2.9.3.~~

~~**503.2.9.1 Air system balancing.** Each supply air outlet and zone terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International Mechanical Code*. Discharge dampers are prohibited on constant volume fans and variable volume fans with motors 25 hp (18.6 kW) and larger.~~
~~**503.2.9.2 Hydronic system balancing.** Individual hydronic heating and cooling coils shall be equipped with means for balancing and pressure test connections.~~

~~**503.2.9.3 Manuals.** The construction documents shall require that an operating and maintenance manual be provided to the building owner by the mechanical contractor. The manual shall include, at least, the following:~~

1. ~~Equipment capacity (input and output) and required maintenance actions.~~
2. ~~Equipment operation and maintenance manuals.~~
3. ~~HVAC system control maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined setpoints shall be permanently recorded on control drawings, at control devices or, for digital control systems, in programming comments.~~
4. ~~A complete written narrative of how each system is intended to operate.~~

503.2.9 Mechanical systems commissioning and completion requirements. Commissioning, testing and balancing, and controls functional performance testing for mechanical systems shall be in accordance with this section.

503.2.9.1 General. Commissioning is a process of verification and documentation that ensures that the selected building systems have been designed, installed, and function properly, efficiently, and shall be maintained in accordance with the contract documents in order to satisfy the building owner's design intent and operational requirements. Drawing notes shall require commissioning and completion requirements in accordance with this section. Drawing notes shall be allowed to refer to specifications for further requirements.

503.2.9.1.1 Simple mechanical systems. For simple mechanical systems, as defined in Section 503.3, commissioning shall include, as a minimum:

1. A Commissioning Plan,
2. Systems Testing and Balancing,
3. Controls Functional Performance Testing,
4. A Preliminary Commissioning Report,
5. Post Construction Documentation in the form of Operations and Maintenance and Record Drawing Review, and
6. A Final Commissioning Report.

503.2.9.1.2 All other mechanical systems. For all other mechanical systems, commissioning shall include, as a minimum:

1. A Commissioning Plan,
2. Systems Testing and Balancing,
3. Equipment Functional Performance Testing,
4. Controls Functional Performance Testing,
5. A Preliminary Commissioning Report,
6. Post Construction Documentation in the form of Operations and Maintenance and Record Drawing Review, and
7. A Final Commissioning Report.

503.2.9.2 Commissioning requirements. Commissioning of mechanical systems shall be in accordance with this section.

503.2.9.2.1 General. Drawing notes shall require commissioning in accordance with this section. Drawing notes shall be allowed to refer to specifications for further commissioning requirements.

503.2.9.2.2 Commissioning plan. The Plan shall require tests mandated by this section be performed and the results recorded. The Plan shall require preparation of preliminary and final reports of test procedures and results as described herein. At a minimum, the Plan shall identify the following for each test:

1. A detailed explanation of the original design intent.
2. Equipment and systems to be tested, including the extent of tests,
3. Functions to be tested (for example calibration, economizer control, etc.),
4. Conditions under which the test shall be performed (for example winter and summer design conditions, full outside air, etc.), and
5. Measurable criteria for acceptable performance.

509.2.9.2.3 Systems balancing. Mechanical systems balancing shall be in accordance with this section.

503.2.9.2.3.1 General. Construction documents shall require that all HVAC systems be balanced in accordance with generally accepted engineering standards. Air and water flow rates shall be measured and adjusted to deliver final flow rates within 10% of design rates, except variable flow distribution systems need not be balanced upstream of the controlling device (for example, VAV box or control valve). Construction documents shall require a written balance report be provided to the owner. Drawing notes shall be allowed to refer to specifications for further systems balancing requirements.

503.2.9.2.3.2 Air systems balancing. Air systems shall be balanced in a manner to first minimize throttling losses then, for fans with system power of greater than 1 hp, fan speed shall be adjusted to meet design flow conditions.

503.2.9.2.3.3 Hydronic system balancing. Hydronic systems shall be proportionately balanced in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions. Each hydronic system shall have either the ability to measure pressure across the pump, or test ports at each side of each pump.

Exceptions:

1. Pumps with pump motors of 10 hp or less.
2. When throttling results in no greater than 5% of the nameplate horsepower draw above that required if the impeller were trimmed.

503.2.9.2.4 Functional performance testing. Functional performance testing of mechanical systems shall be in accordance with this section.

503.2.9.2.4.1 General. Drawing notes shall require commissioning in accordance with this section. Drawing notes shall be allowed to refer to specifications for further commissioning requirements.

503.2.9.2.4.2 Equipment/Systems testing. Functional Performance Testing shall demonstrate the correct installation and operation of each component, system, and system-to-system intertie relationship in accordance with approved plans and specifications. This demonstration is to prove the operation, function, and maintenance serviceability for each of the Commissioned systems. Testing shall include all modes of operation, including:

1. All modes as described in the Sequence of Operation,
2. Redundant or automatic back-up mode,

3. Performance of alarms, and
4. Mode of operation upon a loss of power and restored power.

503.2.9.2.4.3 Controls testing. HVAC control systems shall be tested to ensure that control devices, components, and equipment and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to ensure they operate in accordance with approved plans and specifications.

503.2.9.2.5 Post construction commissioning. Post construction commissioning of mechanical systems shall be in accordance with this section.

503.2.9.2.5.1 General. Construction documents shall require post construction commissioning, and shall be provided to the building owner prior to date of final acceptance. Drawing notes shall be allowed to refer to specifications for further commissioning requirements. Post construction commissioning shall include, as a minimum, review and approval of Operation and Maintenance Materials, Record Drawings, and Systems Operational Training.

503.2.9.2.5.2 Operation and maintenance materials. The operations and maintenance materials shall be in accordance with industry accepted standards and shall include, at a minimum, the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Operation and maintenance manuals for each piece of equipment requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Name, address, phone number, and current contact name of at least one service agency.
4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field determined set points shall be permanently recorded on control drawings at control devices, or, for digital control systems, in programming comments.
5. A complete written narrative of how each system and piece of equipment is intended to operate including:
    - 5.1. A detailed explanation of the original design intent.
    - 5.2. The basis of design (how the design was selected to meet the design intent).
    - 5.3. A detailed explanation of how new equipment is to interface with existing equipment or systems (where applicable).
    - 5.4. Suggested control set points.

NOTE: Sequence of Operation is not acceptable as a narrative for this requirement.

503.2.9.2.5.3 Record drawings: Record drawings shall include, as a minimum, the location and performance data on each piece of equipment, general configuration of duct and pipe distribution system, including sizes, and the terminal air and water design flow rates of the actual installation.

503.2.9.2.5.4 Systems operational training. The training of the appropriate maintenance staff for each equipment type and or system shall include, as a minimum, the following:

1. System/Equipment overview (what it is, what it does and which other systems and or equipment does it interface with).
2. Review of the available operations and maintenance materials.
3. Review of the record drawings on the subject system/equipment.
4. Hands-on demonstration of all normal maintenance procedures, normal operating modes, and all emergency shutdown and start-up procedures.

503.2.9.2.6 Commissioning reports. Commissioning reports for mechanical systems shall be in accordance with this section.

503.2.9.2.6.1 General. Working drawing notes within permit documents shall require commissioning in accordance with this section. These notes shall be allowed to refer to specifications for further commissioning requirements.

503.2.9.2.6.2 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and provided to the owner and the building official. The report shall be identified as “Preliminary Commissioning Report” and shall identify:

1. Itemization of deficiencies found during testing required by this section which have not been corrected at the time of report preparation, and the anticipated date of correction.
2. Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.
3. Climatic conditions required for performance of the deferred tests, and the anticipated date of each deferred test.

503.2.9.2.6.3 Final commissioning report. A complete report of test procedures and results shall be prepared and filed with the Owner and the building official. The report shall be identified as "Final Commissioning Report" and shall identify:

1. Results of all Functional Performance Tests.
2. Disposition of all deficiencies found during testing, including details of corrective measures used or proposed.
3. All Functional Performance Test procedures used during the commissioning process including measurable criteria for test acceptance, provided herein for repeatability.

Exception: Deferred tests which cannot be performed at the time of report preparation due to climatic conditions.

503.2.9.3 Acceptance requirements. Minimum requirements for issuance of a certificate of occupancy for buildings with mechanical systems shall be in accordance with this section.

503.2.9.3.1 General. Working drawing notes within permit documents shall require commissioning in accordance with this section. Drawing notes shall be allowed to refer to specifications for further commissioning requirements.

503.2.9.3.2 Acceptance. Buildings or portions thereof, required by this Code to comply with this section, shall not be issued a temporary or final certificate of occupancy allowing public or owner occupation until such time that the building official determines that the preliminary commissioning report required by Section 503.2.9.2.6.2 has been completed.

Reason: Building commissioning requirements have been in place in Washington since 2000. Commissioning is an important means of ensuring systems are installed and function as designed. Far too many buildings contain substantive defects and programming errors that impact the performance and functionality of the building. Commissioning is a means of discovering and correcting these defects. Commissioning also provides documentation of system design intent and operating sequences, and provides building staff with accurate operation manuals.

The cost of commissioning is a small part of the overall project, yet can provide substantial payback in the form of reduced energy usage, better building performance, improved air quality and higher productivity. A 2004 study by Lawrence Berkeley National Laboratory concluded that commissioning is cost-effective for both new and existing buildings over a variety of uses and sized, not only in energy savings but also in extended equipment lifetimes and lower maintenance costs. Investigators found that the median payback of building commissioning was 4.8 years, and when non-energy impacts were factored in the payback was considerably reduced.

The purpose of the code change proposal is to provide expanded direction on commission requirements.

Bibliography:

Lawrence Berkeley National Laboratory Report Number 56637, The Cost-Effectiveness of Commercial-Buildings Commissioning: a Meta-Analysis of Energy and Non-Energy Impacts in Existing Buildings and New Construction in the United States, December 2004, http://eetd.lbl.gov/emills/PUBS/Cx-Costs-Benefits.html

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

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

EC111–06/07

503.2.9.4, Chapter 6

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

1. Add new text as follows:

503.2.9.4 System commissioning. HVAC control systems shall be tested to ensure that control elements are calibrated, adjusted, and in proper working condition. For buildings larger than 50,000 square feet (except warehouses), detailed instructions for commissioning HVAC systems (in accordance with ASHRAE Guideline 1 or other approved method) shall be provided by the designer in plans and specifications.

2. Add standard to Chapter 6 as follows:

ASHRAE

Guideline 1-1996 The HVAC Commissioning Process

Reason: This code change proposal addresses HVAC system completion requirements. While the IECC currently requires air and hydronic system balancing and construction documentation (in the form of operation and maintenance manuals, calibration information, and design intent), the IECC stops short of requiring actual HVAC "commissioning". The quotes around the word "commissioning" are indicative of the fact that everyone has their own idea what commissioning actually means. In this proposal the idea is to assure that, at a minimum, the HVAC control system is tested to ensure that it works properly. For larger buildings (>50,000 ft2), detailed commissioning plans are required, although actual implementation of those plans is not required. Thus the designer must work with the building owner to determine what level of commissioning makes sense for a particular application.

This proposal delivers to the code a valuable assurance of compliance for commercial buildings. While the code already recognizes the importance of accurate control system operation, this proposal ensures that the targeted levels of building efficiency are delivered by making sure that the control system is tested to ensure proper operation. While such commissioning should be commonplace in good HVAC design and installation, this proposal helps to ensure delivered performance efficiency and improved code compliance.

This proposal makes consistent (to the extent possible) the prescriptive text of the IECC and the corresponding text of the commercial reference standard – ASHRAE/IESNA Standard 90.1. This proposal is an implementation of the existing requirement in Section 6.2.5.4 of ANSI/ASHRAE/IESNA Standard 90.1-2004.

Cost Impact: The code change proposal may increase the cost of construction for commercial buildings (unless commissioning requirements are already included in the construction documentation)

Analysis: Results of review of the proposed standard(s) will be posted on the ICC website by August 20, 2006.

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

EC112–06/07
503.3.1

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing himself

Revise as follows:

503.3.1 Economizers. Supply air economizers shall be provided on each cooling system as shown in Table 503.3.1(1). Economizers shall be capable of providing 100-percent outdoor air, even if additional mechanical cooling is required to meet the cooling load of the building. Systems shall provide a means to relieve excess outdoor air during economizer operation to prevent over pressurizing the building. The relief air outlet shall be located to avoid recirculation into the building. Where a single room or space is supplied by multiple air systems, the aggregate capacity of those systems shall be used in applying this requirement.

Exceptions:

1. Where the cooling equipment is covered by the minimum efficiency requirements of Table 503.2.3(1) or 503.2.3(2) and meets or exceeds the minimum cooling efficiency requirement (EER) by the percentages shown in Table 503.3.1(2).
2. Systems with air or evaporatively cooled condensors and which serve spaces with open case refrigeration or that require filtration equipment in order to meet the minimum ventilation requirements of Chapter 4 of the *International Mechanical Code*.
3. Systems with air or evaporatively cooled condensers which serve spaces involving humidification or dehumidification such as computer rooms, museums, library stacks, or similar.

Reason: The additional exception to the installation of an economizer is required so as to properly facilitate and coordinate such applications to unique building areas and spaces. Each of the areas addressed in the proposed code change require specific humidification of dehumidification requirements, which renders the installation of an economizer as inappropriate.

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

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

EC113–06/07
Table 503.3.1(1), Table 503.3.1(2), 503.3.1

Proponent: John Neff, Washington State Building Code Council

Revise tables as follows:

TABLE 503.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B, 2A, 3A, 4A, 7, 8	No Requirement
2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B	Economizers on All Cooling Systems ≥ 54,000 Btu/h[a]
5A, 6A	Economizers on All Cooling Systems ≥ 135,000 Btu/h[a]

a. The total capacity of all systems without economizers shall not exceed 480,000 Btu/h per building, or 20% of its air economizer capacity, whichever is greater.

For SI: 1 British thermal unit per hour = 0.293 W.

TABLE 503.3.1(2)
EQUIPMENT EFFICIENCY PERFORMANCE EXCEPTION FOR ECONOMIZERS

CLIMATE ZONES	COOLING EQUIPMENT PERFORMANCE IMPROVEMENT (EER OR IPLV)
2B	10% Efficiency Improvement
3B	15% Efficiency Improvement
4B	20% Efficiency Improvement

503.3.1 Economizers. Supply air economizers shall be provided on each cooling system according to Table 503.3.1(1). Economizers shall be capable of providing 100-percent outdoor air, even if additional mechanical cooling is required to meet the cooling load of the building.

Systems shall provide a means to relieve excess outdoor air during economizer operation to prevent overpressurizing the building. The relief air outlet shall be located to avoid recirculation into the building. Where a single room or space is supplied by multiple air systems, the aggregate capacity of those systems shall be used in applying this requirement.

Exceptions:

1. Where the cooling equipment is covered by the minimum efficiency requirements of Table 503.2.3(1), or 503.2.3(2) and meets or exceeds the minimum cooling efficiency requirements (EER) by the percentages shown in Table 503.3.1(2).
2. Systems with air or evaporatively cooled condensors and which serve spaces with open case refrigeration or that require filtration equipment in order to meet the minimum ventilation requirements of Chapter 4 of the *International Mechanical Code*.

Reason: This is already the industry standard approach in the Pacific Northwest. Per the 2004 WSEC designers can not provide full building systems without economizer using units smaller than 54,000 btuh unless the total tonnage is less than 40 tons.

The purpose is to limit the extent to which economizer may be avoided in any given building.

Airside economizer provides significant energy savings. If designers are allowed to fill buildings with small units that do not have economizer, then there can be significant lost opportunity for energy savings. A new building design should have provisions for airside economizer coordinated to meet the spirit of the code.

Cost Impact: The code change proposal will increase the initial cost of construction. However, there would be energy savings and cost benefit over time.

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

EC114–06/07

Table 503.3.1(1)

Proponent: Bob VanBecelaere, Ruskin Company, representing the Air Movement and Control Association

Revise table as follows:

TABLE 503.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B, 2A, ~~3A~~, ~~4A,~~ 7, 8	No requirement
2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B	Economizers on all cooling systems ≥ 54,000 Btu/h
~~5A, 6A~~	~~Economizers on all cooling systems ≥ 135,000 Btu/h~~

For SI: 1 British thermal unit per hour = 0.293 W.

Reason: ASHRAE Standard 90.1 has served as a blueprint for the air conditioning industry for many years. One of the major aspects of the Standard is the requirement for Economizers in various Zones in the United States. The Standard has developed these Zones based on common weather data. The Standard further divides the US into “moist”, “dry”, and “marine” environments. The Standard has resulted in tremendous energy savings for the country.

Today’s economic environment, energy prices, and improved control devices establish the need to re-evaluate the Economizer requirements for the various Zones. When the original Standard was developed, some Zones were considered marginal for energy savings versus the original cost of the equipment. Today, prices for economizers are more competitive due to improved controls (that are less costly than their predecessors), while the cost of energy has skyrocketed. This dictates the new evaluation of each zone.

Economizers typically operate from a temperature range of 65°F down to 40°F to provide virtually free cooling for the building. Obviously, relative humidity plays an important role in conjunction with the dry bulb conditions in providing comfort for the space during economizer operation. Today's humidity and enthalpy (total heat of the air) controls are very reliable. They can guarantee comfort for various Zones by being field adjustable for the region and the application. It is also important to realize that the <u>maximum</u> <u>enthalpy</u> of the air at 65°F is 30.06 Btu/lb. Anything less than 25 Btu/lb and 65°F or less would be acceptable for economizer operation. A chart is provided that shows the majority of the hours available for economizer operation are below the 25 Btu/lb threshold. Since outside air is mixed with return air, the mixed air condition should be taken into consideration when determining the feasibility of an economizer for a particular application (Example: 3000 cfm return to 1000 cfm OA, or 25% OA).

It can be argued that a specific building located in Dallas or Cleveland with the same orientation will have a similar HVAC requirement. It is assumed by many people that Cleveland would be a better location to utilize an economizer because of its location. However, Cleveland (3,407 hours) and Dallas (3,367 hours) have almost exactly the same number of bin weather hours between 65°F and 40°F. Obviously, Dallas has many more hours than Cleveland above 65°F, and conversely, Cleveland has many more below 40°F than Dallas.

Tracking energy savings of 22% on air conditioning requirements is not uncommon and can be verified.

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

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

EC115–06/07
503.4.3.3

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

Revise as follows:

503.4.3.3 Hydronic (water loop) heat pump systems. Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of providing a heat pump water supply temperature dead band of at least 20°F (D11.1°C) between initiation of heat rejection and heat addition by the central devices. For Climate Zones 3 through 8 as indicated in Figure 301.1 and Table 301.1, if a closed-circuit cooling tower is used, either an automatic valve shall be installed to bypass all but a minimal flow of water around the tower, or lower leakage positive closure dampers shall be provided. If an open-circuit tower is used directly in the heat pump loop, an automatic valve shall be installed to bypass all heat pump water flow around the tower. If an open <u>or closed-</u>circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the cooling tower from the heat pump loop, then heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop. Each hydronic heat pump on the hydronic system having a total pump system power exceeding 10 horsepower (hp) (7.5 kW) shall have a two-position valve.

> **Exception:** Where a system loop temperature optimization controller is installed and can determine the most efficient operating temperature based on real time conditions of demand and capacity, dead bands of less than 20°F (11.1°C) shall be permitted.

Reason: The purpose of this proposal is to include a closed circuit cooling tower in the requirements for shutting down the pumps when a heat exchanger is used to control heat loss. Closed circuit cooling towers can be used with or without a heat exchanger on a water source heat pump system. In most cases, a closed circuit cooling tower in combination with a heat exchanger is used when a glycol mixture is used in the tower loop and needs to be isolated from the heat pump loop (colder climates). When used without a heat exchanger (normally warmer climates or when there is a need to reject heat year round) the first set of requirements would apply.

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

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

EC116–06/07
503.4.3.3

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

Revise as follows:

503.4.3.3 Hydronic (water loop) heat pump systems. Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of providing a heat pump water supply temperature dead band of at least 20°F (D11.1°C) between initiation of heat rejection and heat addition by the central devices. For Climate Zones 3 through 8 as indicated in Figure 301.1 and Table 301.1, if a closed-circuit cooling tower is used, either an automatic valve shall be installed to bypass all but a minimal flow of water around the tower, or lower leakage positive closure dampers shall be provided. If an open-circuit tower is used directly in the heat pump loop, an automatic valve shall be installed to bypass all heat pump water flow around the tower. If an open circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the cooling tower from the heat pump loop, then heat loss shall be controlled by shutting down the circulation pump and provide an automatic valve to stop the flow of fluid on the cooling tower loop. Each hydronic heat pump on the hydronic system having a total pump system power exceeding 10 horsepower (hp) (7.5 kW) shall have a two-position valve.

> **Exception:** Where a system loop temperature optimization controller is installed and can determine the most efficient operating temperature based on real time conditions of demand and capacity, dead bands of less than 20°F (11.1°C) shall be permitted.

Reason: The purpose of this proposal is to ensure the elimination of flow within the cooling tower loop when heat rejection is not required. By just requiring the shut down of the tower pumps may not stop the flow of fluid, depending on outside temperature, the fluid will flow due to convection. From past experience, a temperature differential of 4 to 7 degrees has been observed through a heat exchanger on a heat pump loop; due to the fluid flow from convection (tower pumps shut down.) The boiler (heat add) must compensate for the additional unintentional heat rejection, needless to say is not energy efficient and could be a considerable depending on the system size. The requirement for the valve when used with a heat exchanger is no different than the requirement for the valve when the tower is installed within the heat pump loop in order to bypass the tower, which is already required by the code. Both ensure an energy efficient system.

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

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

EC117–06/07

503.4.3.3, 503.4.3.3.1 (New), 503.4.3.3.2 through 503.4.3.3.3 (New)

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

Revise as follows:

503.4.3.3 Hydronic (water loop) heat pump systems. Hydronic heat pump systems shall comply with section 503.4.3.3.1 through 503.4.3.3.3.

503.4.3.3.1 Temperature dead band. Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of providing a heat pump water supply temperature dead band of at least 20°F (D11.1°C) between initiation of heat rejection and heat addition by the central devices.

> **Exception:** Where a system loop temperature optimization controller is installed and can determine the most efficient operating temperature based on real time conditions of demand and capacity, dead bands of less than 20°F (11.1°C) shall be permitted.

503.4.3.3.2 Heat rejection. Heat rejection equipment shall comply with Sections 503.4.3.3.2.1 and 503.4.3.3.2.2.

> **Exception:** Where it can be demonstrated that a heat pump system will be required to reject heat throughout the year.

503.4.3.3.2.1 Climate Zones 3 through 4. For climate Zones 3 and ~~through 8~~ 4 as indicated in Figure 301.1 and Table 301.1;

1. If a closed-circuit cooling tower is used directly in the heat pump loop, either an automatic valve shall be installed to bypass all but a minimal flow of water around the tower, or lower leakage positive closure dampers shall be provided.
2. If an open-circuit tower is used directly in the heat pump loop, an automatic valve shall be installed to bypass all heat pump water flow around the tower.
3. If an open or closed-circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the cooling tower from the heat pump loop, then heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop.

503.4.3.3.2.2 Climate Zones 5 through 8. For climate Zones 5 through 8 as indicated in Figure 301.1 and Table 301.1, if an open or closed-circuit cooling tower is used, ~~in conjunction with~~ then a separate heat exchanger shall be required to isolate the cooling tower from the heat pump loop, then heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop and providing an automatic valve to stop the flow of fluid.

503.4.3.3.3 Two Position Valve. Each hydronic heat pump on the hydronic system having a total pump system power exceeding 10 horsepower (hp) (7.5 kW) shall have a two-position valve.

Reason: The purpose of this proposal is to arrange the code requirements for more uniform enforcement. This proposal better organizes the requirements within this section and provides some needed additional energy requirements for heat rejection equipment.

Revised Section 503.4.3.3.1: Before the proposed revision, the exception would appear to be applied to all the requirements found in section 503.4.3.3, but really only addresses the dead band requirements. As proposed, the exception found in section 503.4.3.3.1 would only apply to the dead band requirements, not the heat rejection requirements or two-position valve requirements; the original intent of the exception.

Revised Section 503.4.3.3.2: This section addresses both closed and open-circuit cooling towers used within hydronic (water loop) heat pump systems. When used directly in the heat pump loop or with a heat exchanger in zones 3 and 4, requirements for controlling heat loss are provided. If a tower is used in zones 5 through 8 (heating-dominated climates) a heat exchanger is required along with the requirements to control heat loss.

This proposal also ensures the elimination of flow within the cooling tower loop when heat rejection is not required. By just requiring the shut down of the tower pumps may not stop the flow of fluid, depending on outside temperature, the fluid will flow due to convection. From past experience, a temperature differential of 4 to 7 degrees has been observed through a heat exchanger on a heat pump loop; due to the fluid flow from convection with the tower pumps shut down. The boiler (heat add) must compensate for the additional unintentional heat rejection, which is not energy efficient and could be a considerable depending on the system size. The requirement for the valve when used with a heat exchanger is no different than the requirement for the valve when the tower is installed within the heat pump loop, to bypass the tower, which is already required by the code. Both ensure an energy efficient system.

Some hydronic heat pump systems are designed/required to reject heat year round. The exception to section 503.4.3.3.2, for the heat rejection requirements, allows a system that will need to reject heat throughout the year from having to meet these requirements. By adding this exception would allow the designer to layout the system that would be most cost effective and energy efficient. Not including this exception, and as in the current code text, in some cases would unnecessarily increase construction cost while providing no significant energy savings. Systems that would need to reject heat year round may or may not be designed with a heat exchanger to isolate the cooling tower; this would be left to the discretion of the designer.

Revised Section 503.4.3.3.3: This requirement in this section remains the same, just re-organized.

Cost Impact: The code change proposal will increase the cost of construction in some cases and will reduce the cost of construction in other cases.

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

EC118–06/07
503.4.5.3

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

Delete without substitution:

~~**503.4.5.3 Single fan dual duct and mixing VAV systems, economizers.** Individual dual duct or mixing heating and cooling systems with a single fan and with total capacities greater than 90,000 Btu/h [(26 375 W) 7.5 tons] shall not be equipped with air economizers.~~

Reason: A group of engineers in the Northwest Energy Code Group reviewed this section and determined that it was simply unnecessary and confusing. We recommend deleting this section unless evidence comes forward substantiating a need for the section.

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

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

EC119–06/07
503.4.5.4

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

Add new text as follows:

503.4.5.4 Supply-air temperature reset controls. Multiple zone HVAC systems must include controls that automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperature. The controls must be capable of resetting the supply air temperature at least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

Exceptions:

1. Systems that prevent re-heating, re-cooling, or mixing of heated and cooled supply air.
2. 75 percent of the energy for reheating is from site-recovered or site solar energy sources.
3. Zones with peak supply air quantities of 300 cfm (142L/s) or less.

Reason: Multiple zone HVAC systems typically deliver supply air at a constant temperature necessary to provide cooling for the zone with the worst-case peak cooling load. Any zone requiring less cooling than this must reduce the amount of cool air to that zone (if a VAV system), and eventually reheat that cool air if necessary to prevent zone overcooling. This is known as simultaneous heating and cooling. Since most Modern building controls system can easily incorporate logic and controls that continually poll the various zones in a system and raise the supply air temperature as high as possible while still satisfying the cooling demand. This reduces the necessity for simultaneous heating and cooling and saves energy.

The purpose of the code change proposal is to require supply air temperature reset controls on multiple zone systems.

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

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

EC120–06/07
505.2.2.2

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing himself

Revise as follows:

505.2.2.2 Automatic lighting shutoff controls. Buildings larger than 5,000 square feet (465m2) shall be equipped with an automatic control device to shut off lighting in those areas. This automatic control device shall function on either:

1. A scheduled basis, using time-of-day, with an independent program schedule that controls the interior lighting in areas that do not exceed 25,000 square feet (2323 m^2) and are not more than one floor; or
2. An occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space; or
3. A signal from another control or alarm system that indicates the area is unoccupied.

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

1. Sleeping unit (see Section 505.2.3).
2. Lighting in spaces where patient care is directly provided.
3. Spaces where an automatic shutoff would endanger occupant safety or security.
4. Where the system is serving an area that must be continuously lit.
5. In residential buildings, hotels and motels, the lighting of corridors, guestrooms, and lodging quarters.
6. Where the use of the space prohibits the use of a pre-established lighting program.

Reason: The heading of "Automatic lighting shutoff" is misleading, since the purpose of this code section is to install controls which automatically shut off the lighting. In order to be consistent with other sections of the code, specifically IECC 505.2.1, 505.2.2 and 505.2.2.1, the word "controls" should be added.

The code as currently written provides no relief to those situations where automatic shut-off controls for lighting are impractical. Systems serving continuously lit (24 hrs/day – 7 days/week) areas involving hospitals, fire and police stations, factories, grocery stores, gas stations, etc. should not be for their installation. Corridors, guestrooms, and lodging quarters in residential buildings, hotels and motels should be exempt since there is no defined time of use, and these spaces are required to operate continuously. Spaces such as charter airplane hangars, storage buildings, educational gymnasiums where the use of the space varies from day to day, and in some cases, may not be used for weeks on end, with limited opportunity for payback on the installation of such systems. This submitter requests that each of the proposed exceptions be reviewed independently so that rejection of any one listed exception does not limit the acceptance of any of the others listed.

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

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

EC121–06/07
505.2.2.2

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing himself

Revise as follows:

505.2.2.2 Automatic lighting shutoff controls. Buildings larger than 5,000 square feet (465m2) shall be equipped with an automatic control device to shut off lighting in those areas. This automatic control device shall function on either:

1. A scheduled basis, using time-of-day, with an independent program schedule that controls the interior lighting in areas that do not exceed 25,000 square feet (2323 m2) and are not more than one floor; or
2. An occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space; or
3. A signal from another control or alarm system that indicates the area is unoccupied.

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

1. Sleeping unit (see Section 505.2.3).
2. Lighting in spaces where patient care is directly provided.
3. Spaces where an automatic shutoff would endanger occupant safety or security.
4. Spaces that must be continuously lit.
5. Spaces where the use of the space prohibits the use of a pre-established lighting program.

Reason: The heading of "Automatic lighting shutoff" is misleading, since the purpose of this code section is to install controls which automatically shut off the lighting. In order to be consistent with other sections of the code, specifically IECC 505.2.1, 505.2.2 and 505.2.2.1, the word "controls" should be added.

The purpose of installing automatic lighting shutoff controls is to save energy. If energy cannot be saved, there should be no need for installation of the controls. If a local grocery store, gas station, factory, etc. is designated for use 24 hours per day, 7 days a week throughout the year, it would seem inappropriate to install, at the owners cost, automatic lighting shut-off controls since installation will not provide any energy savings to the building, the owner or the community.

Additionally, if a space use is always changing from day to day, use of a pre-programmed timing device would be rendered ineffective. An example includes a large storage building which is only occupied to obtain raw factory materials when those at the main factory are in low supply. Such buildings may only be entered only a few days a week, and even then for only short durations. Another example would be an airplane hangar for a business involving charter flights. Such a business might occupy the building limitedly on Sunday morning prior to flight, and may not return until late Tuesday, only to again leave say Thursday at noon and not return until late Saturday evening. A schedule, as described, would be difficult to program.

As part of this proposal, the submitter is asking that each of the listed exemptions be reviewed independently of any other. If the council finds that one of the listed exceptions is questionable, this submitter is asking that the council keep the other exception that is not in question, and include it as part of the code change involving the word "controls" in the section heading.

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

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

EC122–06/07

202, 505.2.2.3 (New)

Proponent: John Neff, Washington State Building Code Council, representing same

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

DAYLIGHT ZONE:

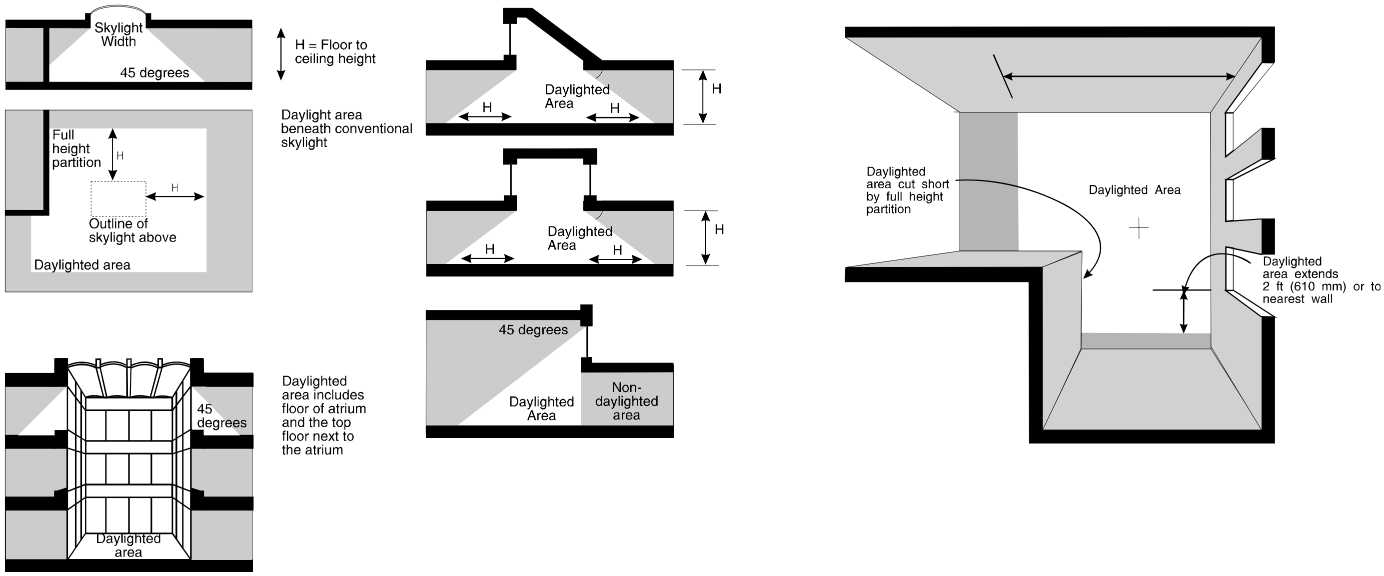
1, **Under skylights**: The area under skylights whose horizontal dimension, in each direction, is equal to the skylight dimension in that direction plus either the floor to ceiling height or the dimension to a ceiling height opaque partition, or one-half the distance to adjacent skylights or vertical fenestration, whichever is least.

2. **Adjacent to vertical fenestration**: The area adjacent to vertical fenestration which receives daylight through the fenestration. For purposes of this definition and unless more detailed analysis is provided, the daylight zone depth is assumed to extend into the space a distance of 15 feet or to the nearest ceiling height opaque partition, whichever is less. The daylight zone width is assumed to be the width of the window plus two feet on each side, or the window width plus the distance to an opaque partition, or the window width plus one-half the distance to adjacent skylight or vertical fenestration, whichever is least.

505.2.2.3 Daylight zone control. Daylight zones, as defined by this code, shall be provided with individual controls which control the lights independent of general area lighting. Contiguous daylight zones adjacent to vertical fenestration are allowed to be controlled by a single controlling device provided that they do not include zones facing more than two adjacent cardinal orientations (i.e. north, east, south, west). Daylight zones under skylights more than 15 feet from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration.

Exception: Daylight spaces enclosed by walls or ceiling height partitions and containing 2 or fewer light fixtures are not required to have a separate switch for general area lighting.

Reason: Presently there is no provision for allowing occupants to take advantage of being in a daylight zone to use natural light instead of energy consuming electric lighting fixtures. If the circuiting is not done correctly, then the occupants are not able to turn off lighting in the daylight zones without also turning off lights in interior zones that do not receive daylight. Recircuiting after initial construction is an added expense that should not have to be incurred. This proposal would remedy that problem and encourage the use of daylighting. The graphics below provide some illustrations of daylight zones.



Cost Impact: This code change proposal would have a minor impact on costs. It would require that the lighting circuiting be laid out along the lines of interior zones and perimeter zones.

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

EC123–06/07
505.2.3

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing himself

Revise as follows:

505.2.3 Sleeping unit controls. Sleeping units in hotels, motels, boarding houses or similar buildings shall have at least one master switch at the main entry door that controls all permanently wired luminaires and switched receptacles, except those in the bathroom(s). Suites shall have a control meeting these requirements at the entry to each room or at the primary entry to the suite.

Reason: Adding the word, "controls" clarifies that this section is dealing with the lighting controls associated with sleeping units, as generalized under IECC Section 505.2

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

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

EC124–06/07
505.5.1

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing himself

Revise as follows:

505.5.1 Total connected interior lighting power. The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment as determined in accordance with Sections 505.5.1.1 through 505.5.1.4.

Exceptions: The connected power associated with the following lighting equipment is not included in calculating total connected lighting power.

1. Specialized medical, dental and research lighting.
2. Professional sports arena playing field lighting.
3. Display lighting for exhibits in galleries, museums and monuments.

4. Sleeping unit lighting in hotels, motels, boarding houses or similar buildings.
5. Emergency lighting automatically off during normal building operation.
6. Lighting for theatrical purposes, including performance, stage, film production and video production.
7. Lighting for photographic processes.
8. Lighting integral to equipment or instrumentation and is installed by the manufacturer.
9. Task lighting for plant growth or maintenance.
10. Advertising signage or directional signage.
11. In restaurant buildings and areas, lighting for food warming or integral to food preparation equipment.
12. Lighting equipment that is for sale.
13. Lighting demonstration equipment in lighting education facilities.
14. Lighting approved because of safety or emergency considerations, inclusive of exit lights.

Reason: The list of exceptions in the 2006 IECC code for items which are not to be included as part of the total connected interior lighting power is incomplete. The proposed list of additional exceptions is clear, concise, and readily identifies various other lighting elements that should not be included as part of the lighting load of the building. The list is a compilation of topics already incorporated into the State of Wisconsin's past State Commercial Building Code. The list has served to be reasonable, fair, and an effective way to save energy without causing conflict with proprietors or other building systems.

Stages require multifaceted lighting to create moods, backgrounds, etc. associated with the performance. The current code has no exception for lighting used for this type of action. Failure to have an exception will cause unfair hardship to those groups involved in the use of theaters and other similar assemblies. In order to provide a clear picture to their customers, television, video, film production require specialized lighting. Photography studios, in order to create professional setting, uses lighting in various intensities, colors and directions in order to create a final, acceptable, product for their customer. Factories may have machines which have integral lighting specific to their use, which does not involve process lighting. Greenhouses require that lights be operational for plant warmth and growth. Although greenhouses are many times used for agricultural purposes, and for research, they also are used for general plant growth in a mercantile setting for future public purchase. Signage involving the name of the store, diner, business, school, etc. is to be exempted as it is a required part of commerce. Directional signage is required for locating toilet areas, refreshment/food areas, lobby areas, etc. Food preparation areas commonly incorporate heat lamps to maintain food warmth. The intent of this lighting is not for lighting of the space, but for warming of the food or other prepared material. Lighting stores require operation of the lighting fixtures they are selling to demonstrate their appearance. It is the intent of the submitter that ONLY those lighting fixtures, clearly identified for sale to the public, be exempt. Lighting in education facilities that is installed to show how the lighting will "look" when installed, how it portrays colors, shades, etc., should be exempt. Lighting education facilities provide an opportunity to view a typical lighting set-up without having to fully implement such a system in the field. Lastly, exit signs are required to be operational at all times, thus if this exception is not included, the current code wording requires that their wattage be included in determining the interior lighting power requirements, which does not follow ASHRAE 90.1. Additionally, using the code to restrict the amount of light used in a place like a penal institution, is unreasonable, and the code should be modified to address this type of situation.

As part of this proposal, the submitter is asking that each of the listed exemptions be reviewed independently of any other. If the council finds that one of the listed exceptions is questionable, this submitter is asking that the council keep all other exceptions that are not in question, and include them as part of the code change.

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

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

EC125–06/07
505.2.4

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

Delete and substitute as follows:

505.2.4Exterior lighting controls. ~~Lighting for all exterior applications shall have automatic controls capable of turning off exterior lighting when sufficient daylight is available or when the lighting is not required during night-time hours. Lighting not designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photosensor. Astronomical time switches shall be capable of retaining programming and the time setting during loss of power for a period of at least 10 hours.~~

> ~~**Exception:** Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.~~

Lighting not designated for dusk-to-dawn operation shall be controlled by either a combination of a photosensor and a time switch, or an astronomical time switch. Lighting designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photosensor. All time switches shall be capable of retaining programming and the time setting during loss of power for a period of at least 10 hours.

Reason: The proposed change provides for better control of exterior lighting by ensuring that non-dawn to dusk lighting such as covered areas is controlled to account for seasonal light level changes and matches the back-up requirement for this equipment (10 hours) with a similar control backup of 10 hours in section 503.2.4.3.2. This also brings Section 505.5.1 into closer agreement with ANSI/ASHRAE/IESNA Standard 90.1-2004.

Cost Impact: The code change proposal may increase the cost of construction for those lighting systems not already employing these types of timing and seasonal controls.

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

EC126–06/07
505.5.1

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

Revise as follows:

505.5.1 Total connected interior lighting power. The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment as determined in accordance with Sections 505.5.1.1 through 505.5.1.4.

Exceptions:

1. The connected power associated with the following lighting equipment is not included in calculating total connected lighting power.

~~1. Specialized medical, dental and research lighting.~~

~~2.~~ 1.1. Professional sports arena playing field lighting.

~~3. Display lighting for exhibits in galleries, museums and monuments.~~

~~4.~~ 1.2. Guestroom lighting in hotels, motels, boarding houses or similar buildings.

~~5~~ 1.3. Emergency lighting automatically off during normal building operation.

2. Lighting equipment used for the following shall be exempt provided that it is in addition to general lighting and is controlled by an independent control device:

2.1. Task lighting for medical and dental purposes.

2.2. Display lighting for exhibits in galleries, museums and monuments.

Reason: Medical, dental, and research applications as well as galleries, museums, and monuments require specialized lighting systems that generally have higher connected power than the code allows. However, this special lighting is only required during a portion of the total illuminated hours of these facilities. For example, the patient area of an operating room may require 200 to 300 foot-candles during a surgical procedure, However during setup, clean-up, and custodial activities, these spaces may require only 40 foot-candles. If the high power specialty lighting system is the only system installed, then excess lighting energy is used whenever the space is occupied, whether specialty lighting is required or not.. Having the specialty lighting exception contingent on installing a code complying ambient system will result in reasonable lighting power use during a large number of operating hours.

The purpose of the code change proposal is to require general lighting systems as well as the exempt lighting systems in the specified spaces.

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

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

EC127–06/07
505.5.1.4

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

Revise as follows:

505.5.1.4 Line voltage lighting track and plug-in busway. The wattage of line-voltage lighting track and plug-in busway that allow the addition and/or relocation of luminaires without altering the wiring of the system shall be the greater of the specified wattage of the luminaires ~~determined in accordance with Sections 505.5.1.1 through 505.5.1.3~~ included in the system with a minimum of 30W/linear foot (98 W/lin m) or the wattage limit of the systems circuit breaker, or the wattage of a system current limiting device.

Reason: The proposed change brings Section 505.5.1.4 into close agreement with ANSI/ASHRAE/IESNA Standard 90.1-2004. The proposed change addresses the fact that there are several other ways of limiting the wattage of line-voltage lighting track and plug-in busway lighting, specifically by the wattage limit on the system circuit breaker or the use of a system current limiting device. The primary issue prompting this change is that in some mostly retail designs, additional track is installed purely for flexibility in lighting displays so that fixture heads can be more freely positioned throughout the sales area. However, since the minimum compliance wattage is based on footage of track, this can unfairly penalize a design that does not intend to load all track length with fixtures. This provision allows the retailer to limit the track to specified load wattage, retain the flexibility of relocating fixtures, and still meet the intent of the code by limiting total wattage allowed on the track.

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

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

EC128–06/07
505.6, 505.6.1

Proponent: Randall R. Dahmen, WI Registered PE, WI Licensed Commercial Building Inspector, representing himself

1. Revise as follows:

505.6 Exterior lighting power requirements. (Mandatory). A building complies with this section if its total connected lighting power calculated under 505.6.1 is not greater than the lighting power densities as calculated under Section 505.6.2 ~~When the power~~ for exterior lighting is supplied through the energy service of a ~~to the~~ building~~, all exterior lighting, other than low-voltage landscape lighting, shall comply with Sections 505.6.1 and 505.6.2~~.

All exterior building grounds luminaires that operate at greater than 100 watts shall contain lamps having a minimum efficacy of 60 lumens per watt unless the luminaire is controlled by a motion sensor or qualifies for one of the exceptions under Section 505.6.2.

Exceptions:

1. Where approved because of historical, safety, signage or emergency considerations.
2. Low voltage landscape lighting.

2. Delete and substitute as follows:

~~**505.6.1 Exterior building grounds lighting.** All exterior building grounds luminaires that operate at greater than 100 watts shall contain lamps having a minimum efficacy of 60 lumens per watt unless the luminaire is controlled by a motion sensor or qualifies for one of the exceptions under Section 505.6.2.~~

505.6.1 Total connected exterior lighting power. The total connected exterior lighting power (watts) shall be the sum of the watts of all exterior lighting equipment as determined in accordance with 505.5.1.1 through 505.5.1.4 and 505.6.1.1.

Reason: As currently listed in the code, there is no direction as to how compliance is to be accomplished when using exterior lighting section of the IECC. The change in the introduction for IECC 505.6 involves the use of similar language to that language used in IECC 505.5 so as to indicate how compliance is to be accomplished.

The total connected exterior power, and how that total is established is not currently defined in the code. Section IECC 505.5 defines how to associate the connected power to various interior lighting assemblies, but that criteria, as currently listed, does not carry over to exterior lighting assemblies.

This proposal is open to modifications so as to be more user friendly to code users, and to maintain continuity in code language between 505.5 and 505.6.

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

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

EC129–06/07
505.7 (New)

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

Add new text as follows:

505.7 Documentation. The location(s) of remote transformers and mini circuit breaker/switches, as applicable, and method of accrual for line-voltage lighting track, integral lamp/ballast track, and plug-in busway systems shall be clearly identified on the construction documents.

(Renumber subsequent section)

Reason: The purpose of this code change is to assist the code official by providing information about the location of transformers and circuit breakers on the construction documents.

From a code enforcement perspective, it is extremely difficult, if not impossible, to determine the presence or location of devices that control either the voltage or amperage of lighting systems and thus control the wattage of those systems. Such devices might include remote transformers in low voltage systems (such as those covered in Section 505.5.1.2) or series-wired sub panels with low-amperage switches. This proposal simply adds a requirement that any voltage or current limiting device used in a lighting system be clearly shown on the plans and the location of such a device be marked on the plans to allow the code official to check for compliance with Sections 505.5.1.2 through 505.5.1.4 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

EC130–06/07
Chapter 10

Proponent: Standards writing organizations as listed below.

Revise standards as follows:

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle NE
Atlanta, GA 30329-2305

Standard reference number	Title
119-88(R2004) (~~R1994~~)	Air Leakage Performance for Detached Single-Family Residential Buildings
13256-1 (2005) ~~2004~~	Water-source Heat Pumps - Testing and Rating for Performance - Part 1: Water-to-Air and Brine-to-Air Heat Pumps (ANSI/ ASHRAE/ IESNA 90.1-2004)
ASHRAE-2005 ~~2004~~	ASHRAE Fundamentals Handbook – 2005 2004

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269-9101

Standard reference number	Title
110-05 ~~02~~	Emergency and Standby Power Systems
111-05 ~~01~~	Stored Electrical Energy Emergency and Standby Power Systems

UL

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, IL 60062-2096

Standard reference number	Title
181A-2005 ~~1995~~	Closure Systems for Use with Rigid Air Ducts and Air Connectors ~~with Revisions through December 1998~~
181B-2005 ~~1995~~	Closure Systems for Use with Flexible Air Ducts and Air Connectors ~~with Revisions through August 2003~~
731-1995	Oil Fired Unit Heaters with Revisions through February 2006

Reason: The *ICC Code Development Process for the International Codes* (Procedures) Section 4.5* requires the updating of referenced standards to be accomplished administratively, and be processed as a Code Proposal. In May 2004 a letter was sent to each developer of standards that are referenced in the I-Codes, asking them to provide ICC with a list of their standards in order to update to the current edition. Above is the list received of the referenced standards under the maintenance responsibility of the IECC Committee.

> ***4.5 Updating Standards:** The updating of standards referenced by the Codes shall be accomplished administratively by the appropriate code development committee in accordance with these full procedures except that multiple standards to be updated may be included in a single proposal.

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

EC131–06/07
Appendix XX (New)

Proponent: Harry Misuriello, Alliance to Save Energy, representing same

Add new text as follows:

INTRODUCTION

The purpose of the Informative Appendix (“Appendix”) to the International Energy Conservation Code (IECC) is to provide jurisdictions with additional energy efficiency measures that can be adopted on a voluntary basis in cases where the jurisdiction has an interest in increasing its energy conservation objectives beyond what the basic IECC provides. The Appendix also serves as a publicly available repository of building energy code “best practices” that provides innovative ways of increasing energy efficiency that have been implemented in other jurisdictions. States and jurisdictions seeking additional energy efficiency options can review these optional measures and adopt them locally on a voluntary basis.

RESIDENTIAL LIGHTING EFFICIENCY

*Jurisdictions seeking to increase energy efficiency levels in residential lighting systems can adopt the following requirements. These provisions can be adopted by creating a new section **405 Lighting** in the basic IECC. These provisions are based on the California Energy Commission's "2005 Building Energy Efficiency Standards for Residential and Nonresidential Buildings" known as Title 24. The mandatory designation should be used if the jurisdiction wishes to prevent efficiency trade-offs between lighting and other building components through the Simulated Performance Alternative method in Section 404 of the IECC.*

SECTION 405
LIGHTING (Mandatory)

405.1 High efficacy luminaires. High Efficacy Luminaires for residential lighting shall contain only high efficacy lamps and shall not contain a medium screw base socket (E24/E26). A high efficacy lamp has a lamp efficacy that is no lower than the efficacies contained in TABLE 405.1. Ballasts for lamps rated 13 Watts or greater shall be electronic and shall have an output frequency no less than 20 kHz.

Exception: High intensity discharge luminaires containing hardwired electromagnetic ballasts in medium screw base sockets shall be considered high efficacy luminaires for the purposes of meeting Section 405.5, provided they meet the efficacies contained in TABLE 405.1.

NOTE: To determine the minimum lamp efficacy category only the watts of the lamp (not the ballast) are to be considered.

TABLE 405.1
HIGH EFFICACY LAMP REQUIREMENTS

LAMP POWER RATINg	MINIMUM LAMP EFFICACY
15 watts or less	40 lumens per watt
over 15 watts to 40 watts	50 lumens per watt
over 40 watts	60 lumens per watt

405.2 Lighting in kitchens. Permanently installed luminaires in kitchens shall be high efficacy luminaires.

Exception: Up to 50 percent of the total rated wattage of permanently installed luminaires in kitchens may be in luminaires that are not high efficacy luminaires, provided that these luminaires are controlled by switches separate from those controlling the high efficacy luminaires. The wattage of high efficacy luminaires shall be the total nominal rated wattage of the installed high efficacy lamp(s).

405.3 Lighting in bathroom, garages, laundry rooms, and utility rooms. Permanently installed luminaires in bathrooms, garages, laundry rooms, and utility rooms shall be high efficacy luminaires.

Exception: Permanently installed luminaires that are not high efficacy shall be allowed provided that they are controlled by an occupant sensor(s) and shall not have a control that allows the luminaire to be turned on automatically or that has an override allowing the luminaire to be always on.

They shall be capable of automatically turning off all the lights in an area no more than 30 minutes after the area has been vacated. In addition, ultrasonic and microwave devices shall have a built-in mechanism that allows calibration of the sensitivity of the device to room movement in order to reduce the false sensing of occupants.

405.4 Lighting other than in kitchens, bathrooms, garages, laundry rooms, and utility rooms. Permanently installed luminaires located other than in kitchens, bathrooms, garages, laundry rooms, and utility rooms shall be high efficacy luminaires.

Exceptions:

1. Permanently installed luminaires that are not high efficacy luminaires shall be allowed provided they are controlled by a dimmer switch.
2. Permanently installed luminaires that are not high efficacy shall be allowed provided that they are controlled by an occupant sensor(s) certified to comply with the exception criteria of Section 405.3. Such motion

sensors shall not have a control that allows the luminaire to be turned on automatically or that has an override allowing the luminaire to be always on.

3. Permanently installed luminaires that are not high efficacy luminaires shall be allowed in closets less than 70 square feet.

NOTE: Lighting in areas adjacent to the kitchen, including but not limited to dining and nook areas, are considered kitchen lighting if they are not separately switched from kitchen lighting.

405.5 Outdoor Lighting. Luminaires providing outdoor lighting and permanently mounted to a residential building or to other buildings on the same lot shall be high efficacy luminaires.

Exceptions:

1, Permanently installed outdoor luminaires that are not high efficacy shall be allowed provided that they are controlled by a motion sensor(s) with integral photocontrol certified to comply with the Exception criteria of Section 405.3.
2. Permanently installed luminaires in or around swimming pools, water features, or other locations subject to the local electrical code need not be high efficacy luminaires.

405.6 Common areas of low-rise residential buildings. Permanently installed lighting in the enclosed, non-dwelling spaces of low-rise residential buildings with four or more dwelling units shall be high efficacy luminaires.

Exception: Permanently installed luminaires that are not high efficacy shall be allowed provided that they are controlled by an occupant sensor(s) certified to comply with the Exception criteria of Section 405.3.

RESIDENTIAL BUILDING ENVELOPE AIR INFILTRATION

*Jurisdictions seeking to increase residential energy efficiency levels through control of outdoor air infiltration can adopt the following requirements. These provisions can be adopted by creating a new section **402.4.4 Building envelope infiltration** in the basic IECC. These provisions are based on the proposed New York State Energy Conservation Construction Code.*

402.4.4 Building envelope infiltration. The building thermal envelope shall not exceed 5.5 ACH50 as verified using instruments and procedures specified in ASHRAE/ASTM E779-1999. The test shall be conducted by a qualified person who shall demonstrate competence, to the satisfaction of the code official, for the conduct of such tests. For the purpose of this section, ACH50 shall mean air changes per hour of infiltration into a house as measured with a blower door at 50 pascals of pressure in accordance with ASHRAE/ASTM standard E779. Test results shall be provided to the code official and shall include:

1. Name and place of business of the tester;
2. Address of the building which was tested;
3. Conditioned floor area of dwelling, calculated in accordance with ANSI Z65-1996, except that conditioned floor area shall include areas where the ceiling height is less than 5 feet (1524 mm);
4. Measurement of ACH50; and
5. Certification of accuracy of test results and signature of tester.

DUCT LEAKAGE AND HVAC EQUIPMENT EFFICIENCIES

*Jurisdictions seeking to increase residential energy efficiency levels through control of HVAC system duct leakage or through higher HVAC equipment efficiencies can adopt the following requirements. These provisions can be adopted by creating a new section **403.2.4 Duct leakage** in the basic IECC. These requirements apply to duct distribution systems. An exception to the requirements can be claimed by using HVAC systems that exceed NAECA minimums. These provisions are based on the proposed New York State Energy Conservation Construction Code.*

403.2.4 Duct leakage. Air leakage from the duct distribution system where tested at CFM_{25} shall not exceed 6 percent of the conditioned floor area of the building, as verified using instruments and procedures specified in ANSI/ASHRAE 152-2004 and ASTM E1554-2003 Test Method A. Tests at other test pressures are permitted to be used if converted to equivalent leakage at 25 pascals (Pa) of pressure, and such equivalence is demonstrated to the satisfaction of the code enforcement official. The test shall be conducted by a qualified person who shall demonstrate competence, to the satisfaction of the code official, for the conduct of such tests. For the purpose of this section CFM25 shall mean the leakage from all ducts and plenums in CFM measured at 25 pascals of pressure in accordance with ASHRAE Standard 152 or ASTM E1554. Test results shall be provided to the code official and shall include:

1. Name and place of business of the tester;
2. Address of the building which was tested;
3. Conditioned floor area of dwelling, calculated in accordance with ANSI Z65-1996, except that conditioned floor area shall include areas where the ceiling height is less than 5 feet (1524 mm);
4. Measurement of CFM_{25} ; and
5. Certification of accuracy of test results and signature of tester.

Exception: Duct systems are exempt from this requirement if the mechanical equipment to which they are connected complies with the requirements of Table 403.2.4.

TABLE 403.2.4
OPTIONAL MECHANICAL EQUIPMENT EFFICIENCY REQUIREMENTS

HEATING SYSTEM TYPE	EFFICIENCY	UNITS
Gas furnace	90%	AFUE
Oil furnace[a]	82%	AFUE
Heat pump	8.2	HSPF

a. Air handler for oil furnace shall have Electricity Use Ratio (EUR) #7 for inputs over 94,000 Btu/hour, and EUR#6 for inputs not exceeding 94,000 Btu/hour. EUR is defined as the ratio of the annual electricity use of a furnace (EAE) divided by the furnace output capacity, in thousands of Btu per hour (kBtu/h). EAE and furnace output capacity shall be determined in accordance with 10 CFR Part 430. Energy Conservation Program for Consumer Products: Test Procedures for Furnaces/Boilers, Vented Home Heating Equipment, and Pool Heaters.

Reason: The states have long served as "living laboratories" for many types of public policy issues. Solutions to problems at the state level have often been adapted to meeting national needs based on successful state experience. The same concept can be applied to building energy codes. Indeed, it not uncommon for code measures that have been successful at the state level to make their way into the IECC in any given development cycle. We recommend that the ICC take an active role in compiling a catalog of state energy code best practices and innovations that have been tested at the state level and could potentially be included in the national IECC code. The proponent expects that if this Appendix concept is adopted, states, other jurisdictions and other interested parties will make useful contributions during each IECC code development cycle. In addition, states and jurisdictions seeking additional energy efficiency options will be able to review these optional measures and adopt them locally on a voluntary basis.

The purpose of the new Informative Appendix ("Appendix") to the International Energy Conservation Code (IECC) is to provide jurisdictions with additional energy efficiency measures that can be adopted on a voluntary basis in cases where the jurisdiction has an interest in increasing its energy conservation objectives beyond what the basic IECC provides. The Appendix can also serve as a publicly available repository of building energy code "best practices" that provides innovative ways of increasing energy efficiency that have been tried in other jurisdictions. The use of informative appendices in other ICC codes has set a precedent for this proposal.

Many of the technical topics of interest to the IECC community have been addressed in energy codes adopted by the states. For example, California's Title 24 energy code now includes provisions for residential lighting. New York is in the final stages of adopting a code requiring higher heating equipment efficiencies while maintaining consistency with NAECA. Massachusetts has included continuous air barrier requirements in its code. Some jurisdictions have adopted local window efficiency requirements that exceed those of Energy Star, and some states have addressed duct leakage and sealing. For the initial version of this Appendix, the proponent has proposed optional measures for residential lighting efficiency (based on California's 2005 Title 24) and building envelope air infiltration and duct leakage and HVAC efficiency requirements based on concepts in the currently proposed New Your State Energy Conservation Construction Code.

These provisions have been developed by states to address local energy efficiency needs and would be of interest to other jurisdictions. The proponent urges the IECC community to adopt this Appendix concept. This will provide jurisdictions with more choice and flexibility in addressing local energy efficiency needs through access to energy code best practices that have been tested in other jurisdictions, but that have not been included in the basic IECC. As they are included in an Informational Appendix, these measures are optional for jurisdictions to adopt on a voluntary basis.

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

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

EC132–06/07
IPC [E] 505.1

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

Revise IPC as follows:

[E] 505.1 Unfired vessel insulation. Unfired hotwater storage tanks shall be insulated to R-12.5 (h·ft^2·ºF)/Btu (R-2.2 m^2·K/W) ~~so that heat loss is limited to a maximum of 15 British thermal units per hour (Btu/h) per square foot (47 W/m^2) of external tank surface area. For purposes of determining this heat loss, the design ambient temperature shall not be higher than 65°F (18°C)~~.

Reason: Revise requirements for consistency with the IECC. This requirement is from the 2006 IECC Table 504.2. The existing IPC language is from an older version of the Model Energy Code. That language was taken from an older version of ASHRAE Standard 90. The requirements in Table 7.8 of ASHRAE/IESNA Standard 90.1-2004 match those in 2006 IECC Table 504.2

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

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