EC112–07/08
Table 502.2(1), Table 502.2(2)

Proponent: Daniel J. Walker, PE, Thomas Associates, Inc., representing Metal Building Manufacturers Association

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~~[a,b] (with R-5 thermal blocks [a],[b])~~	R-19 ~~+ R-10~~ ***U-0.065***	~~R-19~~ R-13 + R-13 U-0.055	~~R-19~~ R-13 + R-13 U-0.055	~~R-19~~ R-13 + R-13 U-0.055	~~R-19~~ R-13 + R-13 U-0.055	~~R-19~~ R-13 + R-19 U-0.049	~~R-19~~ R-13 + R-19 U-0.049	~~R-19 + R-10~~ R-11 + R-19 FC U-0.035
Walls, Above Grade								
Metal building[b]	~~R-13~~ R-16 U-0.093	~~R-13~~ R-16 U-0.093	~~R-13~~ R-19 U-0.084	~~R-13~~ R-19 U-0.084	~~R-13 + R-13~~ R-13 + R-5.6 ci U-0.069	~~R-13 + R-13~~ R-13 + R-5.6 ci U-0.069	~~R-13 + R-13~~ R-19 + R-5.6 ci U-0.057	~~R-13 + R-13~~ R-19 + R-5.6 ci U-0.057

(Portions of table not shown remain unchanged)

~~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.~~

a. When using R-value compliance method, a thermal spacer block is required, otherwise use the U-Factor compliance method. See Table 502.2(2).

(Re-letter subsequent notes)

TABLE 502.2(2)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES

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 roof with single fiberglass insulation layer. ~~Thermal blocks are a minimum, R-5 of rigid insulation., which extends 1 in. beyond the width of the purlin on each side, perpendicular to the purlin.~~ This construction is R-19 faced fiberglass insulation batts draped perpendicular~~ly~~ over the purlins. A minimum R-3.5 ~~T~~thermal spacer block~~s are then~~ is placed above the purlin/batt, and the roof deck is secured to the purlins.	ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"
R-13 + R-13 R-13 + R-19	Standing seam roof with two fiberglass insulation layers. The first R-value is for faced fiberglass insulation batts draped over purlins. The second R-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.	ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"

TABLE 502.2(2)
BUILDING ENVELOPE REQUIREMENTS – OPAQUE ASSEMBLIES (continued)

R-11 + R-19 FC	Filled cavity fiberglass insulation. A continuous vapor barrier is installed below the purlins and uninterrupted by framing members. Both layers of uncompressed, unfaced fiberglass insulation rest on top of the vapor barrier and are installed parallel, between the purlins. A minimum R-3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins.	ASHRAE/IESNA 90.1 Table A2.3 including Addendum "G"
WALLS		
~~R-13~~	~~Single insulation layer.~~ ~~The first layer of R-13 insulation batts is installed continuously perpendicular to the girts and is compressed as the metal skin is attached to the girts.~~	~~ASHRAE/IESNA 90.1 Table A3.2~~
~~R-13 + R-13~~	~~Double insulation layer.~~ ~~The first layer of R-13 insulation batts is installed continuously perpendicular to the girts, and is compressed as the metal skin is attached to the girts. The second layer of R-13 insulation batts is installed within the framing cavity.~~	~~ASHRAE/IESNA 90.1 Table A3.2~~
R-16, R-19	Single fiberglass insulation layer. The construction is faced fiberglass insulation batts installed vertically and compressed between the metal wall panels and the steel framing.	ASHRAE/IESNA 90.1 Table A3.2 including Addendum "G"
R-13 + R-5.6 ci R-19 + R-5.6 ci	The first R-value is for faced fiberglass insulation batts installed perpendicular and compressed between the metal wall panels and the steel framing. The second rated R-value is for continuous rigid insulation installed between the metal wall panel and steel framing, or on the interior of the steel framing.	ASHRAE/IESNA 90.1 Table A3.2 including Addendum "G"

For SI: 1 inch = 25.4 mm

Reason: This proposal corrects issues that were previously introduced into the IECC during the 2004 supplement code cycle that made the metal building provisions nearly impossible to enforce. The proposed minimum prescriptive requirements were determined using ASHRAE's Building Envelope Criteria Generator Spreadsheet, which incorporates updated cost information for energy, insulation, labor, etc. The minimum requirements selected are significantly more stringent than both the previous referenced edition of ASHRAE 90.1 and the 2006 IECC. The introduction of U-factors that relate to the prescriptive systems listed will give designers maximum flexibility in showing compliance using the prescriptive method, especially when alternate materials or methods are desired. A new wall insulation system is introduced (fiberglass + rigid board), which is straightforward for installers and inspectors. Finally, a new roof system construction is introduced, called "filled cavity", which has a significantly higher performance compared to the previous one shown for Climate Zone 8. The previous double layer insulation systems were difficult / impossible to install and the description was incomplete. The proposal is based on a draft addendum that has received a unanimous vote by the ASHRAE 90.1 Main Committee and is currently out for public review.

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

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

EC113–07/08
Table 502.3

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

Revise table as follows:

TABLE 502.3 (Supp)
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
~~***U*-Factor~~								
~~**Framing materials other than metal with or without metal reinforcement or cladding~~								
~~*U*-Factor~~	~~1.20~~	~~0.75~~	~~0.65~~	~~0.40~~	~~0.35~~	~~0.35~~	~~0.35~~	~~0.35~~
~~**Metal framing with or without thermal break~~								
Curtain Wall/Storefront *U*-Factor	1.0	0.70	0.60	0.50	0.45	0.45	0.45	0.45
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~~ 1.05	~~0.75~~ 0.60	~~0.65~~ 0.55	~~0.55~~ 0.40	~~0.55~~ 0.35	~~0.55~~ 0.35	~~0.50~~ 0.35	~~0.50~~ 0.35
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)								
U-Factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

(Footnote not shown remains unchanged)

Reason: This proposal will remove an existing material bias found in Table 502.3 that allows windows with metal frames to meet less restrictive U-Factor requirements. Providing separate performance requirements based upon the type of material used in the window frame is wrong, and gives special treatment to less efficient windows. To that point, the preface to the IECC contains the following statement: *"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 table does not reflect the guiding principles of the IECC and should be changed to provide a level playing field so that innovations in energy performance are encouraged. This proposal maintains the existing requirements for entrance door, storefront and curtain walls, while moving to one set of U-Factors for typical factory-built windows. Approval of this proposal will implement the last step necessary to transition Table 502.3 to material-neutral prescriptive performance requirements while at the same time increasing energy efficiency.

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

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

EC114–07/08
Table 502.3

Proponent: Craig Conner, Building Quality, representing himself

Revise table as follows:

TABLE 502.3 (Supp)
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
***U*-Factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-Factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront *U*-Factor	1.0	0.70	0.60	0.50	0.45	0.45	0.45	0.45
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	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR
Plastic								
U-factor	1.60	0.90	0.90	0.75	0.75	0.75	0.60	0.60
SHCG	0.50	0.50	0.50	0.55	0.55	0.55	NR	NR

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

Reason: Skylight requirements were made much more stringent in the last code cycle. As approved, compliance with the skylight requirement becomes very difficult for plastic skylights. Plastic skylights have advantages in several practical applications; for example, where large skylights are used and where diffuse lighting is an important part of day lighting. The values proposed in the revised Table 502.3 above are more reasonable for plastic skylights. The glass skylight values are unchanged.

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

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

EC115–07/08
Table 502.3, 502.3.2

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

Revise as follows:

TABLE 502.3 (Supp)
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 Except Marine	5 and Marine 4	6	7	8
Vertical Fenestration (40% maximum of above-grade wall)								
***U*-Factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-Factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain Wall/Storefront *U*-Factor	1.0	0.70	0.60	0.50	0.45	0.45	0.45	0.45
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)								
U-Factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

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

502.3.2 Maximum *U*-Factor and SHGC. For vertical fenestration and skylights, 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 be evaluated separately, or an area-weighted *PF* value shall be calculated and used for all windows and glass doors.~~

Reason: This proposal simplifies the commercial buildings prescriptive path by eliminating projection factor trade-offs for SHGC. Users may continue to use projection factors in the more complex "total building performance" compliance path, where orientation and the specific impact of each overhang can be taken into consideration.

By eliminating complicated calculations for overhangs, the proposal simplifies compliance and enforcement efforts, consistent with the purpose of the simplified prescriptive path in section 502 of the IECC, while providing a more sure way of reducing energy cost, energy usage, peak demand, and HVAC size. The current fenestration table in the IECC allows a weaker fenestration SHGC when projection factors are incorporated into the building's design. This extra set of calculations is difficult for code officials and designers alike, because an accurate projection factor must be calculated for each window, and then worked into an area-weighted average. Similarly, the code official must inspect and measure each overhang to determine if the exception is properly applied.

Further, the SHGC trade-off is irregularly applied in the table. The trade-off ratios change depending on climate zone for no particular reason. For example, it makes no sense in climate zones 4-6 that there is no SHGC requirement once the projection factor reaches 0.25. Similarly, the values for climate zones 1-3 do not reflect accurate calculations of the effects of projection factor.

Moreover, in cases where projections (overhangs) are installed, this proposal, if adopted, will save energy, because the building will benefit from both the effect of the overhang and the lower SHGC. Since there is typically no significant cost differential between various SHGC levels for the types of fenestration specified in this table, there is no valid reason for allowing a trade-off that will simply increase overall energy use and cost in most commercial buildings. Good solar control in windows will also provide substantially increased comfort for the occupant and reduce electrical peak demands and HVAC sizing.

Projection factors can be more or less effective, depending on the orientation of the building, climate zone, reflection, and other shading considerations. The angle of the sun and the percentage of the window exposed will vary greatly depending on the orientation of the window and the location of the building. Because orientation is not a required part of the calculation, the projection factor trade-off is simply inaccurate. The projection factor trade-off is particularly problematic because it is traded off against windows with low SHGC, which consistently block unwanted heat gain regardless of the building's orientation. There is also no persuasive evidence that the trade-off values in the current table are reasonable trades, given all the variables that could affect the building's performance.

The proposed change is easier for a building official to enforce, and it allows more design freedom and greater certainty for the designer because it reduces the number of calculations and gives certain values for window performance. The proposed code change is likely, over time, to result in lower product costs due to economies of scale, inventory costs and competitive forces. Most importantly, it equalizes the stringency by removing a trade-off that is inconsistently applied and that cannot guarantee the same level of 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

EC116–07/08
502.3 (New), Chapter 6 (New)

Proponent: Shirley Muns, US Green Fiber, LLC

1. Add new text as follows:

502.3 Roof reflectance. Low and medium sloped roofs in Climate Zones 1, 2, and 3 shall comply with the following requirements for reflectance when tested in accordance with ASTM C1549, E903, E1918 or by testing with a portable reflectometer at near ambient conditions. The roof surface of low sloped roofs (2:12 or less) shall have an initial solar reflectance greater than or equal to 0.65 and shall maintain a reflectance equal or grater than 0.50 for three years after installation. Medium sloped roofs (greater than 2:12 and less than or equal to 5:12) shall have a solar reflectance equal to or greater than 0.15 initially and for three years after installation.

Exceptions:

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

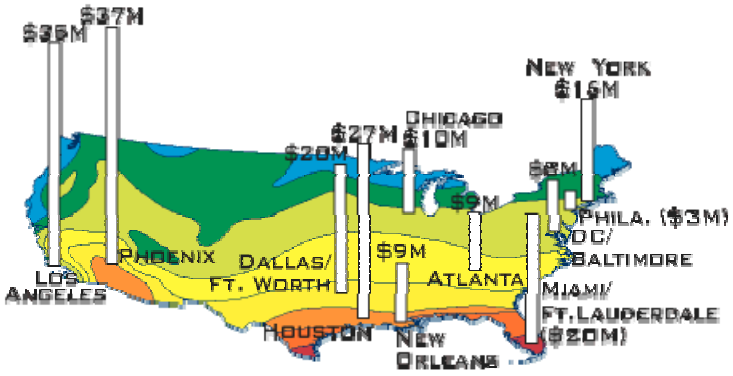
(Renumber subsequent sections)

2. Add standards to Chapter 6 as follows:

ASTM

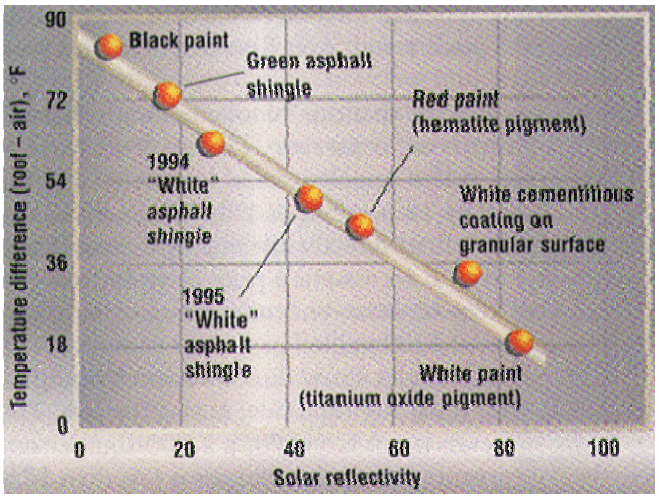
C1549-(04)	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
E903-(1996)	Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres
E1918-(1997)	Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field

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



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

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



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

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

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

EC117–07/08

502.3.2, 502.3.3 (New)

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

1. 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.

502.3.3 External shading. For vertical fenestration with permanently attached horizontal shading devices such as overhangs or eaves, 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.

A projection factor of 0.25 shall be assigned to fenestration using other methods of external shading including permanently attached shading devices, vertical fins, building self-shading, adjacent buildings, or other approved shading methods if the following conditions are met:

1. For fenestration facing within 45 degrees of west, at least 25% of the fenestration area shall be shaded at 5 p.m. on June 21.
2. For fenestration facing within 45 degrees of south, at least 75% of the fenestration area shall be shaded at noon on June 21.
3. For fenestration facing within 45 degrees of east, at least 25% of the fenestration area shall be shaded at 9 a.m. on June 21.
4. For fenestration facing within 45 degrees of north, at least 50% of the fenestration area shall be shaded at 5 p.m. on June 21.

Reason: This proposal clarifies that because the manner in which projection factor (*PF*) is defined here, the *PF* calculation only applies to horizontal projections such as overhangs. At the same time, this proposal also provides for alternate methods of external shading which accomplish the same intent as the projection factor. The building designer may use numerous means to provide external shading including vertical fins, self-shading by other components of the same building, adjacent buildings, or other methods approved by the code official. Rather than defining a prescriptive requirement for each case, this proposal defines general performance criteria in terms of the amount of fenestration shaded on June 21 at a specific time for each orientation. The required percentages of shaded area correspond approximately to the equivalent amount of shading provided a 0.25 *PF* horizontal overhang for a building located in the central U.S., although more conservative for western-facing glass.

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

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

EC118–07/08
502.3.3 (New)

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

Add new text as follows:

502.3.3 External shading. In climate zones 1 through 5, fenestration facing west, south, and east shall be shaded such that the following conditions are met:

1. At least 20% of fenestration area facing within 45 degrees of west shall be shaded at 5 p.m. on June 21.
2. At least 50% of fenestration area facing within 45 degrees of south shall be shaded at noon on June 21.
3. At least 25% of fenestration area facing within 45 degrees of east shall be shaded at 9 a.m. on June 21.

External shading may include permanently attached shading devices, building self-shading, adjacent buildings, or other approved shading methods.

Reason: This proposal presents an aggressive new requirement for external shading of fenestration on west, south, and east orientations. We acknowledge this proposed requirement will increase the cost of construction, but if the committee and code body are looking for new approaches to maximizing energy performance, this proposal promotes a known good building practice which will help reduce cooling energy use and peak load demand. Rather than prescribing a mandatory projection factor (which only applies to horizontal projections such as overhangs), this proposal defines general performance criteria in terms of the amount of fenestration shaded on June 21 at a specific time for each orientation. The building

designer may use numerous means to meet this requirement including permanently attached shading devices (overhangs, eaves, fins), self-shading by other components of the same building, adjacent buildings, or other methods approved by the code official. The required percentages of shaded area correspond roughly to the equivalent amount of shading provided by a 0.25 *PF* horizontal overhang on the east, a 0.15 *PF* horizontal overhang on the south, and a 0.25 *PF* overhang and fin on the west.

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

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

EC119–07/08
502.3.3 (New)

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

Add new text as follows:

502.3.3 Area-weighted U-factor and SHGC. An area-weighted average shall be permitted to satisfy the *U*-factor and SHGC requirements for each fenestration product category listed in Table 502.3. Individual fenestration products from different fenestration product categories listed in Table 502.3 shall not be combined in calculating area-weighted average *U*-factor or SHGC.

Reason: This proposal clarifies that area-weighted averages may be used to comply with the *U*-factor and SHGC requirements in Table 502.3. Currently, it is ambiguous whether each individual fenestration product must meet the specified requirement, or whether the overall average of all the individual products within that product type may be used. This proposal also clarifies that different product categories (skylight, curtainwall, entrance door, etc.) may not be mixed in the area-weighted calculation, because it would then be uncertain which *U*-factor or SHGC requirement would be used for code compliance.

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

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

EC120–07/08
202 (New), 502.3.3 (New), 505.2.5 (New), Chapter 6 (New)

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

1. Add new text as follows as follows:

SECTION 202
GENERAL DEFINITIONS

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

502.3.3 Minimum Skylight Area in Large Enclosed Spaces. In occupancy groups E, F-1, F-2, M, S-1, and S-2 in climate zones 1 through 5, when an enclosed space is greater than 25,000 square feet the following requirements shall apply:

1. The total skylight area shall be greater than or equal to 2% of the roof area.
2. 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.
3. All general lighting in daylight zones under skylights shall be controlled by multi-level daylighting controls that comply with Section 505.2.5.

   Exception: Refrigerated warehouses.

505.2.5 Multi-level daylighting controls. When automatic daylighting controls are required by this code, the general lighting in the daylight zone shall be separately controlled by at least one multi-level daylighting control that reduces the lighting power in response to daylight available in the space. When the daylit illuminance in the space is greater than the rated illuminance of the general lighting of daylight zone under skylights, the general lighting shall be automatically controlled so that its power draw is no greater than 35% of its rated power. The multi-level daylighting control shall be located so that calibration and set point adjustment controls are readily accessible and separate from the light sensor.

2. Add standard to Chapter 6 as follows:

ASTM

D 1003-00 Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics

Reason: This proposal establishes a new requirement for minimum skylight area in M, S, E, and F occupancy groups to increase energy savings through the use of natural daylighting. In previous cycles, the committee has been provided with analyses by Carli Inc. demonstrating that skylights provide energy savings in these types of buildings by significantly reducing lighting requirements. The analyses showed that the savings occur in all climate zones, and are optimized on average when the skylight area is approximately 6% of the roof area, even if the *U*-factor and SHGC requirements are relaxed. Although the energy savings are maximized with automatic daylighting controls, energy savings also occur even with manual on/off lighting controls such as required by section 505.2.2.3. (Background information is available at http://www.fenestration.com/skylights.php.) Similarly, ASHRAE recently approved a proposal (addendum *d* to ASHRAE 90.1-2007) that recognizes the benefit of skylights for offsetting lighting demand, allowing the SHGC requirements to be waived if certain lighting requirements are met.

This proposal does not waive or relax the *U*-factor and SHGC requirements, which was a previous concern of the committee. Instead, to ensure that a base level of natural daylighting is available, it requires a modest minimum skylight area (2%) along with automatic daylighting controls to maximize the lighting savings. All skylights are still required to meet the same *U*-factor and SHGC requirements of Table 502.3. To increase the overall energy savings in the code, we need to take advantage of every resource – in this case, the use of free solar energy in the form of natural daylighting.

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

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

EC121–07/08

502.3.3 (New)

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

Add new text as follows:

502.3.3 Minimum skylight area. In occupancy groups E, F-1, F-2, M, S-1, and S-2 in climate zones 1 through 5, when an enclosed space is greater than 25,000 square feet, the total skylight area shall be greater than or equal to 2% of the roof area.

Exception: Refrigerated warehouses.

Reason: This proposal establishes a new requirement for minimum skylight area in M, S, E, and F occupancy groups to increase energy savings through the use of natural daylighting. In previous cycles, the committee has been provided with analyses by Carli Inc. demonstrating that skylights provide energy savings in these types of buildings by significantly reducing lighting requirements. The analyses showed that the savings occur in all climate zones, and are optimized on average when the skylight area is approximately 6% of the roof area, even if the *U*-factor and SHGC requirements are relaxed. Although the energy savings are maximized with automatic daylighting controls, energy savings also occur even with manual on/off lighting controls such as required by section 505.2.2.3. (Background information is available at http://www.fenestration.com/skylights.php.) Similarly, ASHRAE recently approved a proposal (addendum *d* to ASHRAE 90.1-2007) that recognizes the benefit of skylights for offsetting lighting demand, allowing the SHGC requirements to be waived if certain lighting requirements are met.

This proposal does not waive or relax the *U*-factor and SHGC requirements, which was a previous concern of the committee. Instead, it very simply requires a modest minimum skylight area (2%) to ensure that a base level of natural daylighting is available. To reduce the complexity and cost impact, this proposal does not require automatic daylighting controls. Nonetheless, the new requirements in section 505.2.2.3 for separate lighting controls in daylight zones will still provide energy savings, due to the natural tendency for occupants to turn the lights down or not turn them on at all if sufficient lighting is being provided by daylighting. This use of manual on/off controls was included in the Carli analysis. There is also no conflict with the current requirements of Table 502.3, as the proposed 2% area is less than the 3% already allowed, and all skylights must still meet the same *U*-factor and SHGC requirements. The minimum skylight area will also preserve the potential for daylighting savings if automatic controls are installed in the future, similar to preserving solar access. To increase the overall energy savings in the code, we need to take advantage of every resource – in this case, the use of free solar energy in the form of natural daylighting.

Cost Impact: The code change proposal will increase the cost of construction if the original planned building did not include skylights.

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

EC122–07/08
202 (New), 502.3.3 (New), 505.2.5 (New), Chapter 6 (New)

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

1. Add new text as follows:

SECTION 202
GENRAL DEFINITIONS

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

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

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

502.3.3 Buildings with daylighting controls: Skylights meeting the following criteria shall be exempt from the SHGC requirements of Table 502.3 and the maximum percentage of gross roof assembly area that is skylights shall be 6%.

1. The haze value of the combined skylight glazing materials or diffuser in the skylight assembly is 90% or greater when tested according to ASTM D1003.
2. The skylight VLT is greater than 0.40 when determined in accordance with NFRC 200 or ASTM E972,
3. All general lighting in daylit areas under skylights is controlled by multi-level daylighting controls that comply with Section 505.2.5, and;
4. The U-factor of the skylights meet the requirements of Table 502.3.

505.2.5 Multi-level lighting controls. When multi-level lighting controls are required by this code, the general lighting in the daylight zone shall be separately controlled by at least one multi-level lighting control that reduces the lighting power in response to daylight available in the space. When the daylit illuminance in the space is greater than the rated illuminance of the general lighting of daylight zones under skylight, the general lighting shall be automatically controlled so that its power draw is no greater than 35% of its rated power. The multi-level lighting control shall be located so that calibration and set point adjustment controls are readily accessible and separate from the light sensor.

2. Add standards to Chapter 6 as follows:

ASTM

D1003-00	Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics
E972-96(2002)	Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight

Reason: This proposal provides an alternative prescriptive provision for skylights that provides significant energy savings over the 2006 IECC. The alternative increases the permitted skylight area to 6% of the roof area while providing multi-level lighting controls in the daylight zones under the skylights that automatically reduce the lighting power when daylight is provided. Analysis by Carli, Inc, and the Heschong Mahone Group that was provided to the committee in previous cycles demonstrated that energy savings as great as 40% over the 2006 IECC could be achieved when this combination is used. The analyses showed that savings occur in all climate zones, even if the *U*-factor and SHGC requirements are relaxed. (Background information is available at http://www.fenestration.com/skylights.php.). A similar proposal has been approved for the next edition of ASHRAE 90.1.

A similar proposal that contained more lenient U-factors was presented to the committee last cycle and disapproved, due to concerns that energy savings might not be achieved when skylights with the higher U-factors were used in contrast to new values that were approved for all skylights during that same cycle. Further review of the analysis by Carli and Heschong Mahone Group, however, indicates that comparisons to buildings equipped with skylights that met the new criteria were made during the initial study in climate zones 4 - 8. These comparisons demonstrated that significant energy savings were achieved even when skylights with higher U-factors and SHGC were installed at 6% of the roof area, in combination with automatic lighting controls, in comparison to the installation of skylights that met the more stringent U-factor and SHGC criteria at 3% of the roof area, without automatic lighting controls.

To address the committee's concerns regarding the more lenient U-values of the previous proposal, however, this proposal establishes the maximum U-factor as that given in Table 502.3 of the IECC for prescriptive design of commercial buildings. A minimum Visible Light Transmittance (VLT) of 0.40 is also established to allow the amount of daylight needed to achieve the energy savings anticipated to travel through the skylight. Since reducing the SHGC of the skylights has an adverse effect on VLT, the skylights are exempt from the SHGC requirement of Table 502.3. The restricted maximum U-factor of 0.75 or lower from Table 502.3 will inherently also limit the SHGC of the skylights, due to the need to use special coatings and/or multiple layers of glazing to achieve these U-factors.

Based upon this combination of factors, the anticipated energy savings from the Carli study for each climate zone is given below:

Climate Zone	1	2	3	4 except Marine	5 and Marine 4	6	7	8
Range of % energy saving over 2006 IECC	7 - 30	6 - 30	5 - 40	2 - 30	3 - 30	3 - 23	2 - 25	1 - 33
Average % energy savings over 2006 IECC	16	16	21	11	15	11	9	14

Overall this proposal is much simpler and easier to understand that the proposal previously considered by the IECC. It relies upon the definition of daylight zone under skylights that was approved during the previous ICC code change cycle as well as existing Table 502.3, while still achieving significant energy savings over the 2006 IECC.

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

Analysis: A review of the standards proposed for inclusion in the code, ASTM D1003 and E972 for compliance with ICC criteria for referenced standards given in Section 3.6 of Council Policy #CP 28 will be posted on the ICC website on or before January 15, 2008.

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

EC123–07/08

502.4.3, 502.4.3.1 (New), 502.4.3.2 (New), 502.4.3.3 (New), 502.4.3.4 (New), Chapter 6 (New)

Proponent: Dave Collins, AIA, The Preview Group, Inc., representing the AIA Codes Committee

1. Delete and substitute as follows:

~~**502.4.3 Sealing of the building envelope.** Openings and penetrations in the building envelope shall be sealed with caulking materials or closed with gasketing systems compatible with the construction materials and location. Joints and seams shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials spanning joints between construction materials shall allow for expansion and contraction of the construction materials.~~

502.4.3 Continuous air barrier. Except in unheated structures and as permitted by this section, a continuous air barrier shall be installed and shall have all the following characteristics:

1. Continuous throughout the envelope with all joints and seams sealed and with sealed connections between all transitions in planes and changes in materials and at all penetrations.
2. Joined and sealed in a flexible manner to the air barrier component of adjacent assemblies, allowing for the relative movement of these assemblies and components.
3. Withstand positive and negative combined design wind, fan and stack pressures on the air barrier without damage or displacement, and shall transfer the load to the structure. It shall not displace adjacent materials under full load.
4. Installed in accordance with the manufacturer's instructions and in such a manner as to achieve the performance requirements.
5. Penetrations of the continuous air barrier shall be made in a way such that the integrity of the continuous air barrier is maintained.

   Exception: Buildings that comply with 502.4.3.1.1 below are not required to comply with either 502.4.3 (1) or 502.4.3 (5) above.

502.4.3.1 Compliance. The materials, assemblies or full scale testing of a structure in accordance with Sections 502.4.3.2, 502.4.3.3, or 502.4.3.4. shall be used to determine compliance with Section 502.4.3.

502.4.3.2 Materials. Using individual materials that have an air permeability not to exceed 0.02 $L/s \cdot m^2$ under a pressure differential of 75 Pa (0.004 cfm/ft^2 under a pressure differential of 0.3 in. water (1.57 lb/ft^2)) when tested in accordance with ASTM E2178.

502.4.3.3 Assemblies. Assemblies of materials and components shall have an average air leakage not to exceed 0.2 $L/ s \cdot m^2$ @ 75 Pa (0.04 cfm/ft^2 under a pressure differential of 0.3" w.g. (1.57 psf)) when tested in accordance with ASTM E2357 or ASTM E1677. In addition these assemblies must meet the requirement for joints in accordance with Section 502.4.3.

502.4.3.4 Building. Testing the completed building and demonstrating that the air leakage rate of the building envelope does not exceed 2.0 L/s·m^2 @ 75 Pa (0.40 cfm/ft^2 at a pressure differential of 0.3" w.g. (1.57 psf)) in accordance with ASTM E779 or an equivalent approved method.

2. Add standards to Chapter 6 as follows:

ASTM

E779-99 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
E2357-05 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

Reason: A significant source of energy loss through building envelopes is due to pressure differentials that cause infiltration and exfiltration. The most effective means to prevent this is by means of a continuous air barrier integrated into the building envelope design. An air barrier prevents loss of conditioned air, reduces loads by stabilizing interior conditions, and reduces the possibility of airborne moisture condensing within the building envelope. An air barrier can therefore reduce energy costs, promote occupant comfort and productivity, and minimize the possibility of mold growth and structural damage due to condensation. A cost/benefit analysis of air barrier installations shows a reasonable payback period in all climate zones based on current energy costs.

The AIA has committed to the 2030 Challenge, seeking to reduce emissions of greenhouse gasses in new and existing buildings to 0 by 2030. In order to achieve this goal the efficiency of all building systems, including the building envelope, must be maximized. The importance of achieving this is based upon projections of global temperature rise as a result of global warming. The construction sector worldwide contributes roughly 60% of the emissions responsible for global warming. Air barriers have been found to be a safe and effective way to achieve reduction in energy loss for over a decade in Canada and for almost ten years in Massachusetts.

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

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

EC124–07/08
502.4.3, Chapter 6 (New)

Proponent: Mr. Laverne Dalgleish, Building Professionals Consortium, Inc., representing Air Barrier Association of America, Inc.

1. 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 using materials that have an air permeance not exceeding 0.004 cfm/ft2 at 0.3" wg. (1.57psf) (0.02 L/s.m2 @ 75 Pa) when tested in accordance with ASTM E 2178 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.

2. Add standard to Chapter 6 as follows:

ASTM

E 2178-03 Standard Test Method for Air Permeance of Building Materials

Reason: The purpose of the proposed code change is to clarify the Code. Currently the Code requires "Sealing of the building envelope" but there is no test method referenced to determine whether the material used in the building will actually seal the building envelope. Currently the joints etc could be caulked but the non joint material could allow excess air infiltration/exfiltration which would render the sealing of the joints etc as useless. By referencing the ASTM E 2178 standard, you provide a means for the building official a means to enforce the requirement of the Code otherwise the building official needs to determine requirements on a project by project basis.

Cost Impact: There is no cost impact as the existing requirement already covers the sealing of the building envelope.

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

EC125–07/08
502.4.6

Proponent: Gilbert Gonzales, Murray City Corporation, UT, representing the Utah Chapter of ICC

Revise as follows:

502.4.6 Vestibules. A door that separates conditioned space 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 the vestibule it is not necessary for the interior and exterior doors to open at the same time.

Exceptions:

1. Buildings in Climate Zones 1 and 2 as indicated in Figure 301.1 and Table 301.1.
2. Doors not intended to be used as a building entrance door~~, such as doors to mechanical or electrical equipment rooms~~.
3. Doors opening directly from a sleeping unit or dwelling unit.
4. Doors that open directly from a space less than 3,000 square feet (298 m2) in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

Reason: "Such as" is not appropriate in this location because this leaves the code user with the perception electrical and mechanical room doors are the only doors, which do not require vestibules.

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

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

EC126–07/08
202 (New), 502.4.6

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

1. Add new definition as follows:

SECTION 202
GENERAL DEFINITIONS

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

2. Revise as follows:

502.4.6 Vestibules. Building entrances ~~A door~~ that separate~~s~~ conditioned space 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 the vestibule it is not necessary for the interior and exterior doors to open at the same time. Vestibules shall not be provided with space conditioning.

Exceptions:

1. ~~Buildings~~ Building entrances in buildings located in Climate Zones 1 or ~~and~~ 2 as indicated in Figure 301.1 and Table 301.1.
2. Doors not intended to be used as a building entrance ~~door, such as doors to mechanical or electrical equipment rooms.~~
3. Doors opening directly from a sleeping unit or dwelling unit.

~~4. Doors that open directly from a space less than 3,000 square feet (298 m2) in area.~~
~~5. Revolving doors~~.
~~6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.~~
4. Building entrances with revolving doors and swinging doors, installed adjacent to the revolving door, as required by the *International Building Code*
5. Building entrances in buildings in buildings located in Climate Zones 3 and 4 that are less than four stories above grade and less than 10,000 ft^2 (1000 m^2) in area.
6. Building entrances in buildings located in Climate Zones 5, 6, 7 or 8 that are less than 1000 ft^2 (100 m^2) in area.
7. Doors that open directly from a space that is less than 3000 ft^2 (300 m^2) in area and is separate from the building entrance. A space is defined as an area surrounded by floor to ceiling partitions that is separated from an adjacent space by either a partition, window or door.

Reason: Section 502.4.6 Vestibules, as it appears in the 2006 IECC, is incomplete in its wording and is difficult to apply to a typical commercial building. Several terms in the requirement are not defined in the IECC e.g the term "space" and "entrance door". This requires the code user to refer to other reference documents to fully understand the code provision. Designers can, and, do, use the envelope requirements in ASHRAE/IESNA 90.1-2004 to exempt the building from the vestibule requirement as ASHRAE exempts buildings less than 4 stories from this requirement. This exemption in the ASHRAE creates confusion in the enforcement industry because of the inconsistent way that each of the code handles vestibules.

This proposed code change focuses on clarifying the vestibule requirement in the IECC and provides more consistency between the IECC and ASHRAE/IESNA 90.1-2007 by using the code text directly from language that will appear in Section 504.3.4 that will appear in the ASHRAE Standard. This text has been modified to reflect input from plan reviewers staff that have had problems and issues in the enforcement of the requirement.

The change first provides a definition of the term "building entrance" and then provides the requirements for the vestibule to protect the building entrance. The proposed code change focuses on the size of the building and number of stories verses placing a requirement on the size of the space that the entrance door is associated with. It will require that smaller buildings in colder climates include vestibules in their design but this will reduce the heat loss due to infiltration from the entrance doors which can be a high heat load. The vestibule requirement is intended to address the infiltration load on buildings in colder climates and applies to smaller buildings in Climate Zones 5 and above.

The term space is also defined in this proposed change to eliminate the question of how to demonstrate compliance when an adjacent space is connected to the space containing an entrance door if there is an open passage between the two spaces. Also, the proposed change disallows the ability to provide conditioned air to the vestibule instead depending on indirect heat and cool transfer from the conditioned space to temper the air in the vestibule.

The proposed change exempts the swinging doors that are requiring to be placed within 10 feet of a revolving door as required by the International Building Code. This change exempts these doors as they are intended for limited use into the space.

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

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

EC127–07/08
202 (New), 502.4.6

Proponent: Stephen Turchen, Fairfax County Department of Public Works and Environmental Services, Fairfax, VA

1. Add new definition as follows:

SECTION 202
GENERAL DEFINITIONS

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

2. Revise as follows:

502.4.6 Vestibules. ~~A door~~ Building entrances that separates conditioned space 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 the vestibule it is not necessary for the interior and exterior doors to open at the same time. Door swing and distance between vestibule doors shall conform to Sections 1008.1.2 and 1008.1.7 of the *International Building Code*. Vestibules shall not be made part of the conditioned space of the building to which they are attached.

Exceptions:

~~1. Buildings in Climate Zones 1 and 2 as indicated in Figure 301.1 and Table 301.1.~~

~~2~~ 1. Doors not intended to be used as a building entrance ~~door~~, such as doors to mechanical or electrical equipment rooms.

~~3~~ 2. Doors opening directly from a sleeping unit or dwelling unit.

4 3. Doors that open directly from a space less than 3,000 square feet (298 m_2) in area. Spaces that are separated from the "3000 ft^2 space" by a door or moveable partition shall not be considered part of the "3000 ft^2 space" for purposes of area computation.

~~5~~ 4. Building entrances with revolving doors. Any side-hinged swinging door required in addition to the revolving door in accordance with the 2006 IBC shall not require a vestibule.

~~6~~ 5. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

Reason: The purpose of the proposal is to clarify the IECC provisions as they to apply to vestibules for commercial buildings.
In practice, since this provision first appeared in the 2003 IECC, it has been difficult to interpret the requirements of IECC Section 502.4.6 for determining when an airlock vestibule should be added to a commercial building. What doors should be considered for vestibules? When is the space to which the door connects of a size that would require a vestibule? Answering questions like these in a logical and uniform manner has implications for both building design (and cost) and code enforcement, as well as energy conservation.

The new definition in Section 202 helps to define the class of doors that are eligible for vestibules. Only doors that are "ordinarily used to gain access" should be considered. Many doors can be used to get into a building, such as those discussed in exception #2, but they are not the primary means of access. Doors that are primarily exit discharge doors at the end of dedicated corridors or located to provide additional means of egress from large rooms are similarly ineligible, as they will not be used for "ordinary access." The inclusion of the phrase "or space" in the proposed definition is intended to account for large individual tenant spaces in strip malls or similar buildings which will have building entrance doors that open directly to the outdoors. In effect, the definition causes the designer or code official to answer the following simple question: Is this a door that will be used for significant pedestrian traffic into this building or space? If so, a vestibule will be required, unless one of the proposed exceptions applies.

Text on door swing and distance between vestibule doors was added to ensure conformity with the IBC requirements for means of egress doors. Any door qualifying as a "building entrance door" will with rare exception be an egress door for the building or space.

Text was added to the main paragraph of Sec. 502.4.6 to ensure that vestibules are not themselves separately conditioned. Vestibules will always be indirectly conditioned by the adjacent conditioned area of the building or space to which they are attached and the constant opening and closing of the interior door. The exterior door will always let in unconditioned outside air which the HVAC system will always be trying to condition, wasting energy unnecessarily, considering the short transit time of pedestrians in the vestibule. Providing this additional language will also clarify to designers that direct conditioning of vestibules is not required, another source of confusion in this area.

Exception 1 was deleted as there is no logical reason for excluding cooling-dominated climate zones from the vestibule requirement. Vestibules in these climate zones will help to prevent hot, humid air intrusion into the conditioned space, just as vestibules in heating zones will help to prevent the intrusion of cold outside air.

The addition to exception 4 will clarify how to compute the 3000 ft2 area when applying this exception, another source of confusion. One must consider only that floor area, directly adjacent to the building entrance door, which is completely bounded by walls, doors of any kind, or moveable partitions. (A fixed opening into an adjacent space would add the area of that adjacent space to the area directly adjacent to the building entrance door for the purposes of this exception.)

The addition to exception 5 clarifies the revolving door exemption. The IBC requires a side-hinged swinging door within 10 feet of a revolving door (Sec. 1008.1.3.1). Does the swinging door now become another "building entrance door" that needs a vestibule? The logical answer is "No," as the revolving door is considered to be providing the acceptable air-lock entry into the building or space, even though people may, on occasion, use the swinging door to gain access.

Cost Impact: The code change proposal will increase the cost of construction in those cases where vestibules are now clearly required, based on the revised language, but will decrease the cost of construction in those cases where the proposal provides enough information to determine that a vestibule is not in fact required for the building or space under consideration.

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

EC128–07/08

503.2.1, Chapter 6 (New)

Proponent: Wesley R. Davis, Air Conditioning Contractors of America, representing Air Conditioning Contractors of America and American Society of Heating, Refrigerating, and Air Conditioning Engineers

1. Revise as follows:

503.2.1 Calculation of heating and cooling loads. Design loads shall be determined in accordance with the procedures described in the ASHRAE/ACCA Standard 183 ~~*Fundamentals Handbook*~~. Heating and cooling loads shall be adjusted to account for load reductions that are achieved when energy recovery systems are utilized in the HVAC system in accordance with the ASHRAE *HVAC Systems and Equipment Handbook*. Alternatively, design loads shall be determined by an approved equivalent computation procedure, using the design parameters specified in Chapter 3.

2. Add standard to Chapter 6 as follows:

ANSI/ASHRAE/ACCA

Standard 183-2007	Peak Cooling and Heating Load Calculations in Buildings Except Low-Rise Residential Buildings

Reason: ANSI/ASHRAE/ACCA Standard 183 – 2007, *Peak Cooling and Heating Load Calculations in Buildings Except Low-Rise Residential Buildings* standardizes the methodology in the *Handbook of Fundamentals* and is suitable to replace the Handbook as the reference document.

ANSI/ASHRAE/ACCA Standard 183 – 2007 sets the minimum requirements for methods and procedures used to perform peak cooking and heating load calculations.

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

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

EC129–07/08

503.2.3, Table 403.2.3(7)-(8)-(9)-(10)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

1. Revise as follows:

503.2.3 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables 503.2.3(1), 503.2.3(2), 503.2.3(3), 503.2.3(4), 503.2.3(5), 503.2.3(6), 503.2.3(7), 503.2.3(8), 503.2.3(9), 503.2.3(10) and 503.2.3(11) when tested and rated in accordance with the applicable test procedure. The efficiency shall be verified through certification under an approved certification program or, if no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrates that the combined efficiency of the specified components meets the requirements herein.

Exception: Equipment listed in Table 503.2.3(7) not designed for operation at ARI Standard test conditions of 44°F (7°C) leaving chilled water temperature and 85°F (29°C) entering condenser water temperature shall have a minimum full load COP and IPLV rating as shown in Tables 503.2.3(8) through 503.2.3(10) as applicable. The table values are only applicable over the following full load design ranges:

Leaving Chilled
Water Temperature: 40 to 48°F (4 to 9°C)

Entering Condenser
Water Temperature: 75 to 85°F (24 to 29°C)

Condensing Water
Temperature Rise: 5 to 15°F (Δ3 to Δ8°C)

~~Chillers designed to operate outside of these ranges are not covered by this code.~~ Chillers designed to operate outside of these ranges or applications utilizing fluids or solutions with secondary coolants (e.g., glycol solutions or brines) with a freeze point of 27°F or less for freeze protection are not covered by this code.

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

Equipment Type	Size Category	Minimum Efficiency[a]	Test Procedure[b]
Air Cooled, with Condenser, Electrically Operated	~~< 150 tons~~ all capacities	2.80 COP ~~2.80~~ 3.05 IPLV	ARI 550/590
	~~≥ 150 tons~~	~~2.50 COP~~ ~~2.50 IPLV~~	
Air Cooled, without Condenser, Electrically Operated	All Capacities	3.10 COP ~~3.10~~ 3.45 IPLV	ARI 550/590
Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)	All Capacities	4.20 COP ~~4.65~~ 5.05 IPLV	
Water Cooled, Electrically Operated, Positive Displacement (Rotary Screw and Scroll)	<150 tons	4.45 COP ~~4.50~~ 5.20 IPLV	ARI 550/590
	≥150 tons and <300 tons	4.90 COP ~~4.95~~ 5.60 IPLV	
	≥300 tons	5.50 COP ~~5.60~~ 6.15 IPLV	
Water Cooled, Electrically Operated, Centrifugal	<150 tons	5.00 COP ~~5.00~~ 5.25 IPLV	ARI 550/590
	≥150 tons and <300 tons	5.55 COP ~~5.55~~ 5.90 IPLV	
	≥300 tons	6.10 COP ~~6.10~~ 6.40 IPLV	
Air-Cooled Absorption Single Effect	All Capacities	0.60 COP	ARI 560
Water-Cooled Absorption Single Effect	All Capacities	0.70 COP	
Absorption Double Effect, Indirect-Fired	All Capacities	1.00 COP 1.05 IPLV	
Absorption Double Effect, Direct-Fired	All Capacities	1.00 COP 1.00 IPLV	

For SI: 1 ton = 3.517 kW. °C = [(°F) - 32]/1.8.

a. Chapter 6 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

b. The chiller equipment requirements do not apply for chillers used in low temperature applications where the design leaving fluid temperature is less than or equal to 40°F.

2. Delete Tables 503.2.3(8)-(9)-(10) and substitute as follows:

TABLE 503.2.3(8)
MINIMUM EFFICIENCIES FOR CENTRIFUGAL CHILLERS <150 TONS AS APPROVED BY THE AMERICAN SOCIETY OF HEATING REFRIGERATING AND AIR-CONDITIONING ENGINEERS AND REVISED 2004

Centrifugal Chillers < 150 tons COPstd= 5.00; IPLVstd= 5.25														
			Condenser Flow Rate											
			2 gpm/ton		2.5 gpm/ton		3 gpm/ton		4 gpm/ton		5 gpm/ton		6 gpm/ton	
Leaving Chilled Water Temperature (°F)	Entering Con-denser Water Temperature (°F)	LIFTa (°F)	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc
40	75	35	5.11	5.35	5.33	5.58	5.48	5.73	5.67	5.93	5.79	6.06	5.88	6.15
40	80	40	4.62	4.83	4.92	5.14	5.09	5.32	5.27	5.52	5.38	5.63	5.45	5.70
40	85	45	3.84	4.01	4.32	4.52	4.58	4.79	4.84	5.06	4.98	5.20	5.06	5.29
41	75	34	5.19	5.43	5.41	5.66	5.56	5.81	5.75	6.02	5.89	6.16	5.99	6.26
41	80	39	4.73	4.95	5.01	5.24	5.17	5.41	5.35	5.60	5.46	5.71	5.53	5.78
41	85	44	4.02	4.21	4.46	4.67	4.70	4.91	4.94	5.17	5.06	5.30	5.14	5.38
42	75	33	5.27	5.51	5.49	5.74	5.64	5.90	5.85	6.12	6.00	6.27	6.11	6.39
42	80	38	4.84	5.06	5.10	5.33	5.25	5.49	5.43	5.67	5.53	5.79	5.61	5.87
42	85	43	4.19	4.38	4.59	4.80	4.81	5.03	5.03	5.26	5.15	5.38	5.22	5.46
43	75	32	5.35	5.59	5.57	5.82	5.72	5.99	5.95	6.23	6.11	6.39	6.23	6.52
43	80	37	4.94	5.16	5.18	5.42	5.32	5.57	5.50	5.76	5.62	5.87	5.70	5.96
43	85	42	4.35	4.55	4.71	4.93	4.91	5.13	5.12	5.35	5.23	5.47	5.30	5.54
44	75	31	5.42	5.67	5.65	5.91	5.82	6.08	6.07	6.34	6.24	6.53	6.37	6.67
44	80	36	5.03	5.26	5.26	5.50	5.40	5.65	5.58	5.84	5.70	5.96	5.79	6.05
44	85	41	4.49	4.69	4.82	5.04	5.00	5.25	5.20	5.43	5.30	5.55	5.38	5.62
45	75	30	5.50	5.75	5.74	6.00	5.92	6.19	6.19	6.47	6.38	6.68	6.53	6.83
45	80	35	5.11	5.35	5.33	5.58	5.48	5.73	5.67	5.93	5.79	6.06	5.88	6.15
45	85	40	4.62	4.83	4.92	5.14	5.09	5.32	5.27	5.52	5.38	5.63	5.45	5.70
46	75	29	5.58	5.84	5.83	6.10	6.03	6.30	6.32	6.61	6.54	6.84	6.70	7.00
46	80	34	5.19	5.43	5.41	5.66	5.56	5.81	5.75	6.02	5.89	6.16	5.99	6.26
46	85	39	4.73	4.95	5.01	5.24	5.17	5.41	5.35	5.60	5.46	5.71	5.53	5.78
47	75	28	5.66	5.92	5.93	6.20	6.15	6.43	6.47	6.77	6.71	7.02	6.88	7.20
47	80	33	5.27	5.51	5.49	5.74	5.64	5.90	5.85	6.12	6.00	6.27	6.11	6.39
47	85	38	4.84	5.06	5.10	5.33	5.25	5.49	5.43	5.67	5.53	5.79	5.61	5.87
48	75	27	5.75	6.02	6.04	6.32	6.28	6.56	6.64	6.94	6.89	7.21	7.09	7.41
48	80	32	5.35	5.59	5.57	5.82	5.72	5.99	5.95	6.23	6.11	6.39	6.23	6.52
48	85	37	4.94	5.16	5.18	5.42	5.32	5.57	5.50	5.76	5.62	5.87	5.70	5.96
Condenser DTb			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: C = [(F)-32]/1.8, 1 gallon per minute = 3.785 L/min., 1 ton = 12,000 British thermal units per hour = 3.517 kW

a. LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
b. Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
c. All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperature which is IPLV

$Kadj = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
where X = Condenser DT + LIFT
COPadj = Kadj * COPstd

TABLE503.2.3(9)
MINIMUM EFFICIENCIES FOR CENTRIFUGAL CHILLERS ≥150 TONS, <300 TONS AS APPROVED BY THE AMERICAN SOCIETY OF HEATING REFRIGERATING AND AIR-CONDITIONING ENGINEERS AND REVISED 2004

Centrifugal Chillers ≥150 tons, <300 tons COPstd= 5.55; IPLVstd= 5.90														
			Condenser Flow Rate											
			2 gpm/ton		2.5 gpm/ton		3 gpm/ton		4 gpm/ton		5 gpm/ton		6 gpm/ton	
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFTa (°F)	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc
40	75	35	5.65	6.03	5.90	6.29	6.05	6.46	6.26	6.68	6.40	6.83	6.51	6.94
40	80	40	5.10	5.44	5.44	5.80	5.62	6.00	5.83	6.22	5.95	6.35	6.03	6.43
40	85	45	4.24	4.52	4.77	5.09	5.06	5.40	5.35	5.71	5.50	5.87	5.59	5.97
41	75	34	5.74	6.13	5.80	6.38	6.14	6.55	6.36	6.79	6.51	6.95	6.62	7.06
41	80	39	5.23	5.58	5.54	5.91	5.71	6.10	5.91	6.31	6.03	6.44	6.11	6.52
41	85	44	4.45	4.74	4.93	5.26	5.19	5.54	5.46	5.82	5.60	5.97	5.69	6.07
42	75	33	5.83	6.22	6.07	6.47	6.23	6.65	6.47	6.90	6.63	7.07	6.75	7.20
42	80	38	5.35	5.71	5.64	6.01	5.80	6.19	6.00	6.40	6.12	6.53	6.20	6.62
42	85	43	4.63	4.94	5.08	5.41	5.31	5.67	5.56	5.93	5.69	6.07	5.77	6.16
43	75	32	5.91	6.31	6.15	6.56	6.33	6.75	6.58	7.02	6.76	7.21	6.89	7.35
43	80	37	5.46	5.82	5.73	6.11	5.89	6.28	6.08	6.49	6.21	6.62	6.30	6.72
43	85	42	4.81	5.13	5.21	5.55	5.42	5.79	5.66	6.03	5.78	6.16	5.86	6.25
44	75	31	6.00	6.40	6.24	6.66	6.43	6.86	6.71	7.15	6.90	7.36	7.05	7.52
44	80	36	5.56	5.93	5.81	6.20	5.97	6.37	6.17	6.58	6.30	6.72	6.40	6.82
44	85	41	4.96	5.29	5.33	5.68	5.55	5.90	5.74	6.13	5.86	6.26	5.94	6.34
45	75	30	6.08	6.49	6.34	6.76	6.54	6.98	6.84	7.30	7.06	7.53	7.22	7.70
45	80	35	5.65	6.03	5.90	6.29	6.05	6.46	6.26	6.68	6.40	6.83	6.51	6.94
45	85	40	5.10	5.44	5.44	5.80	5.62	6.00	5.83	6.22	5.95	6.35	6.03	6.43
46	75	29	6.17	6.58	6.44	6.87	6.66	7.11	6.99	7.46	7.23	7.71	7.40	7.90
46	80	34	5.74	6.13	5.80	6.38	6.14	6.55	6.36	6.79	6.51	6.95	6.62	7.06
46	85	39	5.23	5.58	5.54	5.91	5.71	6.10	5.91	6.31	6.03	6.44	6.11	6.52
47	75	28	6.26	6.68	6.56	6.99	6.79	7.24	7.16	7.63	7.42	7.91	7.61	8.11
47	80	33	5.83	6.21	6.07	6.47	6.23	6.64	6.47	6.90	6.63	7.07	6.75	7.20
47	85	38	5.35	5.70	5.64	6.01	5.80	6.19	6.00	6.40	6.12	6.52	6.20	6.61
48	75	27	6.36	6.78	6.68	7.12	6.94	7.40	7.34	7.82	7.62	8.13	7.83	8.35
48	80	32	5.91	6.30	6.15	6.56	6.33	6.75	6.58	7.02	6.76	7.21	6.89	7.35
48	85	37	5.46	5.82	5.73	6.10	5.89	6.28	6.08	6.49	6.21	6.62	6.30	6.71
Condenser DTb			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: C = [(F)-32]/1.8, 1 gallon per minute = 3.785 L/min., 1 ton = 12,000 British thermal units per hour = 3.517 kW

a. LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
b. Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
c. All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperature which is IPLV

$Kadj = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
where X = Condenser DT + LIFT
COPadj = Kadj * COPstd

TABLE 503.2.3(10)
MINIMUM EFFICIENCIES FOR CENTRIFUGAL CHILLERS >300 TONS AS APPROVED BY THE AMERICAN SOCIETYOF HEATING REFRIGERATING AND AIR-CONDITIONING ENGINEERS AND REVISED 2004

Centrifugal Chillers > 300 Tons COPstd= 6.10; IPLVstd= 6.40														
			Condenser Flow Rate											
			2 gpm/ton		2.5 gpm/ton		3 gpm/ton		4 gpm/ton		5 gpm/ton		6 gpm/ton	
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Tem-perature (°F)	LIFTa (°F)	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc	COP	NPLVc
40	75	35	6.23	6.55	6.50	6.83	6.68	7.01	6.91	7.26	7.06	7.42	7.17	7.54
40	80	40	5.63	5.91	6.00	6.30	6.20	6.52	6.43	6.76	6.56	6.89	6.65	6.98
40	85	45	4.68	4.91	5.26	5.53	5.58	5.86	5.90	6.20	6.07	6.37	6.17	6.48
41	75	34	6.33	6.65	6.60	6.93	6.77	7.12	7.02	7.37	7.18	7.55	7.30	7.67
41	80	39	5.77	6.06	6.11	6.42	6.30	6.62	6.52	6.85	6.65	6.99	6.74	7.08
41	85	44	4.90	5.15	5.44	5.71	5.72	6.01	6.02	6.33	6.17	6.49	6.27	6.59
42	75	33	6.43	6.75	6.69	7.03	6.87	7.22	7.13	7.49	7.31	7.68	7.44	7.82
42	80	38	5.90	6.20	6.21	6.53	6.40	6.72	6.61	6.95	6.75	7.09	6.84	7.19
42	85	43	5.11	5.37	5.60	5.88	5.86	6.16	6.13	6.44	6.28	6.59	6.37	6.69
43	75	32	6.52	6.85	6.79	7.13	6.98	7.33	7.26	7.63	7.45	7.83	7.60	7.98
43	80	37	6.02	6.32	6.31	6.63	6.49	6.82	6.71	7.05	6.85	7.19	6.94	7.30
43	85	42	5.30	5.57	5.74	6.03	5.98	6.28	6.24	6.55	6.37	6.70	6.46	6.79
44	75	31	6.61	6.95	6.89	7.23	7.09	7.45	7.40	7.77	7.61	8.00	7.77	8.16
44	80	36	6.13	6.44	6.41	6.73	6.58	6.92	6.81	7.15	6.95	7.30	7.05	7.41
44	85	41	5.47	5.75	5.87	6.17	6.10	6.40	6.33	6.66	6.47	6.79	6.55	6.89
45	75	30	6.71	7.05	6.99	7.35	7.21	7.58	7.55	7.93	7.78	8.18	7.96	8.36
45	80	35	6.23	6.55	6.50	6.83	6.68	7.01	6.91	7.26	7.06	7.42	7.17	7.54
45	85	40	5.63	5.91	6.00	6.30	6.20	6.52	6.43	6.76	6.56	6.89	6.65	6.98
46	75	29	6.80	7.15	7.11	7.47	7.35	7.72	7.71	8.10	7.97	8.37	8.16	8.58
46	80	34	6.33	6.65	6.60	6.93	6.77	7.12	7.02	7.37	7.18	7.55	7.30	7.67
46	85	39	5.77	6.06	6.11	6.42	6.30	6.62	6.52	6.85	6.65	6.99	6.74	7.08
47	75	28	6.91	7.26	7.23	7.60	7.49	7.87	7.89	8.29	8.18	8.59	8.39	8.82
47	80	33	6.43	6.75	6.69	7.03	6.87	7.22	7.13	7.49	7.31	7.68	7.44	7.82
47	85	38	5.90	6.20	6.21	6.53	6.40	6.72	6.61	6.95	6.75	7.09	6.84	7.19
48	75	27	7.01	7.37	7.36	7.74	7.65	8.04	8.09	8.50	8.41	8.83	8.64	9.08
48	80	32	6.52	6.85	6.79	7.13	6.98	7.33	7.26	7.63	7.45	7.83	7.60	7.98
48	85	37	6.02	6.32	6.31	6.63	6.49	6.82	6.71	7.05	6.85	7.19	6.94	7.30
Condenser DTb			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: C = [(F)-32]/1.8, 1 gallon per minute = 3.785 L/min., 1 ton = 1,0000 British thermal units per hour = 3.517 kW

a. LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature
b. Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
c. All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperature which is IPLV

$Kadj = 6.1507 - 0.30244(X) + 0.0062692(X)^2 - 0.000045595(X)^3$
where X = Condenser DT + LIFT
COPadj = Kadj * COPstd

Reason: The purpose of this code change proposal is to update the minimum efficiency requirements for water chiller packages in Section 5 of the IECC to agree with the ASHRAE/IESNA 90.1-2004 and 90.1-2007 equivalent tables. This will increase the stringency the IECC code as well as harmonize the required efficiencies with the current version of ASHRAE/IESNA Standard 90.1-2004 and 90.1-2007 which was revised in 2004 to reflect new ARI 550/590 fouling factors and IPLV equations.

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

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

EC130–07/08
503.2.3, Tables 503.2.3(7) through (10)

Proponents: Karim Amrane, Air-Conditioning and Refrigeration Institute; Steven Nadel, American Council for an Energy-Efficient Economy

1. Revise as follows:

503.2.3 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables 503.2.3(1), 503.2.3(2), 503.2.3(3), 503.2.3(4), 503.2.3(5), 503.2.3(6), 503.2.3(7), ~~503.2.3(8), 503.2.3(9), 503.2.3(10)~~ and 503.2.3(~~11~~ 8) when tested and rated in accordance with the applicable test procedure. The efficiency shall be verified through certification under an approved certification program or, if no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements. Where components, such as indoor or outdoor coils, from different manufacturers are used, calculations and supporting data shall be furnished by the designer that demonstrate that the combined efficiency of the specified components meets the requirements herein.

Exception: ~~Equipment~~ Water-cooled centrifugal water-chilling packages listed in Table 503.2.3(7) not designed for operation at ARI Standard 550/590 test conditions of 44°F (7°C) leaving chilled water temperature and 85°F (29°C) entering condenser water temperature with 3 gpm/ton (0.054 l/s.kW) condenser water flow shall have ~~a minimum~~ maximum full load ~~COP~~ and ~~IPLV~~ NPLV ratings ~~as shown in Tables 503.2.3(8) through 503.2.3(10) as applicable~~ adjusted using the following equations: ~~The table values are only applicable over the following full load design ranges:~~

Adjusted maximum Full load kW/ton rating = (full load kW/ton from Table 503.2.3(7))/K_{adj}
Adjusted maximum NPLV rating = (IPLV from Table 503.2.3(7))/K_{adj}

Where:

$K_{adj} = 6.174722 - 0.303668(X) + 0.00629466(X)^2 - 0.000045780(X)^3$
$X = DT_{std} + LIFT$
DT_{std} = (24+(full load kW/ton from Table 503.2.3(7)) x 6.83)/Flow
Flow = Condenser water flow(GPM)/Cooling Full Load Capacity(Tons)
LIFT = CEWT – CLWT (F)
CEWT = Full Load Condenser Entering Water Temperature (F)
CLWT = Full Load Leaving Chilled Water Temperature (F)

The adjusted full load and NPLV values are only applicable over the following full-load design ranges:

Leaving Chilled
Water Temperature: 40 to 48°F (4 to 9°C)

Entering Condenser
Water Temperature: 75 to 85°F (24 to 29°C)

Condensing Water
~~Temperature Rise: 5 to 15°F (Δ3 to Δ8°C)~~ Flow: 2 to 6 gpm/ton (0.036 to 0. 1076 l/s.kW)

Chillers designed to operate outside of these ranges or applications utilizing fluids or solutions with secondary coolants (e.g., glycol solutions or brines) with a freeze point of 27°F (-2.8°C) or lower for freeze protection are not covered by this code.

2. Delete Table 503.2.3(7) and substitute as follows:

TABLE 503.2.3(7)
WATER CHILLING PACKAGES - EFFICIENCY REQUIREMENTS[a]

EQUIPMENT TYPE	SIZE CATEGORY	UNITS	BEFORE 1/1/2010		AS OF 1/1/2010[c]				TEST PROCEDURE[b]
					PATH A		PATH B[d]		
			FULL LOAD	IPLV	FULL LOAD	IPLV	FULL LOAD	IPLV	
Air-Cooled Chillers	<150 tons	EER	≥9.562	≥10.416	≥9.562	≥12.500	NA[e]	NA[e]	ARI 550/590
	≥150 tons	EER			≥9.562	≥12.750	NA[e]	NA[e]	
Air-Cooled without Condenser, Electrical Operated	All Capacities	EER	≥10.586	≥11.782	Air-cooled chillers without condensers must be rated with matching condensers and comply with the air-cooled chiller efficiency requirements				
Water cooled, Electrically Operated, Reciprocating	All Capacities	kW/ton	≤0.837	≤0.696	Reciprocating units must comply with water cooled positive displacement efficiency requirements				
Water Cooled Electrically Operated, Positive Displacement	<75 tons	kW/ton	≤0.790	≤0.676	≤0.780	≤0.630	≤0.800	≤0.600	
	≥75 tons and < 150 tons	kW/ton			≤0.775	≤0.615	≤0.790	≤0.586	
	≥150 tons and < 300 tons	kW/ton	≤0.717	≤0.627	≤0.680	≤0.580	≤0.718	≤0.540	
	≥300 tons	kW/ton	≤0.639	≤0.571	≤0.620	≤0.540	≤0.639	≤0.490	
Water Cooled Electrically Operated, Centrifugal	<150 tons	kW/ton	≤0.703	≤0.669	≤0.634	≤0.596	≤0.639	≤0.450	
	≥150 tons and < 300 tons	kW/ton	≤0.634	≤0.596					
	≥300 tons and < 600 tons	kW/ton	≤0.576	≤0.549	≤0.576	≤0.549	≤0.600	≤0.400	
	≥600 tons	kW/ton	≤0.576	≤0.549	≤0.570	≤0.539	≤0.590	≤0.400	
Air Cooled Absorption Single Effect	All Capacities	COP	≥0.600	NR[f]	≥0.600	NR[f]	NA[e]	NA[e]	ARI 560
Water-Cooled Absorption Single Effect	All Capacities	COP	≥0.700	NR[f]	≥0.700	NR[f]	NA[e]	NA[e]	
Absorption Double Effect Indirect-Fired	All Capacities	COP	≥1.000	≥1.050	≥1.000	≥1.050	NA[e]	NA[e]	
Absorption Double Effect Direct Fired	All Capacities	COP	≥1.000	≥1.000	≥1.000	≥1.000	NA[e]	NA[e]	

a. The chiller equipment requirements do not apply for chillers used in low-temperature applications where the design leaving fluid temperature is <40 °F.
b. Section 12 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
c. Compliance with this standard can be obtained by meeting the minimum requirements of Path A or Path B. However, both the full load and IPLV must be met to fulfill the requirements of Path A or Path B.
d. All Path B chillers must be equipped with demand limiting control capability.
e. NA means that this requirement is not applicable and can not be used for compliance.
f. NR means that there are no minimum requirements for this category.

3. Delete Tables 503.2.3(8), 503.2.3(9) and 503.2.3(10) without substitution:

~~**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**~~

(Renumber remaining tables)

Reason: Product development for water-cooled chillers in recent years has focused largely on improving off-design and part load performance. In particular, Variable Speed Drives (VSDs) have gone through significant technology advancements and are now finding widespread application in water-cooled chillers. The use of VSDs has a significant improvement in the off-design and part load improvement of the chiller's performance. Improvements of up to 30% in IPLV are possible. Partially offsetting the part load performance improvement is a small decrease in full load efficiency at design conditions, nominally up to 4%. The decrease in full load efficiency is due to inherent electronic drive losses and power line filters.

This proposal accomplishes two main objectives. First it updates the current minimum efficiency requirements for water chilling packages in Section 5 of the 2006 IECC to agree with ASHRAE/IESNA 90.1-2004 equivalent tables. This change increases the stringency of the IECC and harmonizes the required efficiencies with the current version of ASHRAE/IESNA 90.1-2004 to reflect new ARI 550/590 fouling factors and IPLV equations. Second, the proposal establishes effective January 1, 2010, an additional path of compliance for water-cooled chillers. Path A is intended for applications where significant operating time is expected at full load conditions. On the other hand, Path B is an alternative set of efficiency levels for water-cooled chillers intended for applications where significant time is expected at part load. All Path B chillers are required to be equipped with demand limiting controls. Under this proposal, compliance with the standard can be achieved by either meeting the requirements of Path A or Path B. However, both full load and IPLV levels must be met to fulfill the requirements of Path A or Path B.

The proposal also combines all water-cooled positive displacement chillers into one category and adds a new size category for centrifugal chillers at or above 600 tons. The air-cooled chiller without condenser equipment type category has been eliminated. All air-cooled chillers without condensers must now be rated with matching condensers. The minimum efficiencies of air-cooled chillers have also been updated. The minimum efficiencies for absorption chillers were left unchanged as efficiencies have not improved over the last few years and the absorption market has been shrinking with less than 150 units sold in the U.S in 2006. Efficiencies are now expressed in EER for air-cooled chillers, kW/ton for water-cooled chillers and COP for absorption chillers to reflect industry practices. Tables 503.2.3(8), 503.2.3(9) and 503.2.3(10) listing minimum full load and NPLV efficiencies of water-cooled centrifugal chillers at non standard rating conditions have been eliminated and replaced by an algebraic equation (see example below).

The effective date of the new efficiency standards under Path A or Path B is January 1, 2010 to coincide with the phase out date of HCFC-22 mandated under the Clean Air Act of 1992. This proposal is expected to save over 460 GWh of energy per year compared to the requirements of the 2006 IECC. This represents an annual energy saving of approximately 12%.

Example: Calculation of non standard full load and NPLV efficiencies

Path A 600 Ton Centrifugal Chiller
Table 503.2.3(7) efficiencies as of 1/1/2010
Full Load = 0.570 kW/ton
IPLV = 0.539 kW/ton
CEWT = 80°F
Flow = 2.5 gpm/ton
CLWT = 42°F

LIFT = 80 - 42 = 38°F
DT = (24 + 0.570 x 6.83)/2.5 = 11.16°F
X = 38 + 11.16 = 49.16°F
$K_{adj} = 6.174772 - 0.303668(49.16) + 0.00629466(49.16)^2 - 0.00004578(49.16)^3 = 1.020$

Adjusted Full load = 0.570/1.020 = 0.559 kW/ton
NPLV = 0.539/1.020 = 0.528 kW/ton

Cost Impact: Since the proposal increases the minimum energy efficiency of water-chilling packages, there will be an increase in equipment first cost and therefore an increase in the cost of construction. The total shipment weighted incremental cost of annual chillers shipments at the proposed efficiency levels has been estimated at about $32.5 million. However, the savings in operating costs are expected to be around $43 million (460 x 10^6 kWh X 0.0942 $/kWh), resulting in a simple payback of 0.75. The proposal is therefore economically justified.

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

EC131–07/08
503.2.4.4

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

Revise as follows:

503.2.4.4 Shutoff damper controls. ~~Both~~ Outdoor air supply, ~~and~~ exhaust, and relief ducts shall be equipped with motorized dampers that will automatically shut when the systems or spaces served are not in use.

Exceptions:

1. Gravity dampers shall be permitted in buildings less than three stories in height.
2. Gravity dampers shall be permitted for buildings of any height located in climate zones 1, 2, and 3.
3. Gravity dampers shall be permitted for outside air intake or exhaust airflows of 300 cfm (.14 m^3/s) or less.

Reason: The 2006 IECC currently references both outdoor air and exhaust ducts. Questions have arisen as to how to apply this code section to ductwork associated with relieving the building of air. The intent of the current code language is to address all duct openings into, or out of, a building covered by the IECC. Relief dampers may be included as part of the building ductwork or as part of a roof top air handling system. The proposed language is requested in order to clarify 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

EC132–07/08
503.2.4.5 (New)

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

Add new text as follows:

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

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

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

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

This requirement does not apply to snow melt provided by local municipalities that is not controlled by the commercial project. This equirement is also referenced in ANSI/ASHRAE/IESNA Standard 90.1 Section 6.4.3.8 Freeze Protection and Snow/Ice Melting Systems.

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

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

EC133–07/08
Table 503.2.8

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

Revise table as follows:

TABLE 503.2.8
MINIMUM PIPE INSULATION
(thickness in inches)

FLUID	NOMINAL PIPE DIAMETER	
	≤1.5”	**>1.5”**
Steam	1 ½	3
Hot Water	~~1~~ 1 1/2	~~2~~ 2 ½
Chilled water, brine or refrigerant	~~1~~ 2 ½	~~1 ½~~ 3

(Footnotes not shown remain unchanged)

Reason: The pipe insulation requirements for commercial buildings currently in the IECC should be increased due to the recent increases in energy prices. The thicknesses currently in the code are based on economic evaluations for buildings that are operated at a lower number of hours than many buildings built using the IECC.

Cost Impact: The code change proposal will increase the cost of construction. The cost of this change will be less than the energy savings and have a net positive cash flow.

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

EC134–07/08
503.2.9, 503.2.9.1, 503.2.9.1.1 (New), 503.2.9.1.2 (New), 503.2.9.1.3 (New), 503.2.9.1.4 (New), 503.2.9.2, 503.2.9.3, 503.2.9.3.1 (New), 503.2.9.3.2 (New), 503.2.9.3.3 (New), 503.2.9.3.4 (New)

Proponent: John Neff, Washington State Building Code Council

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 (Supp) 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 10 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.

503.2.9.1 System commissioning. Commissioning is a process that verifies and documents that the selected building systems have been designed, installed, and function according to the owner's project requirements and construction documents. Drawing notes shall require commissioning and completion requirements in accordance with this section. Drawing notes may refer to specifications for further requirements. Copies of all documentation shall be given to the owner.

503.2.9.1.1 Commissioning plan. A commissioning plan shall include as a minimum the following items:

1. A detailed explanation of the original owner's project requirements,
2. A narrative describing the activities that will be accomplished during each phase of commissioning, including guidance on who accomplishes the activities and how they are completed,
3. Equipment and systems to be tested, including the extent of tests,
4. Functions to be tested (for example calibration, economizer control, etc.),
5. Conditions under which the test shall be performed (for example winter and summer design conditions, full outside air, etc.), and
6. Measurable criteria for acceptable performance.

503.2.9.1.2 Systems adjusting and balancing. All HVAC systems shall 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. Test and balance activities shall include as a minimum the following items:

1. Air systems 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 10 hp (18.6 kW) and larger. 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.

   Exception: Fan with fan motors of 1 hp or less.

2. Hydronic systems balancing: Individual hydronic heating and cooling coils shall be equipped with means for balancing and pressure test connections. 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 5 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.

503.2.9.1.3 Functional performance testing,

503.2.9.1.3.1 Equipment functional performance testing. Equipment functional performance testing shall demonstrate the correct installation and operation of components, systems, and system-to-system interfacing relationships 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.

Exception: Unitary or packaged HVAC equipment listed in Tables 503.2.3 (1) through (3) that do not require supply air economizers.

503.2.9.1.3.2 Controls functional performance testing. HVAC control systems shall be tested to document that control devices, components, equipment, and systems are calibrated, adjusted and operate in accordance with approved plans and specifications. Sequences of operation shall be functionally tested to document they operate in accordance with approved plans and specifications.

503.2.9.1.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and provided to the Owner. 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 Acceptance. Buildings, or portions thereof, required by this code to comply with this section shall not be issued a final certificate of occupancy allowing public or owner occupation until such time that the building official has received a letter of transmittal from the building owner that stats they have received the Preliminary Commissioning Report as required by Section 503.2.9.1.4. At the request of the building official, a copy of the Preliminary Commissioning Report shall be made available for review.

503.2.9.3 Completion requirements. The construction documents shall require that within 90 days after the date of final certificate of occupancy, the documents described in this section be provided to the building owner.

503.2.9.3.1 Drawings. Construction documents shall include as a minimum the location and performance data on each piece of equipment.

503.2.9.3.2 Manuals. An operating manual and a maintenance manual 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. Manufacturer's operation manuals 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. Names and addresses 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 setpoints shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.
5. A complete narrative of how each system is intended to operate, including suggested setpoints.

503.2.9.3.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section 503.2.9.1.2

503.2.9.3.4 Final Commissioning Report. A complete report of test procedures and results identified as "Final Commissioning Report" shall include:

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.

Reason: The purpose of this code change proposal is to provide expanded direction on commissioning requirements.

Building commissioning requirements have been in place in Washington since 2000. Also, 2005 Title 24 (California's energy code) requires commissioning functional and performance testing. 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 documents that building staff receive accurate operation manuals and drawings.

The cost of commissioning is a small part of the overall project, yet can provide substantial payback in the form of reduce 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 of a variety of uses and sizes, 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.

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 Building 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 increase the cost of construction.

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

EC135–07/08
202 (New), 503.2.9.4 (New)

Proponent: Shirley Muns, US Green Fiber, LLC

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

COMMISSIONING. The testing of mechanical and lighting system controls and equipment to achieve optimum performance as specified by the design professional.

503.2.9.4 Commissioning. The mechanical and electrical systems in new commercial buildings shall be commissioned prior to occupancy. Commissioning of the mechanical and electrical systems in an existing commercial building shall be required when an addition, alteration, renovation or repair exceeding 50% of the aggregate area of the building is completed.

Reason: The current commercial provisions of the IECC do not address the optimal operation of systems controls. Building commissioning has emerged as the preferred method of ensuring that building systems are installed and operated to provide the performance envisioned by the original design professional.

Commissioning processes in an existing building will focus on bringing building operation to the original design intent and more. Over the last 25 years, the building industry has made revolutionary changes: chiller systems have decreased their power requirements by a factor of two, from more than one kW/ton to less than 0.5 kW/ton; the use of variable air volume systems has become common practice; and the use of building automation systems has become the norm, with digital controls increasingly replacing pneumatics. Advances in HVAC technology have greatly improved building comfort and significantly decreased building energy consumption. These advances have also increased the importance of proper operational practices in achieving the efficiency potential of the HVAC systems. Commissioning processes typically reduces energy cost by about 20% in existing buildings as measured by the methods outlined in the USDOE's International Performance Measurement and Verification Protocol.

Cost Impact: The code change proposal will increase the cost of construction. The payback period in energy use is short.

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

EC136–07/08
202 (New), 503.2.10 (New), 503.2.10.1 (New), 503.2.10.1.1 (New), Table 503.2.10.1.1A (New), Table 503.2.10.1.1B (New), 503.2.10.2 (New)

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

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

FAN BRAKE HORSEPOWER. The horsepower delivered to the fan's shaft. Brake horsepower does not include the mechanical drive losses (belts, gears, etc.).

FAN SYSTEM DESIGN CONDITIONS. Operating conditions that can be expected to occur during normal system operation that result in the highest supply fan air flow rate to conditional spaces served by the system.

FAN SYSTEM BHP. The sum of the fan brake horsepower of all fans that are required to operate at fan system design conditions to supply air from the heating or cooling source to the conditioned space(s) and return it to the source or exhaust it to the outdoors.

FAN SYSTEM MOTOR NAMEPLATE HP. The sum of the motor nameplate horsepower of all fans that are required to operate at design conditions to supply air from the heating or cooling source to the conditioned space(s) and return it to the source or exhaust it to the outdoors.

NAMEPLATE HORSEPOWER. The nominal motor horsepower rating stamped on the motor nameplate.

503.2.10 Air system design and control. Each HVAC system having a total *fan system motor nameplate hp* exceeding 5 hp shall meet the provisions of 503.2.10.1 through 503.2.10.2.

503.2.10.1 Fan system power limitation.

503.2.10.1.1 Allowable fan floor horsepower. Each HVAC system at fan system design conditions shall not exceed the allowable fan system motor nameplate hp [Option 1] or fan system bhp [Option 2] as shown in Table 503.2.10.1.1A. This includes supply fans, return/relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability.

Exceptions:

1. Hospital and laboratory systems that utilize flow control devices on exhaust and/or return to maintain space pressure relationships necessary for occupant health and safety or environmental control may use variable volume fan power limitation.
2. Individual exhaust fans with motor nameplate horsepower of 1 hp or less.
3 Fans exhausting air from fume hoods. (Note: If this exception is taken, no related exhaust side credits shall be taken from Table 503.2.10.1.1B and the Fume Exhaust Exception Deduction must be taken from Table 503.2.10.1.1B).

TABLE 503.2.10.1.1(1)
FAN POWER LIMITATION

	LIMIT	CONSTANT VOLUME	VARIABLE VOLUME
Option 1: Fan System Motor Nameplate hp	Allowable Nameplate Motor hp	hp≤ CFM_S*0.0011	hp≤ CFM_S*0.0015
Option 2: Fan System bhp	Allowable Fan System bhp	bhp≤ CFM_S * 0.00094 + A	bhp≤ CFM_S * 0.0013 + A

where:

CFM_S = The maximum design supply air flow rate to conditioned spaces served by the system in cubic feet per minute.
hp = The maximum combined motor nameplate horsepower.
Bhp = The maximum combined fan brake horsepower
A = Sum of [PD x CFM_D / 4131]

where:

PD = Each applicable pressure drop adjustment from Table 503.2.10.1.1B in. w.c.
CFM_D = The design air flow through each applicable device from Table 503.2.10.1.1B in cubic feet per minute

TABLE 503.2.10.1.1B
FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT

DEVICE	ADJUSTMENT
Credits	
Fully ducted return and/or exhaust air systems	0.5 in w.c.
Return and/or exhaust air flow control devices	0.5 in w.c
Exhaust filters, scrubbers, or other exhaust treatment.	The pressure drop of device calculated at fan system design condition.
Particulate Filtration Credit: MERV 9 thru 12	0.5 in w.c.
Particulate Filtration Credit: MERV 13 thru 15	0.9 in w.c.
Particulate Filtration Credit: MERV 16 and greater and electronically enhanced filters	Pressure drop calculated at 2x clean filter pressure drop at fan system design condition.
Carbon and Other gas-phase air cleaners	Clean filter pressure drop at fan system design condition.
Heat Recovery Device	-Pressure drop of device at fan system design condition.
Evaporative Humidifier/Cooler in series with another cooling coil	Pressure drop of device at fan system design conditions
Sound Attenuation Section	0.15 in w.c.
Deductions	
Fume Hood Exhaust Exception (required if 503.2.10.1.1 Exception (c) is taken)	-1.0 in w.c.

503.2.10.2 Motor nameplate horsepower: For each fan, the selected fan motor shall be no larger than the first available motor size greater than the brake horsepower. The fan brake horsepower must be indicated on the design documents to allow for compliance verification by the code official.

Exceptions:

1. For fans less than 6 bhp, where the first available motor larger than the brake horsepower has a nameplate rating within 50% of the brake horsepower, the next larger nameplate motor size may be selected.
2. For fans 6 bhp and larger, where the first available motor larger than the brake horsepower has a nameplate rating within 30% of the brake horsepower, the next larger nameplate motor size may be selected.

Reason: This proposal adds requirements for design of HVAC fan systems and regulates the motor energy use for these systems. Option 1. provides a very simple option based on nameplate motor horsepower and can be used by the majority of projects. Option 2. is a more complex option and is based on brake horsepower for more complex systems that might require additional fan power allowances to overcome the pressure drop of certain required components such as specialized filtration, heat recovery devices, sound attenuators, etc.

According to research conducted for the California Energy Commission, "Fan energy represents between 20% to 50% of total HVAC electrical energy use, or 10% to 30% of the total building electrical energy usage, which can be more than the chiller energy use"[1].

Fan energy is a significant portion of non-residential building energy use and is currently not regulated by the IECC. This is a huge omission in the IECC. The proposed change incorporates the language found in ASHRAE Standard 90.1, 2004 Addendum ac[2], which was developed by a diverse stakeholders group including consulting HVAC engineers, mechanical equipment industry representatives, national laboratory employees, and energy efficiency advocates. It has been amended through the public review process as required of an ANSI consensus standard.

[1] Integrated Energy Systems: Productivity & Building Science, Publication Number: 500-03-082 (a.k.a. CEC-500-2003-082) , October 2003
http://www.energy.ca.gov/pier/final_project_reports/500-03-082.html

[2] ANSI/ASHRAE/IESNA Addenda ac, an, and ao to ANSI/ASHRAE/IESNA Standard 90.1-2004
http://www.ashrae.org/technology/page/132

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

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

EC137–07/08
503.2.10 (New)

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

Add new text as follows:

503.2.10 Heating systems outside a building. Heating systems installed outside a building shall be radiant systems. Such heating systems shall be controlled by an occupancy sensing device or a timer switch, so that the system is automatically de-energized when no occupants are present.

Reason: Heating of outdoor spaces has become much more common as smoking bans within buildings have proliferated. Convective heating systems work by heating air and are ineffective and wasteful for outdoor applications. The warm air simply dissipates. Radiant systems provide comfort by warming stationary surfaces and bodies and are more suitable for this application. The requirement for an occupancy sensor or timer switch ensures that these systems will only operate when they are needed to warm occupants.

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

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

EC138–07/08
503.2.10 (New)

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

Add new text as follows:

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

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

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

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

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

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

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

EC139–07/08
504.7.1

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

Revise as follows:

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

Reason: Propane (LPG) should be subject to the same control requirements as natural gas. It is the intent of the proponent that this change be also incorporated into the proposed change to 403.7, if adopted, for consistency.

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

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

EC140–07/08
202, 505.1

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

1. Delete definition and substitute as follows:

SECTION 202
GENERAL DEFINITIONS

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

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

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

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

2. Revise as follows:

505.1 General. (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications, and minimum acceptable lighting equipment for exterior applications.

Exception: Lighting within dwelling units where 50 percent or more of the permanently installed interior light fixtures are fitted with high-efficacy lamps.

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

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

The average new apartment has 31 sockets. Replacing 50% (16) incandescents with CFLs at an average incremental cost of $2 would increase the cost of construction of a new apartment by $32.

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

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

EC141–07/08
202, 505.2.2.3

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

Delete without substitution:

~~**DAYLIGHT ZONE: (Supp)**~~

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 (Supp) 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: This section is not consistent with the purpose of the code to regulate construction for the effective use of energy. While it may regulate construction, I have heard no explanation of how it may promote effective use of energy. It is very unlikely that someone would turn off the lights a part of a room due to varying daylight levels. In order to properly enforce this provision, plans examiners will have to require additional plan and section drawings to be submitted that are not now being prepared in order to verify what areas are daylight zones. There are no requirements like this in section 9.4 of the ASHRAE standard.

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

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

EC142–07/08
505.3

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

Revise as follows:

505.3 Tandem wiring. (Mandatory). The following luminaires located within the same area shall be tandem wired:

1. Fluorescent ~~luminaires~~ luminaire configurations equipped with one, three or odd-numbered linear lamps greater than 30 W each ~~configurations~~, that are recess-mounted within 10 feet (3048 mm) center-to-center of each other.
2. Fluorescent ~~luminaires~~ luminaire configurations equipped with one, three or any other odd-numbered linear lamps grater than 30 W each ~~configuration~~, that are pendant-or surface-mounted within 1 foot (305 mm) edge-to-edge of each other.

Exceptions:

1. Where electronic high-frequency ballasts are used.
2. Luminaires on emergency circuits.
3. Luminaires with no available pair in the same area.

Reason: ASHRAE 90.1-2004 Section 9.4.2 includes changes to identify ONLY linear lamp configurations involving lamps of 3- W or greater be addressed by tandem wiring. The current version of the IECC does not recognize the ASHRAE changes which are mandated for use by the Federal Governments Energy Policy Act.

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

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

EC143–07/08
505.5.1

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

Revise as follows:

505.5.1 (Supp) 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.
   - 1.1. Professional sports arena playing field lighting.
   - 1.2. Sleeping unit lighting in hotels, motels, boarding houses or similar buildings.
   - 1.3. Emergency lighting automatically off during normal building operation.
   - 1.4. Lighting in spaces specifically designed for use by occupants with special lighting needs including the visually impaired visual impairment and other medical and age related issues.
   - 1.5. Lighting in interior spaces that have been specifically designated as a registered interior historic landmark.
   - 1.6. Casino gaming areas.
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.
3. Lighting for theatrical purposes, including performance, stage, film production and video production.
4. Lighting for photographic processes.
5. Lighting integral to equipment or instrumentation and is installed by the manufacturer.
6. Task lighting for plant growth or maintenance.
7. Advertising signage or directional signage.
8. In restaurant buildings and areas, lighting for food warming or integral to food preparation equipment.
9. Lighting equipment that is for sale.
10. Lighting demonstration equipment in lighting education facilities.
11. Lighting approved because of safety or emergency considerations, inclusive of exit lights.
12. Lighting integral to both open and glass-enclosed refrigerator and freezer cases.
13. Lighting in retail display windows, provided the display area is enclosed by ceiling-height
14. Furniture mounted supplemental task lighting that is controlled by automatic shutoff.

Reason: The proposed changes come from ANSI/ASHRAE/IESNA Standard 90.1-2007. These are exemptions for typical applications that are not practically restricted by the code. Their inclusion in IECC will make IECC more in line with practical code application and make it more effective and therefore more readily applied.

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

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

EC144–07/08
505.5.1.4

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

Revise as follows:

505.5.1.4 Line-voltage lighting track and plug-in busway. The wattage shall be;

1. The specified wattage of the luminaires included in the system with a minimum of 30 W/lin ft. (98 W/lin. m), or
2. the wattage limit of the system's circuit breaker, or
3. the wattage limit of other permanent current limiting device(s) on the system.

~~The wattage shall be the greater of the wattage of the luminaires determined in accordance with Sections 505.5.1.1 through 505.5.1.3 or 30 W/linear foot (98W/lin m).~~

Reason: The proposed changes come from ANSI/ASHRAE/IESNA Standard 90.1-2007. This allows a user to calculate wattage for track lighting based on the maximum wattage that is possible to apply to a section of track instead of a potentially arbitrary value that may be higher than physically possible in the application. This inclusion in IECC will make IECC more in line with practical code application and make it more effective and therefore more readily applied.

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

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

EC145–07/08
Table 505.5.2

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

Revise table notes as follows:

TABLE 505.5.2
INTERIOR LIGHTING POWER ALLOWANCES

(No change to table entries)

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m^2.

a. (No change to current text)

b. Where lighting equipment is specified to be installed to highlight specific merchandise, including all internally illuminated case lighting, in addition to lighting equipment specified for general lighting the following additional power allowance is permitted. The additional power shall be allowed only if the specified lighting is installed and is automatically controlled separately from the general lighting. Automatic controls shall be programmed to turn lighting off during non-business hours. This additional power shall be used only for the specified luminaires, and shall not be used for any other purpose or in any other space. ~~and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for merchandise, or 1.6 W/ft2 times the area of the specific display but not to exceed 50% of the floor area, or 3.9 W/ft2 times the actual case or shelf area for displaying and selling jewelry, china or silver, shall be added to the interior lighting power determined in accordance with this line item.~~

Calculate the additional power allowance by multiplying the following LPDs by the sales floor area for each department excluding major circulation paths.

1. 0.6 w/sf for sales areas not listed below
2. 1.4 w/sf for furniture, clothing, cosmetics and artwork
3. 2.5 w/sf for jewelry, crystal and china

The total additional power allowance is the sum of the allowances for sales category a, b, & c, plus an additional 1000 watts for the base building.

Reason: This proposal simplifies the method used to calculate additional lighting power for retail accent lighting as allowed in footnote b of Table 505.5.2. This proposal uses the floor area of each retail department which is easily calculated. This proposal also establishes lighting power allowance appropriate for this calculation method.

Currently the designer must calculate the "specific display" and or the "actual case or shelf area". This can be difficult to determine - if there is a wall or case display with multiple shelves does the designer get to count all of the display shelves or just the floor area under the shelf? How does the code official by looking at the plans verify this calculation? This is easily gamed. The only safeguard is the 50% of the floor area for general merchandise 1.6 W/ft2, but there is no restriction on the 3.9W/ft2. This proposal uses the floor area of each department which is easily calculated.

The lighting power allowance included in this proposal builds on the work that was done for the ASHRAE/IESNA 90.1-2007 (90.1) section 9.6.2 Additional Interior Lighting Power. The 90.1 lighting power densities are based on four models that meet the lighting levels recommended by the Illuminating Engineering Society of North America, Lighting Merchandising Areas (IESNA RP-02).

- model 1 was for a Grocery/Supermarket
- model 2 was for a Home/Bath Store
- model 3 was for a Upscale Department or Specialty Store
- model 4 was for a Jewelry Store

The general lighting types used in the model assumptions may have been Fluorescent, HID or Halogen IR Incandescent or a combination of these sources. For the feature displays the 90.1-2007 analysis uses 100% Halogen IR technology.

For each retail type, IESNA RP-02 provides a range of recommended lighting levels from "low" to "high". The lighting power densities chosen for this proposal would result in "low" footcandle recommendations using Halogen IR technologies. If the owners chose to increase the footcandle levels in the store they could include higher efficiency sources such as ceramic metal halide (CMH) fluorescent, or light emitting diodes. They may also chose to increase the general area lighting by using more efficient general lighting sources.

There is a base allowance included in this proposal that is an important addition to help out the small stores meet their design goals and the IESNA recommended footcandles. The smaller the store becomes the larger the wall surfaces and vertical displays become as a percentage of the space to the horizontal displays. Vertical displays tend to be larger in area than horizontal displays and this extra 1000 watts per building gives a greater allowance to the small store.

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

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

EC146–07/08
Table 505.5.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)

Revise table as follows:

TABLE 505.5.2
INTERIOR LIGHTING POWER ALLOWANCES

(No change to table entries)

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m^2.

a. In cases where both a general building area type and a more specific building area type are listed, the more specific building area type shall apply.

b. Where lighting equipment is specified to be installed to highlight specific merchandise in addition to lighting equipment specified for general lighting and is switched or dimmed on circuits different from the circuits for general lighting, the smaller of the actual wattage of the lighting equipment installed specifically for merchandise, or additional lighting power as determined below ~~1.6 W/ft^2 times the area of the specific display but not to exceed 50% of the floor area, or 3.9 W/ft2 times the actual case or shelf area for displaying and selling jewelry, china or silver,~~ shall be added to the interior lighting power determined in accordance with this line item.
Calculate the additional lighting power as follows:

Additional Interior Lighting Power Allowance = 1000 watts + (Retail Area 1 x 1.0 W/ft2) + (Retail Area 2 x 1.7 W/ft2) + (Retail Area 3 x 2.6 W/ft2) + (Retail Area 4 x 4.2 W/ft2),

where

Retail Area 1	=	the floor area for all products not listed in Retail Area 2, 3 or 4.
Retail Area 2	=	the floor area used for the sale of vehicles, sporting goods and small electronics.
Retail Area 3	=	the floor area used for the sale of furniture, clothing, cosmetics and artwork.
Retail Area 4	=	the floor area used for the sale of jewelry, crystal, and china.

Exception: Other merchandise categories may be included in Retail Areas 2 through 4 above, provided that justification documenting the need for additional lighting power based on visual inspection, contrast, or other critical display is approved by the authority having jurisdiction

Reason: The proposed changes come from ANSI/ASHRAE/IESNA Standard 90.1-2007. This change presents a much more usable set of lighting allowances that eliminate common issues of application of additional power allowances. The proposed set of allowances also further categorizes application types with the effect of reducing energy use by forcing many product types into lower allowance but appropriate categories.

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

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

EC147–07/08

505.6.2, Table 505.6.2(1) (New), Table 505.6.2

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

1. Revise as follows:

505.6.2 Exterior building lighting power. The total exterior lighting power allowance for all exterior building applications is the sum of the base site allowance plus the individual allowances for areas that are to be illuminated and are ~~lighting power allowances based on the densities~~ permitted in Table 505.6.2(2) ~~for these applications plus an additional unrestricted allowance of 5 percent of that sum~~ for the applicable lighting zone. Tradeoffs are allowed only among exterior lighting applications listed in the Table 505.6.2(2) Tradable Surfaces section. The lighting zone for the building exterior is determined from Table 505.6.2(1) unless otherwise specified by the local jurisdiction. Exterior lighting for all applications (except those included in the exceptions to Section 505.6.2) shall comply with the requirements of Section 505.6.1.

Exceptions: Lighting used for the following exterior applications is exempt when equipped with a control device independent of the control of the non-exempt lighting:

1. Specialized signal, directional, and marker lighting associated with transportation;
2. Advertising signage or directional signage;
3. Integral to equipment or instrumentation and is installed by its manufacturer;
4. Theatrical purposes, including performance, stage, film production and video production;
5. Athletic playing areas;
6. Temporary lighting;
7. Industrial production, material handling, transportation sites, and associated storage areas;
8. Theme elements in theme/amusement parks; and
9. Used to highlight features of public monuments and registered historic landmark structures or buildings.

2. Add new table as follows:

TABLE 505.6.2(1)
EXTERIOR LIGHTING ZONES

LIGHTING ZONE	DESCRIPTION
1	Developed areas of National Parks, State Parks, Forest Land, and Rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas
3	All other areas
4	High activity commercial districts in major metropolitan areas as designated by the local land use planning authority

3. Revise table as follows:

TABLE 505.6.2(2)
INDIVIDUAL LIGHTING POWER ALLOWANCES ~~DENSITIES~~ FOR BUILDING EXTERIORS

		Zone 1	Zone 2	Zone 3	Zone 4
Base Site Allowance (base allowance may be used in tradable or non-tradable surfaces)		500 W	600 W	750 W	1300 W
~~**Applications**~~	~~**Lighting Power Densities**~~				
Tradable Surfaces (Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas may be traded.)	**Uncovered Parking Areas**				
	Parking ~~Lots~~ areas and drives	0.04 W/ft^2	0.06 W/ft^2	0.10 W/ft^2	~~0.15~~ 0.13 W/ft^2
	Building Grounds				
	Walkways less than 10 feet wide	0.7 W/linear foot	0.7 W/linear foot	0.8 W/linear foot	1.0 W/linear foot
	Walkways 10 feet wide or greater Plaza areas Special Feature Areas	0.14 W/ft^2	0.14 W/ft^2	0.16 W/ft^2	0.2 W/ft^2
	Stairways	0.75 W/ft^2	1.0 W/ft^2	1.0 W/ft^2	1.0 W/ft^2
	Pedestrian Tunnels	0.15 W/ft^2	0.15 W/ft^2	0.2 W/ft^2	0.3 W/ft^2
	Building Entrances and Exits				
	Main entries	20 W/linear foot of door width	20 W/linear foot of door width	30 W/linear foot of door width	30 W/linear foot of door width
	Other doors	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width	20 W/linear foot of door width
	Entry Canopies	0.25 W/ft^2	0.25 W/ft^2	0.4 W/ft^2	~~1.25~~ 0.4 W/ft^2
	Sales Canopies ~~and Overhangs~~				
	~~Canopies (~~free standing and attached ~~and overhangs)~~	0.6 W/ft^2	0.6 W/ft^2	0.8 W/ft^2	~~1.25~~ 1.0 W/ft^2
	Outdoor Sales				
	Open areas (including vehicle sales lots)	0.25 W/ft^2	0.25 W/ft^2	0.5 W/ft^2	~~0.5~~ 0.7 W/ft^2
	Street frontage for vehicle sales lots in addition to "open area" allowance	**No allowance**	10 W/linear foot	10 W/linear foot	~~20~~ 30 W/linear foot
Non-Tradable Surfaces (Lighting power density calculations for the following applications can be used only for the specific application and can-not be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowance otherwise permitted in the "tradable Surfaces" section of this table.)	**Building Facades**	**No allowance**	0.1 W/ft^2 for each illuminated wall or surface or 2.5 W/linear foot for each illuminated wall or surface length	0.15 W/ft^2 for each illuminated wall or surface or 3.75 W/linear foot for each illuminated wall or surface length	0.2 W/ft^2 for each illuminated wall or surface or 5.0 W/linear foot for each illuminated wall or surface length
	Automated teller machines and night depositories	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location
	Entrances and gatehouse inspection stations at guarded facilities	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area	0.75 W/ft^2 of covered and uncovered area	~~1.25~~ 0.75 W/ft^2 of covered and uncovered area ~~(covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")~~
	Loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area	0.5 W/ft^2 of covered and uncovered area ~~(covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")~~
	Drive-up windows/doors	400 W per drive-through	400 W per drive-through	400 W per drive-through	400 W per drive-through
	Parking near 24-hour retail entrances	800 W per main entry	800 W per main entry	800 W per main entry	800 W per main entry

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m^2.

Reason: This change is identical to the ASHRAE/IESNA 90.1 addenda passed for public review and publication at the June 2007 ASHRAE meeting.

This proposal will apply a 4-zone lighting power density approach to the existing one size fits all exterior lighting requirements of Table 505.6. The four zone lighting approach recognizes the varying lighting needs and design differences associated with different building locations and the environments that they are located. It is desirable from a environmental and safety standard to reduce the light levels as the designer leaves the downtown city center entering into mixed commercial/high-rise residential districts, then enters into residential areas, and then into rural areas.

Take for example a gas station located along a rural highway. The high light level at the service station compared to the surrounding roads can create a high contrast ratio making it difficult to reenter the highway at night once the eyes have adapted to the high light level of the service station. That same gas station, with the same lighting levels, in an urban setting will have a lower contrast ratio creating a safer environment.

Several organizations including the IESNA (Illuminating Engineering Society of North America), IDA (International Dark Sky Association) and the USGBC (United States Green Building Council) with the LEED Standards have been working to develop a zonal approach to exterior lighting recommended practice and this change in the standard will follow that guidance.

Other Standards use a multi-zone system to either classify LPD, lumen or light trespass requirements are the California T-24 (4-zone W/sf), the upcoming MOL from the IESNA & IDA (5-zone Lumen/sf), and LEED (light trespass). These Standards were evaluated and in some cases incorporated into this proposal.

Comparing the current Standard to this proposal, Zone 4 uses approximately the same energy, zone 3 uses approximately 20-25% less energy, zone 2 uses approximately 40-50% less energy and zone 1 uses approximately 50-60% less energy. This increased stringency will actually reduce the initial installed cost because less fixtures and/or lower wattage lamps will be required. Lower operating costs will also be realized by the owner.

The base 5% unrestricted allowance has been deleted in favor of a base site wattage allowance. With small and odd shaped sites it is harder to meet IESNA footcandle recommendations because there are fewer overlapping lighting patterns and more light spilling off the site compared to a large site. The 5% unrestricted allowance benefited the large site not the small site, the opposite of what is needed. Using a base site allowance benefits the small and odd shaped site.

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

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

EC148–07/08
505.6.2

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

Revise as follows:

505.6.2 Exterior building lighting power. The total exterior lighting power allowance for all exterior building applications is the sum of the individual lighting power allowances based on the densities permitted in Table 505.6.2 for these applications plus an additional unrestricted allowance of 5 percent of that sum. Tradeoffs are allowed only among exterior lighting applications listed in Table 505.6.2 in the Tradable Surfaces section. Exterior lighting for all applications (except those included in the exceptions to Section 505.6.2) shall comply with the requirements of Section 505.6.1.

Exceptions: Lighting used for the following exterior applications is exempt when equipped with a control device independent of the control of the nonexempt lighting:

1. Specialized signal, directional, and marker lighting associated with transportation;
2. Advertising signage or directional signage;
3. Integral to equipment or instrumentation and is installed by its manufacturer;
4. Theatrical purposes, including performance, stage, film production and video production;
5. ~~Athletic playing areas~~ Sporting areas;
6. Temporary lighting;
7. Industrial production, material handling, transportation sites, and associated storage areas;
8. Theme elements in theme/amusement parks; and
9. Used to highlight features of public monuments and registered historic landmark structures or buildings.

Reason: As currently listed, "athletic playing areas" includes areas facilitating outdoor baseball, soccer, volleyball, etc. The wording, as currently listed, does not address dog racing tracks, vehicle racing tracks, go-kart tracks, etc. The proposed wording will appropriately address these types of areas currently not addressed by the current exception language.

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

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

EC149–07/08
505.6.2, Table 505.6.2, Table 505.6.3

Proponent: Leo Smith, representing the International Dark Sky Association

1. Revise as follows:

505.6.2 Exterior building lighting power. The total exterior lighting power allowance for all exterior building applications is the sum of the base site allowance plus the individual ~~lighting power~~ allowances for areas that are to be illuminated and are based on the densities permitted in Table 505.6.2 for the applicable lighting zone ~~these applications plus an additional unrestricted allowance of 5 percent of that sum~~. Tradeoffs are allowed only among exterior lighting applications listed in Table 505.6.2 in the Tradable Surfaces section. The lighting zone for the building exterior is determined from Table 505.6.2 unless otherwise specified by the local jurisdiction. ~~Exterior lighting for all applications (except those included in the exceptions to Section 505.6.2) shall comply with the requirements of Section 505.6.1.~~

Exceptions: Lighting used for the following exterior applications is exempt when equipped with a control device that complies with all control requirements and is independent of the control of the nonexempt lighting:

1. Specialized signal, directional, and marker lighting associated with transportation;
2. Advertising signage or directional signage;
3. Integral to equipment or instrumentation and is installed by its manufacturer;
4. Theatrical purposes, including performance, stage, film production and video production;
5. Athletic playing areas;
6. Temporary lighting;
7. Industrial production, material handling, transportation sites, and associated storage areas;
8. Theme elements in theme/amusement parks; and
9. Used to highlight features of public monuments and registered historic landmark structures or buildings.

2. Add new table and revise and renumber existing table as follows:

TABLE 505.6.2
EXTERIOR LIGHTING ZONES

LIGHTING ZONE	DESCRIPTION
1	Developed areas of National Parks, State Parks, Forest Land, and Rural areas
2	Areas predominantly consisting of residential zoning, neighborhood business districts, light industrial with limited nighttime use and residential mixed use areas.
3	All other areas
4	High activity commercial districts in major metropolitan areas as designated by the local land use planning authority

~~TABLE 505.6.2~~ TABLE 505.6.3
INDIVIDUAL LIGHTING POWER ALLOWANCES ~~DENSITIES~~ FOR BUILDING EXTERIORS

		Zone 1	Zone 2	Zone 3	Zone 4
Base Site Allowance (base allowance may be used in tradable or non-tradable surfaces		500 W	600 W	750 W	1,300 W
Tradable Surfaces (Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas may be traded)	**Uncovered Parking Areas**				
	Parking Lot areas ~~Lots~~ and Drives	0.04 W/ft²	0.06 W/ft²	0.10 ~~0.15~~ W/ft²	0.13 W/ft²
	Building Grounds				
	Walkways less than 10 feet wide	0.07 W/linear foot	0.07 W/linear foot	0.08 W/linear foot	1.0 W/linear foot
	Walkways 10 feet wide or greater Plaza areas Special Feature Areas	0.14 W/ft²	0.14 W/ft²	0.16 W/ft²	0.2 W/ft²
	Stairways	0.75 W/ft²	1.0 W/ft²	1.0 W/ft²	1.0 W/ft²
	Pedestrian Tunnels	0.15 W/ft²	0.15 W/ft²	0.2 W/ft²	0.3 W/ft²
	Building Entrances and Exits				
	Main entries	20 W/linear foot of door width	20 W/linear foot of door width	30 W/linear foot of door width	30 W/linear foot of door width
	Other doors	20 W/linear foot of door width	20 W/linear foot of door width	30 W/linear foot of door width	20 W/linear foot of door width
	Entry canopies	0.25 W/ft²	0.25 W/ft²	0.4 W/ft²	0.4 W/ft²
	Sales Canopies ~~and Overhangs~~				
	Free standing and attached	0.6 W/ft²	0.6 W/ft²	0.8 W/ft²	1.0 W/ft²
	Outdoor Sales				
	Open areas (including vehicle sales lots)	0.25 W/ft²	0.25 W/ft²	0.5 W/ft²	0.7 W/ft²
	Street frontage for vehicle sales lots in addition to "open area" allowance	**No Allowance**	10 W/linear foot	10 W/linear foot	30 W/linear foot
Non-Tradable Surfaces Lighting power density calculations for the following applications can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowances otherwise permitted in the "Tradable Surfaces" section of this table.)	**Building Facades**	**No Allowances**	0.1 W/ft for each illuminated wall or surface or 2.5 W/linear foot for each illuminated wall or surface length	0.15 W/ft for each illuminated wall or surface or 2.5 W/linear foot for each illuminated wall or surface length	0.2 W/ft for each illuminated wall or surface or 2.5 W/linear foot for each illuminated wall or surface length
	Automated teller machines and night depositories	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location	270 W per location plus 90 W per additional ATM per location
	Entrances and gatehouse inspection stations at guarded facilities	0.75 W/ft of covered and uncovered area	0.75 W/ft of covered and uncovered area	0.75 W/ft of covered and uncovered area	0.75 W/ft of covered and uncovered area
	Loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.5 W/ft of covered and uncovered area	0.5 W/ft of covered and uncovered area	0.5 W/ft of covered and uncovered area	0.5 W/ft of covered and uncovered area
	Drive-up windows/doors	400 W per drive-through	400 W per drive-through	400 W per drive-through	400 W per drive-through
	Parking near 24 hour retail entrances	800 W per main entry	800 W per main entry	800 W per main entry	800 W per main entry

For SI: 1 foot = 304.8 mm, 1 watt per square foot = W/0.0929 m2.

Reason: To establish a 4-zone lighting power density approach to exterior lighting requirements, similar to the lighting zone system used for outdoor lighting by the California Energy Commission under Title 24 (4 zones), identical to the proposed revisions to ASHRAE 90.1-2007 Exterior Lighting Section 9.4.5 (4 zones), and similar to the Model Outdoor Lighting Ordinance drafted jointly by the Illuminating Engineering Society and the International Dark Sky Association

The need to vary the degree of regulation of outdoor lighting based on the intensity and type of use or development was first established by the California Energy Commission under Title 24 http://www.energy.ca.gov/2005publications/CEC-400-2005-006/chapters_4q/6_Outdoor_Lighting_Signs.pdf (Section 6.3), when it established a 4-zone lighting power density approach of

Dark, Low, Medium, and High Lighting Zones for Outdoor Lighting Regulations.

ASHRAE Lighting Subcommittee has proposed changes to 90.1-2007 Exterior Lighting Section 9.4.5 that will set energy regulations for outdoor lighting according to these same 4 lighting zones.

IESNA/IDA have proposed a new Model Outdoor Lighting Ordinance, adding a fifth Lighting Zone (Moderately High)

LZ0: No ambient lighting
LZ1: Low ambient lighting
LZ2: Moderate ambient lighting
LZ3: Moderately high ambient lighting
LZ4: High ambient lighting

This IECC Code Change Proposal follows the language proposed for ASHRAE 90.1-2007 in the 9.4.5 Exterior Building Lighting Power section. The reasons submitted for support for the ASHRAE changes have been quoted below in support of the IECC Proposed Code Change:

"This approach recognizes the varying lighting needs and design differences associated with different building locations. It is acceptable and prudent to reduce the light levels as the designer leaves the downtown city center entering into mixed commercial/high-rise residential districts, then enters into residential areas, and then into rural areas. Several organizations including the IESNA have been working to develop a zonal approach to exterior lighting recommended practice and this change in the standard will follow that guidance.

The specific IESNA documents used in this proposal are RP-20, DG-5, IESNA Handbook, RP-2, G-1 and RP-33. There are some instances where IESNA recommendations in these documents are available for all 4 zone criteria, but in many cases only three light level recommendations were found and referenced. Other Standards use a multi-zone system to either classify LPD, lumen or light trespass requirements - California T-24 (4-zone W/sf), the upcoming MOL (5-zone Lumen/sf, and LEED (light trespass). These Standards were evaluated and in some cases incorporated into this proposal.

The first change in the 9.4.5 Exterior Building Lighting Power section is the deletion of the 5% additional power allowances which is replaced by a base wattage allowance per site. The second change to this section is to define the four zones and apply appropriate requirements. The four zones are based on IESNA and other group definitions to match other requirements and guidance expected to be encountered by designers. The majority of building sites will fall into LZ3, LZ2 or LZ1, and the sites that remain in LZ4 will generally be of relatively small sizes. The added "Base Site Allowance" for each zone takes into account that most sites are not rectangular or match the iso-diagram of typical light luminaires."

Bibliography:

The Model Outdoor Lighting Ordinance (International Dark Sky Association & Illuminating Engineering Society - Draft)
California Energy Commission: Title 24 – Section 6 on Exterior Lighting
ASHRAE 90.1-2007 Exterior Lighting Section 9.4.5 (Draft)
IESNA documents RP-20, DG-5, IESNA Handbook, RP-2, G-1 and RP-33

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

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

EC150–07/08

202 (New), 505.6.3 (New)

Proponent: Leo Smith, representing the International Dark Sky Association

Add new text as follows:

SECTION 202
GENERAL DEFINITIONS

FULLY SHIELDED. A light fixture constructed, installed, and maintained in such a manner that all light emitted from the fixture, either directly from the lamp or a diffusing element, or indirectly by reflection or refraction from any part of the fixture, is projected below the horizontal plane through the fixture's lowest light emitting part.

505.6.3 Shielding of exterior building lighting fixtures. Only fully shielded fixtures shall be permitted unless a lighting plan is submitted showing that the use of alternative fixtures would provide greater energy efficiency than any comparable lighting plan using fully shielded fixtures.

Exceptions:

1. Luminaires with an output of 150 Watts incandescent or less, or the equivalent light output.
2. Luminaires intended to illuminate the façade of buildings or to illuminate other objects including but not limited to flagpoles, landscape and water features, statuary and works of art.
3. Luminaires for historic lighting on the premises of an historic building as defined in the *International Existing Building Code* or within a designated historic district.

4. Outdoor sports facility lighting of the participant sport area.
5. Emergency exit discharge lighting.
6. Low voltage landscape lighting.
7. Sign illumination.
8. Festoon lighting as defined in the NFPA 70.
9. Temporary lighting for emergency, repair, construction, special events or similar activities.

Reason: New Section 505.6.3 - Conserve energy in outdoor lighting by reducing or eliminating glare by adopting a requirement to fully shield outdoor luminaires and add a definition for "Fully Shielded" to the General Definitions.

Unshielded or partially shielded outdoor luminaires cause glare in the eye of the observer. Glare at night diminishes the ability of the eye to see at lower light levels. Unshielded or partially shielded luminaires require higher lighting levels to compensate for the reduced capacity of the human eye to see in glare. Fully shielded luminaires eliminate or substantially reduce glare in the eye of the observer, and with glare eliminated or reduced, the level of illumination needed by the observer to see in dark surrounds can be achieved with lower wattage lamps, fewer fixtures, or both.

All outdoor light that is misdirected to areas outside the intended area for illumination is wasted energy. Fully shielded fixtures direct more of the light at the targeted area, thereby reducing the energy waste that would otherwise occur with unshielded or partially shielded luminaires. Currently the IEEC does not include a requirement for fully shielded luminaires.

Numerous municipalities and several states have adopted outdoor lighting regulations, including shielding requirements, as part of energy conservation. Adding a fully shielded requirement for outdoor lights to the IECC will increase uniformity.

When illuminating dark surrounds, bright glare sources in the periphery reduce contrast visibility because light scattered in the lens obscures the fovea. This reduction in contrast visibility requires an increase level of illumination to compensate for veiling luminance caused by glare.

Connecticut amended the IECC in 2004 with a new section titled Light Pollution Controls. The wording for the current proposed code change is the same language used in the Connecticut amendment (Section 805.6.1 – Page 89 revised 2005)
http://www.ct.gov/dps/lib/dps/office_of_state_building_inspector_files/2005_state_building_code.pdf

The ability to see by the illumination of a full moon on a clear night is an example of how lower levels of light allow the human eye to see in dark surrounds once glare has been eliminated or reduced.

The Roadway Lighting Manual (RP-8-00) includes calculations for Small Target Visibility, factoring for glare on target visibility, and showing that by reducing or eliminating glare, visibility can be maintained using lower light levels.

Shielding to reduce glare is also required by the California Energy Commission in Title 24 section on Outdoor Lighting, 6.2.3
http://www.energy.ca.gov/2005publications/CEC-400-2005 006/chapters_4q/6_Outdoor_Lighting_Signs.pdf

LEED certification Green Building Program provides one point to buildings where the exterior lighting is shielded.

The State of New Mexico has incorporated shielding requirements for outdoor lighting as part of the New Mexico Electric Code (section 290.40) under the Night Sky Protection Act.
http://www.conwaygreene.com/nmsu/lpext.dll?f=templates&fn=main-h.htm&2.0

Veiling luminance is the term used in the lighting industry to describe the loss of vision caused by glare. The Illuminating Engineering Society of North America publishes standards on lighting practices that include a calculation for Veiling Luminance, which is used when determining the amount of light required: the greater the veiling luminance caused by glare, the greater the lighting level needed to offset the VL.

By eliminating or reducing glare, contrast visibility is improved, allowing the eye to see better in darkness with lower lighting levels, thereby reducing energy consumption.

Bibliography:
Connecticut State Building Code, 2005 Supplement - Light Pollution Controls, Page 89, Section 805.6.1.

RP-8-00 *Roadway Lighting*, Illuminating Engineering Society, Appendix F, STV Method (Pages 47-53)
http://www.ct.gov/dps/cwp/view.asp?a=2148&Q=305424&PM=1

California Title 24 – Outdoor Lighting – Full cutoff/cutoff shielding requirement, section 6.2.3 New Mexico Statutes, New Mexico Statutes Unannotated, Chapter 74, Article 12.
http://www.energy.ca.gov/2005publications/CEC-400-2005-006/chapters_4q/6_Outdoor_Lighting_Signs.pdf

LEED Certification: SS Credit 8: Light Pollution Reduction https://www.usgbc.org/ShowFile.aspx?DocumentID=1095

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

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

EC151–07/08
506

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

Delete Section 506 and replace with the following:

SECTION 506
TOTAL BUILDING PERFORMANCE

506.1 Scope. This section establishes criteria for compliance using total building performance. The following systems and loads shall be included in determining the total building performance: heating systems, cooling systems, service water heating, fan systems, lighting power, receptacle loads, and process loads.

506.2 Mandatory requirements. Compliance with this section requires that the criteria of Sections 502.4, 502.5, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 be met.

506.3 Performance-based compliance. Compliance based on total building performance requires that a proposed building (proposed design) be shown to have an annual energy cost that is less than or equal to the annual energy cost of the standard reference design. Energy prices shall be taken from a source approved by the code official, such as the Department of Energy, Energy Information Administration's *State Energy Price and Expenditure Report.* Code officials shall be permitted to require time-of-use pricing in energy cost calculations. Nondepletable energy collected off site shall be treated and priced the same as purchased energy. Energy from nondepletable energy sources collected on site shall be omitted from the annual energy cost of the proposed design.

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

506.4 Documentation. Documentation verifying that the methods and accuracy of compliance software tools conform to the provisions of this section shall be provided to the code official.

506.4.1 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 building;
2. An inspection checklist documenting the building component characteristics of the proposed design as listed in Table 506.5.1(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.

506.4.2 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. Thermal zoning diagrams consisting of floor plans showing the thermal zoning scheme for standard reference design and proposed design.
3. Input and output report(s) from the energy analysis simulation program containing the complete input and output files, as applicable. The output file shall include energy use totals and energy use by energy source and end-use served, total hours that space conditioning loads are not met and any errors or warning messages generated by the simulation tool as applicable;
4. An explanation of any error or warning messages appearing in the simulation tool output;
5. A certification signed by the builder providing the building component characteristics of the proposed design as given in Table 506.5.1(1)

506.5 Calculation procedure. Except as specified by this section, the standard reference design and proposed design shall be configured and analyzed using identical methods and techniques.

506.5.1 Building specifications. The standard reference design and proposed design shall be configured and analyzed as specified by Table 506.5.1(1). Table 506.5.1(1) shall include by reference all notes contained in Table 502.2(1).

506.5.2 Thermal blocks. The standard reference design and proposed design shall be analyzed using identical thermal blocks as required in Section 506.5.3.1, 506.3.2 or 506.5.3.3.

506.5.2.1 HVAC zones designed. Where HVAC zones are defined on HVAC design drawings, each HVAC zone shall be modeled as a separate thermal block.

Exception: Different HVAC zones may be combined to create a single thermal block or identical thermal blocks to which multipliers are applied provided:

1. The space use classification is the same throughout the thermal block.
2. All HVAC zones in the thermal block that are adjacent to glazed exterior walls face the same orientation or their orientations are within 45 degrees of each other.
3. All of the zones are served by the same HVAC system or by the same kind of HVAC system.

506.5.2.2 HVAC zones not designed. Where HVAC zones have not yet been designed, thermal blocks shall be defined based on similar internal load densities, occupancy, lighting, thermal and temperature schedules, and in combination with the following guidelines:

1. Separate thermal blocks shall be assumed for interior and perimeter spaces. Interior spaces shall be those located more than 15 ft from an exterior wall. Perimeter spaces shall be those located closer than 15 ft from an exterior wall.
2. Separate thermal blocks shall be assumed for spaces adjacent to glazed exterior walls: a separate zone shall be provided for each orientation, except orientations that differ by no more than 45 degrees may be considered to be the same orientation. Each zone shall include floor area that is 15 ft r less from a glazed perimeter wall, except that floor area within 15 ft of glazed perimeter walls having more than one orientation shall be divided proportionately between zones.
3. Separate thermal blocks shall be assumed for spaces having floors that are in contact with the ground or exposed to ambient conditions from zones that do not share these features.
4. Separate thermal blocks shall be assumed for spaces having exterior ceiling or roof assemblies from zones that do not share these features.

506.5.2.3. Multifamily residential buildings. Residential spaces shall be modeled using one thermal block per space except that those facing the same orientations may be combined into one thermal block. Corner units and units with roof or floor loads shall only be combined with units sharing these features.

506.6 Calculation software tools. Calculation procedures used to comply with this section shall be software tools capable of calculating the annual energy consumption of all building elements that differ between the standard reference design and the proposed design and shall include the following capabilities.

1. Computer generation of the standard reference design using only the input for the proposed design. The calculation procedure shall not allow the user to directly modify the building component characteristics of the standard reference design.
2. Building operation for a full calendar year (8,760 hours).
3. Climate data for a full calendar year (8,760 hours) and shall reflect approved coincident hourly data for temperature, solar radiation, humidity and wind speed for the building location.
4. Ten or more thermal zones.
5. Thermal mass effects.
6. Hourly variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage, and any process loads.
7. Part-load performance curves for mechanical equipment;
8. Capacity and efficiency correction curves for mechanical heating and cooling equipment.
9. Printed code official inspection checklist listing each of the proposed design component characteristics from Table 506.5.1(1) determined by the analysis to provide compliance, along with their respective performance ratings (e.g. R-Value, U-Factor, SHGC, HSPF, AFUE, SEER, EF, etc.).

506.6.1 Specific approval. Performance analysis tools meeting the applicable sections of 506 and tested according to Standard 140 shall be permitted to be approved. Tools are permitted to be approved based on meeting a specified threshold for a jurisdiction. The code official shall be permitted to approve tools for a specified application or limited scope.

506.6.2 Input values. When calculations require input values not specified by Section 502, 503, 504 and 505, those input values shall be taken from an approved source.

TABLE 506.5.1(1):
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT/ CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Space use classification	Same as proposed	The space use classification shall be chosen in accordance with Table 505.5.2 for all areas of the building covered by this permit. Where the space use classification for a building is not known, the building shall be categorized as an office building.
Roofs	Type: Insulation entirely above-deck Gross area: same as proposed U-Factor: from Table 502.1.2 Solar Absorptance: 0.75 Emittance: 0.90	As proposed As proposed As proposed As proposed As proposed
Walls, above-grade	Type: Mass wall if proposed wall is mass; otherwise steel-framed wall Gross Area: same as proposed U-Factor: from Table 502.1.2 Solar Absorptance: 0.75 Emittance: 0.90	As proposed As proposed As proposed As proposed As proposed
Walls, below-grade	Type: Mass wall Gross Area: same as proposed U-Factor: from Table 502.1.2 with insulation layer on interior side of walls	As proposed As proposed As proposed
Floors, above-grade	Type: joist/framed floor Gross Area: same as proposed U-Factor: from Table 502.1.2	As proposed As proposed As proposed
Floors, slab-on-grade	Type: Unheated F-Factor: from Table 502.1.2	As proposed As proposed
Doors	Type: Swinging Area: Same as proposed U-Factor: from Table 502.2(1)	As proposed As proposed As proposed
Glazing	Area: (a) The proposed glazing area; where the proposed glazing area is less than 35% of above-grade wall area (b) 35% of above-grade wall area; where the proposed glazing area is 35% or more of the above grade wall area U-factor: from Table 502.3 SHGC: from Table 502.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used External Shading and PF: None	As proposed As proposed As proposed As proposed
Skylights	Area: (a) The proposed skylight area; where the proposed skylight area is less than 3 percent of gross area of roof assembly (b) 3 percent of gross area of roof assembly; where the proposed skylight area is 3 percent or more of gross area of roof assembly U-factor: from Table 502.3 SHGC: from Table 502.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used	As proposed As proposed As proposed
Lighting, interior	The interior lighting power shall be determined in accordance with Table 505.5.2. Where the occupancy of the building is not known, the lighting power density shall be 1.0 Watt per square foot (10.73 W/m^2) based on the categorization of buildings with unknown space classification as offices	As proposed
Lighting, exterior	The lighting power shall be determined in accordance with Table 505.6.2. Areas and dimensions of tradable and non-tradable surfaces shall be the same as proposed.	As proposed
Internal gains	Same as proposed	Receptacle, motor and process loads shall be

BUILDING COMPONENT/ CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
		modeled and estimated based on the space use classification. All end-use load components within and associated with the building shall be modeled to include, but not limited to the following: exhaust fans, parking garage ventilation fans, exterior building lighting, swimming pool heaters and pumps, elevators, escalators, refrigeration equipment and cooking equipment.
Schedules	Same as proposed	Operating schedules shall include hourly profiles for daily operation and shall account for variations between weekdays, weekends, holidays, and any seasonal operation. Schedules shall model the time-dependant variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage, and any process loads. The schedules shall be typical of the proposed building type as determined by the designer and approved by the jurisdiction.
Mechanical Ventilation	Same as proposed	As proposed, in accordance with Section 503.2.5.
Heating systems	Fuel Type: same as proposed design Equipment Type[1]: from Table 506.5.1(2) and Table 506.5.1(3) Efficiency: from Table 503.2.3(4) and Table 503.2.3(5) Capacity[2]: sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet heating load hours and no larger heating capacity safety factors are provided than in the proposed design.	As proposed As proposed As proposed As proposed
Cooling systems	Fuel Type: same as proposed design Equipment Type[3]: from Table 506.5.1(2) and Table 506.5.1(3) Efficiency: from Table 503.2.3(1), Table 503.2.3(2) and Table 503.2.3(3) Capacity[b]: sized proportionally to the capacities in the proposed design based on sizing runs, and shall be established such that no smaller number of unmet cooling load hours and no larger cooling capacity safety factors are provided than in the proposed design. Economizer[4]: same as proposed, in accordance with Section 503.4.1	As proposed As proposed As proposed As proposed As proposed
Service water heating	Fuel type: same as proposed Efficiency: from Table 504.2 Capacity: same as proposed Where no service water hot water system exists or is specified in the proposed design, no service hot water heating shall be modeled	As proposed As proposed As proposed

1 Where no heating system exists or no heating system has been specified, the heating system shall be modeled as fossil fuel. The system characteristics shall be identical in both the Standard Reference Design and Proposed Design.

2 The ratio between the capacities used in the annual simulations and the capacities determined by sizing runs shall be the same for both the Standard Reference Design and Proposed Design.

3 Where no cooling system exists or no cooling system has been specified, the cooling system shall be modeled as an air-cooled single-zone system, one unit per thermal zone. The system characteristics shall be identical in both the Standard Reference Design and Proposed Design.

4 If an economizer is required as per Table 503.3.1 (1), and if no economizer exists or is specified in the proposed design, then a supply air economizer shall be provided in accordance with Section 503.4.1.

TABLE 506.5.1(2)
HVAC SYSTEMS MAP

Condenser Cooling Source[a]	Heating System Classification[b]	Standard Reference Design HVC System Type[c]		
		Single Zone Residential System	Single Zone Non-Residential System	All Other
Water/Ground	Electric Resistance	System 5	System 5	System 1
	Heat Pump	System 6	System 6	System 6
	Fossil Fuel	System 7	System 7	System 2
Air/None	Electric Resistance	System 8	System 9	System 3
	Heat Pump	System 8	System 9	System 3
	Fossil Fuel	System 10	System 11	System 4

a. Select "Water/Ground" if the *proposed design* system condenser is water or evaporatively cooled; select "Air/None" if the condenser is air-cooled. Closed-circuit drycoolers shall be considered air-cooled. Systems utilizing district cooling shall be treated as if the condenser water type were "water." If no mechanical cooling is specified or the mechanical cooling system in the *proposed design* does not require heat rejection, the system shall be treated as if the condenser water type were "Air." For proposed designs with ground-source or groundwater-source heat pumps, the standard reference design HVAC system shall be water-source heat pump (System 6).

b. Select the path that corresponds to the *proposed design* heat source: electric resistance, heat pump (including air-source and water-source), or fuel-fired. Systems utilizing district heating (steam or hot water) shall be treated as if the heating system type were "Fossil Fuel." Systems with no heating capability shall be treated as if the heating system type were "Fossil Fuel." For systems with mixed fuel heating sources, the system or systems that use the secondary heating source type (the one with the smallest total installed output capacity for the spaces served by the system) shall be modeled identically in the *standard reference design* and the primary heating source type shall be used to determine standard reference design HVAC system type.

c. Select the *standard reference design* HVAC system category: The system under "Single Zone Residential System" shall be selected if the HVAC system in the proposed design is a single-zone system and serves a residential space. The system under "Single Zone Nonresidential System" shall be selected if the HVAC system in the proposed design is a single-zone system and serves other than residential spaces. The system under "All Other" shall be selected for all other cases.

TABLE 506.5.1(3)
SPECIFICATIONS FOR THE STANDARD REFERENCE DESIGN HVAC SYSTEM DESCRIPTIONS

System No.	System Type	Fan Control	Cooling Type	Heating Type
1	Variable air volume with parallel fan-powered boxes [a]	VAV [d]	Chilled Water [e]	Electric Resistance
2	Variable air volume with reheat [b]	VAV [d]	Chilled Water [e]	Hot Water Fossil Fuel Boiler [f]
3	Packaged variable air volume with parallel fan-powered boxes [a]	VAV [d]	Direct Expansion [c]	Electric Resistance
4	Packaged variable air volume with reheat [b]	VAV [d]	Direct Expansion [c]	Hot Water Fossil Fuel Boiler [f]
5	Two-pipe fan-coil	Constant Volume [i]	Chilled Water [e]	Electric Resistance
6	Water-source heat pump	Constant Volume [i]	Direct Expansion [c]	Electric Heat Pump and Boiler [g]
7	Four-pipe fan coil	Constant Volume [i]	Chilled Water [e]	Hot Water Fossil Fuel Boiler [f]
8	Packaged terminal heat pump	Constant Volume [i]	Direct Expansion [c]	Electric Heat Pump [h]
9	Packaged rooftop heat pump	Constant Volume [i]	Direct Expansion [c]	Electric Heat Pump [h]
10	Packaged terminal air conditioner	Constant Volume [i]	Direct Expansion	Hot Water Fossil Fuel Boiler [f]
11	Packaged rooftop air conditioner	Constant Volume [i]	Direct Expansion	Fossil Fuel Furnace

a. **VAV with parallel boxes:** Fans in parallel VAV fan-powered boxes shall be sized for 50% of the peak design flow rate and shall be modeled with 0.35 W/cfm fan power. Minimum volume setpoints for fan-powered boxes shall be equal to the minimum rate for the space required for ventilation consistent with 503.4.5 Exception (5) 1. Supply air temperature setpoint shall be constant at the design condition.

b. **VAV with reheat:** Minimum volume setpoints for VAV reheat boxes shall be 0.4 cfm/ft2 of floor area. Supply air temperature shall be reset based on zone demand from the design temperature difference to a 10°F temperature difference under minimum load conditions. Design air flow rates shall be sized for the reset supply air temperature, i.e., a 10°F temperature difference.

c. **Direct Expansion:** The fuel type for the cooling system shall match that of the cooling system in the *proposed design*.

d. **VAV:** Constant volume can be modeled if the system qualifies for Exception (1) to 503.4.5. When the *proposed design* system has a supply, return, or relief fan motor 25 hp or larger, the corresponding fan in the VAV system of the *standard reference design* shall be modeled assuming a variable speed drive. For smaller fans, a forward-curved centrifugal fan with inlet vanes shall be modeled. If the *proposed design's* system has a direct digital control system at the zone level, static pressure setpoint reset based on zone requirements in accordance with 503.4.2 shall be modeled.

e. **Chilled Water:** For systems using purchased chilled water, the chillers are not explicitly modeled and chilled water costs shall be based as determined in 506.3 and 506.5.2. Otherwise, the *standard reference design's* chiller plant shall be modeled with chillers having the number as indicated in Table 506.5.1(4) as a function of *standard reference building* chiller plant load and type as indicated in Table 506.5.1(5) as a function of individual chiller load. Where chiller fuel source is mixed, the system in the *standard reference design* shall have chillers with the same fuel types and with capacities having the same proportional capacity as the *proposed design's* chillers for each fuel type. Chilled water supply temperature shall be modeled at 44°F design supply temperature and 56°F return temperature. Piping losses shall not be modeled in either building model. Chilled water supply water temperature shall be reset in accordance with 503.4.3.4. Pump system power for each pumping system shall be the same as the *proposed design*; if the *proposed design* has no chilled water pumps, the *standard reference design* pump power shall be 22 W/gpm (equal to a pump operating against a 75 ft head, 65% combined impeller and motor *efficiency*). The chilled water system shall be modeled as primary-only variable flow with flow maintained at the design rate through each chiller using a bypass. Chilled water pumps shall be modeled as riding the pump curve or with variable-speed drives when required in 503.4.3.4. The heat rejection device shall be an axial fan cooling tower with two-speed fans if required in 503.4.4. Condenser water design supply temperature shall be 85°F or 10°F approach to design wet-bulb temperature, whichever is lower, with a design temperature rise of 10°F. The tower shall be controlled to maintain a 70°F leaving water temperature where weather permits, floating up to leaving water temperature at design conditions. Pump system power for each pumping system shall be the same as the *proposed design*; if the *proposed design* has no condenser water pumps, the *standard reference design* pump power shall be 19 W/gpm (equal to a pump operating against a 60 ft head, 60% combined impeller and motor *efficiency*). Each chiller shall be modeled with separate condenser water and chilled water pumps interlocked to operate with the associated chiller.

f. **Fossil Fuel Boiler:** For systems using purchased hot water or steam, the boilers are not explicitly modeled and hot water or steam costs shall be based on actual utility rates. Otherwise, the boiler plant shall use the same fuel as the *proposed design* and shall be natural draft. The *standard reference design* boiler plant shall be modeled with a single boiler if the *standard reference design* plant load is 600,000 Btu/h and less and with two equally sized boilers for plant capacities exceeding 600,000 Btu/h. Boilers shall be staged as required by the load. Hot water supply temperature shall be modeled at 180°F design supply temperature and 130°F return temperature. Piping losses shall not be modeled in either building model. Hot water supply water temperature shall be reset in accordance with 503.4.3.4. Pump system power for each pumping system shall be the same as the *proposed design*; if the *proposed design* has no hot water pumps, the *standard reference design* pump power shall be 19 W/gpm (equal to a pump operating against a 60 ft head, 60% combined impeller and motor *efficiency*). The hot water system shall be modeled as primary-only with continuous variable flow. Hot water pumps shall be modeled as riding the pump curve or with variable speed drives when required by 503.4.3.4.

g. **Electric Heat Pump and Boiler:** Water-source heat pumps shall be connected to a common heat pump water loop controlled to maintain temperatures between 60°F and 90°F. Heat rejection from the loop shall be provided by an axial fan closed-circuit evaporative fluid cooler with two-speed fans if required in 503.4.2. Heat addition to the loop shall be provided by a boiler that uses the same fuel as the *proposed design* and shall be natural draft. If no boilers exist in the *proposed design*, the standard reference building boilers shall be fossil fuel. The *standard reference design* boiler plant shall be modeled with a single boiler if the *standard reference design* plant load is 600,000 Btu/h or less and with two equally sized boilers for plant capacities exceeding 600,000 Btu/h. Boilers shall be staged as required by the load. Piping losses shall not be modeled in either building model. Pump system power shall be the same as the *proposed design*; if the *proposed design* has no pumps, the *standard reference design* pump power shall be 22 W/gpm, which is equal to a pump operating against a 75 foot head, with a 65% combined impeller and motor *efficiency*. Loop flow shall be variable with flow shutoff at each heat pump when its compressor cycles off as required by 503.4.3.3. Loop pumps shall be modeled as riding the pump curve or with variable speed drives when required by 503.4.3.4.

h. **Electric Heat Pump:** Electric air-source heat pumps shall be modeled with electric auxiliary heat. The system shall be controlled with a multi-stage space thermostat and an *outdoor air* thermostat wired to energize auxiliary heat only on the last thermostat stage and when *outdoor air* temperature is less than 40°F.

i. **Constant Volume:** Fans shall be controlled in the same manner as in the *proposed design*; i.e., fan operation whenever the space is occupied or fan operation cycled on calls for heating and cooling. If the fan is modeled as cycling and the fan energy is included in the energy *efficiency* rating of the equipment, fan energy shall not be modeled explicitly.

TABLE 506.5.1(4)
NUMBER OF CHILLERS

TOTAL CHILLER PLANT CAPACITY	NUMBER OF CHILLERS
≤300 tons	1
>300 tons, < 600 tons	2 sized equally
≥600 tons	2 minimum with chillers added so that no chiller is larger than 800 tons, all sized equally

TABLE 506.5.1(5)
WATER CHILLER TYPES

INDIVIDUAL CHILLER PLANT CAPACITY	ELECTRIC CHILLER TYPE	FOSSIL FUEL CHILLER TYPE
≤100 tons	Reciprocating	Single-effect absorption, direct fired
>100 tons, <300 tons	Screw	Double-effect absorption, direct fired
≥300 tons	Centrifugal	Double-effect absorption, direct fired

Reason: DOE is supportive of the use of integrated design processes and whole building simulations in the commercial sector. While DOE recognizes that not all design teams will want to utilize whole building simulations for code compliance, DOE wants to make sure that those teams who do wish to use a whole building approach do it properly. The Department has noted that there is considerable discrepancy between the level of detail provided for the whole building compliance approach in ASHRAE Standard 90.1 (Section 11 Energy Cost Budget Method) and the whole building compliance approach currently found in Section 506 Total Building Performance. Furthermore, there is a surprising amount of difference in the level of detail provided in the commercial whole building approach in Section 506 and the residential whole building approach provided in Section 404 Simulated Performance Alternative. DOE proposes the necessary changes to make sure that the commercial whole building approach is adequately specified in the IECC, simple to use and consistent with residential performance based compliance requirements.

This proposal reflects a combination of the format of Section 404 of the IECC and the technical content of Section 11 of ASHRAE/IESNA Standard 90.1 along with the current provisions of Section 506. DOE does believe that the level of specification provided in ASHRAE/IESNA Standard 90.1 is adequate for a whole building code compliance approach, but the format and requirements are difficult to implement and enforce. IECC Section 404 has a well developed format that is simple to use and building officials are becoming familiar with it for some time and therefore DOE feels this format should be adapted for the commercial buildings with appropriate changes to the ASHRAE 90.1 Section 11. DOE is aware that this code change would add additional pages of detailed text to the IECC, but if a practical and useful total building performance is to be supported by IECC, then the proposed changes are a step in the right direction.

The main difference between using the revised Section 506 of the IECC (found in this proposal) and Section 11 of ASHRAE/IESNA Standard 90.1 is the reference to baseline requirements and simplified mechanical requirements with fewer exceptions as provided in the IECC. This proposal would require the use of the mandatory and prescriptive provisions of Chapter 5 of the IECC instead of the mandatory and prescriptive provisions of ASHRAE Standard 90.1.

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

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

EC152–07/08
202 (IBC 1202); IRC R202

Proponent: Daniel J. Walker, PE, Thomas Associates, Inc., representing the National Sunroom Association

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

PART I – IECC

Revise definition as follows:

SECTION 202 (IBC SECTION 1202)
DEFINITIONS

THERMAL ISOLATION. ~~A separation of conditioned spaces, between a sunroom addition and a dwelling unit,~~ Physical and space conditioning separation from conditioned space(s), consisting of existing or new wall(s), doors and/or windows. The conditioned space(s) shall be controlled as separate zones for heating and cooling or conditioned by separate equipment.

PART II – IRC

Revise definition as follows:

SECTION R202
GENERAL DEFINITIONS

THERMAL ISOLATION. Physical and space conditioning separation from conditioned space(s) consisting of existing or new walls, doors and/or windows. The conditioned space(s) shall be controlled as separate zones for heating and cooling or conditioned by separate equipment.

Reason: The added text comes from the definition of *Thermal Isolation* in the 2006 IBC. The purpose of this code change, and the companion code change to the IBC, is to unify the definitions for this term within these codes. Currently the definition in the IRC and IECC is different than the one in the IBC. The revised definitions will all be identical, which should considerably reduce confusion for code enforcers and contractors.

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

PART I – IECC

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

PART II – IRC B/E

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

EC153–07/08
Chapter 10

Proponent: Standards writing organizations as listed below.

Revise standards as follows:

AMCA Air Movement and Control Association International
30 West University Drive
Arlington Heights, IL 60004-1806

Standard reference number	Title
500D-~~98~~ 07	Laboratory Methods of Testing Dampers for Rating

ASME American Society of Mechanical Engineers
International Three Park Avenue
New York, NY 10016-5990

Standard reference number	Title
PTC 4.1-1964 (Reaffirmed 1991)	Steam Generating Units

NFRC National Fenestration Rating Council, Inc.
8484 Georgia Avenue, Suite 320
Silver Spring, MD 20910

Standard reference number	Title
100-04 ~~01~~	Procedure for Determining Fenestration Product U-factors
200-04 ~~01~~	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence
400-04 ~~01~~	Procedure for Determining Fenestration Product Air Leakage

Reason: The *CP 28 Code Development Policy*, Section 4.5* requires the updating of referenced standards to be accomplished administratively, and be processed as a Code Change Proposal. In May 2007, a letter was sent to each developer of standards that are referenced in the International Codes, asking them to provide the ICC with a list of their standards in order to update to the current edition. Above is the received list of the referenced standards that are 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

EC154–07/08
Appendix A, 202 (New), 401.2, Table 402.1.1, Table 402.1.3, 402.1.5 (New), Table 402.1.5 (New), Table 402.1.6 (New), Table 402.1.7 (New), 402.2.1, 402.2.2, 402.4.1, 402.4.1.1 (New), 402.4.1.2 (New), 402.4.1.3 (New), 402.4.1.4 (New), 402.4.1.5 (New), 402.4.1.6 (New), 402.7 (New), Table 402.7 (New), 403.2.4 (New), 403.4, 403.4.1 (New), 403.4.2 (New), 403.4.3 (New), 403.6, 404, 404.1, 404.2, Table 404.5.2(1)

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

1. Add new text as follows:

NOTE: This proposed Appendix is entirely new text to the IECC. Rather than show all text underlined as new, the proposal is formatted to show ruled format to existing text in the main body of the code in order to show the energy efficiency improvements in comparison to the existing energy code.

APPENDIX A
MEASURES FOR INCREASED ENERGY EFFICIENCY
FOR VOLUNTARY ADOPTION BY JURISDICTIONS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance

Introduction. The purpose of Appendix A ("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 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.

The measures in this version of the Appendix for the 2009 IECC can provide an approximate 30 percent national improvement in residential new construction energy efficiency as compared to the 2006 IECC and its supplement. Jurisdictions wishing to achieve this level of energy efficiency can adopt all the provision in this version. Jurisdictions seeking more modest increases in energy efficiency can adopt selected measures from this appendix as needed.

How to use this Appendix. The measures in this Appendix modify existing sections of the 2006 IECC or add new sections. The measures are numbered according to section numbering of the 2006 IECC and its supplement. Jurisdictions wishing to adopt some or all of these measures can replace selected sections in the 2006 IECC with the corresponding section in this Appendix through state or local amendments. Instructions are provided to "revise text as follows" or to add new text or tables to incorporate the desired changes.

The measures included in this Appendix for the 2009 IECC include the following:

- Section 202 General Definitions, including those needed to implement certain new measures
- Section 402 Building Thermal Envelope, including improved fenestration and insulation requirements and changes to certain U-value tables
- Section 402.4.1 Building thermal envelope, including improved air infiltration sealing to prevent thermal bypasses
- Section 402.7 Minimum opaque envelope requirements (Mandatory) as a new requirement
- Section 403.2 Ducts, including new requirements to improve distribution system efficiency
- Section 403.6 Equipment sizing, including certain limits on equipment oversizing
- Section 403.7 Service Water Heating, including measures to increase water heating system efficiencies
- Section 404 Electrical Power and Lighting Systems, including new requirements for certain efficiencies in selected residential lighting equipment
- Section 404 Simulated Performance Alternative (Performance), including improvements to criteria for conducting performance path simulations

Specific Energy Efficiency Measures Provided for Voluntary Adoption

GENERAL DEFINITIONS
SECTION A202

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

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

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

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

IMPROVED BUILDING ENVELOPE MEASURES

2. Revise as follows:

A401.2 Compliance. Projects shall comply with Sections 401, 402.4, 402.5, 402.6, 402.7, and 403 (referred to as the mandatory provisions) and either:

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

TABLE A402.1.1 (Supp)
INSULATION AND FENESTRATION REQUIREMENTS BY COMPONENT [a]

CLIMATE ZONE	FENESTRATION U-FACTOR	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION SHGC[h]	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[H]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	~~1.20~~ 0.65	0.75	~~0.37~~ 0.25	30	~~13~~ 15	3 / 4	13	0	0	0
2	~~0.75~~ 0.50	0.75	~~0.37~~ 0.25	~~30~~ 38	~~13~~ 15	4 / 6	13	~~0~~ 10/13	0	0
3	~~0.65~~ 0.40	0.65	~~0.40~~[e] 0.25[e]	~~30~~ 38	~~13~~ 18	5 / 8	19	~~0~~ 10/13	0	5/13
4 except Marine	~~0.40~~ 0.35	0.60	NR	~~38~~ 49	~~13~~ 18	5 / 10	19	10/13	10, 2 ft	10/13
5 and Marine 4	0.35	0.60	NR	~~38~~ 49	~~19 or 13+5~~[g] 21	13 / 17	30[f]	10/13	10, 2 ft	10/13
6	0.35	0.60	NR	~~49~~ 60	~~19 or 13+5~~[g] 21	15 / 19	30[f]	~~10~~ 15/19 ~~13~~	10, 4 ft	10/13
7 and 8	0.35	0.60	NR	~~49~~ 60	~~21~~ 24	19 / 21	~~30~~ 38[f]	~~10~~ 15/19 ~~13~~	10, 4 ft	10/13

For SI: 1 foot = 304.8 mm.

a. *R*-values are minimums. *U*-factors and SHGC are maximums. R-19 shall be permitted to be compressed into a 2 × 6 cavity.
b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
c. "15 / 19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall. ~~The first R-value applies to continuous insulation, the second to framing cavity insulation; either insulation meets the requirement.~~
d. R-5 shall be added to the required slab edge *R*-values for heated slabs.
e. There are no SHGC requirements in the Marine zone.
f. Or insulation sufficient to fill the framing cavity, R-19 minimum.
g. ~~"13+5" means R-13 cavity insulation plus R-5 insulated sheathing.~~ Any combination of insulation shall be permitted to meet the requirements by summing the R-value of the cavity insulation and the R-value of the insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2

TABLE A402.1.3
EQUIVALENT U-FACTORS [a]

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

(Footnotes remain unchanged)

3. Add new text and tables as follows:

A402.1.5 Envelope component default values. When calculating the U-factor of an assembly as part of Section 402.1.3, 402.1.4, or 404.5.2, the values in Table 402.1.5 through 402.1.7 shall be used unless alternate values are documented and approved by the code official. In addition, the U-factor of the assembly shall be calculated using a series-parallel calculation.

TABLE A402.1.5
FRAME WALL COMPONENT DEFAULT VALUES

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

TABLE A402.1.6
FLOOR COMPONENT DEFAULT VALUES

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

TABLE A402.1.7
CEILING COMPONENT DEFAULT VALUES

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

4. Revise as follows:

A402.2.1 Ceilings with attic spaces. When Section 402.1.1 would require R-38 in the ceiling, R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Similarly R-38 shall be deemed to satisfy the requirement for R-49 or higher wherever the full height of uncompressed R-38 insulation extends over the wall top plate at the eaves.

A402.2.2 Ceilings without attic spaces. Where Section 402.1.1 would require insulation levels above R-30 and the design of the roof/ceiling assembly does not allow sufficient space for the required insulation, the minimum required insulation for such roof/ceiling assemblies shall be R-30. This reduction of insulation from the requirements of Section 402.1.1 shall be limited to 500 square feet (46 m_2) or 20% of the total insulated ceiling area, which ever is less.

AIR INFILTRATION SEALING TO PREVENT THERMAL BYPASSES

A402.4.1 (Supp) Building thermal envelope. The building thermal envelope shall be durably sealed to limit infiltration and prevent thermal bypasses. The sealing methods between dissimilar materials shall allow for differential expansion and contraction. The thermal envelope, including insulation and air barriers, shall be inspected in accordance with Sections 402.4.1.1 through 402.4.1.6. ~~The following shall be caulked, gasketed, weatherstripped or otherwise sealed with an air barrier material, suitable film or solid material:~~

~~1. All joints, seams and penetrations.~~
~~2. Site-built windows, doors and skylights.~~
~~3. Openings between window and door assemblies and their respective jambs and framing.~~
~~4. Utility penetrations.~~

~~5. Dropped ceilings or chases adjacent to the thermal envelope.~~
~~6. Knee walls.~~
~~7. Walls and ceilings separating a garage from conditioned spaces.~~
~~8. Behind tubs and showers on exterior walls.~~
~~9. Common walls between dwelling units.~~
~~10. Attic access openings.~~
~~11. Other sources of infiltration.~~

5. Add new text and tables as follows:

A402.4.1.1 Walls adjoining exterior walls or unconditioned spaces. Fully insulated wall in substantial contact with air barrier at both interior and exterior, or for Climate Zones 1 thru 3, sealed exterior air barrier aligned with fully supported insulation. The following areas shall meet these requirements: wall behind shower/tub, wall behind fireplace, insulated attic slopes for un-vented attic spaces, attic knee walls, skylight shaft walls, wall adjoining porch roof, staircase walls, double walls.

A402.4.1.2 Floors between conditioned and exterior spaces. An air barrier shall be installed at any exposed insulation edges. Insulation shall be installed to maintain substantial contact w/ sub-floor above and air barrier below. The following areas shall meet these requirements: Insulated floor above un-conditioned and semi-conditioned space.

A402.4.1.3 Shafts. Openings and gaps to unconditioned space shall be fully sealed with an air barrier. The following areas shall meet these requirements: duct, piping and flue shafts and associated penetrations.

A402.4.1.4 Attic and ceiling interface. Attic penetrations and dropped ceilings shall include a full interior air barrier aligned with insulation with any gaps fully sealed. Insulation shall fit snugly in opening and the opening air barrier shall be fully gasketed. The following areas shall meet these requirements: attic access panel, attic drop-down stair, dropped ceiling/soffit, recessed lighting fixtures, whole-house fan.

A402.4.1.5 Common walls between dwelling units. Gap between drywall shaft wall (common wall) and structural framing between units shall be sealed at all exterior boundary conditions.

A402.4.1.6 Gaps and penetrations. Gaps and penetrations in the thermal envelope of the home shall be sealed and insulated. The following areas shall meet these requirements: the perimeters of windows, doors, skylights, and utility penetrations, hose bibs, exterior electrical outlets and light fixtures.

MINIMUM INSULATION REQUIREMENTS

A402.7 Minimum opaque envelope requirements (Mandatory). The thermal requirements for opaque envelope components shall not be less than the requirements in Table 402.7 when determining alternatives to the R-values in Table 402.1.1 under Sections 402.1.3, 402.1.4, or 404.

TABLE A402.7
MINIMUM INSULATION REQUIREMENTS BY COMPONENT

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

a. R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves or the design of the roof/ceiling assembly does not allow sufficient space for the required insulation. This reduction of insulation shall be limited to 500 square feet (46 m^2) of ceiling area.

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

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

IMPROVEMENTS TO DUCT DISTRIBUTION SYSTEMS EFFICIENCY

A403.2.4 Distribution system efficiency. Ducts shall be located completely within the building thermal envelope or achieve an equivalent distribution efficiency of 0.88 or greater.

`Exceptions:

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

SERVICE WATER HEATING EFFICIENCY IMPROVEMENTS

6. Revise as follows:

A403.4 Service Water Heating.

7. Add new text as follows:

A403.4.1 Insulation. All Service Hot Water piping shall be insulated to at least R-2 for the distance between the Service Water Heater to within 5 feet of each fixture connected to the hot water pipe.

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

A403.4.2 Stub-in for solar water. All Service Water Heating distribution systems shall have a stub-in connection point for future Solar Hot Water Systems in an accessible location within 5 feet of the roof.

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

8. Revise as follows:

A403.4.3 Circulating hot water systems. All circulating service hot water piping shall be insulated to at least R-2. Circulating hot water systems shall include an automatic or readily accessible manual switch that can turn off the hot water circulating pump when the system is not in use.

IMPROVED EQUIPMENT SIZING REQUIREMENTS

A403.6 Equipment sizing. Heating and cooling equipment shall be sized in accordance with Section M1401.3 of the *International Residential Code*.

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

The following operating conditions shall be used in the sizing calculations and verified where reviewed by the code official:

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

In specifying equipment, the next available manufactured size may be used. In addition, indoor and outdoor coils shall be matched in accordance with ARI Standard 210/240.

RESIDENTIAL LIGHTING EQUIPMENT EFFICIENCY

SECTION 404 (Supp)
ELECTRICAL POWER AND LIGHTING SYSTEMS

A404.1 Dwelling unit interior and exterior lighting power (Prescriptive). 50% of all dwelling unit interior and exterior hard-wired lighting sockets shall be a qualifying light fixture. All exterior lighting equipment shall be a qualifying light fixture or shall comply with the exterior lighting power requirements of Section 505.7

Exceptions:

1. Swimming pool lighting systems
2. Landscape lighting systems

A404.2 (Supp) Interior lighting power (Prescriptive). Lighting in spaces other than dwelling units, e.g. common areas, shall be high efficacy luminaires or shall comply with the interior lighting power requirements in Section 505.5.

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

EFFICIENCY IMPROVEMENTS TO SIMULATED PERFORMANCE ALTERNATIVE

SECTION A404
SIMULATED PERFORMANCE ALTERNATIVE
(Performance)

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

TABLE A404.5.2(1) (Supp)
SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS

BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Above-grade walls	Type: mass wall if proposed wall is mass; otherwise wood frame Gross Area: same as proposed U-Factor: from Table 402.1.3 Solar absorptance = 0.75 Emittance = 0.90	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a] As proposed As proposed
Basement and crawl-space walls	Type: same as proposed Gross Area: same as proposed U-Factor: from Table 402.1.3, with insulation layer on interior side of walls	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a]
Above-grade floors	Type: wood frame Gross Area: same as proposed U-Factor: from Table 402.1.3	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a]
Ceilings	Type: wood frame Gross Area: same as proposed U-Factor: from Table 402.1.3	As proposed As proposed As proposed, assuming gaps/missing insulation equal to 5%, unless otherwise verified[a]
~~Doors~~	~~Area: 40 ft^2~~ ~~Orientation: North~~ ~~*U*-Factor: same as fenestration from Table 402.1.3~~	~~As proposed~~ ~~As proposed~~ ~~As proposed~~
~~Glazing~~Fenestration[a-b]	Total area[b-c] = (a) The proposed ~~glazing~~fenestration area; where the proposed ~~glazing~~fenestration area is less than ~~18%~~15% of the conditioned floor area (b) ~~18%~~15% of the conditioned floor area; where the proposed ~~glazing~~fenestration area is ~~18%~~15% or more of the conditioned floor area Orientation: equally distributed to four cardinal compass orientations (N, E, S & W) U-Factor: from Table 402.1.1~~2~~ SHGC: For glazing, which shall equal the total area as defined above minus 40 ft^2, from Table 402.1.1 except that for climates with no requirement (NR) SHGC = 0.40 shall be used; for opaque doors, which shall equal 40 ft^2, SHGC = 0 for all climates, equally distributed to four cardinal compass orientations. Interior shade fraction: Summer (all hours when cooling is required) = ~~0.70~~ 0.90 Winter (all hours when heating is required) = ~~0.85~~ 0.90 External shading: none	As proposed As proposed As proposed As proposed Same as standard reference design[c-d] As proposed
Air Exchange Rate	Specific Leakage Area (SLA)[d-e] = ~~0.00036 assuming no energy recovery~~ 0.00015 combined with the mechanical ventilation rate, which shall be 0.01 x CFA + 7.5 x (Nbr+1) where: CFA = conditioned floor area Nbr = number of bedrooms and assuming continuous balanced ventilation using a energy/heat recovery ventilator with a recovery efficiency of 76% [g]	For residences that are not tested, ~~the same as the standard reference design~~ 0.00060 SLA assuming no energy recovery For residences without mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate[~~e~~-f] but not less than 0.35 ACH For residences with mechanical ventilation that are tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate [~~e~~f] combined with the mechanical ventilation rate [g], [f] which shall not be less than 0.01 x CFA + 7.5 x (Nbr+1) where: CFA = conditioned floor area Nbr = number of bedrooms

Internal Gains	IGain = 17,900 + 23.8 x CFA + 4104 x Nbr + $\Delta IG_{lighting}$ (Btu/day per dwelling unit) Where $\Delta IG_{lighting}$ represents the reduced internal gains from efficient lighting as defined by the lighting building component.	~~Same as standard reference design,~~ IGain = 17,900 + 23.8 x CFA + 4104 x Nbr + $\Delta IG_{lighting}$ (Btu/day per dwelling unit) Where $\Delta IG_{lighting}$ represents the reduced internal gains from efficient lighting as defined by the lighting building component.
Heating systems[h, i, j]	Fuel type: same as proposed design Efficiencies: Electric: air-source heat pump with ~~prevailing federal minimum~~ efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum. Nonelectric furnaces: natural gas furnace with ~~prevailing federal minimum~~ efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum Nonelectric boilers: natural gas boiler with ~~prevailing federal minimum~~ efficiency as proposed, unless the proposed is greater than 15% above the federal minimum, in which case it shall be 15% above the federal minimum Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed As proposed As proposed As proposed As proposed
Cooling systems[h, j, k]	Fuel type: Electric Efficiency: as proposed, unless the proposed efficiency is greater than 15% above the ~~in accordance with~~ prevailing federal minimum ~~standards~~ efficiency, in which case it shall be 15% above the federal minimum. Capacity: sized in accordance with Section M1401.3 of the *International Residential Code*	As proposed As proposed As proposed
Service Water Heating[h, k, l]	Fuel type: same as proposed design Efficiency: as proposed, unless the proposed efficiency is greater than 15% above the ~~in accordance with~~ prevailing federal minimum ~~standards~~ efficiency, in which case it shall be 15% above the federal minimum. Use: ~~gal/day=30 + (10 x N_{br})~~ Same as proposed design	As proposed As proposed ~~Same as standard reference~~ Use: gal/day=30 + (10 x N_{br})
Thermal distribution systems	A thermal distribution system efficiency (DSE) of ~~0.80~~ 0.88 shall be applied to both the heating and cooling system efficiencies	~~Same as standard reference design,~~ A thermal distribution system efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies, except as specified by Table 404.5.2(2)
Thermostat	Type: Manual, cooling temperature setpoint = ~~78~~ 75°F; Heating temperature set point = ~~68~~ 70 °F	Same as standard reference
Lighting	kWh/yr = (455 + 0.80 * CFA) + □kWh/yr where: □kWh/yr = [29.5 – 0.5189*CFA *50% –295.12*50% + 0.0519*CFA] Internal gains in the Standard Reference Design shall be reduced by 90% of the impact from efficient lighting, calculated in btu/day using the following equation: $\Delta IG_{lighting}$ = - 0.90 * ΔkWh/yr * 10^6 / 293 / 365	kWh/yr = (455 + 0.80 * CFA) + □kWh/yr where: □kWh/yr = [29.5 – 0.5189*CFA*FL% –295.12*FL% + 0.0519*CFA] FL% = the ratio of Qualifying Light Fixtures to all light fixtures in Qualifying Light Fixture Locations. The Proposed Design shall not have FL% more than 50% from CFL. Internal gains in the Proposed Design shall be reduced by 90% of the impact from efficient lighting, calculated in btu/day using the following equation: $\Delta IG_{lighting}$ = 0.90 * ΔkWh/yr * 10^6 / 293 / 365

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

~~a~~b. Glazing shall be defined as sunlight-transmitting fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Glazing includes the area of sunlight-transmitting fenestration assemblies in walls bounding conditioned basements. For doors where the sunlight-transmitting opening is less

than 50% of the door area, the glazing area is the sunlight transmitting opening area. For all other doors, the glazing area is the rough frame opening area for the door including the door and the frame.

~~b~~c. For residences with conditioned basements, R-2 and R-4 residence and townhouses, the following formula shall be used to determine glazing area:

AF = A_s x FA x F

Where:

AF = Total glazing area.

A_s = Standard reference design total glazing area.

FA = (Above-grade thermal boundary gross wall area)/(above-grade boundary wall area + 0.5 x below-grade boundary wall area).

F = (Above-grade thermal boundary wall area)/(above-grade thermal boundary wall area + common wall area) or 0.56, whichever is greater.

And where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions.

Above-grade thermal boundary wall is any thermal boundary wall component not in contact with soil.

Below-grade boundary wall is any thermal boundary wall in soil contact.

Common wall area is the area of walls shared with an adjoining dwelling unit.

~~c~~d. For fenestrations facing within 15 degrees (0.26 rad) of true south that are directly coupled to thermal storage mass, the winter interior shade fraction shall be permitted to be increased to 0.95 in the proposed design.

~~d~~e. Where Leakage Area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:

SLA = L/CFA

where L and CFA are in the same units.

~~e~~f. Tested envelope leakage shall be determined and documented by an independent party approved by the code official. Hourly calculations as specified in the 2001 ASHRAE Handbook of Fundamentals, Chapter 26, page 26.21, Equation 40 (Sherman-Grimsrud model) or the equivalent shall be used to determine the energy loads resulting from infiltration.

~~f~~g. The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of 2001 ASHRAE Handbook of Fundamentals page 26.24 and the "Whole-house Ventilation" provisions of 2001 ASHRAE Handbook of Fundamentals, page 26.19 for intermittent mechanical ventilation.

~~g~~h. Thermal Storage Element shall mean a component not part of the floors, walls or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase-change containers. A thermal storage element must be in the same room as fenestration that faces within 15 degrees (0.26 rad) of true south, or must be connected to such a room with pipes or ducts that allow the element to be actively charged.

~~h~~i. For a proposed design with multiple heating, cooling or water heating systems using different fuel types, the applicable standard reference design system capacities and fuel types shall be weighted in accordance with their respective loads as calculated by accepted engineering practice for each equipment and fuel type present.

~~i~~j. For a proposed design without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and proposed design. For electric heating systems, the prevailing federal minimum efficiency air-source heat pump shall be used for the standard reference design.

~~j~~k. For a proposed design home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the standard reference design and the proposed design.

~~k~~l. For a proposed design with a nonstorage-type water heater, a 40-gallon storage-type water heater with the prevailing federal minimum Energy Factor for the same fuel as the predominant heating fuel type shall be assumed. For the case of a proposed design without a proposed water heater, a 40-gallon storage-type water heater with the prevailing federal minimum efficiency for the same fuel as the predominant heating fuel type shall be assumed for both the proposed design and standard reference design.

A404.2 Mandatory requirements. Compliance with this Section requires that the criteria of Sections A401, A402.4, A402.5, A402.6, A402.7, and A403 be met.

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 proponents expect 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 Appendix A ("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 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. Several states have provisions requiring higher heating equipment efficiencies while maintaining consistency with NAECA. 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 proponents have proposed optional measures for residential lighting efficiency, improved building envelope requirements , building envelope air infiltration and other measures that can provide an approximate 30 percent improvement in residential new construction energy efficiency..

The proponents urge 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 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. The code change proposal could increase the cost of construction if adopted voluntarily by jurisdictions.

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