April 28, 2014

VT CBES Update – Codes Comparison

Note: This document presents proposed updates to the VT Commercial Building Energy Standards (CBES), including proposals for the "stretch" code which will accompany the 2014 CBES. This list is preliminary and intended to provide context for proposed changes, which will be provided in detail when the red-lined version of the draft VT code update document is released.

The following matrix tables provide a comparison of the current code (2011 CBES) to the proposed preliminary base and stretch 2014 VT code updates, as well as links and/or notes where applicable. Most changes are based on the approved language for the 2015 IECC, and most (not all) links in the following tables hyperlink to the approved 2015 IECC language, in the only currently-available format (the public comments to the 2015 IECC). Please note that in the following uncondensed, unfiltered format, the approved language can be difficult to follow. Here's how it works:

- Each public comment has a number, such as CE 237
- The first comment shows the proposed change in text against the 2012 IECC
- If there are additional comments from other parties on the same section of text, there is typically a statement such as: "*Further modify the proposal as follows:"*
    - Following that will be approved changes against the first proposed change (i.e., NOT against the 2012 IECC)
- The final approved language that will enter the published 2015 IECC will be the combination of the original, approved comment, including any approved modifications.

Code Item	2011 CBES	Proposed Base	Proposed Stretch	Notes/Links to Proposed Code Language
Compliance Paths	Comply with 2011 CBES or ASHRAE 90.1 2007 with provisions	Comply with 2014 CBES or ASHRAE 90.1 2013 with provisions		
Design Intent	None	Construction documents include a statement by a registered design professional that the project design complies, an energy analysis for the building design, a commissioning plan for mechanical and electrical systems and a description of the inspections and tests required	Design team to set energy and environmental goals for project. Design team to submit Operational Performance Requirement (OPR) narrative and Acceptance Testing or Commissioning Plan prior to construction. Prior to occupancy an Owner User Guide and Operations and Maintenance Manual shall be submitted to building	2012 C104.2.1.1
Building Envelope				
Continuous air barrier	3 options (materials, assemblies or testing)	No change, but reorganized text for clarity	2 options (a) Materials list plus leakage testing (i.e., blower door); *or* (b) Materials list plus air barrier commissioning	NA
Insulation values	2009 and some 2012 IECC Values	*[SEE FOLLOWING TABLES]*		NA

COMPONENT	MAXIMUM OVERALL U-FACTOR		MINIMUM R-VALUES	
	All other	Group R	All other	Group R
Roofs				
Insulation entirely above deck	U-0.032 *U-0.028*		R-30ci *R-35ci*	
Metal buildings	~~U-0.049~~ U-0.031 *U-0.029*		~~See Assembly Descriptions~~ R-25 + R-11 LS (Liner System) *R-30 + R-11 LS (Liner System)*	
Attic and other	~~U-0.027~~ U-0.021 *U-0.017*		~~R-38~~ R-49 *~R-60*	

Key: Black/No Italics: No change from 2011 CBES
Red/No Italics: Proposed for Base Code
Blue/Italics: Proposed for Stretch Code

COMPONENT	MAXIMUM OVERALL U-FACTOR		MINIMUM R-VALUES	
	All other	Group R	All other	Group R
Walls, Above grade				
Mass	~~U-0.080~~ U-0.078	U-0.071	R-13.3ci	R-15.2ci
Metal building	~~U-0.054~~ U-0.052		R-11 + R-13ci or R-19.5ci R-13 + R-13ci or TBD	
Metal framed	U-0.064		R-13 + R-7.5ci or R-13ci	
Wood-framed and other	U-0.051 *U-0.036*		R-13 + R-7.5ci or R-20 + R-3.8ci or R-23 or R-15ci *R-13 + R-15.6ci or* *R-20 + R-10ci*	

Key: Black/No Italics: No change from 2011 CBES
Red/No Italics: Proposed for Base Code
Blue/Italics: Proposed for Stretch Code

COMPONENT	MAXIMUM OVERALL U-FACTOR		MINIMUM R-VALUES	
	All other	Group R	All other	Group R
Walls, Below grade				
Below-grade wall	C-0.092		R-10ci	
Floors				
Mass	U-0.064 U-0.051	U-0.057 U-0.055	R-12.5ci R-15ci	R-14.6ci R-16.7ci
~~Joist/framing-metal~~	~~U-0.038~~	~~U-0.032~~	~~R-30~~	~~R-38~~
Joist/framing~~—wood and other~~	U-0.033		R-30	
Slab-on-grade floors				
Unheated slabs	F-0.480	F-0.450	R-10 for 48 in. below	R-15 for 48 in. below
Heated slabs	F-0.55		R-10 for entire slab	

Key: Black/No Italics: No change from 2011 CBES
Red/No Italics: Proposed for Base Code
Blue/Italics: Proposed for Stretch Code

COMPONENT	MAXIMUM OVERALL U-FACTOR		MINIMUM R-VALUES	
	All other	Group R	All other	Group R
Opaque doors				
Swinging	U-0.37		N/A	
Roll-up or sliding	U-0.20		N/A	
Upward-acting, sectional	N/A		R-10	

Key: Black/No Italics: No change from 2011 CBES
Red/No Italics: Proposed for Base Code
Blue/Italics: Proposed for Stretch Code

Vertical fenestration (~~40%~~ 30% maximum of above-grade wall)		
~~**Framing materials other than metal with or without metal reinforcement or cladding**~~		
U-factor	~~0.35~~ Fixed fenestration: 0.36 / *0.29* *(0.22 if 30-40% WWR and 50% floor area daylit* Operable fenestration: 0.43 Entrance doors: 0.77	
~~**Metal framing with or without thermal break**~~		
~~Curtain wall/storefront U-factor~~	~~0.42~~	
~~Entrance door U-factor~~	~~0.80~~	
~~All other U-factor~~	~~0.50~~	
~~**SHGC-all frame types**~~	SEW	N
PF < 0.2~~5~~	0.40	0.53
0.2~~5~~ ≤ PF < 0.5	~~NR~~ 0.48	0.58
PF ≥ 0.5	~~NR~~ 0.64	0.64
Skylights (3% maximum)		
U-factor	~~0.60~~ 0.50	
SHGC	0.40	
Key: Black/No Italics: No change from 2011 CBES Red/No Italics: Proposed for Base Code *Blue/Italics: Proposed for Stretch Code*		

Code Item	2011 CBES	Proposed Base	Proposed Stretch	Notes/Links to Proposed Code Language

Code Item	2011 CBES	Proposed Base	Proposed Stretch	Notes/Links to Proposed Code Language
Window Solar Heat Gain Coefficient (SHGC)	SHGC only considers projection factor	SHGC to consider projection factor *and* orientation *[See preceding table]*	More stringent (lower) SHGC values than base *[See preceding table]*	NA
Skylights in High Bay Areas	None	All high bay areas over 2500 sq. ft. must be 75% daylit		
Mechanical Systems				
HVAC System Controls	Thermostatic controls with setback capability in each zone.	-Part load requirements for water-cooled centrifugal chillers (CE203); -Deadband of at least 5 F for thermostatic controls (CE204); -Isolate zone control requirements for large zones (CE205); -Snow and ice melt system controls (CE208)		CE203; CE204; CE205; CE208; CE209
HVAC Energy Recovery	Mandatory for systems with airflow >5000 cfm	Expand range of exhaust energy recovery down to 10% of outdoor air rate	Required for ventilation systems with high airflow rates (>1000 CFM)	CE214
Economizer Functional Testing	None	-Fault detection and diagnostics requirements; -Low-leakage damper rating and labeling required; -Water-side economizer requirements for non- fan cooling systems		CE209; CE247; CE249

Code Item	2011 CBES	Proposed Base	Proposed Stretch	Notes/Links to Proposed Code Language
Duct Leakage	Duct sealing for low, medium and high pressure systems and pressure classification on construction documents		-Maximum leakage lowered from 6 to 4 for high pressure systems -No more than 5% of ductwork can be located outside of thermal envelope	CE223
Duct Insulation	Min R-8 insulation in unconditioned spaces and R-10 when outside of building		R-8 insulation in unconditioned spaces and R-12 when located outside the building	CE217
Pipe Insulation	Minimum pipe insulation table tied to fluid temps and insulation		More rigorous requirements	NA

Code Item	2011 CBES	Proposed Base	Proposed Stretch	Notes/Links to Proposed Code Language
Service Water Heating				
SHW Piping Insulation	Minimum pipe insulation table tied to fluid temps and insulation		Includes a pipe length limit (Table C404.5.1) option or a water volume option	NA
SHW Piping Insulation	Minimum pipe insulation table tied to fluid temps and insulation		Includes a pipe length limit (Table C404.5.1) option or a water volume option	CE274
Demand Recirculation Pumps	Requirement to shut off automatically or manually when not in operation		-Recirculation system design requirements -Recirculation system controls requirements	CE279; CE282

Code Item	2011 CBES	Proposed Base	Proposed Stretch	Notes/Links to Proposed Code Language
Waste Water Energy Recovery and Commissioning	None	Building with high hot water loads to meet 40% of peak hot water demand with either on-demand, waste water heat recovery or solar hot water system	Service water heating systems commissioning and completion requirements	2012 IECC Section C404.8
Lighting				
Lighting Power Density (LPD)	Based on 2012 IECC	2015 IECC (90.1-2013) as both base and stretch values. One of the efficiency packages is improved LPDs (90% of LPD in table)		CE310
Occupancy Sensors	For buildings >5000 sq. ft. Controlled either by time schedule, occupant sensor or signal from BAS system	-Occupancy sensors in classrooms, conference rooms, lunch and break rooms, private offices, restrooms, warehouse spaces, storage rooms and janitorial closets. -Important reorganization of controls language -Sensors control 50% of load in stairways, parking garages (per ASHRAE)		CE292; CE287; CE293
Sleeping Unit Controls	Requires master switch at main entry controlling all permanently installed luminaires and switched receptacles			CE285
Daylight Controls	Lighting within daylight zones shall be individually controlled from general area lighting.	Spaces with a total of more than 150 watts of general lighting within sidelight and toplight daylight zones shall include daylight responsive controls		CE294
Parking Light Control	Time or astronomical switch, or photosensor control. Total power allowance by application.			C505.2.4
Additional Interior Lighting Power	None	Removes low voltage exemption.		C405.5
Electrical Power & Energy Consumption				
Vertical & Horizontal Transport	None	**Elevator cabs**: Luminaires to exceed 35 lumens per watt. Ventilation fans less than 0.33 watts/cfm **Escalators and moving walks:** Automatic controls to reduce speed to minimum permitted when not in use		CE333

Code Item	2011 CBES	Proposed Base	Proposed Stretch	Notes/Links to Proposed Code Language
Controlled Receptacles	None	-Automatic controls in at least 50 percent of the 125 volt 15- and 20-Ampere receptacles in private offices, computer classrooms and individual workstations and labeled "Automatic Control Receptacle" -Considering "load segregation" requirement (dedicated panels for end-uses)		CE286
Computer/ Server Rooms	None	2015 IECC ventilation requirements	NBI Core Performance Tier 2: Separate economizer, HVAC controls, humidification and fan power limitation and controls for computer rooms over 5 tons	NA
Kitchen Ventilation and Exhaust Systems	None	Replacement air introduced directly into the exhaust hood cavity shall not exceed 10 percent of the hood exhaust airflow rate		CE220
Laboratory Exhaust Systems	None	Requirement responds to the special needs of a laboratory exhaust and ventilation system. Includes an associated table of specifications and conditions for lab applications/uses		CE227

Code Item	2011 CBES	Proposed Base	Proposed Stretch	Notes/Links to Proposed Code Language
Efficiency Packages				

Efficiency Packages

- Base code: require minimum of one package
- Stretch code: require minimum of two packages
- **Six Packages**
  1. Efficient lighting (90% of stated LPD values)
  2. Efficient HVAC (e.g., 10% improvement)
  3. Enhanced digital lighting controls
  4. On-site renewables
  5. Dedicated outdoor air system
  6. Reduced energy use in service water heating

Efficient Lighting System Option	None	Reduced lighting power density. The total interior lighting power (watts) of the building shall be determined by using 90 percent of the lighting power values in Table 505.5.2(1) or by using 90 percent of the interior lighting power allowance calculated by the Space by Space method in section 505.5.2. Or enhanced digital lighting controls		CE337
Efficient HVAC Option	None	Equipment shall exceed federal minimums by 10%		CE337
Enhanced Digital Lighting Controls Option	None	Interior lighting shall comply with six specific requirements [see CE337]		CE337
Onsite Renewables Option	None	At least 1.75 btu / 0.50 watts per sq. ft. of conditioned floor area or No less than 3% of energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 5; derived from qualified on-site renewable source		CE337
Dedicated Outdoor Air System Option	None	Independent ventilation system providing 100% outdoor air		CE337
High Efficiency Service Water Heating Option	None	High use building types to provide at least 60% of hot water load through waste heat recovery or solar water heating system.		CE337
Other				
SHW Functional Testing	None	None	Mechanical and SHW systems commissioning	CE284
Functional Testing and Commissioning	For buildings >50K SF: Economizers, VAV fan control, and hydronic controls	Required for lighting controls, mechanical systems over 480 kBtu cooling and 600 kBtu heating Add specificity for testing of lighting controls and defines role of registered design professional		CE357
Performance Modeling	Model to ASHRAE 90.1 2007	Model to ASHRAE 90.1 2013	Add % improvement	NA

Registered Design Professional	None	None Listed	Responsible for energy simu- lation, yet building owner may also fill this role. The code official must be notified in writing who is in charge of energy simulation	NA
Renovations, Alterations and Additions – Existing Buildings	None	New section on repairs, alterations and additions		CE4; CE5; CE7; CE55
Renovations, Alterations and Additions – Insulation for Re-Roofing	None	When insulation is exposed, it must be brought up to Table C402.1. New definitions.		CE15; CE56
Outcome Based Compliance	None	None Listed	Applicable to buildings between 20,000-50,000 sqft that are pre-approved by the jurisdiction. Determined by actual measure- ment of all energy after building is in full operation	NA

The following changes will appear in the 2015 Commercial IECC. Public Comments are included below if they were passed with the proposal. The Public Comment will modify the language of the proposal.

CE2-13, Part I

C101.3, R101.3 (N1101.2)

Proposed Change as Submitted

Proponent: William W Stewart, FAIA, PE, representing self (codedoc@sbcglobal.net)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.3 Intent. This code shall regulate the design and construction of buildings for the ~~effective~~ use and conservation of energy over the ~~useful~~ life of each building. This code is intended to provide flexibility to permit the use of innovative approaches and techniques to achieve this objective. This code is not intended to abridge safety, health or environmental requirements contained in other applicable codes or ordinances.

CE4-13, Part I

C101.4.1 through C101.4.5, C202, C401.2.1, Chapter 5 (CE) (NEW), R101.4, R202 (IRC N1101.9); R402.3.6 (IRC N1102.3.6), Chapter 5 (RE) (NEW) (IRC N1106 (NEW))

Proposed Change as Submitted

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

PART I – IECC – COMMERICAL PROVISIONS

~~**Delete without substitution as follows:**~~

~~**C101.4.1 Existing buildings.** Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.~~

~~**C101.4.2 Historic buildings.** Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~

~~**C101.4.3 Additions, alterations, renovations or repairs.** Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.~~

~~**Exception:** The following need not comply provided the energy use of the building is not increased:~~

~~1. Storm windows installed over existing fenestration.~~

~~2. Glass only replacements in an existing sash and frame.~~

~~3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.~~

~~4. Construction where the existing roof, wall or floor cavity is not exposed.~~

~~5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.~~
~~6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,~~
~~7. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.~~
~~8. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power. **C101.4.4 Change in occupancy or use.** Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use in a space changes from one use in Table C405.5.2(1) or (2) to another use in Table C405.5.2(1) or (2), the installed lighting wattage shall comply with Section C405.5.~~

~~**C101.4.5 Change in space conditioning.** Any nonconditioned space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.~~

Delete without substitution as follows:
~~**C401.2.1 Application to existing buildings.** Additions, alterations and repairs to existing buildings shall comply with one of the following:~~
~~1. Sections C402, C403, C404 and C405; or~~
~~2. ANSI/ASHRAE/IESNA 90.1.~~

Add new text as follows:

CHAPTER 5 CE
EXISTING BUILDINGS
SECTION C501
GENERAL

C501.1 Scope. The provisions of this chapter shall control the *alteration*, *repair*, *addition* and change of occupancy of existing buildings and structures.

C501.2 Existing buildings. Except as specified in this chapter, this code shall not be used to require the removal, *alteration* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.

C501.3 Maintenance. Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices or and systems which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.

C501.4 Compliance. *Alterations*, *repairs*, *additions* and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for *alterations*, *repairs*, *additions* and changes of occupancy or relocation, respectively, in the *International Building Code, International Fire Code, International Fuel Gas Code, International Mechanical Code, International Plumbing Code, International Property Maintenance Code, International Private Sewage Disposal Code* and NFPA 70.

C501.5 New and replacement materials. Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs, provided no hazard to life, health or property is created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

C501.6 Historic buildings. *Historic buildings* are exempt from this code.

SECTION C502
ADDITIONS

C502.1 General. Additions to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion of the existing building or building system to comply with this code. Additions shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building. Additions complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.

SECTION C503
ALTERATIONS

C503.1 General Alterations to any building or structure shall comply with the requirements of the code for new construction. Alterations shall be such that the existing building or structure is no less conforming with the provisions of this code than the existing building or structure was prior to the alteration. Alterations to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building system to comply with this code. Alterations shall not create an unsafe or hazardous condition or overload existing building systems.

Alterations complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404 and C405.

Exception: The following alterations need not comply with the requirements for new construction provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
3. Construction where the existing roof, wall or floor cavity is not exposed.
4. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

C503.2 Change in space conditioning. Any nonconditioned or low energy space that is altered to become *conditioned space* shall be required to be brought into full compliance with this code.

SECTION C504
REPAIRS

C504.1 General. Buildings and structures, and parts thereof, shall be repaired in compliance with Section C501.3 and this section. Work on nondamaged components that is necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required by Section C501.3, ordinary repairs exempt from *permit*, and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section.

Where a building was constructed to comply with ANSI/ASHRAE/IESNA 90.1. repairs shall comply with the standard and need not comply with Sections C402, C403, C404 and C405.

C504.2 Application. For the purposes of this code, the following shall be considered repairs.

1. Glass only replacements in an existing sash and frame.
2. Roof repairs where neither the sheathing nor the insulation is exposed.
3. Replacement of existing doors that separate conditioned space from the exterior shall not require the installation of a vestibule or revolving door, provided however that an existing vestibule that separates a conditioned space from the exterior shall not be removed. 4. Repairs where only the bulb and/or ballast within the existing luminaires in a space are replaced provided that the replacement does not increase the installed interior lighting power.

SECTION C505

CHANGE OF OCCUPANCY OR USE

C505.1 General. Spaces undergoing a change in occupancy that would result in an increase in demand for either fossil fuel or electrical energy shall comply with this code. Where the use in a space changes from one use in Table C405.5.2(1) or C405.5.2 (2) to another use in Table C405.5.2(1) or C405.5.2 (2), the installed lighting wattage shall comply with Section C405.5.

Add new definitions as follows:

HISTORIC BUILDINGS. Buildings that are listed in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate state or local law.

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

Public Comment 1:

Maureen Traxler, City of Seattle Department of Planning & Development, representing Washington Association of Building Officials Technical Code Development Committee, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

C501.3 Maintenance. Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices or and systems which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's ~~designated~~ authorized agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.

Public Comment 2:

Maureen Traxler, City of Seattle Department of Planning & Development, representing Washington Association of Building Officials Technical Code Development Committee, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.

(Portions of code change proposal not shown remain unchanged)

CE5-13

C202, C101.4.3, C409 (NEW)

Proposed Change as Submitted

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com)

Delete and substitute as follows:

~~**C101.4.3 Additions, alterations, renovations or repairs.** Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.~~

~~**Exception:** The following need not comply provided the energy use of the building is not increased:~~

~~1. Storm windows installed over existing fenestration.~~

~~2. Glass only replacements in an existing sash and frame.~~

~~3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.~~

~~4. Construction where the existing roof, wall or floor cavity is not exposed.~~

~~5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.~~
~~6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed.~~
~~7. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.~~
~~8. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.~~

C101.4.3 Additions, alterations, or repairs. Additions, alterations, or repairs to an existing building, building system or portion thereof shall comply with Section C409.
Add new text as follows:

SECTION C409
ADDITIONS, ALTERATIONS, OR REPAIRS

C409.1 Scope. The provisions of this chapter shall control the *alteration*, *repair,* and *addition* of existing buildings and structures for compliance with the *International Energy Conservation Code*.

C409.2 Existing buildings. Except as specified in this chapter, this code shall not be used to require the removal, *alteration,* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.

C409.3 Maintenance. Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices and/or systems which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.

C409.4 Additions, alterations, or repairs. Additions, alterations, or repairs to an existing building, building system, or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portions of the existing building or building supply system to comply with this code. Additions, alterations, or repairs shall not create an unsafe or hazardous condition or overload existing building systems.

C409.4.1 Additions. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply as a single building. Additions shall comply with Section C409.4.1.1.
Exception: Additions complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404, and C405.

C409.4.1.1 Prescriptive compliance. Additions shall comply with Sections C409.4.1.1.1 through C409.4.1.1.5.

C409.4.1.1.1 Building envelope. New building envelope assemblies that are part of the addition shall comply with Sections C402.1 through C402.4.

C409.4.1.1.1.1 Vertical Fenestration. New vertical fenestration area that results in a total building fenestration area less than or equal to that specified in Section C402.3.1 shall comply with Section C402.3. Additions with vertical fenestration that results in a total building fenestration area greater than C402.4.1 shall comply with Section C402.3.1.1 for the addition only. Additions that result in a total building vertical glass area exceeding that specified in Section C402.3.1.1 shall comply with Section C407 or ASHRAE 90.1.

C409.4.1.1.1.2 Skylight area. New skylight area that results in a total building fenestration area less than or equal to that specified in Section C402.3.1 shall comply with Section C402.3. Additions with skylight area that result in a total building skylight area greater than C402.3 shall comply with Section C402.3.1.2 for the addition

only. Additions that result in a total building skylight area exceeding that specified in Section C402.3.1.2 shall comply with Section C407 or ASHRAE 90.1.

C409.4.1.1.2 Building mechanical systems. New mechanical systems and equipment serving the building heating, cooling or ventilation needs, that are part of the addition, shall comply with Section C403.

C409.4.1.1.3 Service water heating systems. New service water-heating equipment, controls and service water heating piping shall comply with Section C404.

C409.4.1.1.4 Pools and inground permanently installed spas. New pools and inground permanently installed spas shall comply with Section C404.7.

C409.4.1.1.5 Electrical power and lighting systems. New lighting systems that are installed as part of the addition shall comply with Section C405.

C409.4.1.1.5.1 Interior lighting power. The total interior lighting power for the addition shall comply with Section C405.5.2 for the addition alone or if the existing building and the addition complies as a single building.

C409.4.1.1.5.2 Exterior lighting power. The total exterior lighting power for the addition shall comply with Section C405.6.2 for the addition alone or if the existing building and the addition complies as a single building.

C409.4.2 Alterations. Alterations to existing buildings shall comply with Section C409.4.2.1 through C409.4.2.4. *Alterations* shall be such that the existing building or structure is no less complying with the provisions of this code than the existing building or structure was prior to the *alteration*.

Exception: Alterations complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404, and C405.

C409.4.2.1 Building envelope. New building envelope assemblies that are part of the alteration shall comply with Sections C402.1 through C402.4.

C409.4.2.1.1 Vertical Fenestration. The addition of vertical fenestration that results in a total building fenestration area less than or equal to that specified in Section C402.3.1 shall comply with Section C402.3. The addition of vertical fenestration that results in a total building fenestration area greater than C402.4.1 shall comply with Section C405.2.2.3.2 for the space adjacent to the new fenestration only. Alterations that result in a total building vertical glass area exceeding that specified in Section C402.3.1.1 shall comply with Section C407 or ASHRAE 90.1.

C409.4.2.1.2 Skylight area. The addition of skylight area that results in a total building skylight area less than or equal to that specified in Section C402.3.1 shall comply with Section C402.3. The addition of skylight area that results in a total building skylight area greater than C402.3 shall comply with Section C402.3.1.2 for the space adjacent to the new skylights. Alterations that result in a total building skylight area exceeding that specified in Section C402.3.1.2 shall comply with Section C407 or ASHRAE 90.1.

Exceptions: The following building envelope alterations are exempt from Section C409.4.2.1.

1. Storm windows installed over existing fenestration.
2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
3. Construction where the existing roof, wall or floor cavity is not exposed.

C409.4.2.2 Heating and cooling systems. New heating, cooling, and duct systems that are part of the alteration shall comply with Sections C403.

C409.4.2.2.1 Economizers. New cooling systems that are part of alteration shall comply with section C403.3.1 or C403.4.1.

C409.4.2.3 Service hot water systems. New service hot water systems that are part of the alteration shall comply with Section C404.

C409.4.2.4 Lighting. New lighting systems that are part of the alteration shall comply with Section C405.

Exceptions.

1. Alterations that replace less than 10 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
2. Alterations that replace on the bulb and ballast within the existing luminaires in a space provided that the alteration does not increase the installed interior lighting power.

C409.4.3 Repairs. Buildings and structures, and parts thereof, shall be repaired in compliance with Section C409.3 and this section. Work on nondamaged components that is necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required by Section C409.3, ordinary repairs exempt from *permit*, and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section. Where a building was constructed to comply with ANSI/ASHRAE/IESNA 90.1. repairs shall comply with the standard and need not comply with Sections C402, C403, C404 and C405.

Exceptions: The following alterations are exempt from Section C409.4.3.

1. Glass only replacements in an existing sash and frame this is a repair.
2. Reroofing for roofs where neither the sheathing nor the insulation is exposed this is a repair.

Revise definition as follows:

IECC SECTION C202
GENERAL DEFINITIONS

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

C409 (NEW)-EC-MAKELA.doc

Public Comment:

Name: Eric Makela, Britt/Makela Group, representing Northwest Energy Codes Group, requests Approval as Modified by this Public Comment.

Revise as follows:

~~**REPAIR.** The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.~~
~~**Section C101.4.3 Additions, alterations, or repairs.** Additions, alterations, or repairs to an existing building, building system or portion thereof shall comply with Section C409.~~

~~**SECTION C409**~~

~~**ADDITIONS, ALTERATIONS, OR REPAIRS**~~

~~**C409.1 Scope.** The provisions of this chapter shall control the *alteration*, *repair*, and *addition* of existing buildings and structures for compliance with the IECC.~~

~~**C409.2 Existing buildings.** Except as specified in this chapter, this code shall not be used to require the removal, *alteration,* or abandonment of, nor prevent the continued use and maintenance of, an existing building or building system lawfully in existence at the time of adoption of this code.~~

~~**C409.3 Maintenance.** Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices and/or systems which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of energy conservation, fire protection and safety systems and devices in existing structures.~~

~~**C409.4 Additions, alterations, or repairs**~~ **C502.1 General.** Additions, ~~alterations, or repairs~~ to an existing building, building system, or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(~~s~~) of the existing building or building supply system to comply with this code. An ~~A~~additions, ~~alterations, or repairs~~ shall not create an unsafe or hazardous condition or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building. Additions shall comply with Section C502.2.

~~**C409.4.1 Additions**. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply as a single building. Additions shall meet the specific requirements in Section C409.4.1.1.~~

~~**Exception:** Additions complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404, and C405.~~

~~**C409.4.1.1**~~ **C505.2 Prescriptive compliance.** Additions shall comply with Section C402 and Sections ~~C409.4.1.1.1 to C409.4.1.1.5~~ C502.2.1 through C502.2.6.2 when applicable.

~~**C409.4.1.1.1 Building envelope**. New building envelope assemblies that are part of the addition shall comply with Sections C402.1 to C402.4.~~

~~**C409.4.1.1.1.1**~~ **C502.2.1 Vertical Fenestration**. New vertical fenestration area that results in a total building fenestration area less than or equal to that specified in Section C402.3.1 shall comply with Section C402.3. Additions with vertical fenestration that results in a total building fenestration area greater than C402.4.1 shall comply with Section C402.3.1.1 for the addition only. Additions that result in a total building vertical glass area exceeding that specified in Section C402.3.1.1 shall comply with Section C407. or ASHRAE 90.1.

~~**C409.4.1.1.1.2**~~ **C502.2.2 Skylight area.** New skylight area that results in a total building fenestration area less than or equal to that specified in Section C402.3.1 shall comply with Section C402.3. Additions with skylight area that result in a total building skylight area greater than C402.3 shall comply with Section C402.3.1.2 for the addition only. Additions that result in a total building skylight area exceeding that specified in Section C402.3.1.2 shall comply with Section C407. or ASHRAE 90.1.

~~**C409.4.1.1.2**~~ **C502.2.3 Building mechanical systems**. New mechanical systems and equipment serving the building heating, cooling or ventilation
needs, that are part of the addition, shall comply with Section C403.

~~**C409.4.1.1.3**~~ **C502.2.4 Service water heating systems.** New service water-heating equipment, controls and service water heating piping shall comply with Section C404.

~~**C409.4.1.1.4**~~ **C502.2.5 Pools and inground permanently installed spas**. New pools and inground permanently installed spas shall comply with Section C404.7.

~~**C409.4.1.1.5**~~ **C502.2.6 Electrical power and lighting systems.** New lighting systems that are installed as part of the addition shall comply with Section C405.

~~**C409.4.1.1.5.1**~~ ~~**C502**~~**.2.6.1 Interior lighting power.** The total interior lighting power for the addition shall comply with Section C405.5.2 for the addition alone or if the existing building plus the addition complies as a single building.

~~**C409.4.1.1.5.2**~~ **C502.2.6.2 Exterior lighting power.** The total exterior lighting power for the addition shall comply with Section C405.6.2 for the addition alone or if the existing building plus the addition complies as a single building.

~~**C409.4.2 Alterations.** Alterations to existing buildings shall comply with Section C409.4.2.1 to C409.4.2.4. *Alterations* shall be such that the existing building or structure is no less complying with the provisions of this code than the existing building or structure was prior to the *alteration*.~~

~~**Exception:** Alterations complying with ANSI/ASHRAE/IESNA 90.1. need not comply with Sections C402, C403, C404, and C405.~~

~~**C409.4.2.1**~~ **C503.2.1 Building envelope**. New building envelope assemblies that are part of the alteration shall comply with Sections C402.1 to C402.4 as applicable.

~~**C409.4.2.1.1**~~ **C503.2.1.1 Vertical Fenestration**. The addition of vertical fenestration that results in a total building fenestration area less than or equal to that specified in Section C402.3.1 shall comply with Section

C402.3. The addition of vertical fenestration that results in a total building fenestration area greater than C402.4.1 shall comply with Section C405.2.2.3.2 for the space adjacent to the new fenestration only. Alterations that result in a total building vertical glass area exceeding that specified in Section C402.3.1.1 shall comply with Section C407. or ASHRAE 90.1.

~~**C409.4.2.1.2**~~ **C503.2.1.2 Skylight area.** The addition of skylight area that results in a total building skylight area less than or equal to that specified in Section C402.3.1 shall comply with Section C402.3. The addition of skylight area that results in a total building skylight area greater than C402.3 shall comply with Section C402.3.1.2 for the space adjacent to the new skylights. Alterations that result in a total building skylight area exceeding that specified in Section C402.3.1.2 shall comply with Section C407. or ASHRAE 90.1.

~~**Exceptions:** The following building envelope alterations are exempt from Section C409.4.2.1.~~

~~1. Storm windows installed over existing fenestration.~~

~~2. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.~~

~~3. Construction where the existing roof, wall or floor cavity is not exposed.~~

~~**C409.4.2.2**~~ **C503.2.2 Heating and cooling systems.** New heating, cooling, and duct systems that are part of the alteration shall comply with Sections C403 as applicable.

~~**C409.4.2.2.1**~~ **C503.2.2.1 Economizers.** New cooling systems that are part of alteration shall comply with Section C403.3.1 or C403.4.1, as applicable.

~~**C409.4.2.3**~~ **C503.2.3 Service hot water systems**. New service hot water systems that are part of the alteration shall comply with Section C404, as applicable.

~~**C409.4.2.4**~~ **C503.2.4 Lighting.** New lighting systems that are part of the alteration shall comply with Section C405 as applicable.

~~**Exceptions.**~~

~~1. Alterations that replace less than 10 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.~~

~~2. Alterations that replace on the bulb and ballast within the existing luminaires in a space provided that the alteration does not increase the installed interior lighting power.~~

~~**C409.4.3 Repairs.** Buildings and structures, and parts thereof, shall be repaired in compliance with Section C409.3 and this section. Work on nondamaged components that is necessary for the required *repair* of damaged components shall be considered part of the *repair* and shall not be subject to the requirements for *alterations* in this chapter. Routine maintenance required by Section C501.3, ordinary repairs exempt from *permit*, and abatement of wear due to normal service conditions shall not be subject to the requirements for *repairs* in this section. Where a building was constructed to comply with ANSI/ASHRAE/IESNA 90.1. repairs shall comply with the standard and need not comply with Sections C402, C403, C404 and C405.~~

~~**Exceptions:** The following alterations are exempt from Section C409.4.3.~~

~~1. Glass only replacements in an existing sash and frame this is a repair.~~

~~2. Reroofing for roofs where neither the sheathing nor the insulation is exposed this is a repair.~~

CE7-13, Part I

C101.4.2, C202 (NEW), R101.4.2, R202 (NEW) (IRC N1101.9 (NEW))

Proposed Change as Submitted

Proponent: Jim Edelson, New Buildings Institute (jedelson@comcast.net), Ric Cochrane, National Trust for Historic Preservation, David Collins, The Preview Group representing The American Institute of Architects

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C101.4.2 Historic buildings. ~~Any building or structure that is listed in the State or National Register of Historic Places; designated as a historic property under local or state designation law or survey; certified as a contributing resource with a National Register listed or locally designated historic district; or with an opinion or certification that the property is eligible to be listed on the National or State Registers of Historic Places either individually or as a contributing building to a historic district by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, are exempt from this code.~~ The provisions of this code relating to the construction, *repair*, *alteration*, restoration and movement of structures, and *change of occupancy* shall not be mandatory for *historic buildings*. No provision of this code shall be used to require the *alteration* of an *historic building*.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

HISTORIC BUILDING. Any building or structure that is one or more of the following:

1. Listed, or certified as eligible for listing by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places
2. Designated as historic under an applicable state or local law; or
3. Certified as a contributing resource within a National Register listed or locally designated historic district.

Public Comment:
Jim Edelson, New Buildings Institute, Lee Kranz, Washington Association of Building Officials, David Collins, American Institute of Architects, Ryan Meres, Institute for Market Transformation, request Approval as Modified by this Public Comment.

Further modify the proposal as follows:

C101.4.2 Historic buildings. ~~The~~ No provisions of this code relating to the construction, *repair*, *alteration*, restoration and movement of structures, and *change of occupancy* shall not be mandatory for *historic buildings* provided a report has been submitted to the code official and signed by a *registered design professional*, or a representative of the State Historic Preservation Office or the historic preservation authority having jurisdiction, demonstrating that compliance with that provision would threaten, degrade or destroy the historic form, fabric or function of the *building*.

CE15-13, Part I

C101.4.3, C202 (New), C402.2.1.1, R101.4.3 (IRC N1101.3), R202 (New) (IRC N1101.9 (New))

Proposed Change as Submitted

Proponents: Michael. D. Fischer, Kellen Company, representing Center for the Polyurethanes Industry (mfischer@kellencompany.com); Michael D. Fischer, Kellen Company, representing Polyisocyanurate Insulation Manufacturers Association; Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; and Bill Prindle, Energy Efficient Codes Coalition.

PART I – IECC-COMMERCIAL PROVISIONS
Revise as follows:

C101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition

or overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.
Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. ~~Reroofing for roofs where neither the sheathing nor the insulation is exposed.~~ Roof recover or roof repair.
6. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
7. ~~6~~. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
8. ~~7~~. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
9. ~~8~~. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.

Add new text as follows:

C402.2.1.1 Roof replacement. For roof replacements, where the existing roof assembly is part of the *building thermal envelope* and contains insulation entirely above deck, roof replacement shall include compliance with the requirements of Table C402.1.2 or Table C402.2.

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

[B] REROOFING. The process of recovering or replacing an existing *roof covering*. See "Roof recover" and "Roof replacement."
[B] ROOF RECOVER. The process of installing an additional *roof covering* over a prepared existing *roof covering* without removing the existing *roof covering*.
[B] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.
[B] ROOF REPLACEMENT. The process of removing the existing *roof covering*, repairing any damaged substrate and installing a new *roof covering*.

CE24-13

C101.5.2, C202 (NEW)

Proposed Change as Submitted

Proponent: Vickie Lovell, InterCode Inc., representing National Greenhouse Manufacturers Association (vickie@intercodeinc.com)
Revise as follows:
C101.5.2 Low energy buildings. The following buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this code shall be exempt from the *building thermal envelope* provisions of this code:

1. Those with a peak design rate of energy usage less than 3.4 Btu/h · ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.
3. Greenhouses.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

GREENHOUSE. A structure or a separate area of a building that maintains a specialized environment essential for the cultivation, protection or maintenance of plants.

Public Comment 1:
Vickie Lovell, Intercode, Inc. representing National Greenhouse Manufacturers Association, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

GREENHOUSE. A structure or ~~separate~~, thermally isolated area of a building that maintains a specialized sunlit environment specific to and essential for cultivation, protection or maintenance of plants.

Public Comment 2:
Eric Makela, Britt/Makela Group, representing Northwest Energy Codes Group, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

GREENHOUSE. A structure or a separate area of a building that maintains a specialized sunlit environment ~~specific to~~ exclusively used for the cultivation, protection or maintenance of plants.

CE23 – 13

C101.5.2, C402.1, R101.5.2 (IRC N1101.6), R402.1 (IRC N1102.1)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

PART I – IECC-COMMERCIAL PROVISIONS

Delete without substitution as follows:

~~**C101.5.2 Low energy buildings.** The following buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this code shall be exempt from the *building thermal envelope* provisions of this code:~~

~~1. Those with a peak design rate of energy usage less than 3.4 Btu/h ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.~~

~~2. Those that do not contain *conditioned space*.~~

Revise as follows:

~~**C402.1 General (Prescriptive).** The building thermal envelope shall comply with Section C402.1.1. Section C402.1.2 shall be permitted as an alternative to the *R*-values specified in Section C402.1.1.~~

~~**Exception:** The following low energy buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this section shall be exempt from the *building thermal envelope* provisions of Section C402.~~

~~1. Those with a peak design rate of energy usage less than 3.4 Btu/h ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.~~

~~2. Those that do not contain *conditioned space*.~~

PART II – IECC-RESIDENTIAL PROVISIONS
Revise as follows:

R101.5.2 (N1101.6) Low energy buildings. The following buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this code shall be exempt from the *building thermal envelope* provisions of this code:

1. Those with a peak design rate of energy usage less than 3.4 Btu/h ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.
2. Those that do not contain *conditioned space*.

Revise as follows:

R402.1 (N1102.1) General (Prescriptive). The building thermal envelope shall meet the requirements of Sections R402.1.1 through R402.1.4.

Exception: The following low energy buildings, or portions thereof, separated from the remainder of the building by *building thermal envelope* assemblies complying with this section shall be exempt from the *building thermal envelope* provisions of Section R402.

1. Those with a peak design rate of energy usage less than 3.4 Btu/h ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) of floor area for space conditioning purposes.

2. Those that do not contain *conditioned space*.

CE27-13

C101.5.3 (NEW)

Proposed Change as Submitted

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com)

Add new text as follows:

C101.5.3 Equipment buildings. Buildings that comply with all of the following shall be exempt from the *building thermal envelope* provisions of this code:

1. Are separate buildings with floor area no more than 500 square feet (50 m^2).
2. Are intended to house electronic equipment with installed equipment power totaling at least 7 watts per square foot and not intended for human occupancy.
3. Have heating system capacity is no greater than 5 kW (17,000 Btu/hr) and heating thermostat setpoint is restricted to no more than 50°F (10°C).
4. Have an average wall and roof U-factor less than 0.120 in climate zones 1-5 and less than 0.200 in climate zones 6 through 8.
5. Comply with the roof solar reflectance and thermal emittance provisions for Climate Zone 1.

Public Comment:

Brenda Thompson, Manager Building Inspections, Clark County Development Services, representing ICC Sustainability, Energy and High Performance Code Action Committee (SEHPCAC) Chair, requests Approval as Modified by this Public Comment.

Further modify the proposal as follows:

~~**C101.5.3**~~ **C402.1.2 Equipment buildings.** Buildings that comply with all of the following shall be exempt from the *building thermal envelope* provisions of this code:

1. Are separate buildings with floor area no more than 500 square feet (50 m^2).
2. Are intended to house electronic equipment with installed equipment power totaling at least 7 watts per square foot and not intended for human occupancy.
3. Have heating system capacity is no greater than 5 kW (17,000 Btu/hr) and heating thermostat setpoint is restricted to no more than 50°F (10°C).
4. Have an average wall and roof U-factor less than 0.200 in climate zones 1-5 and less than 0.120 in climate zones 6 through 8.
5. Comply with the roof solar reflectance and thermal emittance provisions for Climate Zone 1.

CE36 – 13

C103.2

Proponent: Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee (culp@birchpointconsulting.com)

Revise as follows:

C103.2 Information on construction documents. Construction documents shall be drawn to scale upon suitable material. Electronic media documents are permitted to be submitted when *approved* by the *code official*. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed, and show in sufficient detail pertinent data and features of the building, systems and equipment as herein governed. Details shall include, but are not limited to, as applicable,:

1. Insulation materials and their *R*-values;
2. Fenestration *U*-factors and SHGCs;
3. Area-weighted *U*-factor and SHGC calculations;
4. Mechanical system design criteria;
5. Mechanical and service water heating system and equipment types, sizes and efficiencies;
6. Economizer description;
7. Equipment and systems controls;
8. Fan motor horsepower (hp) and controls;
9. Duct sealing, duct and pipe insulation and location;
10. Lighting fixture schedule with wattage and control narrative;
11. Location of *daylight zones* on floor plans; and
12. Air sealing details.

CE37-13, Part I

C103.2.1 (NEW), R103.2.1 (NEW)

Proposed Change as Submitted

Proponent: Robby Schwarz, EnergyLogic, Inc., (robby@nrglogic.com)

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C103.2.1. **Thermal envelope definition.** The building's thermal envelope shall be defined on the construction documents as the alignment of the air barrier and insulation systems separating conditioned space from unconditioned space. Where it is not possible to define the alignment of the air barrier and thermal barrier systems on the construction documents inspection shall determine success of accomplishing this requirement.

Public Comment:

Robby Schwarz, EnergyLogic, requests Approval as Modified by this Public Comment.

Replace the proposal as follows:

C103.2.1. **Building thermal envelope depiction.** The building's thermal envelope shall be represented on the construction documents.

CE37-13, Part II

C103.2.1 (NEW), R103.2.1 (NEW)

Proposed Change as Submitted

Proponent: Robby Schwarz, EnergyLogic, Inc., (robby@nrglogic.com)

PART II – IECC-RESIDENTIAL PROVISIONS

Add new text as follows:

R103.2.1. **Thermal envelope definition.** The building's thermal envelope shall be defined on the construction documents as the alignment of the air barrier and insulation systems separating conditioned space from unconditioned space. Where it is not possible to define the alignment of the air barrier and thermal barrier systems on the construction documents inspection shall determine success of accomplishing this requirement.

Public Comment:

Robby Schwarz, EnergyLogic, requests Approval as Modified by this Public Comment.
Replace the proposal as follows:

R103.2.1. **Thermal envelope depiction.** The building's thermal envelope shall be represented on the construction documents.

CE38-13, Part I

C103.3, C104.1, C104.2 (NEW), C104.3, C104.3.1 (NEW), C104.3.2 (NEW), C104.3.3 (NEW), C104.3.4 (NEW), C104.3.5 (NEW), C104.3.6 (NEW), C104.5, R103.3, R104.1, R104.2 (NEW), R104.3, R104.3.1 (NEW), R014.3.2 (NEW), R104.3.3 (NEW), R104.3.4 (NEW), R104.3.5 (NEW), R104.3.6 (NEW), R104.5

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C103.3 Examination of documents. The *code official* shall examine or cause to be examined the accompanying construction documents and shall ascertain whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances. In causing the documents to be examined to verify compliance with this code, the *code official* shall be permitted to utilize a registered design professional or other *approved* entity not affiliated with the *building* design or construction in conducting the review of the plans and specifications for compliance with the code.

~~**C104.1 General.** Construction or work for which a permit is required shall be subject to inspection by the *code official*.~~

C104.1 General. Construction or work for which a permit is required shall be subject to inspection by the *code official* or his designated agent, and such construction or work shall remain accessible and exposed for inspection purposes until *approved*. Approved as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the permit applicant to cause the work to remain accessible and exposed for inspection purposes. Neither the *code official* nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material, product, system or building component required to allow inspection to validate compliance with this code.

~~**C104.2 Required approvals.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the *code official*. The *code official*, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed,~~

~~or notify the permit holder or his or her agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the *code official*.~~

C104.2 Preliminary Inspection. Before issuing a permit, the *code official* is authorized to examine or cause to be examined the *building site*, and in the case of work to or on an existing building the *building*, for which an application has been filed.

~~**C104.3 Final inspection.** The building shall have a final inspection and not be occupied until *approved*.~~

C104.3 Required inspections. The *code official* or his designated agent, upon notification, shall make the inspections set forth in Sections C104.3.1 through C104.3.6.

C104.3.1 Footing and foundation inspection. Inspections associated with footings and foundations shall be made before backfilling and shall verify compliance with the code as to R-value, location, thickness, depth of burial and protection of insulation as required by the code and *approved* plans and specifications for:

1. Basement or crawl space walls having insulation applied exterior to or integral with the walls
2. Slabs on grade
3. Buried duct systems associated with HVAC systems
4. Piping systems associated with HVAC or service hot water systems
5. Freeze protection/snow melt systems.

C104.3.2 Framing and rough-in inspection. Inspections at framing and rough-in shall be made before application of interior finish and shall verify compliance with the code as to types of insulation and corresponding R-values and their correct location and proper installation, fenestration thermal properties (U-factor, SHGC and VT) and proper installation of fenestration, and air leakage controls as required by the code and approved plans and specifications for:

1. Opaque walls and wall assemblies
2. Floors and floor assemblies
3. Roof/ceilings and roof/ceiling assemblies
4. Fenestration
5. Required vestibules

C104.3.3 Plumbing rough-in inspection. Inspections at plumbing rough-in shall verify compliance as required by the code and *approved* plans and specifications for:

1. The R-value, location, thickness, depth of burial and protection of insulation on hot water piping
2. The existence of required temperature controls on potable hot water systems
3. The installation of automatic time switches on circulating hot water systems or heat trace
4. The installation of heat traps on hot water storage tanks associated with non-circulating systems.

C104.3.4 Mechanical rough-in inspection. Inspections at mechanical rough-in shall verify compliance as required by the code and *approved* plans and specifications for:

1. Installed HVAC equipment type, efficiency and size
2. Installation of gravity and motorized dampers where required and leakage rates of the dampers
3. Installation of required demand control ventilation
4. Required insulation type, R-value, thickness and proper installation of insulation for ducts, plenums and piping associated with the HVAC system
5. Sealing and any required leakage testing of ducts and plenums
6. Installation of required economizers and associated controls
7. Installation of required temperature, humidity and zone controls
8. Required sizing of HVAC system fans and motors
9. Required energy recovery capability
10. Existence of a means to balance HVAC systems
11. Installation of required controls for HVAC and hydronic systems
12. Required limitations on hot gas bypass for cooling systems
13. Installation of radiant heating systems where not allowed

C104.3.5 Electrical rough-in inspection. Inspections at electrical rough-in shall verify compliance as required by the code and *approved* plans and specifications for:

1. Proper installation of all required lighting controls
2. Installation of all lighting system components (fixtures and lamps)
3. Installation of individual electric meters for each dwelling unit in multi-family residential buildings.

C104.3.6 Final inspection. The *building* shall have a final inspection and shall not be occupied until *approved*. The final inspection shall include verification of the installation of all required *building* controls and their proper operation as well as documentation verifying the activities associated with required *building commissioning* have been conducted and the findings of non-compliance corrected. *Building*s, or portions thereof, shall not be considered for a final inspection until the *code official* has received a letter of transmittal from the building owner acknowledging that the building owner has received the Preliminary Commissioning Report as required in Section C408.2.4.

~~**C104.5 Approved inspection agencies.** The *code official* is authorized to accept reports of *approved* inspection agencies, provided such agencies satisfy the requirements as to qualifications and reliability.~~

C104.5 Approved Inspection agencies. The *code official* is authorized to accept reports of third party inspection agencies not affiliated with the *building* design or construction, provided such agencies are *approved* as to qualifications and reliability relevant to the building components and systems they are inspecting.

Public Comment:

Jeremiah Williams, U.S. Department of Energy, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C103.3 Examination of documents. The *code official* shall examine or cause to be examined the accompanying construction documents and shall ascertain whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances. ~~In causing the documents to be examined to verify compliance with this code~~, The *code official* ~~shall be permitted~~ is authorized to utilize a registered design professional or other *approved* entity not affiliated with the *building* design or construction in conducting the review of the plans and specifications for compliance with the code.

C104.1 General. Construction or work for which a permit is required shall be subject to inspection by the *code official* or his designated agent, and such construction or work shall remain accessible and exposed for inspection purposes until *approved*. ~~Approved as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid.~~ It shall be the duty of the permit applicant to cause the work to remain accessible and exposed for inspection purposes. Neither the *code official* nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material, product, system or building component required to allow inspection to validate compliance with this code.

~~**C104.2 Preliminary Inspection.** Before issuing a permit, the *code official* is authorized to examine or cause to be examined the *building site*, and in the case of work to or on an existing building the *building*, for which an application has been filed.~~

C104.~~3~~ 2 Required inspections. The *code official* or his designated agent, upon notification, shall make the inspections set forth in Sections ~~C104.3.1 through C104.3.6~~ C104.2.1 through 104.2.6.

C104.3.1 C104.2.1 Footing and foundation inspection. Inspections associated with footings and foundations shall be made before backfilling and shall verify compliance with the code as to R-value, location, thickness, depth of burial and protection of insulation as required by the code and *approved* plans and specifications. ~~for:~~

~~1. Basement or crawl space walls having insulation applied exterior to or integral with the walls~~
~~2. Slabs on grade~~
~~3. Buried duct systems associated with HVAC systems~~
~~4. Piping systems associated with HVAC or service hot water systems~~
~~5. Freeze protection/snow melt systems.~~

~~C104.3.2~~ C104.2.2 Framing and rough-in inspection. Inspections at framing and rough-in shall be made before application of interior finish and shall verify compliance with the code as to types of insulation and corresponding R-values and their correct location and proper installation,; fenestration thermal properties (U-factor, SHGC and VT) and proper installation ~~of fenestration,;~~ and air leakage controls as required by the code and approved plans and specifications. ~~for:~~

~~1. Opaque walls and wall assemblies~~
~~2. Floors and floor assemblies3. Roof/ceilings and roof/ceiling assemblies~~
~~4. Fenestration~~
~~5. Required vestibules~~

~~C104.3.3~~ C104.2.3 Plumbing rough-in inspection. Inspections at plumbing rough-in shall verify compliance as required by the code and *approved* plans and specifications as to types of insulation and corresponding R-values and protection, required controls and required heat traps. for:

~~1. The R-value, location, thickness, depth of burial and protection of insulation on hot water piping~~
~~2. The existence of required temperature controls on potable hot water systems~~
~~3. The installation of automatic time switches on circulating hot water systems or heat trace~~
~~4. The installation of heat traps on hot water storage tanks associated with non-circulating systems.~~

~~C104.3.4~~ C104.2.4 Mechanical rough-in inspection. Inspections at mechanical rough-in shall verify compliance as required by the code and *approved* plans and specifications as to installed HVAC equipment type and size, required controls, system insulation and corresponding R-value, system and damper air leakage and required energy recovery and/or economizers. ~~for:~~

~~1. Installed HVAC equipment type, efficiency and size~~
~~2. Installation of gravity and motorized dampers where required and leakage rates of the dampers~~
~~3. Installation of required demand control ventilation~~
~~4. Required insulation type, R-value, thickness and proper installation of insulation for ducts, plenums and piping associated with the HVAC system~~
~~5. Sealing and any required leakage testing of ducts and plenums~~
~~6. Installation of required economizers and associated controls~~
~~7. Installation of required temperature, humidity and zone controls~~
~~8. Required sizing of HVAC system fans and motors~~
~~9. Required energy recovery capability~~
~~10. Existence of a means to balance HVAC systems~~
~~11. Installation of required controls for HVAC and hydronic systems~~
~~12. Required limitations on hot gas bypass for cooling systems~~
~~13. Installation of radiant heating systems where not allowed~~

~~C104.3.5~~ C104.2.5 Electrical rough-in inspection. Inspections at electrical rough-in shall verify compliance as required by the code and *approved* plans and specifications as to installed lighting systems, components and controls and installation of an electric meter for each dwelling unit. ~~for:~~

~~1. Proper installation of all required lighting controls~~
~~2. Installation of all lighting system components (fixtures and lamps)~~
~~3. Installation of individual electric meters for each dwelling unit in multi-family residential buildings.~~

~~C104.3.6~~ C104.2.6 Final inspection. The *building* shall have a final inspection and shall not be occupied until *approved*. The final inspection shall include verification of the installation of all required *building* controls and their proper operation as well as documentation verifying the activities associated with required *building*

commissioning have been conducted and the findings of non-compliance corrected. *Buildings*, or portions thereof, shall not be considered for a final inspection until the *code official* has received a letter of transmittal from the building owner acknowledging that the building owner has received the Preliminary Commissioning Report as required in Section C408.2.4.

C104.5 Approved Inspection agencies. The *code official* is authorized to accept reports of third party inspection agencies not affiliated with the *building* design or construction, provided such agencies are *approved* as to qualifications and reliability relevant to the building components and systems they are inspecting.

CE43-13, Part I

C106.2, R106.2

Proposed Change as Submitted

Proponent: Deborah Taylor, RA, LEED AP, Deborah F. Taylor Consulting, LLC, representing self (taylor@dftconsultingny.com)

PART I – IECC-COMMERCIAL PROVISIONS
Delete without substitution as follows:

~~**C106.2 Conflicting requirements.** Where the provisions of this code and the referenced standards conflict, the provisions of this code shall take precedence.~~

CE44-13, Part I

C108.4, R108.4

Proposed Change as Submitted

Proponent: Shirley Ellis, Energy Systems Laboratory, Texas A&M Engineering Experiment Station, Texas A&M University System (shirleyellis@tamu.edu)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C108.4 Failure to comply. Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be liable to a fine ~~of not less than [AMOUNT] dollars or more than [AMOUNT] dollars.~~as set by the applicable governing authority.

CE49-13, Part I

C202 (New), R202 (New) (IRC N1101.9 (New)), IPC 202 (New)

Proponent: Greg Towsley, LEED AP BD+C Grundfos representing Grundfos (gtowsley@grundfos.com)

PART I – IECC-COMMERCIAL PROVISIONS

Add new definition as follows:

SECTION C202

GENERAL DEFINITIONS

CIRCULATING HOT WATER SYSTEM. A specifically designed water distribution system where one or more pumps are operated in the service hot water piping to circulate heated water from the water-heating equipment to fixtures and back to the water-heating equipment.

CE50 – 13

C202 (NEW), R202 (NEW) (IRC N1101.9 (NEW)), IRC 202 (NEW)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

PART I – IECC – COMMERICAL PROVISIONS
Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

CLIMATE ZONE. A geographical region that has been assigned climatic criteria as specified in this code.

CE51-13, Part I

C202

Proposed Change as Submitted

Proponent: Shaunna Mozingo, City of Cherry Hills Village, representing Colorado Chapter of ICC, Inc (smozingo@coloradocode.net), Brent Ursenbach, Salt Lake County, representing Utah Chapter ICC and Utah Association of Plumbing and Mechanical Officials Chapter ICC (bursenbach@slco.org)

Delete and substitute as follows:

SECTION C202
GENERAL DEFINITIONS

~~**CONDITIONED SPACE.** An area or room within a building being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent *conditioned space*.~~

CONDITIONED SPACE. An area, room or space that is enclosed within the building thermal envelope and that is directly heated or cooled or that is indirectly heated or cooled. Spaces are indirectly heated or cooled where they communicate thru openings with conditioned spaces, where they are separated from conditioned spaces by un-insulated walls, floors or ceilings, or where they contain un-insulated ducts, piping or other sources of heating or cooling.

CE54 – 13

C202 (New)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)
Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

LINER SYSTEM (Ls). A continuous vapor barrier liner membrane is installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the liner membrane between the purlins. For multilayer installations, the last *rated R-value of insulation* is for unfaced insulation draped over purlins and then compressed when the metal roof panels are attached.
FILLED CAVITY (FC). The first *rated R-value of insulation* represents faced or unfaced insulation installed between the purlins. The second *rated R-value of insulation* represents unfaced insulation installed above the first layer, perpendicular to the purlins and compressed when the metal roof panels are attached. A supporting structure retains the bottom of the first layer at the prescribed depth required for the full thickness of insulation.

Public Comment:

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

Modify the proposal as follows:

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[*]

LS = *Liner System*—~~A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.~~

CE55 – 13

C202 (New)

Proponent: Steve Ferguson, ASHRAE (sferguson@ashrae.org), Amanda Hickman, InterCode Incorporated, representing AMCA International (amanda@intercodeinc.com)

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

POWERED ROOF/WALL VENTILATORS. A fan consisting of a centrifugal or axial impeller with an integral driver in a weather-resistant housing and with a base designed to fit, usually by means of a curb, over a wall or roof opening.

CE56 – 13

C202 (NEW)

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

REROOFING. The process of recovering or replacing an existing roof covering.
ROOF RECOVER. The process of installing an additional roof covering over an existing roof covering without removing the existing roof covering.
ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purpose of its maintenance.
ROOF REPLACMENT. The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

CE57 – 13

C202 (NEW)

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

ROOFTOP MONITOR. A raised section of a roof containing vertical fenestration along one or more sides.

CE59-13, Part I

C202, R202 (IRC N1101.9)

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

PART I – IECC-COMMERCIAL PROVISIONS

SECTION C202
GENERAL DEFINITIONS

Revise definitions as follows:

~~**FENESTRATION**~~ **VERTICAL FENESTRATION.** ~~Skylights, roof windows, vertical w~~ Windows (fixed or movable), opaque doors, glazed doors, glazed block and combination opaque/glazed doors composed of. ~~Fenestration includes products with glass and nonglass~~ or other transparent or translucent glazing materials and installed at a slope of at least 60 degrees from horizontal.

~~**SKYLIGHT**~~ **SKYLIGHT**. Glass or other transparent or translucent glazing material installed with a slope of less than 60 degrees (1.05 rad) from horizontal. ~~Glazing material in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls is included in this definition.~~

CE61 – 13

Table C301.1, Table R301.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

PART I – IECC-COMMERCIAL PROVISIONS
Revise as follows:

TABLE C301.1
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID DESIGNATIONS BY STATE, COUNTY AND TERRITORY

COLORADO
5B Adams
6B Alamosa
5B Arapahoe
6B Archuleta
4B Baca
5B Bent
5B Boulder
5B Broomfield
6B Chaffee
(Portions of Table not shown remain unchanged)

CE62 – 13

Figure C301.1, Table C301.1, Figure R301.1 (IRC Figure N1101.10), Table R301.1 (IRC Table N1101.10)

Proponent: Shirley Ellis, Energy Systems Laboratory, Texas A&M Engineering Experiment Station, Texas A&M University System (shirleyellis@tamu.edu)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows: End the Warm-Humid white line at the line separating the Dry (B) and Moist (A) moisture zones.

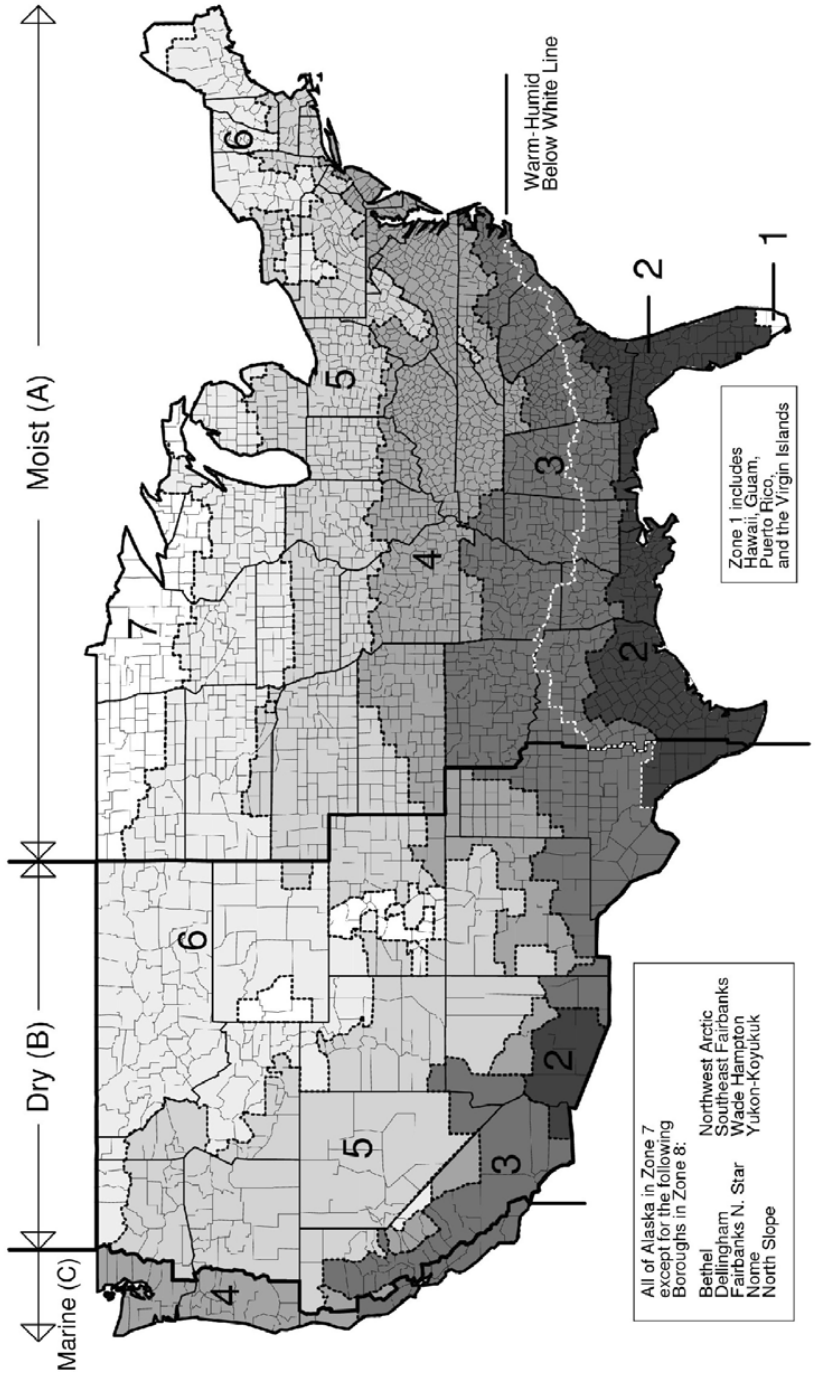

FIGURE C301.1
CLIMATE ZONES

Revise as follows: Remove the asterisk (*) from the following Counties, thereby removing the warm-humid location designation.

TABLE C301.1
CLIMATE ZONES, MOISTURE REGIMES, AND WARM-HUMID DESIGNATIONS BY STATE, COUNTY AND TERRITORY

TEXAS
Bandera*
Dimmit*
Edwards*
Frio*
Kinney*
La Salle*
Maverick*
Medina*
Real*
Uvalde*
Val Verde*
Webb*
Zapata*
Zavala*

CE63 – 13

C303.1.1, R303.1.1 (IRC N1101.12.1)

Proponent: Matt Dobson, Vinyl Siding Institute (mdobson@vinylsiding.org)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C303.1.1 Building thermal envelope insulation. An *R*-value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and *R*-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled *R*-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and *R*-value of installed thickness shall be *listed* on the certification. For insulated siding the *R-value* shall be labeled on the product's package and shall be *listed* on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

CE65 – 13

C303.1.3, Chapter 5, R303.1.3 (IRC N1101.12.3), Chapter 5

Proponent: Joseph R. Hetzel, P.E., Thomas Associates, Inc., representing the Door & Access Systems Manufacturers Association (DASMA) International (jhetzel@thomasamc.com)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C303.1.3 Fenestration product rating. U-factors of fenestration products (windows, doors and skylights) shall be determined in accordance with NFRC 100 ~~by an accredited, independent laboratory, and labeled and certified by the manufacturer.~~

Exception: Where required, garage door U-factors shall be determined in accordance with either NFRC 100 or ANSI/DASMA 105.

U-factors shall be determined by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled U-factor shall be assigned a default U-factor from Table C303.1.3(1) or C303.1.3(2). The solar heat gain coefficient (SHGC) and *visible transmittance* (VT) of glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC or VT shall be assigned a default SHGC or VT from Table C303.1.3(3).

Add new standard to Chapter 5 as follows:

DASMA
ANSI/DASMA 105-2004Test Method for Thermal Transmittance and Air Infiltration of Garage Doors

CE66-13, Part I

C301.4 (NEW), R301.4 (NEW) (IRC N1101.10.3 (NEW)), R406 (NEW) (IRC N1106 (NEW))

Proposed Change as Submitted

Proponent: Craig Conner, Building Quality, representing self (craig.conner@mac.com), Agustin Mujica, Levitt Homes, Puerto Rico

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C301.4 Tropical climate zone. The tropical climate zone shall be defined as:

1. Hawaii, Puerto Rico, Guam, American Samoa, U.S. Virgin Islands, Commonwealth of Northern Mariana Islands, and
2. Islands in the area between the Tropic of Cancer and the Tropic of Capricorn

CE67-13, Part I

C303.1.4.1 (NEW), Chapter 5, R303.1.4.1 (N1101.12.4) (NEW), Chapter 5

Proposed Change as Submitted

Proponent: Matt Dobson, Vinyl Siding Institute (mdobson@vinylsiding.org)
PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C303.1.4 Insulation product rating. The thermal resistance (*R*-value) of insulation shall be determined in accordance with the U.S. Federal Trade
Commission *R*-value rule (CFR Title 16, Part 460) in units of h ×ft2 × °F/Btu at a mean temperature of 75°F (24°C).

C303.1.4.1 Insulated siding. The thermal resistance (*R-value*) of insulated siding shall be determined in accordance with ASTM C1363. Installation for testing shall be in accordance with the manufacturer's installation instructions.

Add new standard to Chapter 5 as follows:

ASTM
C1363 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

CE69-13
C401.1

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C401.1 Scope. The provisions ~~requirements~~ contained in this chapter are applicable to commercial *buildings* and their *building sites* ~~or portions of commercial buildings.~~

CE75-13
C401.2.2 (NEW)

Proposed Change as Submitted

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Add new text as follows:

C401.2.2 Application to replacement fenestration products. Where some or all of an existing *fenestration* unit is replaced with a new *fenestration* product, including sash and glazing, the replacement *fenestration* unit shall meet the applicable requirements for *U-factor* and *SHGC* in Table C402.3.

> **Exception**: An area-weighted average of the *U-factor* of replacement fenestration products being installed in the building for each fenestration product category listed in Table C402.3 shall be permitted to satisfy the *U-factor* requirements for each fenestration product category listed in Table C402.3. Individual fenestration products from different product categories listed in Table C402.3 shall not be combined in calculating the area-weighted average *U-factor*.

CE77 – 13
C402.1, C402.1.1, C402.1.1

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Section C402.1.1. Section C402.1.2 shall be permitted as an alternative to the *R*-values specified in Section C402.1.1. Building thermal envelope assemblies for buildings that are intended to comply with the code on a prescriptive basis, in accordance with the compliance path described in Item 2 of Section C401.2, shall comply with the following:

1. The opaque portions of the building thermal envelope shall comply with the specific insulation requirements of Section C402.2 and the thermal requirements of either the *R*-value based method of Section C402.1.1 or the *U-, C-* and *F*-factor based method of Section C402.1.2;
2. Fenestration in building envelope assemblies shall comply with Section C402.3; and
3. Air leakage of building envelope assemblies shall comply with Section C402.4.

Alternatively, where buildings have a vertical fenestration area or skylight area that exceeds that allowed in Section C402.3, the building and the building thermal envelope shall comply with Section C401.2 Item 1 or Section C401.2 Item 3.

C402.1.1 Insulation and fenestration criteria. Insulation component *R*-value-based method. The *building thermal envelope* shall meet the requirements of Tables C402.2 and C402.3 For opaque portions of the *building thermal envelope* intended to comply on an insulation component *R-value*-basis, the *R*-values for insulation in framing cavities, and for continuous insulation, shall be not less than that specified in Table C402.2, based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table C402.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table C402.2. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table C402.3 shall comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1.

C402.1.2 *U*-factor alternative. Assembly *U*-factor, *C*-factor and *F*-factor-based method. An assembly with a *U-factor*, *C*-factor, or *F*-factor equal or less than that specified in Table C402.1.2 shall be permitted as an alternative to the *R*-values in Table C402.2. *Building thermal envelope* opaque assemblies intended to comply on an assembly *U*-factor, *C*-factor or *F*-factor basis shall have a *U*-factor, *C*-factor, or *F*-factor that is not greater than that specified in Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *U*-factor, *C*-factor, or *F*-factor from the "Group R" column of Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *U*-factor, *C*-factor or *F*-factor from the "All other" column of Table C402.1.2.

CE79 – 13

C402.1.1, Table C402.2

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.1.1 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Tables ~~C402.2~~ C402.1.1 and C402.3 based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table ~~C402.2~~ C402.1.1. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table ~~C402.2~~ C402.1.2. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table C402.3 shall comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1.

TABLE ~~C402.2~~ C402.1.1
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

(Portions of Table not shown remains unchanged.)

CE81 – 13

C402.1.1

Proponent: Brian Dean,, ICF, International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Revise as follows:

C402.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Sections C402.2 and C402.3, including Tables C402.2 and C402.3 based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table C402.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table C402.2. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table by Section C402.3.1 shall use one of the other compliance methods specified in Section C401.2 ~~comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1.~~

CE82-13

C402.1.1, C402.1.2, C402.2.4

Proposed Change as Submitted

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.1.1 Insulation and fenestration criteria. The building thermal envelope shall meet the requirements of Tables C402.2 and C402.3, based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table C402.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table C402.2. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table C402.3 shall comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1. The thermal resistance or R-value of the insulating material installed in, or continuously on, below grade exterior walls of the building envelope required in accordance with Table C402.2 shall extend to a depth of 10 feet (3048 mm) below the outside finished ground level, or to the level of the lowest floor, whichever is less.

C402.1.2 *U*-factor alternative. An assembly with a *U-factor*, *C*-factor, or *F*-factor equal or less than that specified in Table C402.1.2 shall be permitted as an alternative to the *R*-values in Table C402.2. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *U*-factor, *C*-factor, or *F*-factor from the "Group R" column of Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *U*-factor, *C*-factor or *F*-factor from the "All other" column of Table C402.1.2. The C-factor for the below grade exterior walls of the building envelope, as required in accordance with Table C402.1.2, shall extend to a depth of 10 feet (3048 mm) below the outside finished ground level, or to the level of the lowest floor, whichever is less.

~~**C402.2.4 Thermal resistance of below grade walls.** The minimum thermal resistance (*R*-value) of the insulating material installed in, or continuously on, the below-grade walls shall be as specified in Table C402.2, and shall extend to a depth of 10 feet (3048 mm) below the outside finished ground level, or to the level of the lowest floor, whichever is less.~~

CE85-13

C402.1.2.1 (NEW), Table C402.2.3 (NEW)

Proposed Change as Submitted

Proponent: Mark Nowak, M. Nowak Consulting LLC, representing Steel Framing Alliance

Add new text as follows:

C402.1.2.1 Thermal resistance of cold-formed steel walls. U-factors of walls with cold-formed steel studs shall be permitted to be determined in accordance with Equation 4-X:

$U = 1/[R_s + (R_{ins} \times F_c)]$ **Equation 4-x**

Where:

R_s = The cumulative R-value of the wall components along the path of heat transfer, excluding the cavity insulation and steel studs.

R_{ins} = The R-value of the cavity insulation.

F_c = The correction factor from Table 402.2.3

TABLE C402.2.3

F_c VALUES FOR STEEL STUD WALL ASSEMBLIES Nominal stud depth (inches)	Spacing of framing (inches)	Cavity R-Value	Correction factor (F_c)
3-1/2	16	13	0.46
		15	0.43
3-1/2	24	13	0.55
		15	0.52
6	16	19	0.37
		21	0.35
6	24	19	0.45
		21	0.43
8	16	25	0.31
8	24	25	0.38

Public Comment:

Duane Jonlin, City of Seattle, Department of Planning and Development, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C402.1.2.1 Thermal resistance of cold-formed steel walls. U-factors of walls with cold-formed steel studs shall be permitted to be determined in accordance with Equation 4-X:

$U = 1/[R_s + (ER)\ (R_{ins} \times F_c)]$ **Equation 4-X**

Where:

R_s = The cumulative R-value of the wall components along the path of heat transfer, excluding the cavity insulation and steel studs.

ER = The effective R-value of the cavity insulation with steel studs

~~R_{ins} = The R-value of the cavity insulation.~~

~~F_c = The correction factor from Table 402.2.3~~

TABLE C402.2.3

~~F~~ EFFECTIVE R-VALUES FOR STEEL STUD WALL ASSEMBLIES

Nominal stud depth (inches)	Spacing of framing (inches)	Cavity R-Value (insulation)	Correction factor (F_c)	Effective R-Value (ER) (Cavity R-Value x F_c)
3-1/2	16	13	0.46	5.98
		15	0.43	6.45
3-1/2	24	13	0.55	7.15
		15	0.52	7.80
6	16	19	0.37	7.03
		21	0.35	7.35
6	24	19	0.45	8.55
		21	0.43	9.03
8	16	25	0.31	7.75
	24	25	0.38	9.50

CE88-13

C402.1, C402.1.3 (NEW)

Proposed Change as Submitted

Proponent: Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development (WABO TCD) (lkranz@bellevuewa.gov)

Revise as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Section C402.1.1. Section C402.1.2 or Section C402.1.3 shall be permitted as an alternative to the R-values specified in Section C402.1.1.

C402.1.3 Component performance alternative. Building envelope values and fenestration areas determined in accordance with Equation 4-3 shall be permitted in lieu of compliance with the U-factors, F-factors and C-factors in Tables C402.1.2 and C402.3 and the maximum allowable fenestration areas in Section C402.3.1.

(UA Sum) + (FL Sum) + (CA Sum) + (XVG) + (XSky) < Zero. **(Equation 4-3)**

Where:

UA Sum = Sum of the (UA Dif) values for each assembly that comprises a portion of the building thermal envelope.

UA Dif = (UA Proposed) – (UA Table).

UA Table = (Maximum allowable U-factor specified in Table C402.1.2 or Table C402.3) x (Area).

UA Proposed = (Proposed U-value) x (Area).

FL Sum = Sum of the (FL Dif) values for each slab on grade assembly that comprises a portion of the building thermal envelope.

FL Dif = (FL Proposed) – (FL Table).

FL Table = (Maximum allowable F-factor specified in Table C402.1.2) x (Perimeter length).

FL Proposed = (Proposed F-value) x (Perimeter length) .

CA Sum = Sum of the (CA Dif) values for each below-grade wall assembly that comprises a portion of the building thermal envelope.

CA Dif = (CA Proposed) – (CA Table).

CA Table = (Maximum allowable C-factor specified in Table C402.1.2) x (area).

CA Proposed = (Proposed C-value) x (area).

XVG (Excess Vertical Glazing Value) = (XVGArea x UVG) – (XVGArea x UWall), but not less than zero.

XVGArea (Excess Vertical Glazing Area) = (Proposed Vertical Glazing Area) – (Allowable Vertical Glazing Area deterimined in accordance with Section C402.3.1).

UA Wall = Sum of the (UA Proposed) values for each opaque assembly comprising a portion of the exterior wall.

UWall = UA Wall / total opaque exterior wall area.

UA VG = Sum of the (UA Proposed) values for each vertical glazing assembly.

UVG = UA VG / total vertical glazing area.

XSky (Excess Skylight Value) = (XSArea X USky) – (XSArea x U Roof), but not less than zero.

XSArea (Excess Skylight Area) = (Proposed Skylight Area) – (Allowable Skylight Area determined in accordance with Section C402.3.1).

UA Roof = Sum of the (UA Proposed) values for each opaque assembly comprising a portion of a roof.
URoof = UA Roof / total opaque roof area.

UA Sky = Sum of the (UA Proposed) values for each skylight assembly.

USky = UA Sky / total skylight area.

Public Comment:

Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development Committee, requests Approval as Modified by this Public Comment.

Replace the proposal as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Section C402.1.1. Section C402.1.2 or Section C402.1.3 shall be permitted as an alternative to the R-values specified in Section C402.1.1.

C402.1.3 Component performance alternative. Building envelope values and fenestration areas determined in accordance with Equation 4-3 shall be permitted in lieu of compliance with the U-factors, F-factors and C-factors in Tables C402.1.2 and C402.3 and the maximum allowable fenestration areas in Section C402.3.1.

A + B + C + D + E ≤ Zero **(Equation 4-3)**

Where:

A = Sum of the (UA Dif) values for each distinct assembly type of the building thermal envelope, other than slabs on grade and below-grade walls

UA Dif = UA Proposed – UA Table

UA Proposed = Proposed U-value x Area

UA Table = (U-factor from Table C402.1.2 or Table C402.3) x Area B = Sum of the (FL Dif) values for each distinct slab on grade perimeter condition of the building thermal envelope

FL Dif = FL Proposed – FL Table

FL Proposed = Proposed F-value x Perimeter length

FL Table = (F-factor specified in Table C402.1.2) x Perimeter length

C = Sum of the (CA Dif) values for each distinct below-grade wall assembly type of the building thermal envelope

CA Dif = CA Proposed – CA Table

CA Proposed = Proposed C-value x Area

CA Table = (Maximum allowable C-factor specified in Table C402.1.2) x Area

Where the proposed vertical glazing area is less than or equal to the maximum vertical glazing area allowed by Section C402.3.1, the value of D (Excess Vertical Glazing Value) shall be zero. Otherwise:

D = (DA x UVG) – (DA x UWall), but not less than zero.

DA = (Proposed Vertical Glazing Area) – (Vertical Glazing Area allowed by Section C402.3.1)

UA Wall = Sum of the (UA Proposed) values for each opaque assembly of the exterior wall

UWall = Area-weighted average U-value of all above-grade wall assemblies

UAV = Sum of the (UA Proposed) values for each vertical glazing assembly

UV = UAV / total vertical glazing area

Where the proposed skylight area is less than or equal to the skylight area allowed by Section C402.3.1, the value of E (Excess Skylight Value) shall be zero. Otherwise:

E = (EA X US) – (EA x URoof), but not less than zero.

EA = (Proposed Skylight Area) – (Allowable Skylight Area from Section C402.3.1)

URoof = Area-weighted average U-value of all roof assemblies

UAS = Sum of the (UA Proposed) values for each skylight assembly

US = UAS / total skylight area

CE94-13

Table C402.1.2

Proposed Change as Submitted

Proponent: Martha G. VanGeem, representing Masonry Alliance for Codes and Standards

Revise as follows:

TABLE C402.1.2

OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a] CLIMATE ZONE	**1**		**2**		**3**		**4 EXCEPT MARINE**		**5 AND** MARINE 4		**6**		**7**		**8**	
	All oth	**Group**	**All oth**	**Group**	**All oth**	**Group**	**All oth**	**Group**	**All oth**	**Group**	**All oth**	**Group**	**All oth**	**Group**	**All oth**	**Group**

	er	R	er	R	er	R	er	R	er	R	er	R	er	R	er	R
Walls, Above Grade																
Mass	~~U-0.142~~ U-0.151	~~U-0.142~~ U-0.151	~~U-0.142~~ U-0.151	U-0.123	~~U-0.110~~ U-0.123	U-0.104	U-0.104	U-0.090	U-0.078	U-0.078	~~U-0.078~~ U-0.080	U-0.071	~~U-0.061~~ U-0.071	U-0.061	U-0.061	U-0.061

CE95-13

Table C402.1.2

Proposed Change as Submitted

Proponent: Martha G. VanGeem, representing Masonry Alliance for Codes and Standards

Revise as follows:

TABLE C402.1.2

OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a] CLIMATE ZONE	**1**		**2**		**3**		**4 EXCEPT MARINE**		**5 AND** MARINE 4		**6**		**7**		**8**	
	All other	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**	**All other**	**Group R**
Walls, Above Grade																
Mass	U-0.142	U-0.142	U-0.142	U-0.123	U-0.110	U-0.104	U-0.104	U-0.090	~~U-0.078~~ U-0.090	~~U-0.078~~ U-0.080	U-0.078	U-0.071	U-0.061	U-0.061	U-0.061	U-0.061

CE96-13

Table C402.1.2, Table C402.2, C402.2.5

Proposed Change as Submitted

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C402.1.2

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Floors																
Mass[c]	U-0.322	U-0.322	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.057	U-0.055	U-0.051	U-0.055	U-0.051

(Portions of Table not shown remain unchanged)

a. Opaque assembly U-factors, C-factors, and F-factors from ASHRAE 90.1 Appendix A shall be permitted provided the construction complies with the applicable construction details from ASHRAE 90.1 Appendix A.

b. Where heated slabs are below grade, below-grade walls shall comply with the F-factor requirements for heated slabs.

c. "Mass floors" shall include floors weighing not less than:

1. 35 psf (170 kg/m^2) of floor surface area; or

2. 25 psf (120 kg/m^2) of floor surface area where the material weight is not more than 12 pounds per cubic foot (pcf) (1900 kg/m^3).

TABLE C402.2

Climate Zone	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Floors																
Mass[b]	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm ci = Continuous insulation. NR = No requirement.

LS = Liner System- A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, un-faced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ASHRAE 90.1 Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block is required, otherwise use the *U*-factor compliance method in Table C402.1.2.

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

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. Steel floor joist systems shall to be insulated to R-38.

a. "Mass floors" shall include floors weighing not less than:

1. 35 psf (170 kg/m^2) of floor surface area; or

2. 25 psf (120 kg/m^2) of floor surface area where the material weight is not more than 12 pounds per cubic foot (pcf) (1900 kg/m^3).

C402.2.5 Floors over outdoor air or unconditioned space. The thermal properties (component *R*-values or assembly *U*-, *C*- or *F*-factors) ~~resistance (*R*-value) of the insulating material installed either between the floor framing or continuously on the floor assembly~~ of floor assemblies over outdoor air or unconditioned space shall be as specified in Table C402.1.2 or C402.2, based on the construction materials used in the floor assembly. ~~"Mass floors" shall include floors weighing not less than:~~

~~1. 35 psf (170 kg/m^2) of floor surface area; or~~

~~2. 25 psf (120 kg/m^2) of floor surface area if the material weight is not more than 12 pcf (1,900 kg/m^3).~~

CE101 – 13
Table C402.1.2

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Walls, Below Grade																
Below-grade wall [b]	C-1.140[d]	C-1.140[d]	C-1.140[d]	C-1.140[d]	C-1.140[d]	C-1.140[d]	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.119	C-0.092	C-0.092	C-0.092	C-0.092
Floors																
Mass	U-0.322[d]	U-0.322[d]	U-0.107	U-0.087	U-0.076	U-0.076	U-0.076	U-0.074	U-0.074	U-0.064	U-0.064	U-0.057	U-0.055	U-0.051	U-0.055	U-0.051
Joist/Framing	U-0.066[d]	U-0.066[d]	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033 [e]	U-0.033	U-0.033 [e]	U-0.033[e]	U-0.033[e]
Slab-on-Grade Floors																
Unheated slabs	F-0.73[d]	F-0.73[d]	F-0.73[d]	F-0.73[d]	F-0.73[d]	F-0.73[d]	F-0.54	F-0.54	F-0.54	F-0.54	F-0.54	F-0.52	F-0.40	F-0.40	F-0.40	F-0.40
Heated slabs	F-0.70[c]	F-0.70[c]	F-0.70[c]	F-0.70[c]	F-0.70[c]	F-0.70[c]	F-0.65[c]	F-0.65[c]	F-0.58[c]	F-0.58[c]	F-0.58[c]	F-0.58[c]	F-0.55[c]	F-0.55[c]	F-0.55[c]	F-0.55[c]

a. Use of opaque assembly *U*-factors, *C*-factors, and *F*-factors from ASHRAE 90.1 Appendix A shall be permitted provided the construction complies with the applicable construction details from ASHRAE 90.1 Appendix A.
b. Where heated slabs are below grade, below-grade walls shall comply with the F-factor requirements for heated slabs.
c. Evidence of compliance with the *F-factors* indicated in the table for heated slabs shall be demonstrated by the application of the unheated slab *F*-factors and R-*values* derived from ASHRAE 90.1 Appendix A.
d. These *C*-, *F*- and *U-factors* are based on assemblies that are not required to contain insulation.
(Portions of Table not shown remain unchanged)

CE103 – 13

C402.1.1, C402.1.2, C402.2.7, Table C402.1.2, Table C402.2

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.1.1 Insulation and fenestration criteria. The *Building thermal envelope* opaque assemblies shall meet the requirements of Tables C402.2 and C402.3 based on the climate zone specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table C402.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table C402.2. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table C402.3 shall comply with the building envelope provisions of ANSI/ASHRAE/IESNA 90.1. Doors having less than 50 percent glass area shall be considered opaque doors. Opaque swinging doors shall comply with Table C402.1.2 and opaque roll-up or sliding doors shall comply with Table C402.1.1.

C402.1.2 *U*-factor alternative. An opaque assembly with a *U-factor*, *C*-factor, or *F*-factor equal or less than that specified in Table C402.1.2 shall be permitted as an alternative to the *R*-values in Table C402.2. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *U*-factor, *C*-factor, or *F*-factor from the "Group R" column of Table C402.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *U*-factor, *C*-factor or *F*-factor from the "All other" column of Table C402.1.2. Doors having less than 50 percent glass area shall be considered opaque doors. Opaque

swinging doors shall comply with Table C402.1.2 and opaque roll-up or sliding doors shall comply with Table C402.1.1.

C402.2.7 Opaque doors. Opaque doors (doors having less than 50 percent glass area) shall meet the applicable requirements for doors as specified in Table C402.2 and be considered as part of the gross area of above-grade walls that are part of the building envelope.

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, U-FACTOR METHOD[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Heated slabs	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.70	F-0.65	F-0.65	F-0.58	F-0.58	F-0.58	F-0.58	F-0.55	F-0.55	F-0.55	F-0.55
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37

TABLE C402.2
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a]

Climate Zone	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Opaque Doors																
~~Swinging~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.61~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~	~~U-0.37~~
Roll-up or Sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

CE104 – 13

Table C402.1.2, Chapter 5

Proponent: Mark Nowak, M. Nowak Consulting LLC, representing Steel Framing Alliance

Revise as follows:

TABLE C402.1.2
OPAQUE THERMAL ENVELOPE ASSEMBLY REQUIREMENTS[a, b]

a. Use of Opaque assembly U-factors, C-factors, and F-factors from ANSI/ASHRAE/IESNA 90.1 Appendix A shall be permitted, provided the construction, excluding the cladding system on walls, complies with the appropriate construction details from ANSI/ASHRAE/ISNEA 90.1 Appendix A.

b. Opaque assembly U-factors based on designs tested in accordance with ASTM C1363 shall be permitted. Modifications to the test results shall be permitted based on the addition or subtraction of building components on the exterior of the framing of the original tested design.

b. c. Where heated slabs are below grade, below-grade walls shall comply with the F-factor requirements for heated slabs.

(Portions of Table not shown remain unchanged)

Add new standard to Chapter 5 as follows:

ASTM

ASTM C 1363-11 Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus

CE105 – 13

C402.2, C402.2.1 (NEW)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.2 Specific building thermal envelope insulation requirements (Prescriptive). ~~Opaque assemblies shall comply with Table C402.2.~~ Insulation in building thermal envelope opaque assemblies shall comply with Sections C402.2.1 through C402.2.8 and Table C402.2.

C402.2.1. Multiple layers of continuous insulation board. Where two or more layers of continuous insulation board are used in a construction assembly, the continuous insulation boards shall be installed in accordance with Section C303.2. If the continuous insulation board manufacturer's installation instructions do not address installation of two or more layers, the edge joints between each layer of continuous insulation boards shall be staggered.

CE106 – 13

Table C402.2, C402.2.3

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)
Revise as follows:

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

Climate Zone	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Walls, Above Grade																
Mass[b,g]	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R6.5ci	R-13 + R13ci	R-13 + R6.5ci	R-13 + R13ci	R-13 + R13ci	R-13 + R13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 +R13ci	R-13+ R19.5ci	R-13 + R13ci	R-13+ R-19.5ci
Metal Framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13+ R17.5ci
Wood Framed and Other[b]	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 +3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + 3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5 ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-7.5ci or R20 + 3.8ci	R-13 + R-15.6ci or R20 + 10ci	R-13 + R-15.6ci or R20 + 10ci
Walls, Below Grade																
Below Grade Wall[d,f]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci

Portions of Table not shown remain unchanged)
For SI: 1 inch = 25.4 mm ci = Continuous insulation. NR = No requirement.
LS = Liner System- A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, un-faced insulation rests on top of the membrane between the purlins.
a. Assembly descriptions can be found in ASHRAE 90.1 Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.
c. R-5.7 ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2°F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. Steel floor joist systems shall be insulated to R-38.
f. The R-value of integral insulation installed in concrete masonry units shall not be used in determining compliance with Table C402.2.
g. "Mass walls" shall include walls weighing not less than:
1. 35 psf (170 kg/m^2) of wall surface area; or
2. 25 psf (120 kg/m^2) of wall surface area where the material weight is not more than 120 pounds per cubic foot (pcf) (1900 kg/m^3).

~~**C402.2.3 Thermal resistance of above-grade walls.** The minimum thermal resistance (*R*-value) of the insulating materials installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Table C402.2, based on framing type and construction materials used in the wall assembly. The *R*-value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table C402.2.~~
~~"Mass walls" shall include walls weighing not less than:~~
~~1. 35 psf (170 kg/m^2) of wall surface area; or~~
~~2. 25 psf (120 kg/m^2) of wall surface area if the material weight is not more than 120 pounds per cubic foot (pcf) (1900 kg/m^3).~~

CE109 – 13

Table C402.2

Proponent: Robert A. Zabcik, NCI Building Systems, representing self

Revise as follows:

TABLE C402.2

OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
ROOFS								
Insulation entirely above deck	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci
Metal Buildings ~~(with R-5 thermal blocks)~~[a,b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38

(Portions of Table not shown remain unchanged)

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.
LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.
a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.

CE110 – 13

Table C402.2

Proponent: Mark Halverson, APA-The Engineered Wood Association (mark.halverson@apawood.org), Paul Coats, The American Wood Council

Revise as follows:

Table C402.2

OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

Walls, Above Grade																
CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Mass	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal buildings	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R13 + 13ci	R-13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 13ci	R13 + 19.5ci	R13 + 13ci	R13 + 19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + 7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R15.6ci	R-13 + R-7.5ci	R-13 + R17.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R3.87, ~~5~~ci or R20 ~~+R3.8~~ ci	R13 + R7.5ci or R20 +R3.8 ci	R13 + R7.5ci or R20 +R3.8 ci	R13 + R7.5ci or R20 +R3.8 ci	R13 + R7.5ci or R20 +R3.8 ci	R13 + R15.6 ci or R20 +R10c i	R13 + R15.6 ci or R20 +R10c i

For SI:1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.
LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.
a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f₂ °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. Steel floor joist systems shall be insulated to R-38.

(Portions of Table not shown remain unchanged)

CE111 – 13

Table C402.2

Proponent: Joseph R. Hetzel, P.E., Thomas Associates, Inc., representing the Door & Access Systems Manufacturers Association (DASMA) International (jhetzel@thomasamc.com)

Revise as follows:

TABLE C402.2

CLIMATE ZONE	1		2		3		4 except Marine		5 & Marine 4		6		7		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
~~Roll-up or sliding~~ Non-swinging	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CE114 – 13

C402.2.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.2, based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U*-factor is equivalent to the same assembly with the *R*-value specified in Table C402.2.
2. Unit skylight curbs included as a component of ~~an NFRC 100 rated assembly~~ a skylight listed and labeled in accordance with NFRC 100 shall not be required to be insulated.

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

CE115 – 13

C402.2.1

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

C402.2.1 Roof assembly. The minimum thermal resistance (*R*-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.2, based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

Exceptions:

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted *U*-factor is equivalent to the same assembly with the *R*-value specified in Table C402.2.
2. Where tapered insulation is used with insulation entirely above deck, the *R*-value where the insulation thickness varies 1 inch (25 mm) or less from the minimum thickness of tapered insulation shall comply with the *R*-value specified in Table C402.2
2 3. Unit skylight curbs included as a component of an NFRC 100 rated assembly shall not be required to be insulated.

Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.

CE117 – 13

C402.1, C402.1.1, Table C402.2.1.1

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Sections C402.1.1 and C402.3. Section C402.1.2 shall be permitted as an alternative to the *R*-values specified in Section C402.1.1.

~~**C402.2.1.1**~~ **C402.3 Roof solar reflectance and thermal emittance.** Low-sloped roofs, with a slope less than 2 units vertical in 12 horizontal, directly above cooled *conditioned spaces* in Climate Zones 1, 2, and 3 shall comply with one or more of the options in Table ~~C402.2.1.1~~ C402.3.

Exceptions: The following roofs and portions of roofs are exempt from the requirements in Table C402.2.1.1:

1. Portions of roofs that include or are covered by:
   1.1. Photovoltaic systems or components.
   1.2. Solar air or water heating systems or components.
   1.3. Roof gardens or landscaped roofs.
   1.4. Above-roof decks or walkways.
   1.5. Skylights.
   1.6. HVAC systems, components, and other opaque objects mounted above the roof.
2. Portions of roofs shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings.
3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (psf) (74kg/m^2) or 23 psf (117 kg/m^2) pavers.
4. Roofs where a minimum of 75 percent of the roof area meets a minimum

TABLE ~~C402.2.1.1~~ C402.3
MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]

(Portions of Table not shown remain unchanged)

CE118-13

C202 (NEW), C402.2.1.1

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.1.1 Roof solar reflectance and thermal emittance. Low sloped roofs~~, with a slope less than 2 units vertical in 12 units horizontal,~~ directly above cooled conditioned spaces in Climate Zones 1, 2, and 3 shall comply with one or more of the options in Table C402.2.1.1.

Exceptions: The following roofs and portions of roofs are exempt from the requirements in Table C402.2.1.1:

1. Portions of roofs that include or are covered by:
   1.1. Photovoltaic systems or components.
   1.2. Solar air or water heating systems or components.
   1.3. Roof gardens or landscaped roofs.
   1.4. Above-roof decks or walkways.
   1.5. Skylights.
   1.6. HVAC systems, components, and other opaque objects mounted above the roof.
2. Portions of roofs shaded during the peak sun angle on the summer solstice by permanent features of the building, or by permanent features of adjacent buildings.
3. Portions of roofs that are ballasted with a minimum stone ballast of 17 pounds per square foot (psf) (74 kg/m^2) or 23 psf (117 kg/m^2) pavers.
4. Roofs where a minimum of 75 percent of the roof area meets a minimum of one of the exceptions above.

Add new definition as follows:

LOW SLOPED ROOF. A roof having a slope less than 2 units vertical in 12 units horizontal.

CE119 – 13

Table C402.2.1.1, Chapter 5

Proponent: Sherry Hao, Energy Solutions, representing Cool Roof Rating Council (sherry@coolroofs.org)

Revise as follows:

TABLE C402.2.1.1
MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS[a]

b. Solar reflectance tested in accordance with ASTM C1549, ASTM E903, ~~or~~ ASTM E1918, or the CRRC-1 Standard.
c. Thermal emittance tested in accordance with ASTM C1371, ~~or~~ ASTM E408, or the CRRC-1 Standard.
(Portions of Table not shown remain unchanged)

Add new standard to Chapter 5 as follows:

CRRC Cool Roof Rating Council
1610 Harrison Street
Oakland, CA 94612

CRRC-1-12 CRRC-1 Standard

CE121-13

Table C402.2.1.1, C402.1.1.1 (NEW), Chapter 5

Proposed Change as Submitted

Proponent: Robert A. Zabcik, P.E., NCI Building Systems, Inc., representing Cool Metal Roofing Coaliton

Revise as follows:

TABLE C402.2.1.1

MINIMUM ROOF REFLECTANCE AND EMITTANCE OPTIONS[a] Three-year aged solar reflectance[b] of 0.55 and three-year aged thermal emittance[c] of 0.75
~~Initial solar reflectance[b] of 0.70 and initial thermal emittance[c] of 0.75~~
Three-year-aged solar reflectance index[d] of 64
~~Initial solar reflectance index[d] of 82~~

a. The use of area-weighted averages to meet these requirements shall be permitted~~. Materials lacking initial tested values for either solar reflectance or thermal emittance, shall be assigned both an initial solar reflectance of 0.10 and an initial thermal emittance of 0.90.~~ Materials lacking three-year aged tested values for either solar reflectance or thermal emittance shall be assigned both a three-year aged solar reflectance in accordance with Section C402.2.1.1.1 of 0.10 and a three-year aged thermal emittance of 0.90.

b. Aged s~~S~~olar reflectance tested in accordance with CRRC-1~~ASTM C 1549, ASTM E 903or ASTM E 1918.~~

c. Aged t~~T~~hermal emittance tested in accordance with CRRC-1~~ASTM C 1371 or ASTM E408.~~

d. Solar reflectance index (SRI) shall be determined in accordance with ASTM E 1980 using a convection coefficient of 2.1 Btu/h × ft2 ×°F (12W/m^2 × K). Calculation of aged SRI shall be based on aged tested values of solar reflectance and thermal emittance. Calculation of initial SRI shall be based on initial tested values of solar reflectance and thermal emittance.

C402.2.1.1.1 Aged roof solar reflectance.

Where an aged solar reflectance required by Section C402.2.1.1 is not available, it shall be determined in accordance with Equation 4-X.

$R_{aged} = [0.2+0.7(R_{initial}-0.2)]$ (Equation 4-X)

where:

R_{aged} = The aged solar reflectance

$R_{initial}$ = The initial solar reflectance determined in accordance with CRRC-1

Add new standard to Chapter 5 as follows:

CRRC Cool Roof Rating Council
1610 Harrison St
Oakland, CA 94612
CRRC-1 2012 Cool Roof Rating Council, CRRC-1 Standard

CE124-13

C202 (New), C402.2.2, C402.2.2.1, C402.2.2.2

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Delete without substitution as follows:

~~**C402.2.2 Classification of walls.** Walls associated with the building envelope shall be classified in accordance with Section C402.2.2.1 or C402.2.2.2.~~
~~**C402.2.2.1 Above-grade walls.** Above-grade walls are those walls covered by Section C402.2.3 on the exterior of the building and completely above grade or walls that are more than 15 percent above grade.~~

~~**C402.2.2.2 Below-grade walls.** Below-grade walls covered by Section C402.2.4 are basement or first-story walls associated with the exterior of the building that are at least 85 percent below grade.~~

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building.

WALL, BELOW-GRADE. A wall associated with the basement or first story of the building that is part of the *building thermal envelope* , is at least 85 percent below grade and is on the exterior of the building.

Public Comment 1:
Jeremiah Williams, U.S. Department of Energy, requests Approval as Modified by this Public Comment. Modify the proposal as follows:

SECTION C202
GENERAL DEFINITIONS

~~**ABOVE-GRADE WALL.** A wall more than 50 percent above grade and enclosing conditioned space. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.~~

~~**BASEMENT WALL.** A wall 50 percent or more below grade and enclosing conditioned space.~~

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15% above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building.

WALL, BELOW-GRADE. A wall associated with the basement or first story of the building that is part of the *building thermal envelope*, is at least 85% below grade and is on the exterior of the building.
(Portions of proposal not shown remain unchanged)

CE126 – 13

C402.2.3

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.3 Thermal resistance of above-grade walls. The minimum thermal resistance (R-value) of the insulating materials installed in the wall cavity between the framing members, where required, and continuously

on the walls, where required, shall be as specified in Table C402.2, based on framing type and construction materials used in the wall assembly. The R-value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table 402.2.
"Mass walls" shall include walls weighing not less than:

1. 35 psf (170 kg/m2) of wall surface area; or
2. 25 psf (120 kg/m2) of wall surface area if the material weight is not more than 120 pounds per cubic foot (pcf) (1900 kg/m3).

CE127-13, Part I

C402.2.3, R402.2.5 (IRC N1102.2.5)

Proposed Change as Submitted

Proponent: James D. Katsaros, PhD, DuPont Building Innovations (james.d.katsaros@dupont.com)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C402.2.3 Thermal resistance of above-grade walls. The minimum thermal resistance (*R*-value) of the insulating materials installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Table C402.2, based on framing type and construction materials used in the wall assembly. The *R*-value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table C402.2.
"Mass Walls" shall include walls weighing not less than:

1. 35 psf (170 kg/m^2) of wall surface areas; or
2. 25 psf (120 kg/m^2) of wall surface area if the material weight is not more than 120 pound per cubic foot (pcf) (1900 kg/m^3), or
3. Having a heat capacity greater than or equal to 6 BTU/ft^2 x ^oF [123 kJ/m^2 x K].

Public Comment:
Martha VanGeem, representing Masonry Alliance of Codes and Standards; Theresa A. Weston, PhD., DuPont Building Innovations, request Approval as Modified by this Public Comment

Modify the proposal as follows:

C402.2.3 Thermal resistance of above-grade walls. The minimum thermal resistance (*R*-value) of the insulating materials installed in the wall cavity between the framing members and continuously on the walls shall be as specified in Table C402.2, based on framing type and construction materials used in the wall assembly. The *R*-value of integral insulation installed in concrete masonry units (CMU) shall not be used in determining compliance with Table C402.2.
"Mass Walls" shall include walls ~~weighing not less than:~~

1. weighing not less than 35 psf (170 kg/m^2) of wall surface areas; or
2. weighing not less than 25 psf (120 kg/m^2) of wall surface area if the material weight is not more than 120 pound per cubic foot (pcf) (1900 kg/m^3), or
3. having a heat capacity exceeding 7 Btu/ft^2 ·°F ~~greater than or equal to 6 BTU/ft^2 x ^oF~~ [144 123 kJ/m^2 x K], or
4. having a heat capacity exceeding 5 Btu/ft^2 ·°F [103 kJ/m^2 x K], where the material weight is not more than 120 pound per cubic foot (pcf) (1900 kg/m^3).

CE128 – 13

C402.2.4

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.4 Thermal resistance of below-grade walls. The minimum thermal resistance (R-value) of the insulating materials installed ~~in, or~~ continuously within or on the below-grade walls shall be as specified in Table C402.2 and shall extend to a depth of not less than 10 feet (3048 mm) below the outside finish ground level, or to the level of the floor of the conditioned space enclosed by the below-grade wall, whichever is less.

CE129 – 13

C402.2.5

Proponent: Joseph Lstiburek, Building Science Corporation, representing self

Delete and substitute as follows:

~~**C402.2.5 Floors over outdoor air or unconditioned space.** The minimum thermal resistance (*R*-value) of the insulating material installed either between the floor framing or continuously on the floor assembly shall be as specified in Table C402.2, based on construction materials used in the floor assembly.~~

~~"Mass floors" shall include floors weighing not less than:~~

~~1. 35 psf (170 kg/m^2) of floor surface area; or~~

~~2. 25 psf (120 kg/m^2) of floor surface area if the material weight is not more than 12 pcf (1,900 kg/m^3).~~

C402.2.5 Floors. Floor framing cavity insulation or structural slab insulation shall be installed to maintain permanent contact with the underside of the subfloor decking or structural slabs.

> **Exception:** The floor framing cavity insulation or structural slab insulation shall be permitted to be in contact with the topside of sheathing or continuous insulation installed on the bottom side of floor framing when combined with insulation that meets or exceeds the minimum Metal framed or Wood framed and other Walls, Above Grade, R-value in Table C402.1.2 and extends from the bottom to the top of all perimeter floor framing or floor assembly members.

CE130 – 13

C402.2.5

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.5 Floors ~~over outdoor air or unconditioned space~~. The minimum thermal resistance (R-value) of the insulating materials installed either between the floor framing or continuously on the floor assembly shall be as specified in Table C402.2, based on construction materials used in the floor assembly. Insulation applied on the underside of the floor assembly facing outdoor air or unconditioned space shall be installed to maintain permanent contact with the underside of the floor assembly.

> **Exception**: Insulation applied to the underside of concrete floor slabs shall be permitted an air space of not more than 1 inch where it turns up and is in contact with the underside of the floor under walls associated with the *building thermal envelope.*

CE131-13

C402.2.6

Proposed Change as Submitted

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.2.6 Slab~~s~~-on-grade perimeter insulation. Where the slab-on-grade is in contact with the ground**,** the minimum thermal resistance (*R*-value) of the insulation around the perimeter of unheated or heated slab-on-grade floors designed in accordance with the *R*-value method of Section C402.1.2 shall be as specified in Table C402.2. The insulation shall be placed on the outside of the foundation or on the inside of the foundation wall. The insulation shall extend downward from the top of the slab for a minimum distance as shown in the table or to the top of the footing, whichever is less, or downward to at least the bottom of the slab and then horizontally to the interior or exterior for the total distance shown in the table. Insulation extending away from the building shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil.

Exception: Where the slab-on-grade floor is greater than 24 inches (61 mm) below the finished exterior grade, perimeter insulation is not required.

CE133 – 13

C202 (NEW), C402.2.7

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

~~**C402.2.7**~~ **C402.3.5 ~~Opaque d~~Doors.** *Opaque doors* ~~(having less than 50% glass area)~~ shall meet the applicable requirements for doors as specified in Table C402.2 and be considered part of the gross area of above-grade walls that are part of the building *thermal* envelope. All other doors shall meet the provisions of Section C402.3.3 for vertical fenestration.

Add a definition as follows:

OPAQUE DOORS. Doors that are at least 50 percent opaque in surface area.

CE134 – 13

C202 (NEW), C402.2.8

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.2.8 Insulation of radiant heating systems. *Radiant heating system* panels, and their associated components ~~U-bends and headers, designed for sensible heating of an indoor space through heat transfer from the thermally effective panel surfaces to the occupants or indoor space or thermal radiation and natural convection and the bottom surfaces of floor structures incorporating radiant heating~~ that are installed in interior or exterior assemblies shall be insulated with a minimum of R-3.5 (0.62 m2/K × W) on all surfaces not facing the space being heated. *Radiant heating system* panels that are installed in the *building thermal envelope* shall be separated from the exterior of the building or unconditioned or exempt spaces by not less than the R-value of insulation installed in the opaque assembly in which they are installed or the assembly shall comply with Section C402.1.2.

Exception: Heated slabs on grade insulated in accordance with Section C402.2.6.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

RADIANT HEATING SYSTEM. A heating system that transfers heat to objects and surfaces within a conditioned space primarily by infrared radiation.

CE137-13

C202 (NEW), C402.3, C402.3.1.1, C402.3.1.2, C402.3.2.1, C402.3.3.3, C402.3.3.4, Table C406.3, C408.3.1

Proposed Change as Submitted

Proponent: Jack Bailey, One Lux Studio, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

Revise as follows:

C402.3 Fenestration (Prescriptive). Fenestration shall comply with Table C402.3. ~~Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.~~ *Daylight responsive controls* shall comply this section and Section C405.2.2.3.2.

C402.3.1.1 Increased vertical fenestration area with daylighting controls daylight responsive controls. In Climate Zones I through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. No less than 50 percent of the conditioned floor area is within a daylight zone;

2. ~~Automatic daylighting controls~~ *Daylight responsive controls* are installed in daylight zones; and

3. Visible transmittance (VT) of vertical fenestration is greater than or equal to 1.1 times solar heat gain coefficient (SHGC).

   Exception: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 3.

C402.3.1.2 Increased skylight area with ~~daylighting controls~~ daylight responsive controls. The skylight area shall be permitted to be a maximum of 5 percent of the roof area provided ~~automatic daylighting controls~~ *daylight responsive controls* are installed in daylight zones under skylights.

C402.3.2.1 Lighting controls in daylight zones under skylights. ~~All lighting in the daylight zone shall be controlled by multilevel lighting controls that comply with Section C405.2.2.3.3.~~ *Daylight responsive controls* shall be provided to control the electric lights within *daylight zones* under skylights.

~~**Exception:** Skylights above daylight zones of enclosed spaces are not required in:~~

~~1. Buildings in Climate Zones 6 through 8.~~

~~2. Spaces where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2).~~

~~3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.~~

~~4. Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.~~

C402.3.3.3 Increased skylight SHGC. In Climate Zones 1 through 6, skylights shall be permitted a maximum SHGC of 0.60 where located above daylight zones provided with ~~automated daylighting controls~~ *daylight responsive controls*.

C402.3.3.4 Increased skylight *U*-factor. Where skylights are installed above daylight zones provided with ~~automated daylighting controls~~ *daylight responsive controls*, a maximum *U*-factor of 0.9 shall be permitted in Climate Zones 1 through 3; and a maximum *U*-factor of 0.75 shall be permitted in Climate Zones 4 through 8.

TABLE C406.3

REDUCED INTERIOR LIGHTING POWER

(*Portions of Table not shown remain unchanged)*

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. First LPD value applies if no less than 30 percent of conditioned floor area is in daylight zones. ~~Automatic daylighting controls~~ *Daylight responsive controls* shall be installed in daylight zones and shall meet the requirements of Section C405.2.2.3. In all other cases, second LPD value applies.

c. No less than 70 percent of the floor area shall be in the daylight zone. Automatic daylighting controls shall be installed in daylight zones and shall meet the requirements of Section 405.2.2.3.

C408.3.1 Functional testing. Testing shall ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. The construction documents shall state the party who will conduct the required functional testing. Where required by the code official, an approved party independent from the design or construction of the project shall be responsible for the functional testing and shall provide documentation to the code official certifying that the installed lighting controls meet the provisions of Section C405.

Where occupant sensors, time switches, programmable schedule controls, photosensors or ~~daylighting controls~~ *daylight responsive controls* are installed, the following procedures shall be performed:

1. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance.

2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.

3. Confirm that the placement and sensitivity adjustments of ~~photosensor~~ *daylight responsive controls* reduce electric light based on the amount of usable daylight in the space as specified.

Add new definition as follows:

SECTION C202

GENERAL DEFINITIONS

DAYLIGHT RESPONSIVE CONTROL. A device or system that provides automatic control of electric light levels based on the amount of daylight in a space.

CE139 – 13

C402.3, C402.3.1.1, C402.3.1.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.3 Fenestration (Prescriptive). Fenestration shall comply with Table C402.3. ~~Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.~~

C402.3.1.1 Increased vertical fenestration area with daylighting controls. In Climate Zones 1 through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. No less than 50 percent of the conditioned floor area is within a daylight zone;
2. Automatic daylighting controls complying with Section C405.2.2.3.2 are installed in daylight zones; and
3. Visible transmittance (VT) of vertical fenestration is greater than or equal to 1.1 times solar heat gain coefficient (SHGC).

   Exception: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 3.

C402.3.1.2 Increased skylight area with daylighting controls. The skylight area shall be permitted to be a maximum of 5 percent of the roof area provided automatic daylighting controls complying with Section C405.2.2.3.2 are installed in daylight zones under the skylights.

CE140 – 13

C402.3, Table C402.3

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.3 Fenestration (Prescriptive). Fenestration shall comply with Sections C402.3 through C402.3.4 and Table C402.3. Automatic daylighting controls specified by this section shall comply with Section C405.2.2.3.2.

TABLE C402.3
BUILDING ENVELOPE FENESTRATION MAXIMUM U-FACTOR AND SHGC ~~REQUIREMENTS: FENESTRATION~~

CE142-13

Table C402.3, C402.3.3, C402.3.3.1, Table C402.3.3.1

Proposed Change as Submitted

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov); Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee and Aluminum Extruders Council (culp@birchpointconsulting.com)

Revise as follows:

TABLE C402.3

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Vertical fenestration																
***U*-factor**																
Fixed fenestration	0.50		0.50		0.46		0.38		0.38		0.36		0.29		0.29	
Operable fenestration	0.65		0.65		0.60		0.45		0.45		0.43		0.37		0.37	
Entrance doors	1.10		0.83		0.77		0.77		0.77		0.77		0.77		0.77	
SHGC																
Orientation[a]	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N	SEW	N
~~SHGC~~ PF < 0.2	0.25	0.33	0.25	0.33	0.25	0.33	0.40	0.53	0.40	0.53	0.40	0.53	0.45	NR	0.45	NR
0.2 ≤ PF < 0.5	0.30	0.37	0.30	0.37	0.30	0.37	0.48	0.58	0.48	0.58	0.48	0.58	NR	NR	NR	NR
PF ≥ 0.5	0.40	0.40	0.40	0.40	0.40	0.40	0.64	0.64	0.64	0.64	0.64	0.64	NR	NR	NR	NR
Skylights																
U-factor	0.75		0.65		0.55		0.50		0.50		0.50		0.50		0.50	
SHGC	0.35		0.35		0.35		0.40		0.40		0.40		NR		NR	

NR = No requirement.

a. "N" indicates vertical fenestration oriented within 45 degrees of true north. "SEW" indicates orientations other than "N." For buildings in the southern hemisphere, reverse south and north. Buildings located at less than 23.5 degrees latitude shall use SEW for all orientations.

C402.3.3 Maximum *U*-factor and SHGC. For vertical fenestration, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table C402.3, based on the window projection factor and orientation. For skylights, the maximum *U*-factor and solar heat gain coefficient (SHGC) shall be as specified in Table C402.3.
The window projection factor shall be determined in accordance with Equation 4-2.
PF = *A/B* **(Equation 4-2)**
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.

~~**C402.3.3.1 SHGC adjustment.** Where the fenestration projection factor for a specific vertical fenestration product is greater than or equal to 0.2, the required maximum SHGC from Table C402.3 shall be adjusted by multiplying the required maximum SHGC by the multiplier specified in Table C402.3.3.1 corresponding with the orientation of the fenestration product and the projection factor.~~

~~**TABLE C402.3.3.1**~~

~~**SHGC ADJUSTMENT MULTIPLIERS PROJECTION FACTOR**~~	~~**ORIENTED WITHIN 45 DEGREES OF TRUE NORTH**~~	~~**ALL OTHER ORIENTATION**~~
~~0.2 ≤ PF < 0.5~~	~~1.1~~	~~1.2~~
~~PF ≤□0.5~~	~~1.2~~	~~1.6~~

CE148 – 13

C402.3.2

Proponent: Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee (culp@birchpointconsulting.com)

Revise as follows:

C402.3.2 Minimum skylight fenestration area. In an enclosed space greater than ~~10,000~~ 2,500 square feet (~~929~~ 232 m^2), directly under a roof with ceiling heights greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage, gymnasium/exercise center, convention center, automotive service, manufacturing, nonrefrigerated warehouse, retail store, distribution/sorting area, transportation, or workshop, the total daylight zone under skylights shall be not less than half the floor area and shall provide a minimum skylight area to daylight zone under skylights of either:

1. Not less than 3 percent with a skylight VT of at least 0.40; or

2. Provide a minimum skylight effective aperture of at least 1 percent determined in accordance with Equation 4-1.

(Equation 4-1) Skylight Effective Aperature= $\frac{0.85 \times \text{Skylight Area} \times \text{Skylight VT} \times \text{WF}}{\text{Daylight zone under skylight}}$

where:

Skylight area = Total fenestration area of skylights.
Skylight VT = Area weighted average visible transmittance of skylights.
WF = Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater.
Light well depth = Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.

Exception: Skylights above daylight zones of enclosed spaces are not required in:

1. Buildings in climate zones 6 through 8.
2. Spaces where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2).
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
4. Spaces where the daylight zone under the rooftop monitors is greater than 50 percent of the enclosed space floor area.
5. Spaces where the total area minus the area of *daylight zones adjacent to vertical fenestration* is less than 2,500 square feet (929 232 m^2), and where the lighting is controlled according to Section C405.2.2.3.2.

CE149-13

C402.3.2

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.3.2 Minimum skylight fenestration area. In an enclosed space greater than 10,000 square feet (929 m^2) in floor area directly under a roof with a not less than 75 percent of ceiling area with heights greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage space, gymnasium/exercise center, convention center, automotive service area, space where manufacturing occurs, non-refrigerated warehouse, retail store, distribution/sorting area, transportation depot, or workshop, the total daylight zone under skylights shall be not less than half the floor area and shall provide ~~a minimum skylight area to daylight zone under skylights of~~ either

1. A minimum skylight area to daylight zone under skylights of not less than 3 percent with a skylight where all skylights have a VT of at least 0.40 when tested in accordance with NFRC 202, or
2. A provide minimum skylight effective aperture of at least 1 percent as determined in accordance with Equation 4-1.

(Equation 4-1) Skylight Effective Aperature= $\frac{0.85 \times \text{Skylight Area} \times \text{Skylight VT} \times \text{WF}}{\text{Daylight zone under skylight}}$

where:

Skylight area = Total fenestration area of skylights.

Skylight VT = Area weighted average visible transmittance of skylights.

WF = Area weighted average well factor, where well factor is 0.9 if light well depth is less than 2 feet (610 mm), or 0.7 if light well depth is 2 feet (610 mm) or greater.

Light well depth = Measure vertically from the underside of the lowest point of the skylight glazing to the ceiling plane under the skylight.

Exception: Skylights above daylight zones of enclosed spaces are not required in:

1. Buildings in climate zones 6 through 8.
2. Spaces where the designed *general lighting* power densities are less than 0.5 W/ft^2 (5.4 W/m^2).
3. Areas where it is documented that existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed area for more than 1,500 daytime hours per year between 8 am and 4 pm.
4. Spaces where the daylight zone under rooftop monitors is greater than 50 percent of the enclosed space floor area.

Public Comment:

Jeremiah Williams, U.S. Department of Energy, requests Approval as Modified by this Public Comment. Modify the proposal as follows:

C402.3.2 Minimum skylight area. In an enclosed space greater than 10,000 square feet (929 m^2) in floor area directly under a roof with a not less than 75 percent of the ceiling area with a ceiling height ~~heights~~ greater than 15 feet (4572 mm), and used as an office, lobby, atrium, concourse, corridor, storage space, gymnasium/exercise center, convention center, automotive service area, space where manufacturing occurs, non-refrigerated warehouse, retail store, distribution/sorting area, transportation depot, or workshop, the total daylight zone under skylights shall be not less than half the floor area and shall provide either

1. A minimum skylight area to daylight zone under skylights of not less than 3 percent where all skylights have a VT of at least 0.40 ~~when tested in accordance with NFRC 202~~ as determined in accordance with Section C303.1.3, or
2. A minimum skylight effective aperture of at least 1 percent as determined in accordance with Equation 4-1.

CE152-13

C402.3.3 (NEW)

Proposed Change as Submitted

Proponent: Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee (culp@birchpointconsulting.com)

Add new text as follows:

C402.3.3 Daylight zones. In *buildings* not greater than two stories above grade plane, not less than 10 percent of the net floor area shall be located within a *daylight zone*. In *buildings* three or more stories above grade plane, not less than 5 percent of the net floor area shall be located within a *daylight zone.*

Exception: Daylighting in accordance with this section is not required in the following spaces:

1. Auditoriums, places of religious worship, theaters, museums, mercantile occupancies with less than 10,000 square feet of net floor area, and refrigerated warehouses.

2. Existing buildings undergoing *alteration*, *repair*, relocation, or a change of occupancy.

3. *Buildings* where the total daylight potential (TDP) calculated in accordance with Section 808.3 of the *International Green Construction Code* is less than 0.5.

Public Comment:

Dr. Thomas C. Culp, Birch Point Consulting LLC, representing Glazing Industry Code Committee, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C402.3.1.1 Increased vertical fenestration area with daylighting controls. In Climate Zones 1 through 6, a maximum of 40 percent of the gross above-grade wall area shall be permitted to be vertical fenestration, provided:

1. In buildings not greater than two stories above grade, not No less than 50 percent of the conditioned net floor area is within a *daylight zone*; In buildings three or more stories above grade, not less than 25 percent of the net floor area is within a *daylight zone*;

2. Automatic daylighting controls are installed in daylight zones; and

3. Visible transmittance (VT) of vertical fenestration is greater than or equal to 1.1 times solar heat gain coefficient (SHGC).

Exception: Fenestration that is outside the scope of NFRC 200 is not required to comply with Item 3.

~~**C402.3.3 Daylight zones.** In *buildings* not greater than two stories above grade plane, not less than 10 percent of the net floor area shall be located within a *daylight zone*. In *buildings* three or more stories above grade plane, not less than 5 percent of the net floor area shall be located within a *daylight zone*.~~

~~**Exception:** Daylighting in accordance with this section is not required in the following spaces:~~

~~1. Auditoriums, places of religious worship, theaters, museums, mercantile occupancies with less than 10,000 square feet of net floor area, and refrigerated warehouses.~~

~~2. Existing buildings undergoing *alteration*, *repair*, relocation, or a change of occupancy.~~

~~3. *Buildings* where the total daylight potential (TDP) calculated in accordance with Section 808.3 of the *International Green Construction Code* is less than 0.5.~~

Section C202

Definitions:

FLOOR AREA, NET. The actual occupied area not including unoccupied accessory areas such as corridors, stairways, toilet rooms, mechanical rooms and closets.

CE153-13

C402.3.2.2

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.3.2.2 Haze factor. Skylights in office, storage, automotive, service, manufacturing, non-refrigerated warehouse, retail store and distribution/sorting area spaces shall have a glazing materials or diffuser with a measured haze factor greater than 90 percent when tested in accordance with Procedure A of ASTM D 1003.
Exception: Skylights ~~designed~~ installed to exclude direct sunlight entering the occupied space by use of fixed or automated baffles, or the geometry of skylight and light well ~~need not comply with Section C402.3.2.2.~~

Public Comment:
Jeremiah Williams, U.S. Department of Energy, requests Approval as Modified by this Public Comment. Modify the proposal as follows:
C402.3.2.2 Haze factor. Skylights in office, storage, automotive service, manufacturing, non-refrigerated warehouse, retail store and distribution/sorting area spaces shall have a glazing materials or diffuser with a haze factor greater than 90 percent when tested in accordance with ~~Procedure A of~~ ASTM D 1003.

Exception: Skylights designed and installed in such a manner as to exclude direct sunlight entering the occupied space by use of fixed or automated baffles, or the geometry of the skylight and light well.

CE154 – 13

C402.3.2.2

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C402.3.2.2 Haze factor. Skylights in office, storage, automotive service, manufacturing, nonrefrigerated warehouse, retail store, and distribution/sorting area spaces shall have a glazing material or diffuser with a measured haze factor greater than 90 percent when tested in accordance with the procedures contained in ASTM D 1003.

Exception: Skylights designed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles, or the geometry of skylight and light well need not comply with Section C402.3.2.2.

CE155 – 13

C402.3.3

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.3.3 Maximum U-factor and SHGC. ~~For vertical fenestration, the~~ The maximum U-factor and solar heat gain coefficient (SHGC) for fenestration shall be as specified in Table C402.3, ~~based on the window projection factor. For skylights, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table C402.3.~~

The window projection factor shall be determined in accordance with Equation 4-2.

$PF = A/B$ **(Equation 4-2)**

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.

CE158 – 13

C402.3.3.2

Proponent: Brian Dean, ICF International, representing Energy Efficient Codes Coalition; Garrett Stone, Brickfield Burchette Ritts & Stone, PC; Jeff Harris, Alliance to Save Energy; Harry Misuriello, American Council for an Energy-Efficient Economy; Bill Prindle, Energy Efficient Codes Coalition; and Don Vigneau, Northeast Energy Efficiency Partnerships.

Delete without substitution as follows:

~~**C402.3.3.2 Increased vertical fenestration SHGC.** In Climate Zones 1, 2 and 3, vertical fenestration entirely located not less than 6 feet (1729 mm) above the finished floor shall be permitted a maximum SHGC of 0.40.~~

CE161-13, Part I

C402.3.3.5, R402.3.2 (IRC N1102.3.2)

Proposed Change as Submitted

Proponent: Dr. Helen Sanders, SAGE Electrochromics Inc. (helen.sanders@sageglass.com)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C402.3.3.5 Dynamic glazing. ~~For compliance with Section C402.3.3, the SHGC for *dynamic glazing* shall be determined using the manufacturer's lowest-rated SHGC, and the VT/SHGC ratio shall be determined using the maximum VT and maximum SHGC.~~ *Dynamic glazing* shall be permitted to satisfy the SHGC and VT requirements of Table C402.3 and Section C402.3.1.1 provided the ratio of the higher to lower labeled SHGC is greater than or equal to 3, and the *dynamic glazing* is automatically controlled to modulate the amount of solar

gain into the space in multiple steps. *Dynamic glazing* shall be considered separately from other fenestration, and area-weighted averaging with other fenestration that is not *dynamic glazing* shall not be permitted.

Public Comment:

Dr. Helen Sanders, SAGE Electrochromics Inc., requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C402.3.3.5 Dynamic glazing. *Dynamic glazing* shall be permitted to satisfy the SHGC and VT requirements of Section ~~Table~~ C402.3 ~~and Section C402.3.1.1~~ provided the ratio of the higher to lower labeled SHGC is greater than or equal to 3 2.4, and the *dynamic glazing* is automatically controlled to modulate the amount of solar gain into the space in multiple steps. *Dynamic glazing* shall be considered separately from other fenestration, and area-weighted averaging with other fenestration that is not *dynamic glazing* shall not be permitted.

Exception: *Dynamic glazing* is not required to comply with this section when both the lower and higher labeled SHGC already comply with the requirements of Table C402.3.

CE164-13

C402.4, C402.4.1.2, C402.4.1.2.3

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.4 Air leakage (Mandatory). The thermal envelope of buildings shall comply with Sections C402.4.1 through C402.4.8. Alternatively the building thermal envelope shall be permitted to be tested in accordance with ASTM E779 at a pressure differential of 0.3 inches water gauge, or an equivalent method approved by the code official, and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope does not exceed 0.40 cfm/ft^2. Where compliance is based on such testing the building shall also comply with Sections C402.4.5, 402.4.6 and 402.4.7.

C402.4.1.2 Air barrier compliance options. A continuous air barrier for the opaque portions of the building thermal envelope shall comply with Section C402.4.1.2.1, or C402.4.1.2.2. or C402.4.1.2.3.

~~**C402.4.1.2.3 Building test.** The completed building shall be tested and the air leakage rate of the *building envelope* shall not exceed 0.40 cfm/ft^2 at a pressure differential of 0.3 inches water gauge (2.0 L/s · m^2 at 75 Pa) in accordance with ASTM E 779 or an equivalent method approved by the code official.~~

Public Comment 1:
Jeremiah Williams, U.S. Department of Energy, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C402.4 Air leakage (Mandatory). The thermal envelope of buildings shall comply with Sections C402.4.1 through C402.4.8. Alternatively the building thermal envelope shall be permitted to be tested in accordance with ASTM E779 at a pressure differential of 0.3 inches water gauge, or an equivalent method approved by the code official, and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope does not exceed 0.40 cfm/ft^2. Where compliance is based on such testing the building shall also comply with Sections C402.4.5, 402.4.6 and 402.4.7.

C402.4.1.1 Air barrier construction. The *continuous air barrier* shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. Air barrier penetrations shall be sealed in accordance with Section C402.4.2. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Recessed lighting fixtures shall comply with Section C404.2.8. Where similar objects are installed which penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

   ~~**Exception:** Buildings that comply with Section C402.4.1.2.3 are not required to comply with Items 1 and 3.~~

(Portions of code change proposal not shown remain unchanged)

CE165-13

C402.4

Proposed Change as Submitted

Proponent: Mark S. Graham, National Roofing Contractors Association (mgraham@nrca.net)

Revise as follows:

C402.4 Air leakage (Mandatory). The thermal envelope of buildings shall comply with Sections C402.4.1 through C402.4.8.

Exception: The provisions of this section shall not be required for roof repairs, roof recovering and roof replacement where the alterations, renovations or repairs to the building do not also include alterations, renovations or repairs to the remainder of the building envelope.

Public Comment:

Jason Wilen, AIA, CDT, RRO, National Roofing Contractors Association, requests Approval as Modified by this Public Comment.

Replace the proposal as follows:

C101.4.3 Additions, alterations, renovations or repairs. Additions, alterations, renovations or repairs to an existing building, building system or portion thereof shall conform to the provisions of this code as they relate to new construction without requiring the unaltered portion(s) of the existing building or building system to comply with this code. Additions, alterations, renovations or repairs shall not create an unsafe or hazardous condition or

overload existing building systems. An addition shall be deemed to comply with this code if the addition alone complies or if the existing building and addition comply with this code as a single building.

Exception: The following need not comply provided the energy use of the building is not increased:

1. Storm windows installed over existing fenestration.
2. Glass only replacements in an existing sash and frame.
3. Existing ceiling, wall or floor cavities exposed during construction provided that these cavities are filled with insulation.
4. Construction where the existing roof, wall or floor cavity is not exposed.
5. Reroofing for roofs where neither the sheathing nor the insulation is exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.
6. Replacement of existing doors that separate *conditioned space* from the exterior shall not require the installation of a vestibule or revolving door, provided, however, that an existing vestibule that separates a *conditioned space* from the exterior shall not be removed,
7. Alterations that replace less than 50 percent of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.
8. Alterations that replace only the bulb and ballast within the existing luminaires in a space provided that the *alteration* does not increase the installed interior lighting power.
9. Air barriers shall not be required for roof repair, roof recover, and roof replacement where the alterations, renovations or repairs to the building do not also include alterations, renovations or repairs to the remainder of the building envelope.

CE166-13

C402.4.1

Proposed Change as Submitted

Proponent: Theresa A. Weston, PhD., DuPont Building Innovations (theresa.a.weston@usa.dupont.com)

Revise as follows:

C402.4.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof. The air barrier shall comply with Sections C402.4.1.1 and C402.4.1.2.

~~**Exception:** Air barriers are not required in buildings located in Climate Zones 1, 2 and 3.~~

Public Comment 1:

Theresa W. Weston, DuPont Building Innovations, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C402.4.1 Air barriers. A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof. The air barrier shall comply with Sections C402.4.1.1 and C402.4.1.2.

Exception: Air barriers are not required in buildings located in Climate Zone 2B

CE167-13

C402.4.1.1, C402.4.2

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.4.1.1 Air barrier construction. The *continuous air barrier* shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. Air barrier penetrations shall be sealed in accordance with Section C402.4.2. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seats associated with penetrations shall be sealed in the same manner or taped or covered with moisture vapor-permeable wrapping material. Sealing materials shall be appropriate to the construction materials being sealed and shall be securely installed around the penetration so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

~~3.~~ 4. Recessed lighting fixtures shall comply with Section C404.2.8. Where similar objects are installed which penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

Exception: Buildings that comply with Section C402.4.1.2.3 are not required to comply with Items 1 and 3.

~~**C402.4.2 Air barrier penetrations.** Penetrations of the air barrier and paths of air leakage shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seals shall be sealed in the same manner or taped or covered with moisture vapor-permeable wrapping material. Sealing materials shall be appropriate to the construction materials being sealed. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.~~

Public Comment:

Jeremiah Williams, U.S. Department of Energy, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C402.4.1.1 Air barrier construction. The *continuous air barrier* shall be constructed to comply with the following:

1. The air barrier shall be continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.
2. Air barrier joints and seams shall be sealed, including sealing transitions in places and changes in materials. ~~Air barrier penetrations shall be sealed in accordance with Section C402.4.2.~~ The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.
3. Penetrations of the air barrier shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seats associated with penetrations shall be sealed in the same manner or taped or covered with moisture vapor-permeable wrapping material. Sealing materials shall be appropriate to the construction materials being sealed and shall be securely installed

around the penetration so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

4. Recessed lighting fixtures shall comply with Section C404.2.8. Where similar objects are installed which penetrate the air barrier, provisions shall be made to maintain the integrity of the air barrier.

Exception: Buildings that comply with Section C402.4.1.2.3 are not required to comply with Items 1 and 3.

CE173 – 13

C402.4.1.2.1

Proponent: Charles Clark, Brick Industry Association, representing Masonry Alliance for Codes and Standards (cclark@bia.org)

Revise as follows:

402.4.1.2.1 Materials. Materials with an air permeability no greater than 0.004 cfm/ft^2 (0.02 L/s·m^2) under a pressure differential of 0.3 in. water (w.g.)(75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Materials in items 1 through ~~15~~ 16 shall be deemed to comply with this section provided joints are sealed and materials are installed as air barriers in accordance with the manufacturer's instructions.

16. Solid or fully grouted masonry constructed of clay or shale masonry units.

(Portions of text not shown remain unchanged)

CE175 – 13

C402.4.1.2.2

Proponent: Charles Clark, Brick Industry Association, representing Masonry Alliance for Codes and Standards (cclark@bia.org)

Revise as follows:

402.4.1.2.2 Assemblies. Assemblies of materials and components with an average air leakage not to exceed 0.04 cfm/ft^2 (0.2 L/s·m^2) under a pressure differential of 0.3 inches of water gauge (w.g.)(75 Pa) when tested in accordance with ASTM E 2357, ASTM E 1677 or ASTM E 283 shall comply with this section. Assemblies listed in items 1 ~~and 2~~ through 3 shall be deemed to comply provided joints are sealed and requirements of Section 402.4.1.1 are met.

1. Concrete masonry walls coated with either one application either of block filler or and two applications of a paint or sealer coating;
2. Masonry walls constructed of clay or shale masonry units with a nominal width of 4-inches or more;
3. ~~2.~~ A Portland cement/sand parge, stucco or plaster minimum ½ inch (12 mm) in thickness.

CE177-13, Part I

C402.4.1.2 (New), R402.1.2 (New), (IRC N1102.4.1.2 (New))

Proposed Change as Submitted

Proponent: Brent Ursenbach, Salt Lake County representing Utah Chapter ICC and Utah Association of Plumbing and Mechanical Officials Chapter ICC (bursenbach@slco.org)

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C 402.4.1.2 Combustion air openings. In climate zones 3 through 8, where open combustion air ducts provide combustion air to open combustion space conditioning fuel burning appliances, the appliances and combustion air opening shall be located outside the *building thermal envelope* or enclosed in a room, isolated from inside the thermal envelope. Such rooms shall be sealed and insulated in accordance with the envelope requirements of Table C402.1.2 or C402.2, where the walls shall meet a minimum of the below-grade wall R-value requirement. The door into the room shall be fully gasketed and any water lines and ducts in the room insulated in accordance with Section C403. The combustion air duct shall be insulated where it passes through conditioned space to a minimum of R-8.

Exceptions:

1. Direct vent appliances with both intake and exhaust pipes installed continuous to the outside.
2. Fireplaces and stoves complying with Sections 901, 902, 903, 904, and 905 of the *International Mechanical Code*, and Section 2111.13 of the *International Building Code.*

CE179-13, Part I

C402.4.2, Table R402.4.1.1 (IRC Table N1102.4.1.1)

Proposed Change as Submitted

Proponent: Jeffrey M. Hugo, CBO, National Fire Sprinkler Association (hugo@nfsa.org)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C402.4.2 Air barrier penetrations. Penetrations of the air barrier and paths of air leakage shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seals shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping material. Sealing materials shall be appropriate to the construction materials being sealed. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation.

Exception:

1. Penetrations of the air barrier for a*utomatic* sprinkler systems installed according to the *International Building Code* or the *International Fire Code*,

Public Comment:

Adolf Zubia. Chairman IAFC Fire and Life Safety Section, representing ICC Fire Code Action Committee, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C402.4.2 Air barrier penetrations. Penetrations of the air barrier and paths of air leakage shall be caulked, gasketed or otherwise sealed in a manner compatible with the construction materials and location. Joints and seals shall be sealed in the same manner or taped or covered with a moisture vapor-permeable wrapping

material. Sealing materials shall be appropriate to the construction materials being sealed. The joints and seals shall be securely installed in or on the joint for its entire length so as not to dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation. Sealing of concealed fire sprinklers, when required, shall be in a manner that is recommended by the manufacturer. Caulking or other adhesive sealants shall not be used to fill voids between fire sprinkler cover plates and walls or ceilings.

~~**Exception:**~~

~~1. Penetrations of the air barrier for *automatic* sprinkler systems installed according to the *International Building Code* or the *International Fire Code*,~~

CE183-13

C402.4.4

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.4.4 Doors and access openings to shafts, chutes, stairways, and elevator lobbies. Doors and access openings from conditioned space to shafts, chutes, stairways and elevator lobbies not within the scope of the fenestration assemblies covered in Section C402.4.3 shall ~~either meet the requirements of Section C402.4.3 or shall~~ be gasketed, weatherstripped or sealed.

Exception: Door openings required to comply with Section 716 or 716.4 of the *International Building Code*; or doors and door openings required to comply with UL 1784 by the International Building Code ~~to comply with UL 1784 shall not be required to comply with Section C402.4.4.~~

Public Comment:

Jeremiah Williams, U.S. Department of Energy, requests Approval as Modified by this Public Comment. Modify the proposal as follows:

C402.4.4 Doors and access openings to shafts, chutes, stairways, and elevator lobbies. Doors and access openings from conditioned space to shafts, chutes, stairways and elevator lobbies not within the scope of the fenestration assemblies covered in Section C402.4.3 shall be gasketed, weatherstripped or sealed.

Exception: Door openings required to comply with Section 716 or 716.4 of the International Building Code; or doors and door openings required to comply with UL 1784 by the International Building Code.

CE184 – 13

C402.4.4, C402.4.5, C402.4.5.1, C402.4.5.2, C403.2.4.4 (NEW)

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

~~**C402.4.4 Doors and access openings to shafts, chutes, stairways, and elevator lobbies.** Doors and access openings from conditioned space to shafts, chutes stairways and elevator lobbies shall either meet the requirements of Section C402.4.3 or shall be gasketed, weatherstripped or sealed.~~

~~**Exception:** Door openings required to comply with Section 715 or 715.4 of the *International Building Code*; or doors and door openings required by the *International Building Code* to comply with UL 1784 shall not be required to comply with Section C402.4.4.~~

C402.4.5 Air intakes, exhaust openings, stairways and shafts. Stairway enclosures and elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope shall be provided with dampers in accordance with Sections C402.4.5.1 and C402.4.5.2 C403.2.4.4.

~~**C402.4.5.1 Stairway and shaft vents.** Stairway and shaft vents shall be provided with Class I motorized dampers with a maximum leakage rate of 4 cfm/ft$_2$ (20.3 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.~~

~~Stairway and shaft vent dampers shall be installed with controls so that they are capable of automatically opening upon:~~

~~1. The activation of any fire alarm initiating device of the building's fire alarm system; or~~
~~2. The interruption of power to the damper.~~

~~**C402.4.5.2 Outdoor air intakes and exhausts.** *Outdoor air* supply and exhaust openings shall be provided with Class IA motorized dampers with a maximum leakage rate of 4 cfm/ft$_2$ (20.3 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.~~

~~**Exceptions:**~~

~~1. Gravity (nonmotorized) dampers having a maximum leakage rate of 20 cfm/ft$_2$ (101.6 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D are permitted to be used as follows:~~

~~1.1 In buildings for exhaust and relief dampers.~~

~~1.2 In buildings less than three stories in height above grade.~~

~~1.3. For ventilation air intakes and exhaust and relief dampers in buildings of any height located in Climate Zones 1, 2 and 3.~~

~~1.4. Where the design *outdoor air* intake or exhaust capacity does not exceed 300 cfm (141 L/s).~~

~~Gravity (nonmotorized) dampers for ventilation air intakes shall be protected from direct exposure to wind.~~

~~2. Dampers smaller than 24 inches (610 mm) in either dimension shall be permitted to have a leakage of 40 cfm/ft^2 (203.2 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.~~

C403.2.4.4 Shutoff dampers. Outdoor air intake and exhaust openings and stairway and shaft vents shall be provided with Class 1 motorized dampers having a maximum air leakage rate of 4 cfm/ft^2 of damper surface area at 1.0 inch water gauge when tested in accordance with AMCA 500D. Outdoor air intake and exhaust dampers shall be installed with automatic controls configured to close when the systems or spaces served are not in use or during unoccupied period warm-up and setback operation unless the systems served require outdoor or exhaust air in accordance with the *International Mechanical Code* or the dampers are opened to provide intentional economizer cooling.

Stairway and shaft vent dampers shall be installed with automatic controls configured to open upon the activation of any fire alarm initiating device of the building's fire alarm system or the interruption of power to the damper.

Exceptions: Gravity (non-motorized) dampers shall be permitted to be used as follows:

1. In buildings less than three stories in height above grade plane.
2. In buildings of any height in climate zones 1, 2 or 3.
3. Where the design exhaust capacity is not greater than 300 cfm.

All gravity (non-motorized) dampers shall have a maximum air leakage rate of 20 cfm/ft^2 where not less than 24 inches in either dimension and 40 cfm/ft^2 where less than 24 inches in either dimension. The rate of air leakage shall be determined at 1.0 inch water gauge when tested in accordance with AMCA 500D.

CE186 – 13

C402.4.5.1

Proponent: Amanda Hickman, Intercode Incorporated, representing AMCA International (Amanda@intercodeinc.com)

Revise as follows:

C402.4.5.1 Stairway and shaft vents. Stairway and shaft vents shall be provided with Class I motorized dampers. Dampers shall have with a maximum leakage rate of 4 cfm/ft2 (20.3 L/s · m2) at 1.0 inch water gauge (w.g.) (249 Pa) and shall be labeled by an *approved agency* when tested in accordance with AMCA 500D for such purpose.
Stairway and shaft vent dampers shall be installed with controls so that they are capable of automatically opening upon:

1. The activation of any fire alarm initiating device of the building's fire alarm system; or
2. The interruption of power to the damper.

CE187 – 13

C402.4.5.2

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International

Revise as follows:

C402.4.5.2 Outdoor air intakes and exhausts. *Outdoor air* supply and exhaust openings shall be provided with Class ~~IA~~ I motorized dampers with a maximum leakage rate of 4 cfm/ft2 (20.3 L/s · m2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.

Exceptions:

1. Gravity (nonmotorized) dampers having a maximum leakage rate of 20 cfm/ft$_2$ (101.6 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D are permitted to be used as follows:
   1.1. In buildings for exhaust and relief dampers.
   1.2. In buildings less than three stories in height above grade.
   1.3. For ventilation air intakes and exhaust and relief dampers in buildings of any height located in Climate Zones 1, 2 and 3.
   1.4. Where the design *outdoor air* intake or exhaust capacity does not exceed 300 cfm (141 L/s). Gravity (nonmotorized) dampers for ventilation air intakes shall be protected from direct exposure to wind.
2. Dampers smaller than 24 inches (610 mm) in either dimension shall be permitted to have a leakage of 40 cfm/ft^2 (203.2 L/s · m^2) at 1.0 inch water gauge (w.g.) (249 Pa) when tested in accordance with AMCA 500D.

CE188 – 13

C402.4.5.2

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International (amanda@intercodeinc.com)

Revise as follows:

C402.4.5.2 Outdoor air intakes and exhausts. *Outdoor air* supply and exhaust openings shall be provided with Class IA motorized dampers. The dampers shall have ~~with~~ a maximum leakage rate of 4 cfm/ft2 (20.3 L/s · m2) at 1.0 inch water gauge (w.g.) (249 Pa) and shall be labeled by an *approved agency* when tested in accordance with AMCA 500D for such purpose.

CE192-13

C202 (NEW), C402.4.7, Chapter 5

Proposed Change as Submitted

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International (amanda@intercodeinc.com)

Revise as follows:

C402.4.7 Vestibules. All building entrances 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. The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors.

Exceptions: Vestibules are not required for the following:

1. Buildings in Climate Zones 1 and 2.
2. Doors not intended to be used by the public, such as doors to mechanical or electrical equipment rooms, or intended solely for employee use.
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 that have an installed air curtain that has been tested in accordance with ANSI/AMCA 220. Air curtains shall be controlled with the opening and closing of the door.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

AIR CURTAIN. A device that generates and discharges a laminar air stream installed at the building entrance intended to prevent the infiltration of external, unconditioned air into the conditioned spaces, or the loss of interior, conditioned air to the outside.

Add new standard to Chapter 5 as follows:
AMCA
220-05 Laboratory Methods of Testing Air Curtain Units for Aerodynamic Performance Rating.

Public Comment:

Shaunna Mozingo, City of Cherry Hills Village, CO, representing Colorado Chapter of ICC, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C402.4.7 Vestibules. All building entrances 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. The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors.

Exceptions: Vestibules are not required for the following*:*

1. Buildings in Climate Zones 1 and 2.
2. Doors not intended to be used by the public, such as doors to mechanical or electrical equipment rooms, or intended solely for employee use.
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 that have an air curtain with a minimum velocity of 2 m/s at the floor, that has have been tested in accordance with ANSI/AMCA 220 and installed in accordance with manufacturer's instructions. Air curtains shall be controlled Manual or automatic controls shall be provided that will operate the air curtain with the opening and closing of the door. Air curtains and their controls shall comply with Section C408.2.3.

(Portions of proposal not shown remain unchanged)

CE193 – 13

C402.4.8

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C402.4.8 Recessed lighting. Recessed luminaires installed in the building thermal envelope shall be: ~~sealed to limit air leakage between conditioned and unconditioned spaces. All recessed luminaires shall be~~

1. IC-rated, and
2. Llabeled as having an air leakage rate of not more than 2.0 cfm when tested in accordance with ASTM D E 283 at a 1.57 psf pressure differential, and. ~~All recessed luminaires shall be s~~
3. Sealed with gasket or caulk between the housing and interior wall or ceiling covering.

CE194-13

C202 (NEW), C402.1, C402.5 (NEW), C403.1, C403.5 (NEW), C403.6, C405.1, C405.10 (NEW)

Proposed Change as Submitted

Proponent: Tim Nogler, Washington Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C402.1 General (Prescriptive). The building thermal envelope shall comply with Section C402.1.1. Section C402.1.2 shall be permitted as an alternative to the *R*-values specified in Section C402.1.1. Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C402.5.

C402.5 Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers. *Walk-in coolers*, *walk-in freezers*, *refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall comply with all of the following:

1. Be equipped with automatic door closers that firmly close walk-in doors that have been closed to within 1 inch of full closure.

   Exception: Automatic closers are not required for doors wider than 3 feet 9 inches or taller than 7 feet.
2. Doorways shall have strip doors, curtains, spring-hinged doors, or other method of minimizing infiltration when doors are open.

3. *Walk-in coolers* and *refrigerated warehouse coolers* shall contain wall, ceiling, and door insulation of not less than R–25 and *walk-in freezers* and *refrigerated warehouse freezers* shall contain wall, ceiling, and door insulation of not less than R–32.

   Exception: Glazed portions of doors or structural members need not be insulated.

4. *Walk-in freezers* shall contain floor insulation of not less than R–28.

5. Transparent reach-in doors for *walk-in freezers* and windows in *walk-in freezer* doors shall be of triple-pane glass, either filled with inert gas or with heat-reflective treated glass.

6. Windows and transparent reach-in doors for *walk-in coolers* doors shall be of double-pane or triple-pane, inert gas-filled, heat-reflective treated glass.

C403.1 General. Mechanical systems and equipment serving the building heating, cooling, or ventilating needs shall comply with Section C403.2 (referred to as the mandatory provisions) and either:
1. Section C403.3 (Simple systems); or
2. Section C403.4 (Complex systems).

Walk-in coolers, *walk-in freezers*, *refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall comply with Section C403.5.

C403.5 Walk-in coolers, walk-in freezers, r**efrigerated warehouse coolers and refrigerated warehouse freezers.** *Walk-in coolers*, *walk-in freezers*, *refrigerated warehouse coolers* and *refrigerated warehouse freezers* shall comply with all of the following:
1. Evaporator fan motors that are less than 1 horsepower and less than 460 volts shall use electronically commutated motors, brushless direct current motors, or 3-phase motors.
2. Condenser fan motors that are less than 1 horsepower shall use electronically commutated motors, permanent split capacitor-type motors or 3-phase motors.
3. Where anti-sweat heaters without anti-sweat heater controls are provided, they shall have a total door rail, glass, and frame heater power draw of not more than 7.1 Watts per square foot of door opening for *walk-in freezers*, and 3.0 Watts per square foot of door opening for *walk-in coolers*.
4. Where anti-sweat heater controls are provided, they shall reduce the energy use of the anti-sweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.

C405.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications, electrical energy consumption, and minimum acceptable lighting equipment for exterior applications.

Exception: Dwelling units within commercial buildings shall not be required to comply with Sections C405.2 through C405.5 provided that not less than 75 percent of the permanently installed light fixtures, other than low voltage lighting, shall be fitted for, and contain only, high efficacy lamps..

Walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall comply with Section C405.10.

C405.10 Walk-in coolers, walk-in freezers, r**efrigerated warehouse coolers and refrigerated warehouse freezers.** Lights in walk-in coolers, walk-in freezers, refrigerated warehouse coolers and refrigerated warehouse freezers shall either use light sources with an efficacy of not less than 40 lumens per Watt, including ballast losses , or shall use light sources with an efficacy of not less than 40 lumens per Watt, including ballast losses , in conjunction with a device that turns off the lights within 15 minutes when the space is not occupied.

Add new definitions as follows:

SECTION C202
GENERAL DEFINITIONS

REFRIGERATED WAREHOUSE COOLER. An enclosed storage space capable of being refrigerated to temperatures above 32°F that can be walked into and has a total chilled storage area of not less than 3,000 square feet.

REFRIGERATED WAREHOUSE FREEZER: An enclosed storage space capable of being refrigerated to temperatures at or below 32°F that can be walked into and has a total chilled storage area of not less than 3,000 square feet.

WALK-IN COOLER. An enclosed storage space capable of being refrigerated to temperatures above 32°F that can be walked into and has a total chilled storage area of less than 3,000 square feet.

WALK-IN FREEZER: An enclosed storage space capable of being refrigerated to temperatures at or below 32°F that can be walked into and has a total chilled storage area of less than 3,000 square feet..

CE196 – 13

C403.2.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.1 Calculation of heating and cooling loads. Design loads associated with heating, ventilating and air conditioning of the building shall be determined in accordance with ~~the procedures described in~~ ANSI/AHRAE/ACCA Standard 183 or by an *approved* equivalent computational procedure using the design parameters specified in Chapter 3. ~~The design loads shall account for the building envelope, lighting, ventilation and occupancy loads based on the project design.~~ Heating and cooling loads shall be adjusted to account for load reductions that are achieved where 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 computational procedure using the design parameters specified in Chapter 3.~~

CE198-13

C403.2.2

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.2 Equipment and ~~system~~ sizing. The output capacity of heating and cooling equipment ~~and systems~~ shall not exceed the loads calculated in accordance with Section C403.2.1. A single piece of equipment providing both heating and cooling shall satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.

Exceptions:

1. Required standby equipment and systems provided with controls and devices that allow such systems or equipment to operate automatically only when the primary equipment is not operating.
2. Multiple units of the same equipment type with combined capacities exceeding the design load and provided with controls that have the capability to sequence the operation of each unit based on load.

CE200-13

Table C403.2.3(1), Table C403.2.3(2), Table C403.2.3(3), Table C403.2.3(8), Chapter 5

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

TABLE C403.2.3(1)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY			TEST PROCEDURE[a]
				~~Before 6/1/2011~~	~~As of 6/1/2011~~ Before 1/1/2016	As of 1/1/2016	
Air conditioners, air cooled	< 65,000 Btu/h[b]	All	Split System	~~13.0 SEER~~	13.0 SEER	13.0 SEER	AHRI 210/240
			Single Package	~~13.0 SEER~~	~~13.0~~ 14.0 SEER	14.0 SEER	
Through-the-wall (air cooled)	≤ 30,000 Btu/h[b]	All	Split system	~~12.0 SEER~~	12.0 SEER	12.0 SEER	
			Single Package	~~12.0 SEER~~	12.0 SEER	12.0 SEER	
Small-duct high-velocity (air cooled)	< 65,000 Btu/h[b]	All	Split System	~~10.0 SEER~~	~~10.0~~ 11.0 SEER	11.0 SEER	
Air conditioners, air cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.2 EER~~ ~~11.4 IEER~~	11.2 EER 11.4 IEER	11.2 EER 12.8 IEER	AHRI 340/360
		All other	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	11.0 EER 11.2 IEER	11.0 EER 12.6 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	11.0 EER 11.2 IEER	11.0 EER 12.4 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~11.0 IEER~~	10.8 EER 11.0 IEER	10.8 EER 12.2 IEER	
	≥ 240,000 Btu/h and < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~10.0 EER~~ ~~10.1 IEER~~	10.0 EER 10.1 IEER	10.0 EER 11.6 IEER	
		All other	Split System and Single Package	~~9.8 EER~~ ~~9.9 IEER~~	9.8 EER 9.9 IEER	9.8 EER 11.4 IEER	
	≥ 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~9.7 EER~~ ~~9.8 IEER~~	9.7 EER 9.8 IEER	9.7 EER 11.2 IEER	
		All other	Split System and Single Package	~~9.5 EER~~ ~~9.6 IEER~~	9.5 EER 9.6 IEER	9.5 EER 11.0 IEER	

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY			TEST PROCEDURE[a]
				~~Before 6/1/2011~~	~~As of 6/1/2011~~ Before 1/1/2016	As of 1/1/2016	
Air conditioners, water cooled	< 65,000 Btu/h[b]	All	Split System and Single Package	~~12.1 EER~~ ~~12.3 IEER~~	12.1 EER 12.3 IEER	12.1 EER 12.3 IEER	AHRI 210/240
	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.5 EER~~ ~~11.7 IEER~~	12.1 EER 12.3 IEER	12.1 EER 13.9 IEER	AHRI 340/360
		All other	Split System and Single Package	~~11.3 EER~~ ~~11.5 IEER~~	11.9 EER 12.1 IEER	11.9 EER 13.7 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	12.5 EER 12.5 IEER	12.5 EER 13.9 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~11.0 IEER~~	12.3 EER 12.5 IEER	12.3 EER 13.7 IEER	
	≥ 240,000 Btu/h And < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.1 IEER~~	12.4 EER 12.6 IEER	12.4 EER 13.6 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~10.9 IEER~~	12.2 EER 12.4 IEER	12.2 EER 13.4 IEER	
	≥ 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.1 IEER~~	12.2 EER 12.4 IEER	12.2 EER 13.5 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~10.9 IEER~~	12.0 EER 12.2 IEER	12.0 EER 13.3 IEER	
Air conditioners, evaporatively cooled	< 65,000 Btu/h[b]	All	Split System and Single Package	~~12.1 EER~~ ~~12.3 IEER~~	12.1 EER 12.3 IEER	12.1 EER 12.3 IEER	AHRI 210/240
	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.5 EER~~ ~~11.7 IEER~~	12.1 EER 12.3 IEER	12.1 EER 12.3 IEER	AHRI 340/360
		All other	Split System and Single Package	~~11.3 EER~~ ~~11.5 IEER~~	11.9 EER 12.1 IEER	11.9 EER 12.1 IEER	
	< 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 EER~~ ~~11.2 IEER~~	12.0 EER 12.2 IEER	12.0 EER 12.2 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~11.0 IEER~~	11.8 EER 12.0 IEER	11.8 EER 12.0 IEER	
	< 240,000 Btu/h and < 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 ERR~~ ~~11.1 ERR~~	11.9 ERR 12.1 IERR	11.9 ERR 12.1 IEER	
		All other	Split System and Single Package	~~10.8 EER~~ ~~10.9 EER~~	~~12.2~~ 11.7 ERR 11.9 IEER	11.7 ERR 11.9 IEER	
	≥ 760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	~~11.0 ERR~~ ~~11.1 EER~~	11.7 ERR 11.9 ERR	11.7 ERR 11.9 ERRT	

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY			TEST PROCEDURE[a]
				~~Before 6/1/2011~~	~~As of 6/1/2011~~ Before 1/1/2016	As of 1/1/2016	
		All other	Split System and Single Package	~~10.8 ERR~~ ~~10.9 ERR~~	11.5 ERR 11.7 ERR	11.5 ERR 11.7 ERR	
Condensing units, air cooled	≥ 135,000 Btu/h			~~10.1 EER~~ ~~11.1 IEER~~	10.5 EER ~~11.0~~ 11.8 IEER	10.5 EER 11.8 IEER	AHRI 365
Condensing units, water cooled	≥ 135,000 Btu/h			~~13.1 EER~~ ~~13.6 IEER~~	13.5 EER 14.0 IEER	13.5 EER 14.0 IEER	
Condensing units, evaporatively cooled	≥ 135,000 Btu/h			~~13.1 EER~~ ~~13.6 IEER~~	13.5 EER 14.0 IEER	13.5 EER 14.0 IEER	

For SI: 1 British thermal unit per hour = 0.2931 W.

a. Chapter 5 of the referenced standard contains a complete specification of the referenced test procedure, including the reference year version of the test procedure.

b. Single-phase, air-cooled air conditioners less than 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

TABLE C403.2.3(2)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
				Before 1/1/2016	As of 1/1/2016	
Air cooled (cooling mode)	< 65,000 Btu/h[b]	All	Split System	~~12.0~~ 14.0 SEER	14.0 SEER	AHRI 210/240
			Single Packaged	~~13.0~~ 14.0 SEER	14.0 SEER	
Through-the-wall, air cooled	≤ 30,000 Btu/h[b]	All	Split System	~~13.0~~ 12.0 SEER	12.0 SEER	
			Single Packaged	~~13.0~~ 12.0 SEER	12.0 SEER	
Single-duct high-velocity air cooled	< 65,000 Btu/h[b]	All	Split System	~~10.0~~ 11.0 SEER	11 SEER	
Air cooled (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER 11.2 IEER	11.0 EER 12.0 IEER	AHRI 340/360
		All other	Split System and Single Package	10.8 EER 11.0 IEER	10.8 EER 11.8 IEER	
EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
				Before 1/1/2016	As of 1/1/2016	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.6 EER 10.7 IEER	10.6 EER 11.6 IEER	
		All other	Split System and Single Package	10.4 EER 10.5 IEER	10.4 EER 11.4 IEER	
	≥ 240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.5 EER 9.6 IEER	9.5 EER 10.6 IEER	
		All other	Split System and Single Package	9.3 EER 9.4 IEER	9.3 EER 10.4 IEER	
~~Water-source (cooling mode)~~	~~< 17,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~11.2 EER~~		~~ISO 13256-1~~
	~~≥ 17,000 Btu/h and < 65,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~12.0 EER~~		
	~~≥ 65,000 Btu/h and < 135,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~12.0 EER~~		
~~Ground-water-source (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~59°F entering water~~	~~16.2 EER~~		
		~~All~~	~~77°F entering water~~	~~13.4 EER~~		
~~Water-source water-to-water (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~86°F entering water~~	~~10.6 EER~~		~~ISO 13256-2~~
			~~59°F entering water~~	~~16.3 EER~~		
~~Ground-water-source Brine-to-water (cooling mode)~~	~~< 135,000 Btu/h~~	~~All~~	~~77°F entering fluid~~	~~12.1 EER~~		
~~Air-cooled (heating mode)~~	~~< 65,000 Btu/h[a]~~	—	~~Split System~~	~~7.7 HSPF~~		~~AHRI 210/240~~
		—	~~Single Package~~	~~7.7 HSPF~~		

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
				Before 1/1/2016	As of 1/1/2016	
~~Through-the-wall, (air cooled, heating mode)~~	~~≤ 30,000 Btu/h[b] (cooling capacity)~~	—	~~Split System~~	~~7.4 HSPF~~		
		—	~~Single Package~~	~~7.4 HSPF~~		
~~Small duct high velocity (air cooled, heating mode)~~	~~< 65,000 Btu/h[b]~~	—	~~Split System~~	~~6.8 HSPF~~		
~~Air cooled (heating mode)~~	~~≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)~~	=	~~47°F db/43°F wb Outdoor Air~~	~~3.3 COP~~		~~AHRI 340/360~~
			~~17°F db/15°F wb Outdoor Air~~	~~2.25 COP~~		
	~~≥ 135,000 Btu/h (cooling capacity)~~	—	~~47°F db/43°F wb Outdoor Air~~	~~3.2 COP~~		
			~~17°F db/15°F wb Outdoor Air~~	~~2.05 COP~~		
~~Water source (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~68°F entering water~~	~~4.2 COP~~		~~ISO 13256-1~~
~~Ground water source (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~50°F entering water~~	~~3.6 COP~~		
~~Ground source (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~32°F entering fluid~~	~~3.1 COP~~		
~~Water source water-to-water (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~68°F entering water~~	~~3.7 COP~~		~~ISO 13256-2~~
		—	~~50°F entering water~~	~~3.1 COP~~		
~~Ground source brine-to-water (heating mode)~~	~~< 135,000 Btu/h (cooling capacity)~~	—	~~32°F entering fluid~~	~~2.5 COP~~		
Water to Air: Water Loop (cooling mode)	<17,000 Btu/h	All	86 °F entering water	12.2 EER	12.2 EER	ISO 13256-1

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
				Before 1/1/2016	As of 1/1/2016	
	≥17,000 Btu/h and <65,000 Btu/h	All	86 °F entering water	13 EER	13 EER	
	≥65,000 Btu/h and <135,000 Btu/h	All	86 °F entering water	13 EER	13 EER	
Water to Air: Ground Water (cooling mode)	<135,000 Btu/h	All	59 °F entering water	18.0 EER	18.0 EER	ISO 13256-1
Brine to Air: Ground Loop (cooling mode)	<135,000 Btu/h	All	77 F entering water	14.1 EER	14.1 EER	ISO 13256-1
Water to Water: Water Loop (cooling mode)	<135,000 Btu/h	All	86 °F entering water	10.6 EER	10.6 EER	ISO-13256-2
Water to Water: Ground Water (Cooling Mode)	<135,000 Btu/h	All	59 °F entering water	16.3 EER	16.3 EER	
Brine to Water: Ground Loop (cooling mode)	<135,000 Btu/h	All	77 °F entering water	12.1 EER	12.1 EER	
Air cooled (heating mode)	<65,000 Btu/h[b]	—	Split System	8.2 HSPF	8.2 HSPF	AHRI 210/240
		—	Single Package	8.0 HSPF	8.0 HSPF	
Through-the-wall, (air cooled, heating mode)	≤30,000 Btu/h[b] (cooling capacity)	—	Split System	7.4 HSPF	7.4 HSPF	
		—	Single Package	7.4 HSPF	7.4 HSPF	
Small-Duct high velocity (air cooled, heating mode)	<65,000 Btu/h[b]	—	Split System	6.8 HSPF	6.8 HSPF	
Air Cooled (Heating Mode)	≥65,000 Btu/h and <135,000 Btu/h (Cooling Capacity)	—	47°F db/43°F wb Outdoor Air	3.3 COP	3.3 COP	AHRI 340/360
			17°F db/15°F wb Outdoor Air	2.25 COP	2.25 COP	

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
				Before 1/1/2016	As of 1/1/2016	
	≥135,000 Btu/h (Cooling Capacity)	—	47°F db/43°F wb Outdoor Air	3.2 COP	3.2 COP	
			17°F db/15°F wb Outdoor Air	2.05 COP	2.05 COP	
Water to Air: Water Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	68 °F entering water	4.3 COP	4.3 COP	ISO 13256-1
Water to Air Ground Water (heating mode)	<135,000 Btu/h (cooling capacity)	—	50 °F entering water	3.7 COP	3.7 COP	
Brine to Air: Ground Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	32 °F entering fluid	3.2 COP	3.2 COP	
Water to Water: Water Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	68 °F entering water	3.7 COP	3.7 COP	ISO 13256-2
Water to Water: Ground Water (heating mode)	<135,000 Btu/h (cooling capacity)	—	50 °F entering water	3.1 COP	3.1 COP	
Brine to Water: Ground Loop (heating mode)	<135,000 Btu/h (cooling capacity)	—	32 °F entering fluid	2.5 COP	2.5 COP	

For SI: 1 British thermal unit per hour = 0.2931 W. °C = [(°F) – 32]/1.8

a. Chapter 5 of the referenced standard contains a complete specification of the referenced test procedure, including the reference year version of the test procedure.

b. Single-phase, air-cooled air conditioners less than 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.

TABLE C403.2.3(3)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS,
PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS,
SINGLE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS AND ROOM AIR-CONDITIONER HEAT PUMPS

EQUIPMENT TYPE	SIZE CATEGORY (INPUT)	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE[a]
			~~Before 10/08/2012~~	~~As of 10/08/2012~~	
PTAC (cooling mode) new construction	All Capacities	95°F db outdoor air	~~12.5 - (0.213 × Cap/1000) EER~~	~~13.8 - (0.300 × Cap/1000) EER~~ 14.0 – (0.300 × Cap/1000)[g] EER	AHRI 310/380
PTAC (cooling mode) replacements[b]	All Capacities	95°F db outdoor air	~~10.9 - (0.213 × Cap/1000) EER~~	10.9 - (0.213 × Cap/1000) EER	
PTHP (cooling mode) new construction	All Capacities	95°F db outdoor air	~~12.3 - (0.213 × Cap/1000) EER~~	14.0 - (0.300 × Cap/1000) EER	
PTHP (cooling mode) replacements[b]	All Capacities	95°F db outdoor air	~~10.8 - (0.213 × Cap/1000) EER~~	10.8 - (0.213 × Cap/1000) EER	
PTHP (heating mode) new construction	All Capacities	—	~~3.2 - (0.026 × Cap/1000) COP~~	3.2 - (0.026 × Cap/1000) COP	
PTHP (heating mode) replacements[b]	All Capacities	—	~~2.9 - (0.026 × Cap/1000) COP~~	2.9 - (0.026 × Cap/1000) COP	
SPVAC (cooling mode)	< 65,000 Btu/h	95°F db/ 75°F wb outdoor air	~~9.0 EER~~	9.0 EER	AHRI 390
	≥ 65,000 Btu/h and < 135,000 Btu/h	95°F db/ 75°F wb outdoor air	~~8.9 EER~~	8.9 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	95°F db/ 75°F wb outdoor air	~~8.6 EER~~	8.6 EER	
SPVHP (cooling mode)	< 65,000 Btu/h	95°F db/ 75°F wb outdoor air	~~9.0 EER~~	9.0 EER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	95°F db/ 75°F wb outdoor air	~~8.9 EER~~	8.9 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	95°F db/ 75°F wb outdoor air	~~8.6 EER~~	8.6 EER	
SPVHP (heating mode)	<65,000 Btu/h	47°F db/ 43°F wb outdoor air	~~3.0 COP~~	3.0 COP	AHRI 390
	≥ 65,000 Btu/h and < 135,000 Btu/h	47°F db/ 43°F wb outdoor air	~~3.0 COP~~	3.0 COP	

	≥ 135,000 Btu/h and < 240,000 Btu/h	47°F db/ 75°F wb outdoor air	~~2.9 COP~~	2.9 COP	
Room air conditioners, with louvered slides	< 6,000 Btu/h	—	~~9.7 SEER~~	9.7 SEER	ANSI/AHAM RAC-1
	≥ 6,000 Btu/h and < 8,000 Btu/h	—	~~9.7 EER~~	9.7 EER	
	≥ 8,000 Btu/h and < 14,000 Btu/h	—	~~9.8 EER~~	9.8 EER	
	≥ 14,000 Btu/h and < 20,000 Btu/h	—	~~9.7 SEER~~	9.7 SEER	
	≥ 20,000 Btu/h	—	~~8.5 EER~~	8.5 EER	
Room air conditioners, with louvered slides	< 8,000 Btu/h	—	~~9.0 EER~~	9.0 EER	
	≥ 8,000 Btu/h and < 20,000 Btu/h	—	~~8.5 EER~~	8.5 EER	
	≥ 20,000 Btu/h	—	~~8.5 EER~~	8.5 EER	
Room air-conditioner heat pumps with louvered sides	< 20,000 Btu/h	—	~~9.0 EER~~	9.0 EER	
	≥ 20,000 Btu/h	—	~~8.5 EER~~	8.5 EER	
Room air-conditioner heat pumps without louvered sides	< 14,000 Btu/h	—	~~8.5 EER~~	8.5 EER	
	≥ 14,000 Btu/h	—	~~8.0 EER~~	8.0 EER	
Room air conditioner casement only	All capacities	—	~~8.7 EER~~	8.7 EER	
Room air conditioner casement-slider	All capacities	—	~~9.5 EER~~	9.5 EER	

For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) - 32]/1.8.

"Cap" = The rated cooling capacity of the project in Btu/h. If the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculations

a. Chapter 5 of the referenced standard contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

b. Replacement unit shall be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY: NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches (406 mm) in height and less than 42 inches (1067 mm) in width.

TABLE C403.2.3(8)
MINIMUM EFFICIENCY REQUIREMENTS:

HEAT REJECTION EQUIPMENT

EQUIPMENT TYPE[a]	TOTAL SYSTEM HEAT REJECTION CAPACITY AT RATED CONDITIONS	SUBCATEGORY OR RATING CONDITION[i]	PERFORMANCE REQUIRED[b, c, d, e, g, h]	TEST PROCEDURE[e, f]
Propeller or axial fan open circuit cooling towers	All	95°F Entering Water 85°F Leaving Water 75°F Entering wb	~~≥38.2~~ ≥ 40.2 gpm/hp	CTI ATC-105 and CTI STD-201
Centrifugal fan open circuit cooling towers	All	95°F Entering Water 85°F Leaving Water 75°F Entering wb	≥ 20.0 gpm/hp	CTI ATC-105 and CTI STD-201
Propeller or axial fan closed circuit cooling towers	All	102°F Entering Water 90°F Leaving Water 75°F Entering wb	≥ 14.0 gpm/hp	CTI ATC-105S and CTI STD-201
Centrifugal closed circuit cooling towers	All	102°F Entering Water 90°F Leaving Water 75°F Entering wb	≥ 7.0 gpm/hp	CTI ATC-105S and CTI STD-201
Propeller or axial fan evaporative condensers	All	Ammonia Test Fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F *entering wb*	≥ 134,000 Btu/h·hp	CTI ATC-106
Centrifugal fan evaporative condensers	All	Ammonia Test Fluid 140°F entering gas temperature 96.3°F condensing temperature 75°F *entering wb*	≥ 110,000 Btu/h·hp	CTI ATC-106
Propeller or axial fan evaporative condensers	All	R-507A Test Fluid 165°F entering gas temperature 105°F condensing temperature 75°F *entering wb*	≥ 157,000 Btu/h·hp	CTI ATC-106
Centrifugal fan evaporative condensers	All	R-507A Test Fluid 165°F entering gas temperature 105°F condensing temperature 75°F *entering wb*	≥ 135,000 Btu/h·hp	CTI ATC-106
Air-cooled condensers	All	125°F Condensing Temperature ~~R-22 Test Fluid~~ 190°F Entering Gas Temperature 15°F Subcooling 95°F Entering db	≥ 176,000 Btu/h·hp	ARI 460

For SI: °C = [(°F)-32]/1.8, L/s · kW = (gpm/hp)/(11.83), COP = (Btu/h · hp)/(2550.7)
db = dry bulb temperature, °F, wb = wet bulb temperature, °F.

a. The efficiencies and test procedures for both open and closed circuit cooling towers are not applicable to hybrid cooling towers that contain a combination of wet and dry heat exchange sections.
b. For purposes of this table, open circuit cooling tower performance is defined as the water flow rating of the tower at the thermal rating condition listed in Table 403.2.3(8) divided by the fan nameplate rated motor power.
c. For purposes of this table, closed circuit cooling tower performance is defined as the water flow rating of the tower at the thermal rating condition listed in Table 403.2.3(8) divided by the sum of the fan nameplate rated motor power and the spray pump nameplate rated motor power.
d. For purposes of this table, air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate rated motor power.
e. Chapter 6 of the referenced standard contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure. The certification requirements do not apply to field erected cooling towers.
f. If a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program, or, if a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings, but the product is not listed in the existing certification program, the ratings shall be verified by an independent laboratory test report.
g. All cooling towers shall comply with the minimum efficiency listed in the table for that specific type of tower with the capacity effect of any project specific accessories and / or options included in the capacity of the cooling tower
h. For purposes of this table, evaporative condenser performance is defined as the heat rejected at the specified rating condition in the table divided by the sum of the fan motor nameplate power and the integral spray pump nameplate power
I. Requirements for evaporative condensers are listed with ammonia (R-717) and R-507A as test fluids in the table. Evaporative condensers intended for use with halocarbon refrigerants other than R-507A shall meet the minimum efficiency requirements listed above with R-507A as the test fluid.

Add new standards as follows:
CTI
ATC 105S-11 Acceptance Test Code for Closed Circuit Cooling Towers

ATC 106-11 Acceptance Test Code for Mechanical Draft Evaporative Vapor Condensers

Public Comment:

Steve Ferguson, ASHRAE, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE C403.2.3(1)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS

Air conditioners air cooled	<65,000 Btu/h[b]	All	Split System	13 SEER	13 SEER	AHRI 210/240
			Single Package	13 ~~14~~ SEER[c]	14 SEER[c]	

c. Minimum efficiency as of 1/1/2015".
(Portions of code change proposal not remain unchanged)

TABLE C403.2.3(2)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS

Air cooled (cooling mode)	<65,000 Btu/h[b]	All	Split System	13 ~~14~~ SEER[c]	~~13~~14.0 SEER[c]	AHRI 210/240
			Single Package	13 ~~14~~ SEER[c]	14,0 SEER[c]	
Air cooled (heating mode)	<65,000 Btu/h[b]	-	Split System	~~8.2~~7.7 HSPF[c]	8.2 HSPF[c]	AHRI 210/240
			Single Package	~~8.0~~7.7 HSPF[c]	8.0 HSPF[c]	

c. Minimum efficiency as of 1/1/2015"..
(Portions of code change proposal not remain unchanged)

TABLE C403.2.3(3)
MINIMUM EFFICIENCY REQUIREMENTS:
ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS,
PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS,
SINGLE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS AND ROOM AIR-CONDITIONER HEAT PUMPS

PTAC (cooling mode) New Construction	All Capacities	95 F db outdoor air	Split System Single Package		14.0 – (0.300 × Cap/1000) EER [c]	AHRI 310/380

c. Before 1/1/2015 the minimum efficiency shall be13.8 – (0.300 × Cap/1000) EER

CE201-13

C202 (NEW), Table 403.2.3(9) (NEW), Chapter 5

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new Table as follows:

TABLE C403.2.3 (9) TABLE C403.2.3 (9)
MINIMUM EFFICIENCY AIR CONDITIONERS AND CONDENSING UNITS SERVING COMPUTER ROOMS

Equipment Type	Net Sensible Cooling Capacity[a]	MinimumSCOP-127[b] Efficiency Downflow units / Upflow units	Test Procedure
Air conditioners, air cooled	65,000 Btu/h	2.20 / 2.09	
	≥65,000 Btu/h and < 240,000 Btu/h	2.10 / 1.99	
	≥240,000 Btu/h	1.90 / 1.79	
Air conditioners, water cooled	65,000 Btu/h	2.60 / 2.49	
	≥65,000 Btu/h and < 240,000 Btu/h	2.50 / 2.39	
	≥240,000 Btu/h	2.40 /2.29	
	65,000 Btu/h	2.55 /2.44	

a. Net sensible cooling capacity: The total gross cooling capacity less the latent cooling less the energy to the air movement system. (Total Gross – latent – Fan Power)
b. Sensible coefficient of performance (SCOP-127): a ratio calculated by dividing the net sensible cooling capacity in watts by the total power input in watts (excluding re-heaters and humidifiers) at conditions defined in ASHRAE Standard 127. The net sensible cooling capacity is the gross sensible capacity minus the energy dissipated into the cooled space by the fan system.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

COMPUTER ROOM. A room whose primary function is to house equipment for the processing and storage of electronic data and that has a design electronic data equipment power density exceeding 20 watts/ft^2 of *conditioned floor area*.

Add new standard to Chapter 5 as follows:

ASHRAE

127-07 Method of Testing for Raining Computer and Data Processing Room Unitary Air Conditioners

Public Comment:

Brenda Thompson, CBCO, Manager Building Inspections, Clark County Development Services, ICC Sustainability, Energy and High Performance Code Action Committee (SEHPCAC) Chair, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C403.2.3 HVAC equipment performance requirements. Equipment shall meet the minimum efficiency requirements of Tables C403.2.3(1), C403.2.3(2), C403.2.3(3), C403.2.3(4), C403.2.3(5), C403.2.3(6), C403.2.3(7), and C403.2.3(8) and C403.2.3(9) when tested and rated in accordance with the applicable test procedure. Plate-type liquid-to-liquid heat exchangers shall meet the minimum requirements of Table ~~C403.2.3(9)~~ C403.2.3(10). 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.

CE202 – 13

C403.2.3.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.3.1 Water-cooled centrifugal chilling packages. Equipment not designed for operation at AHRI 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 maximum full-load kW/ton and *NPLV* ratings adjusted using Equations 4-3 and 4-4.

Adjusted minimum full-load COP ratings = (Full-load COP from Table 6.8.1C of AHRI 550/590) × K_{adj} **(Equation 4-3)**

Adjusted minimum NPLV rating = (IPLV from Table 6.8.1C of AHRI 550/590) × K_{adj} **(Equation 4-4)**
where:

K_{adj} = A × B
A = 0.0000015318 × (LIFT)^4 – 0.000202076 × (LIFT)^3 + 0.0101800 × (LIFT)^2 – 0.264958 × LIFT + 3.930196
B = 0.0027 × $L_{vg\text{Evap}}$ (°C) + 0.982
LIFT = $L_{vg\text{Cond}}$ – $L_{vg\text{Evap}}$
L_{vg}^{Cond} = Full-load condenser leaving water temperature (°C)
$L_{vg\text{Evap}}$ = Full-load leaving evaporator temperature (°C)
SI units shall be used in the K_{adj} equation.

The adjusted full-load and *NPLV* values shall only be applicable for centrifugal chillers meeting all of the following full-load design ranges:

1. The leaving evaporator fluid temperature is not less than 36°F (2.2°C).
2. The leaving condenser fluid temperature is not greater than 115°F (46.1°C).
3. LIFT is not less than 20°F (11.1 °C) and not greater than 80°F (44.4°C).

Exception: Centrifugal chillers designed to operate outside of these the temperature and flow ranges specified in this section need not meet the minimum efficiency requirements in Table C403.2.3(7) ~~need not comply with this code.~~

CE203 – 13

C403.2.3.1, C403.2.3.2, Table C403.2.3(7)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.2.3.1 Water-cooled centrifugal chilling packages. Equipment not designed for operation at AHRI Standard 550/590 test conditions of 44°F (7°C) leaving chilled-water temperature and 2.4 gpm/ton evaporator fluid

flow and 85°F (29°C) entering condenser water temperature with 3 gpm/ton (0.054 l/s · kW) condenser water flow shall have maximum full-load kW/ton (FL) and *NPLV* part load ratings requirements adjusted using Equations 4-3 and 4-4.

Adjusted minimum full-load COP ratings = (Full-load COP from Table 6.8.1C of AHRI Standard 550/590) × K_{adj}

$FL_{adj} = FL / K_{adj}$

Adjusted minimum NPLV rating = (IPLV from Table 6.8.1C of AHRI Standard 550/590) × K_{adj}

$PLV_{adj} = IPLV / K_{adj}$ **Equation 4-4)**

where:

$K_{adj} = A \times B$

$A = 0.0000015318 \times (LIFT)^4 - 0.000202076 \times (LIFT)^3 + 0.0101800 \times (LIFT)^2 - 0.264958 \times LIFT + 3.930196$

$B = 0.0027 \times L_{vgEvap}$ (°C) + 0.982

$LIFT = L_{vgCond} - L_{vgEvap}$

L_{vg}^{Cond} = Full-load condenser leaving water temp-erature (°C)

L_{vgEvap} = Full-load leaving evaporator temperature (°C)

SI units shall be used in the K_{adj} equation.

The adjusted full-load and *NPLV* values shall only be applicable for centrifugal chillers meeting all of the following full-load design ranges:

1. The leaving evaporator fluid temperature is not less than 36°F (2.2°C).
2. The leaving condenser fluid temperature is not greater than 115°F (46.1°C).
3. LIFT is not less than 20°F (11.1 °C) and not greater than 80°F (44.4°C).

Exception: Centrifugal chillers designed to operate outside of these ranges need not comply with this code.

FL = full-load kW/Ton value from Table C403.2.3(7)

FL_{adj} = maximum full-load kW/Ton rating, adjusted for non-standard conditions

IPLV = IPLV value from Table C403.2.3(7)

PLV_{adj} = maximum *NPLV* rating, adjusted for non-standard conditions

$A = 0.00000014592 \times (LIFT)^4 - 0.0000346496 \times (LIFT)^3 + 0.00314196 \times (LIFT)^2 - 0.147199 \times (LIFT) + 3.9302$

$B = 0.0015 \times LvgEvap + 0.934$

$LIFT = LvgCond - LvgEvap$

LvgCond = Full-load condenser leaving fluid temperature (°F)

LvgEvap = Full-load evaporator leaving temperature (°F)

The $FL_{adj.}$ and $PLV_{adj.}$ values are only applicable for centrifugal chillers meeting all of the following full-load design ranges:

- Minimum Evaporator Leaving Temperature:36°F
- Maximum Condenser Leaving Temperature:115°F
- 20°F ≤ LIFT ≤ 80°F

C403.2.3.2 Positive displacement (air- and water-cooled) chilling packages. Equipment with a leaving fluid temperature higher than 32°F (0°C) and water-cooled positive displacement chilling packages with a condenser leaving fluid temperature below 115°F, shall meet the requirements of Table C403.2.3(7) when tested or certified with water at standard rating conditions, in accordance with the referenced test procedure.

~~**TABLE C403.2.3(7) MINIMUM EFFICIENCY REQUIREMENTS: WATER CHILLING PACKAGES**[a]~~

TABLE C403.2.3(7). Water Chilling Packages – Efficiency Requirements[a, b, e]

Equipment Type	Size Category	Units	Effective 1/1/2010 Path A	Effective 1/1/2010 Path B	Effective 1/1/2015 Path A	Effective 1/1/2015 Path B	Test Procedure[c]
Air-Cooled Chillers	< 150 Tons	EER (Btu/W)	≥9.562 FL ≥12.500 IPLV	NA[d]	≥10.100 FL ≥13.700 IPLV	≥9.700 FL ≥15.800 IPLV	AHRI 550/590
	≥150 Tons		≥9.562 FL ≥12.750 IPLV	NA[d]	≥10.100 FL ≥14.000 IPLV	≥9.700 FL ≥16.100 IPLV	
Air-Cooled without Condenser, Electrically Operated	All Capacities	EER(Btu/W)	Air-cooled chillers without condenser must be rated with matching condensers and comply with air-cooled chiller efficiency requirements				
Water-Cooled, Electrically Operated Positive Displacement	< 75 Tons	kW/ton	≤0.780 FL ≤0.630 IPLV	≤0.800 FL ≤0.600 IPLV	≤0.750 FL ≤0.600 IPLV	≤0.780 FL ≤0.500 IPLV	
	≥ 75 tons and <150 tons		≤0.775 FL ≤0.615 IPLV	≤0.790 FL ≤0.586 IPLV	≤0.720 FL ≤0.560 IPLV	≤0.750 FL ≤0.490 IPLV	
	≥ 150 tons and < 300 tons		≤0.680-FL ≤0.580 IPLV	≤0.718 FL ≤0.540 IPLV	≤0.660 FL ≤0.540 IPLV	≤0.680 FL ≤0.440 IPLV	
	≥ 300 tons and < 600 tons		≤0.620-FL ≤0.540 IPLV	≤0.639-FL ≤0.490 IPLV	≤0.610 FL ≤0.520 IPLV	≤0.625 FL ≤0.410 IPLV	
	≥ 600 tons		≤0.620-FL ≤0.540 IPLV	≤0.639 FL ≤0.490 IPLV	≤0.560 FL ≤0.500 IPLV	≤0.585 FL ≤0.380 IPLV	
Water Cooled, Electrically Operated Centrifugal	< 150 Tons	kW/ton	≤0.634 FL ≤0.596 IPLV	≤0.639-FL ≤0.450 IPLV	≤0.610 FL ≤0.550 IPLV	≤0.695 FL ≤0.440 IPLV	
	≥ 150 tons and <300 tons		≤0.634 FL ≤0.596 IPLV	≤0.639 FL ≤0.450 IPLV	≤0.610 FL ≤0.550 IPLV	≤0.635 FL ≤0.400 IPLV	
	≥ 300 tons and <400 tons		≤0.576 FL ≤0.549 IPLV	≤0.600 FL ≤0.400 IPLV	≤0.560 FL ≤0.520 IPLV	≤0.595 FL ≤0.390 IPLV	
	≥ 400 tons and <600 tons		≤0.576-FL ≤0.549 IPLV	≤0.600 FL ≤0.400 IPLV	≤0.560 FL ≤0.500 IPLV	≤0.585 FL ≤0.380 IPLV	
	≥ 600 tons		≤0.570-FL ≤0.539 IPLV	≤0.590 FL ≤0.400 IPLV	≤0.560 FL ≤0.500 IPLV	≤0.585 FL ≤0.380 IPLV	
Air-Cooled Absorption,Single Effect	All Capacities	COP	≥0.600 FL	NA[d]	≥0.600 FL	NA[d]	AHRI 560
Water-Cooled	All	COP	≥0.700 FL	NA[d]	≥0.700 FL	NA[d]	

Absorption, Single Effect	Capacities					
Absorption Double-Effect, Indirect-Fired	All Capacities	COP	≥1.000 FL ≥1.050 IPLV	NA[d]	≥1.000 FL ≥1.050 IPLV	NA[d]
Absorption Double-Effect, Direct-Fired	All Capacities	COP	≥1.000 FL ≥1.000 IPLV	NA[d]	≥1.000 FL ≥1.000 IPLV	NA[d]

[a] The requirements for centrifugal chiller shall be adjusted for non-standard rating conditions per C403.2.3.1and are only applicable for the range of conditions listed in C403.2.3.1. The requirements for air-cooled, water-cooled positive displacement and absorption chillers are at standard rating conditions defined in the reference test procedure.

[b] Both the full load and IPLV requirements must be met or exceeded to comply with this standard. When there is a Path B, compliance can be with either Path A or Path B for any application.

[c] NA means the requirements are not applicable for Path B and only Path A can be used for compliance.

[e] FL is the full load performance requirements and IPLV is for the part load performance requirements

CE204 – 13

C403.2.4.1.2, C403.2.4.1.3 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.2.4.1.2 ~~C403.2.4.2 Set point overlap restriction~~ Deadband. Where used to control both heating and cooling, *zone* thermostatic controls shall be capable of providing provide a temperature range or deadband of at least 5°F (2.8°C) within which the supply of heating and cooling energy to the *zone* is ~~capable of being~~ shut off or reduced to a minimum.

Exceptions:

1. Thermostats requiring manual changeover between heating and cooling modes.
2. Occupancies or applications requiring precision in indoor temperature control as *approved* by the *code official.*

C403.2.4.1.3 Setpoint overlap restriction. Where a *zone* has a separate heating and a separate cooling thermostatic control located within the *zone*, a limit switch, mechanical stop, or direct digital control system with software programming shall be provided with the capability to prevent the heating setpoint from exceeding the cooling setpoint and to maintain a deadband in accordance with Section C403.2.4.1.2.

CE205 – 13

C403.2.4.5 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.4.5 Zone isolation. HVAC systems serving *zones* that are over 25,000 square feet in floor area or that span more than one floor and designed to operate or be occupied non-simultaneously shall be divided into isolation areas. Each isolation area shall be equipped with isolation devices and controls configured to automatically shut off the supply of conditioned air and outdoor air to and exhaust air from the isolation area. Each isolation area shall be controlled independently by a device meeting the requirements of Section C403.2.4.3.2. Central systems and plants shall be provided with controls and devices that will allow system and

equipment operation for any length of time while serving only the smallest isolation area served by the system or plant.

Exceptions:

1. Exhaust air and outdoor air connections to isolation areas when the fan system to which they connect does not exceed 5000 cfm.
2. Exhaust airflow from a single isolation area of less than 10 percent of the design airflow of the exhaust system to which it connects.
3. Isolation areas intended to operate continuously or intended to be inoperative only when all other isolation areas in a *zone* are inoperative.

CE206 – 13

C403.2.4.5

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.4.5 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.~~

CE208 – 13

C403.2.4.5, C403.2.4.6 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.2.4.5 Snow and ice 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.~~

C403.2.4.6 Freeze protection system controls. Freeze protection systems, such as heat tracing of outdoor piping and heat exchangers, including self-regulating heat tracing, shall include automatic controls configured to shut off the systems when outdoor air temperatures are above 40°F or when the conditions of the protected fluid will prevent freezing.

CE209 – 13

C403.2.4.6 (NEW)

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com), Jim Edelson, New Buildings Institute

Add new text as follows:

C403.2.4.6 Economizer fault detection and diagnostics (FDD). Air-cooled unitary direct-expansion units listed in Tables C403.2.3(1) through (3) and variable refrigerant flow (VRF) units that are equipped with an economizer in accordance with Section C403.3 or Section C403.4 shall include a fault detection and diagnostics (FDD) system complying with all of the following:

1. The following temperature sensors shall be permanently installed to monitor system operation:
   1.1. Outside air,
   1.2. Supply air,
   1.3. Return air;
2. Temperature sensors shall have an accuracy of ±2°F over the range of 40°F to 80°F;
3. Refrigerant pressure sensor, where used, shall have an accuracy of ±3 percent of full scale;
4. The unit controller shall be capable of providing system status by indicating the following:
   4.1. Free cooling available.
   4.2. Economizer enabled.
   4.3. Compressor enabled.
   4.4. Heating enabled.
   4.5. Mixed air low limit cycle active.
   4.6. The current value of each sensor.
5. The unit controller shall be capable of manually initiating each operating mode so that the operation of compressors, economizers, fans, and heating system can be independently tested and verified;
6. The unit shall be capable of reporting faults to a fault management application accessible by day-to-day operating or service personnel, or annunciated locally on zone thermostats; and
7. The FDD system shall be capable of detecting the following faults:
   7.1. Air temperature sensor failure/fault.
   7.2 Not economizing when the unit should be economizing.
   7.3. Economizing when the unit should not be economizing.
   7.4. Damper not modulating.
   7.5. Excess outdoor air.

CE211 – 13

C403.2.5.2 (NEW)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.5.2 Enclosed parking garage ventilation controls. Enclosed parking garages used for storing or handling automobiles operating under their own power shall employ contamination sensing devices and automatic controls configured to stage fans or modulate fan average airflow rates to 50 percent or less of design capacity or intermittently operate fans less than 20 percent of the occupied time or as required to maintain acceptable contaminant levels in accordance with IMC provisions. Failure of contamination sensing devices shall cause the exhaust fans to operate continuously at design airflow.

Exceptions:

1. Garages with total exhaust capacity less than 22,500 cfm (10,600 L/s) with ventilation systems that do not utilize heating or mechanical cooling.
2. Garages that have a garage area to ventilation system motor nameplate power ratio that exceeds 1125 cfm/hp (710 L/s/kW) and do not utilize heating or mechanical cooling.

CE212-13

C403.2.6

Proposed Change as Submitted

Proponent: Tim Manz, City of Blaine, MN, representing the Association of Minnesota Building Officials (tmanz@ci.blaine.mn.us)

Revise as follows:

C403.2.6 Energy recovery ventilation systems. Where the supply airflow rate of a fan system exceeds the values specified in Table C403.2.6, the system shall include an energy recovery system. The energy recovery system shall have the capability to provide a change in the enthalpy of the outdoor air supply of not less than 50 percent of the difference between the outdoor air and return air enthalpies, at design conditions. Where an air economizer is required, the energy recovery system shall include a bypass or controls which permit operation of the economizer as required by Section C403.4

Exception: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are prohibited by the *International Mechanical Code*.
2. Laboratory fume hood systems that include at least one of the following features:
   2.1. Variable-air-volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of design values <u>except when higher volumes are required to maintain safe operating conditions</u>.
   2.2. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (1.1°C) above room setpoint, cooled to no cooler than 3°F (1.7°C) below room setpoint, no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Systems serving spaces that are heated to less than 60°F (15.5°C) and are not cooled.
4. Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.
5. Heating energy recovery in Climate Zones 1 and 2.
6. Cooling energy recovery in Climate Zones 3C, 4C, 5B, 5C, 6B, 7 and 8.
7. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
8. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design *outdoor air* flow rate.
9. Systems expected to operate less than 20 hours per week at the *outdoor air* percentage covered by Table C403.2.6
10. <u>Systems exhausting toxic, flammable, paint, or corrosive fumes or dust.</u>
11. <u>Commercial kitchen hoods used for collecting and removing grease vapors and smoke</u>.

Public Comment:

Eric Makela, Britt/Makela Group, representing Northwest Energy Codes Group, requests Approval as

Modified by this Public Comment.

Modify the proposal as follows:

C403.2.6 Energy recovery ventilation systems. Where the supply airflow rate of a fan system exceeds the values specified in Table C403.2.6, the system shall include an energy recovery system. The energy recovery system shall have the capability to provide a change in the enthalpy of the outdoor air supply of not less than 50 percent of the difference between the outdoor air and return air enthalpies, at design conditions. Where an air economizer is required, the energy recovery system shall include a bypass or controls which permit operation of the economizer as required by Section C403.4

Exceptions: An energy recovery ventilation system shall not be required in any of the following conditions:

1. Where energy recovery systems are prohibited by the *International Mechanical Code.*
2. Laboratory fume hood systems that include at least one of the following features:

2.1 Variable-air-volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent of less of design values. ~~except when higher volumes are required to maintain safe operating conditions.~~

2.2 Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (1.1°C) above room setpoint, cooled to no cooler than 3°F (1.7°C) below room setpoint, no humidification added, and no simultaneous heating and cooling used for dehumidification control.

3. Systems serving spaces that are heated to less than 60°F (15.5°C) and are not cooled.
4. Where more than 60 percent of the outdoor eating energy is provided from site-recovered or site solar energy.
5. Heating energy recovery in Climate Zones 1 and 2.
6. Cooling energy recovery in Climate Zones 3C, 4C, 5B, 5C, 6B, 7 and 8.
7. Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
8. Where the largest source of air exhausted at a single location at the building exterior is less than 75 percent of the design *outdoor air* flow rate.
9. Systems expected to operate less than 20 hours per week at the *outdoor air* percentage covered by Table C403.2.6
10. Systems exhausting toxic, flammable, paint, or corrosive fumes or dust.
11. Commercial kitchen hoods used for collecting and removing grease vapors and smoke.

CE214-13

Table C403.2.6

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

TABLE C403.2.6 ENERGY RECOVERY REQUIREMENT

CLIMATE ZONE	PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE							
	≥10% and <20%	≥20% and <30%	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
	DESIGN SUPPLY FAN AIRFLOW RATE (cfm)							
3B, 3C, 4B, 4C, 5B	NR	NR	NR	NR	NR	NR	~~≥5000~~ NR	~~≥5000~~ NR
1B, 2B, 5C	NR	NR	NR	NR	≥26000	≥12000	≥5000	≥4000
6B	≥28000	≥26500	≥11000	≥5500	≥4500	≥3500	≥2500	≥1500
1A, 2A, 3A, 4A, 5A, 6A	≥26000	≥16000	≥5500	≥4500	≥3500	≥2000	≥1000	> 0
7, 8	≥4500	≥4000	≥2500	≥1000	> 0	> 0	> 0	> 0

Public Comment:

Steve Ferguson, ASHRAE, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE C403.2.6 (1)

ENERGY RECOVERY REQUIREMENT (ventilation systems operating <8000 hr/yr)

(Portions of code change proposal not shown remain unchanged)

TABLE C403.2.6 (2) Energy Recovery Requirement (ventilation systems operating ≥8000 hrs/yr

Zone	% *Outdoor Air* at Full Design Airflow Rate							
	≥10% and <20%	≥20% and <30%	≥30% and <40%	≥40% and <50%	≥50% and <60%	≥60% and <70%	≥70% and <80%	≥80%
	Design Supply Fan Airflow Rate (cfm)							
3C	NR	NR	NR	NR	NR	NR	NR	NR
1B, 2B, 3B, 4C, 5C	NR	≥19500	≥9000	≥5000	≥4000	≥3000	≥1500	>0
1A, 2A, 3A, 4B, 5B	≥2500	≥2000	≥1000	≥500	>0	>0	>0	>0
4A, 5A, 6A, 6B, 7, 8	>0	>0	>0	>0	>0	>0	>0	>0

CE217 – 13

C403.2.7

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.7 Duct and plenum insulation and sealing. All supply and return air ducts and plenums shall be insulated with a minimum of R-6 insulation where located in unconditioned spaces and a minimum of R-8 insulation where located outside the building with a minimum of R-8 insulation in climate zones 1 through 4 and a minimum of R-12 insulation in climate zones 5 through 8. Where located within a building envelope assembly, the

duct or plenum shall be separated from the building exterior or unconditioned or exempt spaces by a minimum of R-8 insulation in climate zones 1 through 4 and a minimum of R-12 insulation in climate zones 5 through 8.

Exceptions:

1. Where located within equipment.
2. Where the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F (8°C).

All ducts, air handlers and filter boxes shall be sealed. Joints and seams shall comply with Section 603.9 of the *International Mechanical Code*.

CE220-13

C403.2.7 (NEW), Table C403.2.7 (NEW)

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.7 Kitchen exhaust systems. Replacement air introduced directly into the exhaust hood cavity shall not exceed 10 percent of the hood exhaust airflow rate. Conditioned supply air delivered to any space containing a kitchen hood shall not exceed the greater of the ventilation rate required to meet the space heating or cooling load or the hood exhaust flow minus the available transfer air from adjacent space where available transfer air is considered that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.

When total kitchen hood exhaust airflow rate is greater than 5,000 cfm each hood shall have a maximum exhaust rate in accordance with Table C403.2.7 and shall meet one of the following:

1. At least 50 percent of all replacement air is transfer air that would otherwise be exhausted.
2. Demand ventilation systems on at least 75 percent of the exhaust air that are capable of at least 50 percent reduction in exhaust and replacement air system airflow rates, including controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of smoke, effluent and combustion products during cooking and idle.
3. Listed energy recovery devices with a sensible heat recovery effectiveness of at least 40 percent on at least 50 percent of the total exhaust airflow.

When a single hood, or hood section, is installed over appliances with different duty ratings, then the maximum allowable flow rate for the hood or hood section shall be based on the requirements for the highest appliance duty rating under the hood or hood section.

Exception: When at least 75 percent of all the replacement air is transfer air that would otherwise be exhausted

TABLE C403.2.7

MAXIMUM NET EXHAUST FLOW RATE, CFM PER LINEAR FOOT OF HOOD LENGTH **Type of Hood**	**Light Duty Equipment**	**Medium Duty Equipment**	**Heavy Duty Equipment**	**Extra Heavy Duty Equipment**
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island (per side)	175	210	280	385
Eyebrow	175	175	Not allowed	Not allowed
Backshelf/Pass-over	210	210	280	Not allowed

Public Comment:

Steve Ferguson, ASHRAE, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C403.2.7 Kitchen Exhaust Systems. Replacement air introduced directly into the exhaust hood cavity shall not exceed 10 percent of the hood exhaust airflow rate. Conditioned supply air delivered to any space containing a kitchen hood shall not exceed the greater of the ventilation rate required to meet the space heating or cooling load or the hood exhaust flow minus the available transfer air from adjacent space where available transfer air is considered that portion of outdoor ventilation air not required to satisfy other exhaust needs, such as restrooms, and not required to maintain pressurization of adjacent spaces.

When total kitchen hood exhaust airflow rate is greater than 5,000 cfm, each hood shall be a factory-built commercial exhaust hood listed by a nationally recognized testing laboratory to comply with the requirements of UL710. Each hood shall have a maximum exhaust rate in accordance with Table C403.2.7 and shall meet one of the following

CE222 – 13

C403.2.7.1.1

Proponent: Vickie Lovell InterCode Inc. representing DuctMate Industries (vickie@intercodeinc.com)

Revise as follows:

C403.2.7.1.1 Low-pressure duct systems. All longitudinal and transverse joints, seams and connections of supply and return ducts operating at a static pressure less than or equal to 2 inches water gauge (w.g.) (500 Pa) shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus embedded- fabric systems or tapes installed in accordance with the manufacturer's installation instructions. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the *International Mechanical Code*.

Exception: ~~Continuously welded and locking type longitudinal joints and seams on ducts operating at static pressures less than 2 inches water gauge (w.g.) (500 Pa) pressure classification.~~ For ducts having a static pressure classification of less than 2 inches of water column (500 Pa), additional closure systems shall not be required for continuously welded joints and seams and locking-type joints and seams of other than the snap-lock and button-lock types.

CE223-13

C403.2.7.1.1

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.7.1.1 Low-pressure duct systems. All longitudinal and transverse joints, seams and connections of supply and return ducts operating at a static pressure less than or equal to 2 inches water gauge shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems or tapes installed in accordance with the manufacturer's installation instructions. Pressure classifications specific to the duct system shall be clearly indicated on the construction documents in accordance with the *International Mechanical Code*.

Exception: ~~Continuously welded and l~~Locking-type longitudinal joints and seams need not be sealed as specified in this section ~~on ducts operating at static pressures less than 2 inches water gauge (w.g.) (500 Pa) pressure classification~~.

CE225 – 13

C403.2.7.1.3

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.7.1.3 High-pressure duct systems. Ducts and plenums designed to operate at static pressures ~~in excess of~~ greater than 3 inches water gauge shall be insulated and sealed in accordance with Section C403.2.7. In addition, ducts and plenums shall be leak tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual with the and shown to have a rate of air leakage (CL) less than or equal to 6.0 as determined in accordance with Equation 4-5.

$CL = F/P^{0.65}$ **(Equation 4-5)**
where:

F = The measured leakage rate in cfm per 100 square feet of duct surface.
P = The static pressure of the test.

Documentation shall be furnished by the designer demonstrating that representative sections totaling at least 25 percent of the duct area have been tested and that all tested sections meet the requirements of this section.

CE226 – 13

403.2.7.1.3

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferugson@ashrae.org)

Revise as follows:

C403.2.7.1.3 High-pressure duct systems. All ducts and plenums designed to operate at static pressures in excess of 3 inches water gauge (750 Pa) shall be insulated and sealed in accordance with Section C403.2.7. In addition, ducts and plenums shall be leak tested in accordance with the SMACNA HVAC Air Duct Leakage Test Manual with the rate of air leakage (CL) less than or equal to ~~6.0~~ 4.0 as determined in accordance with Equation 4-5.

$CL = F/P^{0.65}$ **(Equation 4-5)**

where:

F = The measured leakage rate in cfm per 100 square feet of duct surface.

P = The static pressure of the test.

Documentation shall be furnished by the designer demonstrating that representative sections totaling at least 25 percent of the duct system area have been tested and that all tested sections meet the requirements of this section.

CE229 – 13

Table C403.2.8

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

TABLE C403.2.8 MINIMUM PIPE INSULATION THICKNESS (thickness in inches)[a]

FLUID OPERATING TEMPERATURE RANGE AND USAGE (°F)	INSULATION CONDUCTIVITY		NOMINAL PIPE OR TUBE SIZE (inches)				
	Conductivity Btu · in./(h · ft^2 · °F)[b]	Mean Rating Temperature, °F	<1	1 to < 1 1/2	1 1/2 to < 4	4 to < 8	≥ 8
> 350	0.32 – 0.34	250	4.5	5.0	5.0	5.0	5.0
251 – 350	0.29 – 0.32	200	3.0	4.0	4.5	4.5	4.5
201 – 250	0.27 – 0.30	150	2.5	2.5	2.5	3.0	3.0
141 – 200	0.25 – 0.29	125	1.5	1.5	2.0	2.0	2.0
105 – 140	0.21 – 0.28	100	1.0	1.0	1.5	1.5	1.5
40 – 60	0.21 – 0.27	75	0.5	0.5	1.0	1.0	1.0
< 40	0.20 – 0.26	~~75~~ 50	0.5	1.0	1.0	1.0	1.5

(Portions of Table not shown remain unchanged)

CE230 – 13

C403.2.8.2 (NEW), R403.3.2 (NEW) (IRC N1103.2 (NEW))

Proponent: Howard Ahern, Airex Mfg., representing self (howard.ahern@airexmfg.com)

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C403.2.8.2 Chilled water and refrigerant suction piping. Insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall include a Class I or Class II vapor retarding facing located outside the insulation. Piping insulation protection shall be removable and reusable. Piping insulation shall be in accordance with Section C403.2.8.1.

CE234 – 13

C202 (NEW), C403.2.10, C403.2.10.3 (NEW), Chapter 5

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International (amanda@intercodeinc.com)

Revise as follows:

C403.2.10 Air system design and control. Each HVAC system having a total fan system motor nameplate horsepower (hp) exceeding 5 horsepower (hp) (3.7 kW) shall meet the provisions of Sections C403.2.10.1 through ~~C403.2.10.2~~ C403.2.10.3.

C403.2.10.3 Fan efficiency. Fans shall have a fan efficiency grade (FEG) of at least 67 when determined in accordance with AMCA 205 by an *approved*, independent testing laboratory and labeled by the manufacturer. The total efficiency of the fan at the design point of operation shall be within 15 percentage points of the maximum total efficiency of the fan.

Exceptions: The following fans are not required to have a fan efficiency grade:

1. Fans of 5 hp or less as follows:

    1.1 Single fan with a motor nameplate horsepower of 5 hp or less, unless Exception 1.2 applies.
    1.2 Multiple fans in series or parallel that have a combined motor nameplate horsepower of 5 hp or less and are operated as the functional equivalent of a single fan.
2. Fans that are part of equipment covered under Section C403.2.3.
3. Fans included in an equipment package certified by an *approved agency* for air or energy performance.
4. Powered wall/roof ventilators.
5. Fans outside the scope of AMCA 205.
6. Fans that are intended to operate only during emergency conditions.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

FAN EFFICIENCY GRADE (FEG). A numerical rating identifier that specifies the fan's aerodynamic ability to convert shaft power, or impeller power in the case of a direct driven fan, to air power. FEGs are based on fan peak (optimum) energy efficiency that indicates the quality of the fan energy usage and the potential for minimizing the fan energy usage.

Add new standard to Chapter 5 as follows:

AMCA

AMCA 205-12 Energy Efficiency Classification for Fans

CE235 – 13

C403.2.10.1

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.10.1 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 C403.2.10.1(1). This includes supply fans, exhaust fans, return/relief fans, and fan-powered terminal units associated with systems providing heating or cooling capability. Single *zone* variable-air-volume systems shall comply with the constant volume fan power limitation.

~~**Exceptions:** The following fan systems are exempt from allowable fan floor horsepower requirement.~~

1. Hospital, vivarium 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 shall be permitted to use variable volume fan power limitation.
2. Individual exhaust fans with motor nameplate horsepower of 1 hp or less2. Individual exhaust fans with motor nameplate horsepower of 1 hp or less are exempt from the allowable fan horsepower requirement.

CE236 – 13

Table C403.2.10.1(2)

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

TABLE C403.2.10.1(2) FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT

DEVICE	ADJUSTMENT
Credits	
Fully ducted return and/or exhaust air systems	0.5 inch w.c. (2.15 in w.c. for laboratory and vivarium systems)
Return and/or exhaust air flow control devices	0.5 inch 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 inch w.c.
Particulate filtration credit: MERV 13 thru 15	0.9 inch. 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.
Biosafety cabinet	Pressure drop of device at fan system design condition.
Energy recovery device, other than coil runaround loop	(2.2 × energy recovery effectiveness) – 0.5 inch w.c. for each airstream
Coil runaround loop	0.6 inch w.c. for each airstream
Evaporative humidifier/cooler in series with another cooling coil	Pressure drop of device at fan system design conditions
Sound attenuation section (fans serving spaces with design background noise goals below NC35)	0.15 inch w.c.
Exhaust system serving fume hoods	0.35 inch w.c.
Laboratory and vivarium exhaust systems in high-rise buildings	0.25 inch w.c./100 feet of vertical duct exceeding 75 feet
Deductions	
Systems without central cooling device	- 0.6 in. w.c.
Systems without central heating device	- 0.3 in. w.c.
Systems with central electric resistance heat	- 0.2 in. w.c.

w.c. = water column
For SI: 1 inch w.c. = 249 Pa, 1 inch = 25.4 mm.

CE237 – 13

C403.2.10.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.2.10.2 Motor nameplate horsepower. For each fan, the fan brake horse power shall be indicated on the construction documents and the selected motor shall be no larger than the first available motor size greater than the following: ~~brake horsepower. The fan brake horse power shall be indicated on the design documents to allow for compliance verification by the code official.~~

~~**Exceptions:**~~

1. For fans less than 6 bhp (4413 W), ~~where the first available motor larger than the brake horsepower has a nameplate rating within 50 percent of the bhp, selection of the next larger nameplate motor size is allowed.~~ 1.5 times the fan brake horsepower
2. For fans 6 bhp (4413 W) and larger, ~~where the first available motor larger than the bhp has a nameplate rating within 30 percent of the bhp, selection of the next larger nameplate motor size is allowed.~~ 1.3 times the fan brake horsepower.

CE238 – 13

C403.2.10.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.2.10.2 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 (bhp). The fan brake horsepower (bhp) shall be indicated on the design documents to allow for compliance verification by the *code official*.

Exceptions:

1. For fans less than 6 bhp (4413 W), where the first available motor larger than the brake horsepower has a nameplate rating within 50 percent of the bhp, selection of the next larger nameplate motor size is allowed.
2. For fans 6 bhp (4413 W) and larger, where the first available motor larger than the bhp has a nameplate rating within 30 percent of the bhp, selection of the next larger nameplate motor size is allowed.
3. Systems complying with Section C403.2.10.1 *fan system motor nameplate hp* (Option 1).

CE239-13

C403.2.12 (NEW), Table C403.2.12(1) (NEW), Table C403.2.12 (2) (NEW), Chapter 5

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.12 Refrigeration equipment performance. Refrigeration equipment shall have an energy use in kWh/day not greater than the values of Tables C403.2.12(1) and C403.2.12(2) when tested and rated in accordance with AHRI Standard 1200. The energy use shall be verified through certification under an approved certification program or, where no certification program exists, the energy use shall be supported by data furnished by the equipment manufacturer.

TABLE C403.2.12(1) MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL REFRIGERATION

Equipment Type	Application	Energy Use Limits (kWh per day) [a]	Test Procedure
Refrigerator with solid doors	Holding Temperature	0.10 x V + 2.04	AHRI 1200
Refrigerator with transparent doors		0.12 x V + 3.34	
Freezers with solid doors		0.40 x V + 1.38	
Freezers with transparent doors		0.75 x V + 4.10	
Refrigerators/freezers with solid doors		the greater of 0.12 x V + 3.34 or 0.70	
Commercial refrigerators	Pulldown	0.126 x V + 3.51	

[a] V = volume of the chiller or frozen compartment as defined in AHAM-HRF-1

TABLE C403.2.12(2) MINIMUM EFFICIENCY REQUIREMENTS: COMMERCIAL REFRIGERATORS AND FREEZERS

Equipment Type				Energy Use Limits (kWh/day) as of 1/1/2012 [a,b]	Test Procedure
Equipment Class [c]	Family Code	Operating Mode	Rating Temperature		
VOP.RC.M	Vertical Open	Remote Condensing	Medium Temperature	0.82 × TDA + 4.07	AHRI 1200
SVO.RC.M	Semivertical Open	Remote Condensing	Medium Temperature	0.83 × TDA + 3.18	
HZO.RC.M	Horizontal Open	Remote Condensing	Medium Temperature	0.35 × TDA + 2.88	
VOP.RC.L	Vertical Open	Remote Condensing	Low Temperature	2.27 × TDA + 6.85	
HZO.RC.L	Horizontal Open	Remote Condensing	Low Temperature	0.57 × TDA + 6.88	

Equipment Type				Energy Use Limits (kWh/day) as of 1/1/2012 [a,b]	Test Procedure
Equipment Class[c]	Family Code	Operating Mode	Rating Temperature		
VCT.RC.M	Vertical Transparent Door	Remote Condensing	Medium Temperature	0.22 TDA + 1.95	
VCT.RC.L	Vertical Transparent Door	Remote Condensing	Low Temperature	0.56 × TDA + 2.61	
SOC.RC.M	Service Over Counter	Remote Condensing	Medium Temperature	0.51 × TDA + 0.11	
VOP.SC.M	Vertical Open	Self Contained	Medium Temperature	1.74 × TDA + 4.71	
SVO.SC.M	Semivertical Open	Self Contained	Medium Temperature	1.73 × TDA + 4.59	
HZO.SC.M	Horizontal Open	Self Contained	Medium Temperature	0.77 × TDA + 5.55	
HZO.SC.L	Horizontal Open	Self Contained	Low Temperature	1.92 × TDA + 7.08	
VCT.SC.I	Vertical Transparent Door	Self Contained	Ice Cream	0.67 × TDA + 3.29	
VCS.SC.I	Vertical Solid Door	Self Contained	Ice Cream	0.38 × V + 0.88	
HCT.SC.I	Horizontal Transparent Door	Self Contained	Ice Cream	0.56 × TDA + 0.43	
SVO.RC.L	Semivertical Open	Remote Condensing	Low Temperature	2.27 × TDA + 6.85	
VOP.RC.I	Vertical Open	Remote Condensing	Ice Cream	2.89 × TDA + 8.7	
SVO.RC.I	Semivertical Open	Remote Condensing	Ice Cream	2.89 × TDA + 8.7	
HZO.RC.I	Horizontal Open	Remote Condensing	Ice Cream	0.72 × TDA + 8.74	
VCT.RC.I	Vertical Transparent Door	Remote Condensing	Ice Cream	0.66 × TDA + 3.05	
HCT.RC.M	Horizontal Transparent Door	Remote Condensing	Medium Temperature	0.16 × TDA + 0.13	
HCT.RC.L	Horizontal Transparent Door	Remote Condensing	Low Temperature	0.34 × TDA + 0.26	
HCT.RC.I	Horizontal Transparent Door	Remote Condensing	Ice Cream	0.4 × TDA + 0.31	
VCS.RC.M	Vertical Solid Door	Remote Condensing	Medium Temperature	0.11 × V + 0.26	
VCS.RC.L	Vertical Solid Door	Remote Condensing	Low Temperature	0.23 × V + 0.54	
VCS.RC.I	Vertical Solid Door	Remote Condensing	Ice Cream	0.27 × V + 0.63	
HCS.RC.M	Horizontal Solid	Remote Condensing	Medium	0.11 × V + 0.26	

Equipment Type				Energy Use Limits (kWh/day) as of 1/1/2012 [a,b]	Test Procedure
Equipment Class[c]	Family Code	Operating Mode	Rating Temperature		
	Door		Temperature		
HCS.RC.L	Horizontal Solid Door	Remote Condensing	Low Temperature	0.23 × V + 0.54	
HCS.RC.I	Horizontal Solid Door	Remote Condensing	Ice Cream	0.27 × V + 0.63	
HCS.RC.I	Horizontal Solid Door	Remote Condensing	Ice Cream	0.27 × V + 0.63	
SOC.RC.L	Service Over Counter	Remote Condensing	Low Temperature	1.08 × TDA + 0.22	
SOC.RC.I	Service Over Counter	Remote Condensing	Ice Cream	1.26 × TDA + 0.26	
VOP.SC.L	Vertical Open	Self Contained	Low Temperature	4.37 × TDA + 11.82	
VOP.SC.I	Vertical Open	Self Contained	Ice Cream	5.55 × TDA + 15.02	
SVO.SC.L	Semivertical Open	Self Contained	Low Temperature	4.34 × TDA + 11.51	
SVO.SC.I	Semivertical Open	Self Contained	Ice Cream	5.52 × TDA + 14.63	
HZO.SC.I	Horizontal Open	Self Contained	Ice Cream	2.44 × TDA + 9.0	
SOC.SC.I	Service Over Counter	Self Contained	Ice Cream	1.76 × TDA + 0.36	
HCS.SC.I	Horizontal Solid Door	Self Contained	Ice Cream	0.38 × V + 0.88	

[a] V = Volume of the case, as measured in accordance with Appendix C of AHRI 1200.

[b] TDA = Total display area of the case, as measured in accordance with Appendix D of AHRI 1200.

[c] Equipment class designations consist of a combination (in sequential order separated by periods(AAA).(BB).(C)) of:

(AAA) An equipment family code where:

VOP=vertical open

SVO=semivertical open

HZO=horizontal open,

VCT=vertical transparent doors

VCS=vertical solid doors

HCT=horizontal transparent doors

HCS=horizontal solid doors

SOC=service over counter

(BB) An operating mode code, either

RC=remote condensing, or

SC=self-contained).

(C) A rating temperature code, either:

M=medium temperature (38 °F)

L=low temperature (0 °F), or

I=ice-cream temperature (15 °F).

For example, ‘‘VOP.RC.M’’ refers to the ‘‘vertical open, remote condensing, medium temperature’’ equipment class.

Add new standards to Chapter 5 as follows:

AHRI

1200-10 Performance Rating of Commercial Refrigerated Display Merchandisers and Storage Cabinets.

AHAM

HRF-1 2007 Energy, Performance and Capacity of Household Refrigerators, Refrigerator-Freezers and Freezers

CE240-13

C202 (NEW), C403.2.12 (NEW), C403.2.13 (NEW), C403.5 (NEW), C403.5.1 (NEW), C403.5.2 (NEW)

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.2.12 Walk-in Coolers and Walk-in Freezers. Site assembled or site constructed *walk-in coolers* and *walk-in freezers* shall comply with the following:

1. Automatic door closers shall be provided that fully close walk-in doors that have been closed to within 1 inch of full closure.

Exception: Closers are not required for doors over 3 feet 9 inches wide or 7 feet tall.

2. Doorways shall be provided with strip doors, curtains, spring-hinged doors, or other method of minimizing infiltration when the doors are open.

3. Walls shall be provided with insulation having a thermal resistance of not less than R–25, ceilings shall be provided with insulation having a thermal resistance of not less than R–25 and doors of *walk-in coolers* and *walk –in freezers* shall be provided with insulation having a thermal resistance of not less than R–32.

   Exception: Insulation is not required for glazed portions of doors or at structural members associated with the walls, ceiling or door frame.

4. The floor of *walk-in freezers* shall be provided with insulation having a thermal resistance of not less than R–28.

5. Evaporator fan motors that are less than 1 horsepower and less than 460 volts shall be electronically commutated motors or 3-phase motors.

6. Light sources shall have an efficacy of not less than 40 lumens per Watt, including any ballast losses or shall be provided with a device that automatically turns off the lights within 15 minutes of when the *walk-in cooler* or *walk-in freezer* was last occupied.

7. Transparent reach-in doors for and windows in opaque walk-*in freezer* doors shall be provided with triple-pane glass having the interstitial spaces filled with inert gas or provided with heat-reflective treated glass.

8. Transparent reach-in doors for and windows in opaque *walk-in cooler* doors shall be double-pane heat-reflective treated glass having the interstitial space gas filled;

9. Anti-sweat heaters that are not provided with anti-sweat heater controls shall have a total door rail, glass, and frame heater power draw not greater than 7.1 Watts per square foot of door opening for *walk-in freezers*, and not greater than 3.0 Watts per square foot of door opening for *walk-in coolers*.

10. Anti-sweat heater controls shall be capable of reducing the energy use of the anti-sweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.

11. Condenser fan motors that are less than 1 horsepower in capacity shall be of the electronically commutated or permanent split capacitor-type or shall be 3-phase motors.

Exception: Fan motors in *walk-in coolers* and *walk-in freezers* combined in a single enclosure greater than 3,000 square feet in floor area are exempt.

C403.2.13 Refrigerated display cases. Site assembled or site constructed refrigerated display cases shall comply with the following:

1. Lighting in refrigerated display cases and glass doors installed on walk-in coolers and freezers shall be controlled by one of the following;

1.1 Automatic time switch controls to turn off lights during non-business hours. Timed overrides for display cases or walk-in coolers and freezers may be used to turn the lights on for up to one hour and shall automatically time out to turn the lights off.

1.2 Motion sensor controls on each display case or walk-in door section that reduce lighting power by at least 50 percent within 3 minutes after the area within the sensor range is vacated. how about is 'unoccupied' as you have used in other proposals.

2. All low temperature display cases shall incorporate temperature based defrost termination control with a time limit default. The defrost cycle shall terminate first on an upper temperature limit breach and second upon a time limit breach.

3. Anti-sweat heater controls shall reduce the energy use of the anti-sweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.

C403.5 Refrigeration systems Refrigerated display cases, *walk-in coolers* or *walk-in freezers* that are served by remote compressors and remote condensers not located in a *condensing unit*, shall meet the requirements of Section C403.5.and C403.5.2.

Exception: Systems where the working fluid in the refrigeration cycle goes through both subcritical and supercritical states (transcritical) or systems that use ammonia refrigerant are exempt.

C403.5.1 Condensers serving refrigeration systems. Fan-powered condensers shall comply with the following:

1. The design *saturated condensing temperatures* for air-cooled condensers shall not exceed the design dry bulb temperature plus 10°F for *low temperature refrigeration systems*, and the design dry bulb temperature plus 15°F for *medium temperature refrigeration systems* where the s*aturated condensing temperature* for blend refrigerants shall be determined using the average of liquid and vapor temperatures as converted from the condenser drain pressure

2. Condenser fan motors that are less than 1 horsepower shall use electronically commutated motors, permanent split capacitor-type motors or 3-phase motors.

3. All condenser fans for air-cooled condensers, evaporatively cooled condensers, air or water cooled fluid coolers or cooling towers shall reduce fan motor demand to no more than 30% of design wattage at 50% of design air volume, and incorporate one of the following continuous variable speed fan control approaches:

   3.1 Refrigeration system condenser control for air-cooled condensers shall use variable setpoint control logic to reset the condensing temperature setpoint in response to ambient drybulb temperature.

   3.2 Refrigeration system condenser control for evaporatively cooled condensers shall use variable setpoint control logic to reset the condensing temperature setpoint in response to ambient wetbulb temperature.

4. Multiple fan condensers shall be controlled in unison.

5. The minimum condensing temperature setpoint shall be no greater than 70˚F.

C403.5.2 Compressor systems. Refrigeration compressor systems shall comply with the following:

1. Compressors and multiple-compressor systems suction groups shall include control systems that use floating suction pressure control logic to reset the target suction pressure temperature based on the temperature requirements of the attached refrigeration display cases or walk-ins.

   Exception. Controls are not required for the following:

1. Single compressor systems that do not have variable capacity capability.

   2. Suction groups that have a design saturated suction temperature of 30˚F or higher, suction groups that comprise the high stage of a two-stage or cascade system or suction groups that primarily serve chillers for secondary cooling fluids.

2. Liquid sub-cooling shall be provided for all low temperature compressor systems with a design cooling capacity equal to or greater than 100,000 Btu/hr with a design saturated suction temperature of -10˚F or lower. The sub-cooled liquid temperature shall be controlled at a maximum temperature setpoint t of 50˚F at the exit of the sub-cooler using either compressor economizer (inter-stage) ports or a separate compressor suction group operating at a saturated suction temperature of 18˚F or higher.

2.1 Insulation for liquid lines with a fluid operating temperature less than 60˚F are shall comply with Table C403.2.8.

3. All compressors that incorporate internal or external crankcase heaters shall provide a means to cycle the heaters off during compressor operation.

Add new definitions as follows:

SECTION C202

GENERAL DEFINITIONS

BUBBLE POINT. The refrigerant liquid saturation temperature at a specified pressure

CONDENSING UNIT. A factory-made assembly of refrigeration components designed to compress and liquefy a specific refrigerant. The unit consists of one or more refrigerant compressors, refrigerant condensers (air-cooled, evaporatively – cooled, and/or water-cooled), condenser fans and motors (where used) and factory-supplied accessories.

REFRIGERANT DEW POINT. The refrigerant vapor saturation temperature at a specified pressure.

REFRIGERATION SYSTEM, LOW TEMPERATURE. Systems for maintaining food product in a frozen state in refrigeration applications.

REFRIGERATION SYSTEM, MEDIUM TEMPERATURE. Systems for maintaining food product above freezing in refrigeration applications.

SATURATED CONDENSING TEMPERATURE. The saturation temperature corresponding to the measured refrigerant pressure at the condenser inlet for single component and azeotropic refrigerants, and the arithmetic average of the dew point and *bubble point* temperatures corresponding to the refrigerant pressure at the condenser entrance for zeotropic refrigerants.

WALK-IN COOLER. An enclosed storage space less than 3,000 square feet in floor area, designed to maintain the space warmer than 32°F but cooler than 55°F that has a ceiling height of not less than 7 feet

WALK-IN FREEZER. An enclosed storage space less than 3,000 square feet in floor area, designed to maintain the space at no greater than 32°F that has a ceiling height of not less than 7 feet

CE241-13

C403.1, C403.3, C403.3.1.1 (New), C403.1.1.1, C403.3.3.1.1.2, C403.3.1.2 (New), C403.3.1.1.3, Table C403.3.1.1(1), Table C403.3.1.1.3(2), C403.3.1.1.4, C403.3.1.4 (New), C403.3.1.4.1 (New), C403.3.1.4.2 (New), C403.3.2, C403.4 through C403.4.3.5

Proposed Change as Submitted

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C403.1 General. Mechanical systems and equipment serving the building heating, cooling or ventilating needs shall comply with Section C403.2 (referred to as the mandatory provisions) and ~~either~~: shall comply with Sections C403.3 and C403.4 based on the equipment and systems provided.

~~1. Section C403.3 (Simple systems); or~~

~~2. Section C403.4 (Complex systems).~~

C403.3 ~~Simple HVAC systems and equipment~~ Economizers (Prescriptive). This section applies to buildings served by unitary or packaged HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(8). ~~, each serving one *zone* and controlled by a single thermostat in the *zone* served. It also applies to two-pipe heating systems serving one or more *zones*, where no cooling system is installed~~

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections C403.3.1.1 through C403.3.1.1.4.

Exception: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.
3. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).
4. Systems expected to operate less than 20 hours per week.
5. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table C403.3.1(2).

C403.3.1.1 Integrated economizer control. Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even where additional mechanical cooling is required to meet the remainder of the cooling load.

Exceptions:

1. Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25 percent of the total system capacity.
2. Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h (15 827 W) and use nonintegrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.

C403.3.1.2 Economizer heating system impact. HVAC system design and economizer controls shall be such that economizer operation does not increase the building heating energy use during normal operation.

Exception: Economizers on VAV systems that cause *zone* level heating to increase due to a reduction in supply air temperature.

TABLE C403.3.1(1)
ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems ≥ 33,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.2931 W.

a. The total capacity of all systems without economizers shall not exceed 300,000 Btu/h per *building*, or 20 percent of its air economizer capacity, whichever is greater.

TABLE C403.3.1(2)
EQUIPMENT EFFICIENCY
PERFORMANCE EXCEPTION FOR ECONOMIZERS

CLIMATE ZONES	COOLING EQUIPMENT PERFORMANCE IMPROVEMENT (EER OR IPLV)
2B	10% Efficiency Improvement
3B	15% Efficiency Improvement
4B	20% Efficiency Improvement

~~**C403.3.1.1**~~ **C403.3.1.3 Air economizers.** Air economizers shall comply with Sections ~~C403.3.1.1.1 through C403.3.1.1.4.~~ C403.3.1.3.1 through C403.3.1.3.4.

~~**C403.3.1.1.1**~~ **C403.3.1.3.1 Design capacity.** Air economizer systems shall be capable of modulating *outdoor air* and return air dampers to provide up to 100 percent of the design supply air quantity as *outdoor air* for cooling.

~~**C403.3.1.1.2**~~ **C403.3.1.3.2 Control signal.** Economizer dampers shall be capable of being sequenced with the mechanical cooling equipment and shall not be controlled by only mixed air temperature.

Exception: The use of mixed air temperature limit control shall be permitted for systems controlled from space temperature (such as single-*zone* systems).

~~**C403.3.1.1.3.**~~ **C403.3.1.3.3 High-limit shutoff.** Air economizers shall be capable of automatically reducing *outdoor air* intake to the design minimum *outdoor air* quantity when *outdoor air* intake will no longer reduce cooling energy usage. High-limit shutoff control types for specific climates shall be chosen from Table ~~C403.3.1.1.3(1)~~ C403.3.1.3.3(1). High-limit shutoff control settings for these control types shall be those specified in Table ~~C403.3.1.1(2)~~ C403.3.1.3.3(2).

TABLE ~~C403.3.1.1(1)~~ C403.3.1.3.3(1)

HIGH-LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS CLIMATE ZONES	ALLOWED CONTROL TYPES	PROHIBITED CONTROL TYPES
1B, 2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B, 7, 8	Fixed dry bulb Differential dry bulb Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Fixed enthalpy
1A, 2A, 3A, 4A	Fixed dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Differential dry bulb
All other climates	Fixed dry bulb Differential dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	—

a. Electronic enthalpy controllers are devices that use a combination of humidity and dry-bulb temperature in their switching algorithm.

TABLE ~~C403.3.1.1.3(2)~~C403.3.1.3.3(2)

HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS DEVICE TYPE	CLIMATE ZONE	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHEN):	
		EQUATION	DESCRIPTION
Fixed dry bulb	1B, 2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B, 7, 8	T_{OA} > 75°F	Outdoor air temperature exceeds 75°F
	5A, 6A, 7A	T_{OA} > 70°F	Outdoor air temperature exceeds 70°F

	All other zones	T_{OA} > 65°F	Outdoor air temperature exceeds 65°F
Differential dry bulb	1B, 2B, 3B, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	$T_{OA} > T_{RA}$	Outdoor air temperature exceeds return air temperature
Fixed enthalpy	All	h_{OA} > 28 Btu/lb[a]	Outdoor air enthalpy exceeds 28 Btu/lb of dry air[a]
Electronic Enthalpy	All	(T_{OA}, RH_{OA}) > *A*	Outdoor air temperature/RH exceeds the "A" setpoint curve[b]
Differential enthalpy	All	$h_{OA} > h_{RA}$	Outdoor air enthalpy exceedsreturn air enthalpy
Dew-point and dry bulb temperatures	All	DP_{OA} > 55°F or T_{OA} > 75°F	Outdoor air dry bulb exceeds 75°F or outside dew point exceeds 55°F (65 gr/lb)

For SI: °C = (°F - 32) × 5/9 , 1 Btu/lb = 2.33 kJ/kg.

a. At altitudes substantially different than sea level, the Fixed Enthalpy limit shall be set to the enthalpy value at 75°F and 50-percent relative humidity. As an example, at approximately 6,000 feet elevation the fixed enthalpy limit is approximately 30.7 Btu/lb.

b. Setpoint "A" corresponds to a curve on the psychometric chart that goes through a point at approximately 75°F and 40-percent relative humidity and is nearly parallel to dry-bulb lines at low humidity levels and nearly parallel to enthalpy lines at high humidity levels.

~~**C403.3.1.1.4**~~ **C403.3.1.3.4 Relief of excess outdoor air.** Systems shall be capable of relieving excess *outdoor air* during air economizer operation to prevent over-pressurizing the building. The relief air outlet shall be located to avoid recirculation into the building.

C403.3.1.4 Water-side economizers. Water-side economizers shall comply with Sections C403.3.1.4.1 through C403.3.1.4.2

C403.3.1.4.1 Design capacity. Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at *outdoor air* temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) and below.

Exception: Systems in which a water economizer is used and where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) shall

satisfy 100 percent of the expected system cooling load at 45°F dry bulb (7.2°C dry bulb)/40°F wet bulb (4.5°C wet bulb).

C403.3.1.4.2 Maximum pressure drop. Precooling coils and water-to-water heat exchangers used as part of a water economizer system shall either have a water-side pressure drop of less than 15 feet (4572 mm) of water or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling (noneconomizer) mode.

~~**C403.3.2 Hydronic system controls.** Hydronic systems of at least 300,000 Btu/h (87 930 W) design output capacity supplying heated and chilled water to comfort conditioning systems shall include controls that meet the requirements of Section C403.4.3.~~

C403.4 ~~Complex~~ Hydronic and multi-zone HVAC system controls and equipment. (Prescriptive). This section applies to buildings served by HVAC equipment and systems not covered in Section C403.3. Hydronic and multi-zone HVAC system controls and equipment shall comply with this section.

~~**C403.4.1 Economizers.** Economizers shall comply with Sections C403.4.1.1 through C403.4.1.4.~~

~~**C403.4.1.1 Design capacity.** Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at *outdoor air* temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) and below.~~

~~**Exception:** Systems in which a water economizer is used and where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) shall satisfy 100 percent of the expected system cooling load at 45°F dry bulb (7.2°C dry bulb)/40°F wet bulb (4.5°C wet bulb).~~

~~**C403.4.1.2 Maximum pressure drop.** Precooling coils and water-to-water heat exchangers used as part of a water economizer system shall either have a water-side pressure drop of less than 15 feet (4572 mm) of water or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling (noneconomizer) mode.~~

~~**C403.4.1.3 Integrated economizer control.** Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even where additional mechanical cooling is required to meet the remainder of the cooling load.~~

~~**Exceptions:**~~

~~1. Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25 percent of the total system capacity.~~

~~2. Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h (15 827 W) and use nonintegrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.~~

~~**C403.4.1.4 Economizer heating system impact.** HVAC system design and economizer controls shall be such that economizer operation does not increase the building heating energy use during normal operation.~~

~~**Exception:** Economizers on VAV systems that cause *zone* level heating to increase due to a reduction in supply air temperature.~~

~~**C403.4.2**~~ **C403.4.1 Variable air volume (VAV) fan control.** Individual VAV fans with motors of 7.5 horsepower (5.6 kW) or greater shall be:

1. Driven by a mechanical or electrical variable speed drive;

2. Driven by a vane-axial fan with variable-pitch blades; or

3. The fan shall have controls or devices that will result in fan motor demand of no more than 30 percent of their design wattage at 50 percent of design airflow when static pressure set point equals one-third of the total design static pressure, based on manufacturer's certified fan data.

~~**C403.4.2.1**~~ **C403.4.1.1 Static pressure sensor location.** Static pressure sensors used to control VAV fans shall be placed in a position such that the controller setpoint is no greater than one-third the total design fan static pressure, except for systems with *zone* reset control complying with Section C403.4.2.2. For sensors installed down-stream of major duct splits, at least one sensor shall be located on each major branch to ensure that static pressure can be maintained in each branch.

~~**C403.4.2.2**~~ **C403.4.1.2 Set points for direct digital control.** For systems with direct digital control of individual *zone* boxes reporting to the central control panel, the static pressure set point shall be reset based on the *zone* requiring the most pressure, i.e., the set point is reset lower until one *zone* damper is nearly wide open.

~~**C403.4.3**~~ **C403.4.2 Hydronic systems controls.** The heating of fluids that have been previously mechanically cooled and the cooling of fluids that have been previously mechanically heated shall be limited in accordance with Sections ~~C403.4.3.1 through C403.4.3.3~~ C403.4.2.1 through C403.4.2.3. Hydronic heating systems comprised of multiple-packaged boilers and designed to deliver conditioned water or steam into a common distribution system shall include automatic controls capable of sequencing operation of the boilers. Hydronic heating systems comprised of a single boiler and greater than 500,000 Btu/h (146 550 W) input design capacity shall include either a multistaged or modulating burner.

~~C403.4.3.1~~ **C403.4.2.1 Three-pipe system.** Hydronic systems that use a common return system for both hot water and chilled water are prohibited.

~~C403.4.3.2~~ **C403.4.2.2 Two-pipe changeover system.** Systems that use a common distribution system to supply both heated and chilled water shall be designed to allow a dead band between changeover from one mode to the other of at least 15°F (8.3°C) outside air temperatures; be designed to and provided with controls that will allow operation in one mode for at least 4 hours before changing over to the other mode; and be provided with controls that allow heating and cooling supply temperatures at the changeover point to be no more than 30°F (16.7°C) apart.

~~C403.4.3.3~~ **C403.4.2.3 Hydronic (water loop) heat pump systems.** Hydronic heat pump systems shall comply with Sections ~~C403.4.3.3.1~~ C403.4.2.3.1, through ~~C403.4.3.3.3~~

C403.4.2.3.2.

~~C403.4.3.3.1~~ **C403.4.2.3.1 Temperature dead band.** Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of providing a heat pump water supply temperature dead band of at least 20°F (11.1°C) between initiation of heat rejection and heat addition by the central devices.

Exception: Where a system loop temperature optimization controller is installed and can determine the most efficient operating temperature based on realtime conditions of demand and capacity, dead bands of less than 20°F (11°C) shall be permitted.

~~C403.4.3.3.2~~ **C403.4.2.3.2 Heat rejection.** Heat rejection equipment shall comply with Sections ~~C403.4.3.3.2.1 and C403.4.3.3.2.2.~~ C403.4.2.3.2.1 and C403.4.2.3.2.2

Exception: Where it can be demonstrated that a heat pump system will be required to reject heat throughout the year.

~~C403.4.3.3.2.1~~ **C403.4.2.3.2.1 Climate Zones 3 and 4.** For climate zones 3 and 4:

1. If a closed-circuit cooling tower is used directly in the heat pump loop, either an automatic valve shall be installed to bypass all but a minimal flow of water around the tower, or lower leakage positive closure dampers shall be provided.

2. If an open-circuit tower is used directly in the heat pump loop, an automatic valve shall be installed to bypass all heat pump water flow around the tower.

3. If an open- or closed-circuit cooling tower is used in conjunction with a separate heat exchanger to isolate the cooling tower from the heat pump loop, then heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop.

~~C403.4.3.3.2.2~~ C403.4.2.3.2.2 **Climate Zones 5 through 8.** For Climate Zones 5 through 8, if an open- or closed-circuit cooling tower is used, then a separate heat exchanger shall be provided to isolate the cooling tower from the heat pump loop, and heat loss shall be controlled by shutting down the circulation pump on the cooling tower loop and providing an automatic valve to stop the flow of fluid.

~~C403.4.3.3.3~~ C403.4.2.3.3. **Two position valve.** Each hydronic heat pump on the hydronic system having a total pump system power exceeding 10 horsepower (hp) (7.5 kW) shall have a two-position valve.

~~C403.4.3.4~~ C403.4.3.3 **Part load controls.** Hydronic systems greater than or equal to 300,000 Btu/h (87 930 W) in design output capacity supplying heated or chilled water to comfort conditioning systems shall include controls that have the capability to:

1. Automatically reset the supply-water temperatures using zone-return water temperature, building-return water temperature, or outside air temperature as an indicator of building heating or cooling demand. The temperature shall be capable of being reset by at least 25 percent of the design supply-to-return water temperature difference; or

2. Reduce system pump flow by at least 50 percent of design flow rate utilizing adjustable speed drive(s) on pump(s), or multiple-staged pumps where at least one-half of the total pump horsepower is capable of being automatically turned off or control valves designed to modulate or step down, and close, as a function of load, or other *approved* means.

~~C403.4.3.5~~ C403.4.3.4 **Pump isolation.** Chilled water plants including more than one chiller shall have the capability to reduce flow automatically through the chiller plant when a chiller is shut down. Chillers piped in series for the purpose of increased temperature differential shall be considered as one chiller.

Boiler plants including more than one boiler shall have the capability to reduce flow automatically through the boiler plant when a boiler is shut down.

Public Comment 1:

Brenda Thompson, CBCO, Manager Building Inspections, Clark County Development Services, ICC Sustainability, Energy and High Performance Code Action Committee (SEHPCAC) Chair; Jeremiah Williams, U.S. Department of Energy, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

C403.1 General. Mechanical systems and equipment serving the building heating, cooling or ventilating needs shall comply with Section C403.2 (referred to as the mandatory provisions) and shall comply with Sections C403.3 and C403.4 based on the equipment and systems provided.

C403.3 Economizers (Prescriptive). ~~This section applies to buildings served HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(8).~~ **~~C403.3.1 Economizers.~~** Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections ~~C403.3.1.1~~ C403.3.1 through ~~C403.3.1.1.4~~ C403.3.4.

Exception: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1). C403.3(1)
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.
3. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).
4. Systems expected to operate less than 20 hours per week.
5. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table C403.3.1(2). C403.3(2)

~~C403.3.1.1~~ C403.3.1 Integrated economizer control. Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even where additional mechanical cooling is required to meet the remainder of the cooling load.

Exceptions:

1. Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25 percent of the total system capacity.
2. Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h (15 827 W) and use nonintegrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling.

~~C403.3.1.2~~ C403.3.2 Economizer heating system impact. HVAC system design and economizer controls shall be such that economizer operation does not increase the building heating energy use during normal operation.

Exception: Economizers on VAV systems that cause *zone* level heating to increase due to a reduction in supply air temperature.

Table ~~C403.3.1(1)~~ C403.3(1)

ECONOMIZER REQUIREMENTS

Table ~~C403.3.1(2)~~ C403.3(2)

EQUIPMENT EFFICIENCY

PERFORMANCE EXCEPTION FOR ECONOMIZERS

~~**C403.3.1.3**~~ **C403.3.3 Air economizers.** Air economizers shall comply with Sections ~~C403.3.1.3.1~~ C403.3.3.1 through ~~C403.3.1.3.4.~~ C403.3.3.4

~~**C403.3.1.3.1**~~ **C403.3.3.1 Design capacity.** Air economizer systems shall be capable of modulating *outdoor air* and return air dampers to provide up to 100 percent of the design supply air quantity as *outdoor air* for cooling.

~~**C403.3.1.3.2**~~ **C403.3.3.2 Control signal.** Economizer dampers shall be capable of being sequenced with the mechanical cooling equipment and shall not be controlled by only mixed air temperature.

> **Exception:** The use of mixed air temperature limit control shall be permitted for systems controlled from space temperature (such as single-*zone* systems).

~~**C403.3.1.3.3**~~ **C403.3.3.3 High-limit shutoff.** Air economizers shall be capable of automatically reducing *outdoor air* intake to the design minimum *outdoor air* quantity when *outdoor air* intake will no longer reduce cooling energy usage. High-limit shutoff control types for specific climates shall be chosen from Table C403.3.1.3.3(1). C403.3.3.3(1) High-limit shutoff control settings for these control types shall be those specified in Table C403.3.1.3.3(2). C403.3.3.3(2)

~~**Table C403.3.1.3.3(1)**~~ **C403.3.3.3(1)**

HIGH-LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS

~~**Table C403.3.1.3.3(2)**~~ **C403.3.3.3(2)**

~~**HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS**~~

~~**C403.3.1.3.4**~~ **C403.3.3.4 Relief of excess outdoor air.** Systems shall be capable of relieving excess *outdoor air* during air economizer operation to prevent over-pressurizing the building. The relief air outlet shall be located to avoid recirculation into the building.

~~**C403.3.1.4**~~ **C403.3.4 Water-side economizers.** Water-side economizers shall comply with Sections

~~C403.3.1.4.1~~ C403.3.4.1 through ~~C403.3.1.4.2~~ C403.3.4.2

~~**C403.3.1.4.1**~~ **C403.3.4.1 Design capacity.** Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at *outdoor air* temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) and below.

Exception: Systems in which a water economizer is used and where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb (10°C dry bulb)/45°F wet bulb (7.2°C wet bulb) shall satisfy 100 percent of the expected system cooling load at 45°F dry bulb (7.2°C dry bulb)/40°F wet bulb (4.5°C wet bulb).

~~**C403.3.1.4.2**~~ **C403.3.4.2. Maximum pressure drop.** Precooling coils and water-to-water heat exchangers used as part of a water economizer system shall either have a water-side pressure drop of less than 15 feet (4572 mm) of water or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling (non-economizer) mode.

C403.4 Hydronic and multi-zone HVAC system controls and equipment. (Prescriptive). ~~This section applies to buildings served by HVAC equipment and systems not covered in Section C403.3.~~ Hydronic and multi-zone HVAC system controls and equipment shall comply with this section.

(Portions of proposal not shown remain unchanged)

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C403.3.1, Table C403.3.1(1)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C403.3 Simple HVAC systems and equipment (Prescriptive). This section applies to buildings served by unitary or packaged HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(8), each serving one *zone* and controlled by a single thermostat in the *zone* served. It also applies to two-pipe heating systems serving one or more *zones*, where no cooling system is installed.

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections C403.3.1.1 through C403.3.1.1.4.

Exception: Economizers are not required for the systems listed below.

~~1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).~~

1. In cooling systems for buildings located in climate zones 1A and 1B.

2. In climate zones other than 1A and 1B, where individual cooling units have a capacity of less than 33,000 Btu/h. The total supply capacity of all fan-cooling units not provide with economizers shall not exceed 20 percent of the total supply capacity of all fan-cooling units in the building nor 300,000 Btu/h, whichever is greater.

~~2.~~ 3. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.

~~3.~~ 4. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).

4. 5. Systems expected to operate less than 20 hours per week.

~~5.~~ 6. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.

~~6.~~ 7. Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table C403.3.1(2).

~~**TABLE C403.3.1(1) ECONOMIZER REQUIREMENTS**~~

~~**CLIMATE ZONES**~~	~~**ECONOMIZER REQUIREMENT**~~
~~1A, 1B~~	~~No requirement~~
~~2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8~~	~~Economizers on all cooling systems ≥ 33,000 Btu/h[a]~~

~~For SI: 1 British thermal unit per hour = 0.2931 W.~~

~~a. The total capacity of all systems without economizers shall not exceed 300,000 Btu/h per *building*, or 20 percent of its air economizer capacity, whichever is greater~~

CE244-13

C403.3.1, Table C403.3.1(1)

Proposed Change as Submitted

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections C403.3.1.1 through C403.3.1.1.4.

Exception: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.
3. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).
4. Systems expected to operate less than 20 hours per week.
5. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table C403.3.1(2).
7. Systems under 110,000 Btu/h total cooling capacity that utilize multiple stage cooling capacity control and multiple speed fan control.

TABLE C403.3.1(1) ECONOMIZER REQUIREMENTS

CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems ≥ 33,000 ≥ 54,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.2931 W.

The total capacity of all systems without economizers shall not exceed 300,000 Btu/h per *building*, or 20 percent of its air economizer capacity, whichever is greater.

Public Comment:

Brenda Thompson, CBCO, Manager Building Inspections, Clark County Development Services, ICC Sustainability, Energy and High Performance Code Action Committee (SEHPCAC) Chair requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections C403.3.1.1 through C403.3.1.1.4.

Exception: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.

3. Systems that serve *residential* spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).
4. Systems expected to operate less than 20 hours per week.
5. Where the use of *outdoor air* for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling *efficiency* meets or exceeds the *efficiency* requirements in Table C403.3.1(2).
~~7. Systems under 110,000 Btu/h total cooling capacity that utilize multiple stage cooling capacity control and multiple speed fan control.~~

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C403.3.1, Table C403.3.1(1), C403.3.1.4, C4033.1.1.5 (NEW), Table C403.3.1.1.3(2), C403.3.1.2 (NEW), C403.3.1.2.1 (NEW)

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections C403.3.1.1 through ~~C403.3.1.1.4.~~ C403.3.1.1.5.

Exception: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.
3. Systems that serve residential spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).
4. Systems expected to operate less than 20 hours per week.
5. Where the use of outdoor air for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling efficiency meets or exceeds the efficiency requirements in Table C403.3.1(2).
7. Systems that include a heat recovery system in accordance with Section C403.4.6.
8. Systems that serve spaces whose sensible cooling load at design conditions, excluding transmission and *infiltration* loads, is not more than the transmission and *infiltration* losses at an outdoor temperature of 60°F.

TABLE C403.3.1(1)

ECONOMIZER REQUIREMENTS CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems ≥ 33,000 54,000 [a] Btu/h

For SI: 1 British thermal unit per hour = 0.2931 W.

The total capacity of all systems without economizers shall not exceed 300,000 Btu/h per *building*, or 20 percent of its air economizer capacity, whichever is greater.

C403.3.1.1.4 Dampers. Return, exhaust/relief, and outdoor air dampers shall in accordance with Section C402.4.5.2

C403.3.1.1.5 Relief of excess outdoor air. Systems shall be capable of relieving excess outdoor air during air economizer operation to prevent over-pressurizing the building. The relief air outlet shall be located to avoid recirculation into the building.

TABLE C403.3.1.1.3(2)
HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS

DEVICE TYPE	CLIMATE ZONE	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHEN):	
		EQUATION	DESCRIPTION
Fixed dry bulb	1B, 2B, 3B, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	*TOA* > 75°F	Outdoor air temperature exceeds 75°F
	~~5A, 6A, 7A~~	*TOA* > 70°F	Outdoor air temperature exceeds 70°F
	~~All other zones~~	~~*TOA* > 65°F~~	~~Outdoor air temperature exceeds 65°F~~
Differential dry bulb	1B, 2B, 3B, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	*TOA* > *TRA*	Outdoor air temperature exceeds return air temperature
Fixed enthalpy	~~All~~ 2A, 3A, 4A, 5A, 6A	*hOA* > 28 Btu/lb[a]	Outdoor air enthalpy exceeds 28 Btu/lb of dry air[a]
Electronic Enthalpy	All	(*TOA*, *RHOA*) > *A*	Outdoor air temperature/RH exceeds the "A" setpoint curve[b]
Differential enthalpy	All	*hOA* > *hRA*	Outdoor air enthalpy exceeds return air enthalpy
Dew-point and dry bulb temperatures	All	*DPOA* > 55°F or *TOA* > 75°F	Outdoor air dry bulb exceeds 75°F or outside dew point exceeds 55°F (65 gr/lb)

For SI:°C = (°F - 32) × 5/9, 1 Btu/lb = 2.33 kJ/kg.

a. At altitudes substantially different than sea level, the Fixed Enthalpy limit shall be set to the enthalpy value at 75°F and 50-percent relative humidity. As an example, at approximately 6,000 feet elevation the fixed enthalpy limit is approximately 30.7 Btu/lb.

b. Setpoint "A" corresponds to a curve on the psychometric chart that goes through a point at approximately 75°F and 40-percent relative humidity and is nearly parallel to dry-bulb lines at low humidity levels and nearly parallel to enthalpy lines at high humidity levels.

C403.3.1.2 Water economizers. Water economizers shall comply with Sections C403.3.1.2.1 through C403.3.1.2.2.

C403.3.1.2.1 Design capacity. Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at outdoor air temperatures not greater than 50°F dry bulb/45°F wet bulb.

Exceptions:

1. Systems primarily serving computer rooms in which 100 percent of the expected system cooling load at 40°F dry bulb/35°F wet bulb is met with evaporative water economizers.

2. Systems primarily serving computer rooms with dry cooler water economizers which satisfy 100 percent of the expected system cooling load at 35°F dry bulb.

3. Systems where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb/45°F wet bulb and where 100 percent of the expected system cooling load at 45°F(7°C) dry bulb/40°F (4°C) wet bulb is met with evaporative water economizers.

C403.3.1.2.2 Maximum pressure drop. Precooling coils and water-to-water heat exchangers used as part of a water economizer system shall either have a water-side pressure drop of less than 15 feet of

water (45 kPa) or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling (non-economizer) mode.

Public Comment 1:

Steve Ferguson, ASHRAE, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections C403.3.1.1 through C403.3.1.1.5.

Exception: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).

2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.

3. Systems that serve residential spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).

4. Systems expected to operate less than 20 hours per week.

5. Where the use of outdoor air for cooling will affect supermarket open refrigerated casework systems.

6. Where the cooling efficiency meets or exceeds the efficiency requirements in Table C403.3.1(2).

7. Systems that include a heat recovery system in accordance with Section C403.4.6.

8. Systems that serve spaces whose sensible cooling load at design conditions, excluding transmission and *infiltration* loads, is not more than the transmission and *infiltration* losses at an outdoor temperature of 60°F.

TABLE C403.3.1(1)

ECONOMIZER REQUIREMENTS CLIMATE ZONES	ECONOMIZER REQUIREMENT
1A, 1B	No requirement
2A, 2B, 3A, 3B, 3C, 4A, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	Economizers on all cooling systems ≥ 54,000 Btu/h[a]

For SI: 1 British thermal unit per hour = 0.2931 W.

a. The total capacity of all systems without economizers shall not exceed 300,000 Btu/h per *building*, or 20 percent of its air economizer capacity, whichever is greater.

C403.3.1.1.4 Dampers. Return, exhaust/relief, and outdoor air dampers shall in accordance with Section C402.4.5.2

C403.3.1.1.5 Relief of excess outdoor air. Systems shall be capable of relieving excess outdoor air during air economizer operation to prevent over-pressurizing the building. The relief air outlet shall be located to avoid recirculation into the building.

TABLE C403.3.1.1.3(1)

HIGH LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS

TABLE C403.3.1.1.3(2)

DEVICE TYPE	CLIMATE ZONE	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHEN):	
		EQUATION	DESCRIPTION
Fixed dry bulb	1B, 2B, 3B, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	$T_{OA} > 75°F$	Outdoor air temperature exceeds 75°F
	5A, 6A	$T_{OA} > 70°F$	Outdoor air temperature exceeds 70°F
	1a, 2a, 3a, 4a	$T_{OA} > 65°F$	Outdoor air temperature exceeds 65°F
Differential dry bulb	1B, 2B, 3B, 3C, 4B, 4C, 5A, 5B, 5C, 6A, 6B, 7, 8	$T_{OA} > T_{RA}$	Outdoor air temperature exceeds return air temperature
Fixed enthalpy with fixed dry-bulb temperature	All ~~2A, 3A, 4A, 5A, 6A~~	$h_{OA} > 28$ Btu/lb[a] or $T_{OA} > 75°F$	Outdoor air enthalpy exceeds 28 Btu/lb of dry air[a] or Outdoor air temperature exceeds 75°F
~~Electronic Enthalpy~~	~~All~~	~~$(T_{OA}, RH_{OA}) > A$~~	~~Outdoor air temperature/RH exceeds the "A" setpoint curve[b]~~
Differential enthalpy with fixed dry-bulb temperature	All	$h_{OA} > h_{RA}$ or $T_{OA} > 75$	Outdoor air enthalpy exceeds return air enthalpy or Outdoor air temperature exceeds 75°F
~~Dew-point and dry-bulb temperatures~~	~~All~~	~~$DP_{OA} > 55°F$ or $T_{OA} > 75°F$~~	~~Outdoor air dry bulb exceeds 75°F or outside dew point exceeds 55°F (65 gr/lb)~~

For SI:°C = (°F - 32) × 5/9, 1 Btu/lb = 2.33 kJ/kg.

a. At altitudes substantially different than sea level, the Fixed Enthalpy limit shall be set to the enthalpy value at 75°F and 50-percent relative humidity. As an example, at approximately 6,000 feet elevation the fixed enthalpy limit is approximately 30.7 Btu/lb.

~~b. Setpoint "A" corresponds to a curve on the psychometric chart that goes through a point at approximately 75°F and 40-percent relative humidity and is nearly parallel to dry-bulb lines at low humidity levels and nearly parallel to enthalpy lines at high humidity levels.~~ Devices ~~with selectable setpoints shall be capable of being set to within 2°F and 2 Btu/lb of the setpoint listed.~~

C403.3.1.2 Water economizers. Water economizers shall comply with Sections C403.3.1.2.1 through C403.3.1.2.2.

C403.3.1.2.1 Design capacity. Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100 percent of the expected system cooling load at outdoor air temperatures not greater than 50°F dry bulb/45°F wet bulb.

Exceptions:

1. Systems primarily serving computer rooms in which 100 percent of the expected system cooling load at 40°F dry bulb/35°F wet bulb is met with evaporative water economizers.

2. Systems primarily serving computer rooms with dry cooler water economizers which satisfy 100 percent of the expected system cooling load at 35°F dry bulb.

3. Systems where dehumidification requirements cannot be met using outdoor air temperatures of 50°F dry bulb/45°F wet bulb and where 100 percent of the expected system cooling load at 45°F(7°C) dry bulb/40°F (4°C) wet bulb is met with evaporative water economizers.

C403.3.1.2.2 Maximum pressure drop. Precooling coils and water-to-water heat exchangers used as part of a water economizer system shall either have a water-side pressure drop of less than 15 feet of water (45 kPa) or a secondary loop shall be created so that the coil or heat exchanger pressure drop is not seen by the circulating pumps when the system is in the normal cooling (non-economizer) mode.

Public Comment 2:

Steve Ferguson, ASHRAE, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C403.3.1 Economizers. Each cooling system that has a fan shall include either an air or water economizer meeting the requirements of Sections C403.3.1.1 through C403.3.1.1.4.

Exception: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1).
2. Where more than 25 percent of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F (1.7 °C) dew-point temperature to satisfy process needs.
3. Systems that serve residential spaces where the system capacity is less than five times the requirement listed in Table C403.3.1(1).
4. Systems expected to operate less than 20 hours per week.
5. Where the use of outdoor air for cooling will affect supermarket open refrigerated casework systems.
6. Where the cooling efficiency meets or exceeds the efficiency requirements in Table C403.3.1(2).
7. Systems that include a heat recovery system in accordance with Section C403.4.6.

~~8. Systems that serve spaces whose sensible cooling load at design conditions, excluding transmission and *infiltration* loads, is not more than the transmission and *infiltration* losses at an outdoor temperature of 60°F.~~

CE246-13

C202 (NEW), Table C403.3.1.1.3(1)

Proposed Change as Submitted

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C403.3.1.1.3(1)

HIGH-LIMIT SHUTOFF CONTROL OPTIONS FOR AIR ECONOMIZERS CLIMATE ZONES	ALLOWED CONTROL TYPES	PROHIBITED CONTROL TYPES
1B, 2B, 3B, 3C, 4B, 4C, 5B, 5C, 6B, 7, 8	Fixed dry bulb Differential dry bulb Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Fixed enthalpy
1A, 2A, 3A, 4A	Fixed dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy Dew-point and dry-bulb temperatures	Differential dry bulb
All other climates	Fixed dry bulb Differential dry bulb Fixed enthalpy Electronic enthalpy[a] Differential enthalpy	—

	Dew-point and dry-bulb temperatures	

~~a. Electronic enthalpy controllers are devices that use a combination of humidity and dry-bulb temperature in their switching algorithm.~~

Add new definition as follows:

SECTION C202

GENERAL DEFINITIONS **ELECTRONIC ENTHALPY CONTROLLER.** A device that uses a combination of humidity and dry bulb temperature in its switching algorithm.

CE247 – 13

C403.3.1.1, C403.3.1.1.5 (NEW)

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International (amanda@intercodeinc.com)

Revise as follows:
C403.3.1.1 Air economizers. Air economizers shall comply with Sections C403.3.1.1.1 through ~~C403.3.1.1.4~~ C403.3.1.1.5.

C403.3.1.1.5 Economizer dampers. Dampers used in economizers shall comply with the requirements of Section C402.4.5.2.

CE249 – 13

C403.4.1, Table C403.4.1(NEW)

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C403.4.1 Economizers. ~~Economizers shall comply with~~ Each cooling system shall include either an air economizer in compliance with Section C403.3.1.1 or water economizer in compliance with Sections C403.4.1.1 through C403.4.1.4.

Exceptions: Economizers are not required for the systems listed below.

1. Individual fan-cooling units with a supply capacity less than the minimum listed in Table C403.3.1(1) that either:
   1.1. Have direct expansion cooling coils, or
   1.2. Where the total chilled water system capacity less the capacity of fan units with air economizers is less than the minimum listed in Table C403.4.1.
2. Chilled-water cooling systems that are passive (without a fan) or use induction where the total chilled water system capacity less the capacity of fan units with air economizers is less than the minimum listed in Table C403.4.1.

3. Individual cooling units that are in compliance with exceptions 2 through 6 to economizers under Section C403.3.1.

TABLE C403.4.1
MINIMUM CHILLED WATER SYSTEM COOLING CAPACITY FOR DETERMINING ECONOMIZER COOLING REQUIREMENTS~~Minimum Chilled Water System Cooling Capacity for Determining Economizer Cooling Requirements~~

Climate Zones (Cooling)	Total Chilled Water System Capacity Less Capacity of Cooling Units with Air Economizers	
	Local Water-Cooled Chilled Water Systems	Air-cooled Chilled Water Systems or District Chilled Water Systems
1a	No economizer requirement	No economizer requirement
1b, 2a, 2b	960,000 Btu/h (280 kW)	1,250,000 Btu/h (365 kW)
3a, 3b, 3c, 4a, 4b, 4c	720,000 Btu/h (210 kW)	940,000 Btu/h (275 kW)
5a, 5b, 5c, 6a, 6b, 7, 8	1,320,000 Btu/h (385 kW)	1,720,000 Btu/h (505 kW)

CE250-13

C403.4.1.3, Table C403.4.1.3 (NEW), C403.4.2.1 (NEW), Table C403.4.2.1 (NEW), C403.4.2.1, C403.4.2.2, C403.4.7

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.4.1.3 Integrated economizer control. Economizer systems shall be integrated with the mechanical cooling system and be capable of providing partial cooling even where additional mechanical cooling is required to meet the remainder of the cooling load. Controls shall not be capable of creating a false load the mechanical cooling systems by limiting or disabling the economizer or any other means, such as hot gas bypass except at the lowest stage of mechanical cooling.

Units that include an air economizer shall comply with the following:

1. Unit controls shall have the mechanical cooling capacity control interlocked with the air economizer controls such that the outdoor air damper is at the 100 percent open position when *mechanical cooling* is on and the outdoor air damper does not begin to close to prevent coil freezing due to minimum compressor run time until the leaving air temperature is less than 45°F.

2. DX units that control 75,000 Btu/h or greater of rated capacity of the capacity of the mechanical cooling directly based on occupied space temperature shall have no fewer than 2 stages of mechanical cooling capacity

3. All other DX units including those that control space temperature by modulating the airflow to the space shall be in accordance with Table C403.4.1.3

~~**Exceptions:**~~

~~1. Direct expansion systems that include controls that reduce the quantity of *outdoor air* required to prevent coil frosting at the lowest step of compressor unloading, provided this lowest step is no greater than 25 percent of the total system capacity.~~

~~2. Individual direct expansion units that have a rated cooling capacity less than 54,000 Btu/h (15 827 W) and use nonintegrated economizer controls that preclude simultaneous operation of the economizer and mechanical cooling~~.

TABLE C403.4.1.3 DX COOLING STATESTAGE REQUIREMENTS FOR MODULATING AIRFLOW UNITS

Rating Capacity	Minimum Number of Mechanical Cooling Stages	Minimum Compressor Displacement[a]
≥65,000 Btu/h and <240,000 Btu/h	3 stages	≤35% of full Load
≥240,000 Btu/h	4 stages	≤25% full load

a. For *mechanical cooling* stage control that does not use variable compressor displacement the percent displacement shall be equivalent to the mechanical cooling capacity reduction evaluated at the full load rating conditions for the compressor.

C403.4.2 ~~Variable air volume (VAV)~~ fan control. ~~Individual VAV fans with motors of 7.5 horsepower (5.6 kW) or greater shall be:~~

~~1. Driven by a mechanical or electrical variable speed drive;~~

~~2. Driven by a vane-axial fan with variable-pitch blades; or~~

~~3. The fan shall have controls or devices that will result in fan motor demand of no more than 30 percent of their design wattage at 50 percent of design airflow when static pressure set point equals one-third of the total design static pressure, based on manufacturer's certified fan data~~

C403.4.2.1 Fan airflow control Each cooling system listed in Table C403.4.2.1 shall be designed to vary the indoor fan airflow as a function of load and shall comply with the following requirements.

1. DX and chilled water cooling units that control the capacity of the mechanical cooling directly based on space temperature shall have no fewer than 2 stages of fan control. Low or minimum speed shall not exceed 66 percent of full speed. At low or minimum speed the fan system shall draw no more than 40 percent of the fan power at full fan speed. Low or minimum speed shall be used during periods of low cooling load and ventilation only operation.

2. All other units including DX cooling units and chilled water units that control the space temperature by modulating the airflow to the space shall have modulating fan control. Minimum speed shall not exceed 50 percent of full speed. At minimum speed the fan system shall draw no more than 30 percent of the power at full fan speed. Low or minimum speed shall be used during periods of low cooling load and ventilation only operation.

3. Units that include an airside economizer to meet the requirements of Section C403.3.1 shall have no fewer than of 2 speeds of fan control during economizer operation

Exceptions:

1. Modulating fan control is not required for chilled water and evaporative cooling units with fan moters of less than 1 HP where the units are not used to provide *ventilation air* and the indoor fan cycles with the load.

2. Where the volume of outdoor air required to meet the *ventilation* requirements of the *International Mechanical Code* at low speed exceeds the air that would be delivered at the speed defined in Section C403.4.2 then the minimum speed shall be selected to provide the required *ventilation air*.

TABLE C403.4.2.1

EFFECTIVE DATES FOR FAN CONTROL Cooling System Type	**Fan Motor Size**	**Mechanical Cooling Capacity**
DX Cooling	any	≥75,000 Btu/h (before 1/1/2016)
		≥65,000 Btu/h (after 1/1/2016
Chilled Water and	≥5 HP	Any

Evaporative cooling	≥1/4 HP	Any

~~**C403.4.2.1**~~ **C403.2.2 VAV Static pressure sensor location.** Static pressure sensors used to control .VAV fans shall be placed in a position such that the controller setpoint is no greater than one-third the total design fan static pressure, except for systems with *zone* reset control complying with Section C403.4.2.2. For sensors installed down-stream of major duct splits, at least one sensor shall be located on each major branch to ensure that static pressure can be maintained in each branch.

~~**C403.4.2.2**~~ **C403.4.2.3 VAV Set points for direct digital control.** For systems with direct digital control of individual *zone* boxes reporting to the central control panel, the static pressure set point shall be reset based on the *zone* requiring the most pressure, i.e., the set point is reset lower until one *zone* damper is nearly wide open.

C403.4.7 Hot gas bypass limitation. Cooling systems shall not use hot gas bypass or other evaporator pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation. The capacity of the hot gas bypass shall be limited as indicated in Table C403.4.7 as limited by Section C403.4.1.3

~~**Exception:** Unitary packaged systems with cooling capacities not greater than 90,000 Btu/h (26 379 W).~~

CE251-13

C403.4.2.1, C403.4.2.2

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.4.2.1 Static pressure sensor location. Static pressure sensors used to control VAV fans shall be ~~placed in a position~~ located such that the controller setpoint is no greater than ~~one-third the total design fan static pressure~~, ~~except for systems with *zone* reset control complying with Section C403.4.2.2~~ 1.2 inches w.c. ~~For sensors~~ Where this results in one or more sensors being ~~installed~~ located down-stream of major duct splits, at

least one sensor shall be located on each major branch to ensure that static pressure can be maintained in each branch.

C403.4.2.2 Set points for direct digital control. For systems with direct digital control of individual ~~*zone* boxes~~ zones reporting to the central control panel, the static pressure set point shall be reset based on the zone requiring the most pressure, i.e., the set point is reset lower until one *zone* damper is nearly wide open. The direct digital controls shall be capable of monitoring zone damper positions; or shall have an alternative method of indicating the need for static pressure which is capable of all of the following:

1. Automatically detecting any zone which excessively drives the reset logic;

2. Generating an alarm to the system operational location; and

3. Allowing an operator to readily remove one or more zones from the reset algorithm.

CE253 – 13

C403.4.3.4

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com

Revise as follows:

C403.4.3.4 Part load controls. Hydronic systems greater than or equal to ~~300,000~~ 500,000 Btu/h (87 930W) in design output capacity supplying heated or chilled water to comfort conditioning systems shall include controls that have the capability to:

1. Automatically reset the supply-water temperatures in response to varying building heating and cooling demand using: coil valve position, zone-return water temperature, building-return water temperature, or out-side air temperature ~~as an indicator of building heating or cooling demand~~. The temperature shall be capable of being reset by at least 25 percent of the design supply-to-return water temperature difference; or and
2. Automatically vary fluid flow for hydronic systems with a combined motor capacity of 10 hp (7.5 kW) or larger with three or more ~~Reduce systems pump flow by at least 50 percent of design flow rate utilizing adjustable speed drive(s) on pump(s), or multiple-staged pumps where at least one-half of the total pump horsepower is capable of being automatically turned off or~~ control valves or other devices by reducing the system design flow rate by at least 50 percent by designed valves that modulate or step open ~~down~~, and close, or pumps that modulate or turn on and off as a function of load ~~or other approved means;~~ and
3. Automatically vary pump flow on chilled water systems and heat rejection loops serving water cooled unitary air-conditioners with a combined motor capacity of 10 hp (7.5 kW) or larger by reducing ~~system~~ pump design flow by at least 50 percent of ~~design flow rate~~ utilizing adjustable speed drive(s) on pump(s), or multiple-staged pumps where at least one-half of the total pump horsepower is capable of being automatically turned off ~~or control valves designed to modulate or step down, and close, as a function of load, or other *approved* means.~~ Pump flow shall be controlled to maintain one control valve nearly wide open or to satisfy the minimum differential pressure.

   Exceptions:

   1. Supply-water temperature reset for chilled water systems supplied by offsite district chilled water or chilled water from ice storage systems.
   2. Minimum flow rates other than 50 percent as required by the equipment manufacturer for proper operation of equipment where using flow bypass or end-of-line 3-way valves.

3. Variable pump flow on dedicated equipment circulation pumps where configured in primary/secondary design to meet minimum flow requirements required by the equipment manufacturer for proper operation of equipment,

CE254-13

C202 (NEW), C403.4.3.5 (NEW), Table C403.4.3.5 (NEW)

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.4.3.5 Boiler Turndown. *Boiler systems* with design input of greater than 1,000,000 Btu/h shall comply with the turndown ratio specified in Table 403.4.3.5.

The system turndown requirement shall be met through the use of multiple single input boilers, one or more *modulating boilers* or a combination of single input and modulating boilers.

TABLE 403.4.3.5

BOILER TURNDOWN Boiler System Design Input (Btu/h)	**Minimum Turndown Ratio**
≥ 1,000,000 and less than or equal to 5,000,000	3 to 1
> 5,000,000 and less than or equal to 10,000,000	4 to 1
> 10,000,000	5 to 1

Add new definitions as follows:

SECTION C202

GENERAL DEFINITIONS

BOILDER, MODULATING. A boiler that is capable of more than a single firing rate in response to a varying temperature or heating load.

BOILER SYSTEM. One or more boilers, their piping and controls that work together to supply steam or hot water to heat output devices remote from the boiler.

CE255-13

C403.4.4, C403.4.4.1 (NEW), C403.4.4.2 (NEW), C403.4.4.2.1 (NEW), C403.4.4.2.2 (NEW), C403.4.4.3, C403.4.4.4 (NEW)

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C403.4.4 Heat rejection equipment ~~fan speed control.~~ Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate that fan at two-thirds of full speed or less, and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature/pressure of the heat rejection device.

Exception: Factory-installed heat rejection devices within HVAC equipment tested and rated in accordance with Tables C403.2.3(6) and C403.2.3(7).

C403.4.4.1 General. Heat rejection equipment such as air-cooled condensers, dry coolers, open-circuit cooling towers, closed-circuit cooling towers, and evaporative condensers used for comfort cooling applications shall comply with this section.

Exception: Heat rejection devices whose energy usage is included in the equipment efficiency ratings listed in Tables C403.2.3 (6) and C403.2.3 (7).

C403.4.4.2 Fan speed control. The fan speed shall be controlled as follows:

C403.4.4.2.1 Fan motors at least 7.5 hp. Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate that fan at two-thirds of full speed or less, and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature/pressure of the heat rejection device.

Exceptions: The following fan motors over 7.5 hp are exempt:

1. Condenser fans serving multiple refrigerant circuits.

2. Condenser fans serving flooded condensers.

3. Installations located in climate zones 1 and 2.

C403.4.4.2.2 Multiple cell heat rejection equipment. Multiple cell heat rejection equipment with variable speed fan drives shall:

1. Be controlled to operate the maximum number of fans allowed that comply with the manufacturer's requirements for all system components, and

2. Be controlled so all fans can operate at the same fan speed required for the instantaneous cooling duty as opposed to staged (on/off) operation.

Minimum fan speed shall be the minimum allowable speed of the fan drive system in accordance with the manufacturer's recommendations.

C403.4.4.3 Limitation on centrifugal fan open-circuit cooling towers. Centrifugal fan open-circuit cooling towers with a combined rated capacity of 1100 gpm or greater at 95°F condenser water return, 85°F condenser water supply, and 75°F outdoor air wet-bulb temperature shall meet the energy efficiency requirement for axial fan open-circuit cooling towers listed in Table C403.2.3(8).

Exception: Centrifugal open-circuit cooling towers that designed with inlet or discharge ducts or require external sound attenuation.

C403.4.4.4 Tower flow turndown. Open circuit cooling towers used on water cooled chiller systems that are configured with multiple or variable speed condenser water pumps shall be designed so that all open circuit cooling tower cells can be run in parallel with the larger of the flow that is produced by the smallest pump at its minimum expected flow rate or at 50 percent of the design flow for the cell.

CE257-13

C403.4.5

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferuson@ashrae.org)

Revise as follows:

C403.4.5 Requirements for complex mechanical systems serving multiple zones. Sections C403.4.5.1 through C403.4.5.3 shall apply to complex mechanical systems serving multiple zones. Supply air systems serving multiple zones shall be VAV systems which, during periods of occupancy, are designed and capable of being controlled to reduce primary air supply to each *zone* to one of the following before reheating, recooling or mixing takes place:

1. Thirty percent of the maximum supply air to each *zone*.

2. Three hundred cfm (142 L/s) or less where the maximum flow rate is less than 10 percent of the total fan system supply airflow rate.

3. The minimum ventilation requirements of Chapter 4 of the *International Mechanical Code.*

4. Any higher rate that can be demonstrated to reduce overall system annual energy use by offsetting reheat/recool energy losses through a reduction in *outdoor air* intake for the system, as *approved* by the *code official*.

5. The air flow rate required to comply with applicable codes or accreditation standards, such as pressure relationships or minimum air change rates.

Exception: The following define where individual *zones* or where entire air distribution systems are exempted from the requirement for VAV control:

~~1. *Zones* where special pressurization relationships or cross-contamination requirements are such that VAV systems are impractical.~~

~~2.~~ 1. *Zones* or supply air systems where at least 75 percent of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered or site-solar energy source.

~~3.~~ 2. *Zones* where special humidity levels are required to satisfy process needs.

4. 3. *Zones* with a peak supply air quantity of 300 cfm (142 L/s) or less and where the flow rate is less than 10 percent of the total fan system supply airflow rate.

~~5.~~ 4. *Zones* where the volume of air to be reheated, recooled or mixed is no greater than the volume of outside air required to meet the minimum ventilation requirements of Chapter 4 of the *International Mechanical Code*.

~~6.~~ 5. *Zones* or supply air systems with thermostatic and humidistatic controls capable of operating in sequence the supply of heating and cooling energy to the *zones* and which are capable of preventing reheating, recooling, mixing or simultaneous supply of air that has been previously cooled, either mechanically or through the use of economizer systems, and air that has been previously mechanically heated.

CE258-13

C403.4.5.4 (NEW)

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.4.5.4 Fractional HP fan motors. Motors for fans that are 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70 percent rated in accordance with DOE 10 CFR 431 . These motors shall also have the means to adjust motor speed for either balancing or remote control. The use of belt-driven fans to sheave adjustments for airflow balancing in lieu of a varying motor speed shall be permitted.

Exception Motors in the airstream within fan-coils and terminal units that only provide heating to the space served.

Public Comment:

Steve Ferguson, ASHRAE, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C403.4.5.4 Fractional HP fan motors. Motors for fans that are 1/12 HP or greater and less than 1 HP shall be electronically-commutated motors or shall have a minimum motor efficiency of 70 percent rated in accordance with DOE 10 CFR 431 . These motors shall also have the means to adjust motor speed for either balancing or remote control. The use of belt-driven fans to sheave adjustments for airflow balancing in lieu of a varying motor speed shall be permitted.

Exceptions: The following motors are not required to comply with this section:

1. Motors in the airstream within fan-coils and terminal units that only provide heating to the space served.

2. Motors in space conditioning equipment that comply with Section C403.2.3 or C403.2.10.

3. Motors that comply with C405.8

CE259-13

C403.4.5.5 (NEW)

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C403.4.5.5 Multiple-zone VAV system ventilation optimization control. Multiple-zone VAV systems with direct digital control of individual zone boxes reporting to a central control panel shall have automatic controls configured to reduce outdoor air intake flow below design rates in response to changes in *system ventilation efficiency (E_v)* as defined by the *International Mechanical Code*.

Exceptions:

1. VAV systems with zonal transfer fans that recirculate air from other zones without directly mixing it with outdoor air, dual-duct dual-fan VAV systems, and VAV systems with fan-powered terminal units.

2. Systems having exhaust air energy recovery complying with Section C403.2.6.

3. Systems where total design exhaust airflow is more than 70 percent of total design outdoor air intake flow requirements.

CE262-13

Table C404.2, C404.2.1 (New)

Proponent: Steve Ferguson representing the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (sferguson@ashrae.org)

Revise as follows:

TABLE C404.2 MINIMUM PERFORMANCE OF WATER-HEATING EQUIPMENT

EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED [a,b]	TEST PROCEDURE
Water heaters, electric	≤ 12 kW[d]	Resistance	0.97 - 0.00 132*V*, EF	DOE 10 CFR Part 430
	> 12 kW	Resistance	~~1.73*V*+ 155 SL, Btu/h~~ (0.3 + 27/V_m), %/h	ANSI Z21.10.3
	≤ 24 amps and ≤ 250 volts	Heat pump	0.93 - 0.00 132*V*, EF	DOE 10 CFR Part 430
Storage water heaters, oil	≤ 105,000 Btu/h	≥ 20 gal	0.59 - 0.0019*V*, EF	DOE 10 CFR Part 430
	≥ 105,000 Btu/h	< 4,000 Btu/h/gal	~~78%~~ 80% E_t (Q/800 + 110$\sqrt{T}$)SL, Btu/h	ANSI Z21.10.3
Heat pump pool heaters	All	50°F dry bulb and 44.2°F wet bulb outdoor air and 80.0°F entering water	4.0 COP	AHRI 1160

b. Standby loss (SL) is the maximum Btu/h based on a nominal 70°F temperature difference between stored water and ambient requirements. In the SL equation, *Q* is the nameplate input rate in Btu/h. ~~and~~ In the ~~SL~~ equations for electric water heaters, *V* is the rated volume in gallons and *Vm* is the measured volume in gallons. In the SL equation for oil and gas water heaters and boilers, *V* is the rated volume in gallons.

d. Electric water heaters with an input rating of 12kW or less that are designed to heat water to temperatures of 180°F or greater shall comply with the requirements for electric water heaters that have an input rating greater than 12kW.

(Portions of Table not shown remain unchanged)

C402.2.1 High input-rated service water heating systems. This section shall apply only to gas fired water heating equipment installed in new buildings. Where a singular piece of water heating equipment serves the

entire building and the input rating of the equipment is 1,000,000 Btu/h (293 kW) or greater, such equipment shall have a thermal efficiency, E*t*, of not less than 90 percent. Where multiple pieces of water heating equipment serve the building and the combined input rating of the water heating equipment is 1,000,000 Btu/h (293 kW) or greater, the combined input-capacity-weighted-average thermal efficiency, E*t*, shall be not less than 90 percent.

Exceptions:

1. Where 25 percent of the annual *service water heating* requirement is provided by site-solar or site-recovered energy, the minimum thermal efficiency requirements of this section shall not apply.
2. The input rating of water heaters installed in individual dwelling units shall not be required to be included in the total input rating of *service water heating* equipment for a building.
3. The input rating of water heaters with an input rating of not greater than 100,000 Btu/h (29.3 kW) shall not be required to be included in the total input rating of *service water heating* equipment for a building.

CE263-13

Table C404.2

Proponent: Jennifer. Hatfield, J. Hatfield & Associates, PL representing Association of Pool & Spa Professionals (APSP) (jhatfield@apsp.org)

Revise as follows:

TABLE C404.2

MINIMUM PEFORMANCE OF WATER-HEATING EQUIPMENT EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED[a,b]	TEST PROCEDURE
Pool heaters, gas and oil	All	--	78 82% E_t	ASHRAE 146

CE264 – 13

C404.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C404.2 Service water-heating equipment performance. Water-heating equipment and hot water storage tanks shall meet the requirements of Table C404.2. The efficiency shall be verified through data furnished by the manufacturer of the equipment or through certification under an *approved* certification program. Water heating equipment also intended to be used to provide space heating shall meet the applicable provisions of Table C404.2.

CE271-13, Part I

C202 (NEW), C404.5, C404.5.1 (NEW), Table C404.5.1 (NEW), C404.5.2 (NEW), C404.5.3 (NEW), IPC [E]607.5

Proposed Change as Submitted

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, gary@aim4sustainability.com

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C404.5 Pipe Insulation of piping. ~~For automatic-circulating hot water and heat-traced systems, piping shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h ● ft^2 ● °F (1.53 W per 25 mm/m^2 ● K). The first 8 feet (2438 mm) of piping in non-hot water-supply temperature maintenance systems served by equipment without integral heat traps shall be insulated with 0.5 inch (12.7 mm) of material having a conductivity not exceeding 0.27 Btu per inch/h ● ft^2 ● °F (1.53 W per 25 mm/m^2 ● K).~~ Piping to the inlet of a water heater and piping conveying water heated by a water heater shall be insulated in accordance with Sections C404.5.1, C404.5.2 and C404.5.2.3. Where tubular pipe insulation is used for insulating piping, the thermal conductivity, k, of such insulation shall be not greater than 0.28 Btu per inch/h●ft^2 ● F [0.40 W/(m●K)] for water temperatures less than or equal to 140°F (60°C) and not greater than 0.29 Btu per inch/h●ft^2 ● F [0.42 W/(m●K)] for water temperatures greater than 140°F (60°C) and less than or equal to 200°F (93.3°C). Tubular pipe

insulation shall be installed in accordance with the insulation manufacturer's instructions. Pipe insulation shall be continuous except where the piping passes through a framing member. The minimum insulation thickness requirements of this section shall not supersede any greater insulation thickness requirements necessary for the protection of piping from freezing temperatures or the protection of personnel against external surface temperatures on the insulation. This section shall not be construed as requiring insulation on the following:

~~**Exception:** Heat-traced piping systems shall meet the insulation thickness requirements per the manufacturer's installation instructions. Untraced piping within a heat traced system shall be insulated with not less than 1 inch (25 mm) of insulation having a conductivity not exceeding 0.27 Btu per inch/h ● ft^2 ● °F (1.53 W per 25 mm/m^2 ● K).~~

1. The tubing from the connection at the termination of the fixture supply piping to a fixture fitting or a water consuming appliance.

2. Valves, pumps, strainers and threaded unions in piping that is 1 inch or less in nominal diameter

3. Piping from user-controlled shower and bath mixing valves to the water outlets.

4. Cold water piping of a demand recirculation water system.

5. Tubing from a hot drinking-water heating unit to the water outlet.

6. Piping at locations where a vertical support of the piping is installed.

C404.5.1 Circulating system piping and heat-traced piping. Heated water circulation system piping shall be insulated in accordance with Table C404.5.1. Piping that is heat-traced to maintain heated water temperature shall be insulated in accordance with Table C404.5.1 or shall have insulation thickness in accordance with the heat tracing manufacturer's requirements. Untraced piping within a heat-traced system shall be insulated in accordance with Table C404.5.1.

TABLE C404.5.1

MINIMUM TUBULAR PIPE INSULATION WALL THICKNESS NOMINAL PIPE OR TUBE DIAMETER (inches)	MINIMUM INSULATION WALL THICKNESS (inches)	
	>140 °F to 200 °F WATER TEMPERATURE	≤140 °F WATER TEMPERATURE
≤3/8	3/8	3/8
> 3/8 to <3/4	1/2	1/2
≥ 3/4 to <1	3/4	1
≥1 to <1 1/2	1	1 1/2
≥1 ½ to <4	1 1/2	2

≥4 to <8	1 1/2	2
≥8	1 1/2	2

For SI: 1 inch = 25.4 mm, oC= [(oF – 32)/1.8]

C404.5.2 Inlet piping connecting to water heaters and storage tanks. Where a water heater or a heated water storage tank is not equipped with integral heat traps, the inlet piping within 8 feet (2438 mm) of piping length of the water heater or storage tank shall be insulated in accordance with Table C404.5.1. This requirement shall not supersede the water heater manufacturer's requirements for a greater insulation thickness on the inlet piping.

Exceptions:

1. Inlet piping or tubing to a water heater serving only plumbing fixtures or plumbing appliances that are within 8 feet (2438 mm) piping length of the water heater shall not be required to be insulated.

2. Valves, pumps, strainers and threaded unions in water heater or heated water storage inlet piping that is 1 inch (25.4 mm) nominal diameter or less shall not be required to be insulated.

C404.5.3 Other heated water piping. Piping conveying heated water that is not addressed by Sections C404.5.1 and C404.5.2 shall have insulation with a wall thickness of not less than that indicated in Table C404.5.1.

Exceptions:

1. Outlet piping or tubing from a water heater serving only plumbing fixtures or plumbing appliances that are within 8 feet (2438 mm) piping length of the water heater shall not be required to be insulated.

2. Piping or tubing that is completely surrounded by not less than 1 inch (25.4 mm) thickness of building thermal envelope insulation in walls, attics and crawl spaces shall not be required to be insulated with tubular pipe insulation provided that the piping or tubing is 1 inch (25.4 mm) nominal diameter or smaller.

Add new definition as follows:

WATER HEATER. Any heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system.

Public Comment:

Gary Klein, Affiliated International Management, LLC, representing self, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**C404.5 Insulation of piping.** Piping to the inlet of a water heater and piping conveying water heated by~~ from ~~a water heater~~ to the termination of the heated water fixture supply pipe ~~shall be insulated in accordance with~~ Table ~~C403.2.8. On both the inlet and outlet piping of a storage water heater or heated water storage tank, the piping to a heat trap or the first 8 feet (2438 mm) of piping, whichever is less, shall be insulated. Piping that is heat traced shall be insulated in accordance with Table C403.2.8 or the heat trace manufacturer's instructions. Sections C404.5.1, C404.5.2 and C404.5.2.3. Where tubular pipe insulation is used for insulating piping, the thermal conductivity, k, of such insulation shall be not greater than 0.28 Btu per inch/h●ft2 ● F [0.40 W/(m●K)] for water temperatures less than or equal to 140◦F (60◦C) and not greater than 0.29 Btu per inch/h●ft2 ● F [0.42 W/(m●K)] for water temperatures greater than 140◦F (60◦C) and less than or equal to 200◦F (93.3◦C).~~ Tubular pipe insulation shall be installed in accordance with the insulation manufacturer's instructions. Pipe insulation shall be continuous except where the piping passes through a framing member. The minimum insulation thickness requirements of this section shall not supersede any greater insulation thickness requirements necessary for the protection of piping from freezing temperatures or the protection of personnel against external surface temperatures on the insulation. ~~This section shall not be construed as requiring insulation on the following:~~

Exception: Tubular pipe insulation shall not be required on the following:

1. The tubing from the connection at the termination of the fixture supply piping to a plumbing fixture or plumbing appliance ~~fixture fitting or a water consuming appliance.~~
2. Valves, pumps, strainers and threaded unions in piping that is 1 inch or less in nominal diameter
3. Piping from user-controlled shower and bath mixing valves to the water outlets.
4. Cold water piping of a demand recirculation water system.
5. Tubing from a hot drinking-water heating unit to the water outlet.

6. Piping at locations where a vertical support of the piping is installed.

7. Piping surrounded by building insulation with a thermal resistance (R-value) of not less than R-3.

C404.5.1 Circulating system piping and heat-traced piping. Heated water circulation system piping shall be insulated in accordance with Table C404.5.1. Piping that is heat-traced to maintain heated water temperature shall be insulated in accordance with Table C404.5.1 or shall have insulation thickness in accordance with the heat tracing manufacturer's requirements. Untraced piping within a heat-traced system shall be insulated in accordance with Table C404.5.1.

TABLE C404.5.1

MINIMUM TUBULAR PIPE INSULATION WALL THICKNESS NOMINAL PIPE OR TUBE DIAMETER (inches)	MINIMUM INSULATION WALL THICKNESS (inches)	
	>140 °F to 200 °F WATER TEMPERATURE	≤140 °F WATER TEMPERATURE
≤3/8	3/8	3/8
> 3/8 to <3/4	1/2	1/2
≥ 3/4 to <1	3/4	1
≥1 to <1 1/2	1	1 1/2
≥1 ½ to <4	1 1/2	2
≥4 to <8	1 1/2	2
≥8	1 1/2	2

For SI: 1 inch = 25.4 mm, °C= [(°F – 32)/1.8]

C404.5.2 Inlet piping connecting to water heaters and storage tanks. Where a water heater or a heated water storage tank is not equipped with integral heat traps, the inlet piping within 8 feet (2438 mm) of piping length of the water heater or storage tank shall be insulated in accordance with Table C404.5.1. This requirement shall not supersede the water heater manufacturer's requirements for a greater insulation thickness on the inlet piping.

Exceptions:

1. Inlet piping or tubing to a water heater serving only *plumbing fixture*s or *plumbing appliances* that are within 8 feet (2438 mm) piping length of the water heater shall not be required to be insulated.

2. Valves, pumps, strainers and threaded unions in water heater or heated water storage inlet piping that is 1 inch (25.4 mm) nominal diameter or less shall not be required to be insulated.

~~**C404.5.3 Other heated water piping.** Piping conveying heated water that is not addressed by Sections C404.5.1 and C404.5.2 shall have insulation with a wall thickness of not less than that indicated in Table C404.5.1.~~

~~**Exceptions:**~~

~~1. Outlet piping or tubing from a water heater serving only *plumbing fixtures* or *plumbing appliances* that are within 8 feet (2438 mm) piping length of the water heater shall not be required to be insulated.~~

~~2. Piping or tubing that is completely surrounded by not less than 1 inch (25.4 mm) thickness of building thermal envelope insulation in walls, attics and crawl spaces shall not be required to be insulated with tubular pipe insulation provided that the piping or tubing is 1 inch (25.4 mm) nominal diameter or smaller.~~

CE274-13

C202 (New), C404.5 (New), C404.5.1 (New), C404.5.1 (New), Table C404.5.1 (New), C404.5.2 (New), C404.5.2.1 (New)

Proposed Change as Submitted

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, gary@aim4sustainability.com

Add new text as follows:

C404.5 Efficient heated water supply piping. Heated water supply piping shall be in accordance with Section C404.5.1 or Section C404.5.2. The flow rate through ¼ inch piping shall not exceed 0.5 gpm (1.9 Lpm). The flow rate through 5/16 inch piping shall not exceed 1 gpm (3.8 Lpm). The flow rate through 3/8 inch piping shall not exceed 1.5 gpm (5.7 Lpm).

C404.5.1 Maximum allowable pipe length method. The maximum allowable piping length from the nearest source of heated water to the termination of the fixture supply pipe for *plumbing fixtures* and *plumbing appliances* shall be in accordance with the maximum piping length column in Table C404.5.1. Where the piping contains more than one size of pipe, the largest size of pipe within the piping shall be used for determining the maximum allowable length of the piping in Table C404.5.1.

TABLE C404.5.1

PIPING VOLUME AND MAXIMUM	VOLUME (liquid ounces per foot	MAXIMUM PIPING LENGTH

PIPING LENGTHS NOMINAL PIPE SIZE (inch)	length)	(feet)	
		WATER FROM A WATER HEATER	WATER FROM A RECIRCULATION LOOP OR HEAT TRACED PIPE
1/4	0.33	50	50
5/16	0.5	50	48
3/8	0.75	50	32
1/2	1.5	43	16
5/8	2	32	12
3/4	3	21	8
7/8	4	16	6
1	5	13	5
1 ¼	8	8	3
1 ½	11	6	2
2 or larger	18	4	1

1 Gallon = 128 ounces. For SI: 1 inch=25.4 mm, 1 foot = 304.8 mm, 1 liquid ounce = 0.030 L

C404.5.2 Maximum allowable pipe volume method. The water volume in the piping shall be calculated in accordance with Section C404.5.2.1. The maximum volume from the nearest source of heated water to the termination of the fixture supply pipe for a *plumbing fixture* or *plumbing appliance* shall be 0.5 gallon (1.89 L) where the source of heated water is a water heater; and 0.19 gallon (0.7 L) where the source of heated water is a recirculating system or heat-traced piping.

C404.5.2.1 Water volume determination. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. The volume in the piping shall be determined from the volume column in Table C404.5.1. The volume contained within fixture shut off valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination. Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

Add new definition as follows:

SECTION C202

GENERAL DEFINITIONS

WATER HEATER. Any heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system.

Public Comment 1:

Gary Klein, Affiliated International Management, LLC, representing self, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE C404.5.1

PIPING VOLUME AND MAXIMUM PIPING LENGTHS NOMINAL PIPE SIZE (inch)	VOLUME (liquid ounces per foot length)	MAXIMUM PIPING LENGTH (feet)	
		~~WATER FROM A WATER HEATER~~	~~WATER FROM A RECIRCULATION LOOP OR HEAT TRACED PIPE~~
1/4	0.33	50	~~50~~
5/16	0.5	50	~~48~~
3/8	0.75	50	~~32~~
1/2	1.5	~~43~~	~~16~~
5/8	2	32	~~12~~
3/4	3	21	~~8~~
7/8	~~4~~	16	~~6~~
1	5	13	~~5~~
1 ¼	8	8	~~3~~
1 ½	11	6	~~2~~
2 or larger	18	~~4~~	~~1~~

1 Gallon = 128 ounces. For SI: 1 inch=25.4 mm, 1 foot = 304.8 mm, 1 liquid ounce = 0.030 L

C404.5.2 Maximum allowable pipe volume method. The water volume in the piping shall be calculated in accordance with Section C404.5.2.1. The maximum volume from the nearest source of heated water to the termination of the fixture supply pipe for a *plumbing fixture* or *plumbing appliance* shall be 0.5 gallon (1.89 L). ~~where the source of heated water is a water heater; and 0.19 gallon (0.7 L) where the source of heated water is a recirculating system or heat-traced piping.~~ Water heaters, circulating water systems and heat trace temperature maintenance systems shall be considered sources of heated water.

CE275-13

C202 (NEW), C404.5 (NEW), C404.5.1 (NEW), Table C404.5.1 (NEW), C404.5.2 (NEW), C404.5.2.1 (NEW)

Proposed Change as Submitted

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

Add new text as follows:

C404.5 Efficient heated water supply piping. Heated water supply piping shall be in accordance with Section C404.5.1 or Section C404.5.2. The flow rate through ¼ inch piping shall not exceed 0.5 gpm (1.9 Lpm). The flow rate through 5/16 inch piping shall not exceed 1 gpm (3.8 Lpm). The flow rate through 3/8 inch piping shall not exceed 1.5 gpm (5.7 Lpm).

C404.5.1 Maximum allowable pipe length method. The maximum piping length from the nearest source of heated water to the termination of the fixture supply pipe for a public lavatory faucet shall be in accordance with the maximum piping length column in Table C404.5.1. Where the piping contains more than one size of pipe, the largest size of pipe within the piping shall be used for determining the maximum allowable length of the piping in Table C404.5.1.

TABLE C404.5.1

PIPING VOLUME AND MAXIMUM PIPING LENGTHS NOMINAL PIPE SIZE (inch)	VOLUME (liquid ounces per foot length)	MAXIMUM PIPING LENGTH (feet)
		LAVATORY FAUCETS—PUBLIC
1/4	0.33	6
5/16	0.5	4
3/8	0.75	3
1/2	1.5	2
5/8	2	1
3/4	3	0.5
7/8	4	0.5
1	5	0.5
1 ¼	8	0.5
1 ½	11	0.5
2 or larger	18	0.5

For SI: 1 inch=25.4 mm, 1 foot = 304.8 mm, 1 liquid ounce = 0.030 L

C404.5.2 Maximum allowable pipe volume method. The maximum piping volume from the nearest source of heated water to the termination of the fixture supply pipe for a public lavatory faucet shall be 2 ounces (0.06 L). The water volume in the piping shall be calculated in accordance with Section C404.5.2.1.

C404.5.2.1 Water volume determination. The volume shall be the sum of the internal volumes of pipe, fittings, valves, meters and manifolds between the nearest source of heated water and the termination of the fixture supply pipe. The volume in the piping shall be determined from the volume column in Table C404.5.1. The volume contained within fixture shut off valves, within flexible water supply connectors to a fixture fitting and within a fixture fitting shall not be included in the water volume determination. Where heated water is supplied by a recirculating system or heat-traced piping, the volume shall include the portion of the fitting on the branch pipe that supplies water to the fixture.

Add new definition as follows:

SECTION C202

GENERAL DEFINITIONS

WATER HEATER. Any heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system.

CE278-13, Part I

C404.6, C404.7 (NEW), IPC [E] 607.2.1, IPC [E] 607.2.1.1 (NEW)

NOTE: PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS ON THE CONSENT AGENDA, PART II IS REPRODUCED ONLY FOR INFORMATION PURPOSES FOLLOWING ALL OF PART I.

Proposed Change as Submitted

Proponent: Steve Ferguson representing the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (sferguson@ashrae.org)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C404.6 Hot water <u>temperature maintenance</u> system controls. <u>For hot water distribution system</u> circulating ~~hot water~~ system pumps ~~or~~ <u>and</u> heat trace, <u>the pumps and heat trace</u> shall be arranged to be turned off either automatically ~~or manually~~ when there is ~~limited~~ <u>not</u> hot water demand. Operating controls <u>shall be *readily accessible*</u> .

<u>C404.7.1 Storage tank hot water circulation systems.</u> <u>Circulating pumps intended to maintain storage tank water temperature shall have controls that will limit operation of the pump from heating cycle start up to not greater than 5 minutes after the end of the cycle. *Ready access* shall be provided to the operating controls.</u>

CE279-13, Part I

C404.6, C404.6.1 (NEW), C404.6.2 (NEW), Chapter 5, IPC [E]607.2.1,

IPC [E]607.2.1.1 (NEW), IPC [E]607.2.1.1.1 (NEW), IPC [E]607.2.1.1.2 (NEW),

IPC Chapter 14

<u>Proposed Change as Submitted</u>

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

PART I-IECC-COMMERCIAL PROVISIONS

Revise as follows:

~~**C404.6 Circulating hot** **Heated** **water** **circulating and temperature maintenance** **systems controls** **(Mandatory).** Circulating hot water systems shall be provided with an automatic or readily *accessible* manual switch that can turn off the hot water circulating pump when the system is not in use~~ Heated water circulation systems shall be in accordance with Section C404.6.1. Heat trace temperature maintenance systems shall be in accordance with Section C404.6.2. Automatic controls, temperature sensors and pumps shall be *accessible*. Manual controls shall be *readily accessible*.

C404.6.1 Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be prohibited. Circulation system pump controls shall be demand activated. The controls shall start the pump upon sensing the presence of a user of a fixture or appliance, receiving a signal from the action of an action of a user of a fixture or appliance or sensing the flow of heated water to a fixture or appliance. The controls shall limit the water temperature increase in the return water piping to not more than 10ºF (5.6 ºC) greater than the initial temperature of the water in the return piping and shall limit the return water temperature to 102ºF (38.9ºC).

C404.6.2 Heat trace systems. Electric heat trace systems shall comply with IEEE 515.1. Controls for such systems shall be able to automatically adjust the energy input to the heat tracing to maintain the desired water temperature in the piping in accordance with the times when heated water is used in the occupancy.

Add new standard to Chapter 5 as follows:

IEEE The Institute of Electrical and Electronic Engineers, Inc.

3 Park Avenue

New York, NY 1016-5997

515.1-2012 IEEE Standard for the Testing, Design, Installation, and Maintenance of

Electrical Resistance Trace Heating for Commercial Applications

Public Comment:

Gary Klein, Affiliated International Management, LLC, representing self, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C404.6 Heated water circulating and temperature maintenance systems (Mandatory). Heated water circulation systems shall be in accordance with Section C404.6.1. Heat trace temperature maintenance systems shall be in accordance with Section C404.6.2. Automatic controls, temperature sensors and pumps shall be *accessible*. Manual controls shall be *readily accessible*.

C404.6.1 Circulation systems. Heated water circulation systems shall be provided with a circulation pump. The system return pipe shall be a dedicated return pipe or a cold water supply pipe. Gravity and thermo-syphon circulation systems shall be prohibited. ~~Circulation system pump controls shall be demand activated. The controls shall start the pump upon sensing the presence of a user of a fixture or appliance, receiving a signal from the action of an action of a user of a fixture or appliance or sensing the flow of heated water to a fixture or appliance. The controls shall limit the water temperature increase in the return water piping to not more than 10ºF (5.6 ºC) greater than the initial temperature of the water in the return piping and shall limit the return water temperature to 102ºF (38.9ºC).~~ Controls for circulating hot water system pumps shall start the pump based on the identification of a demand for hot water within the occupancy. The controls shall automatically turn off the pump when the water in the circulation loop is at the desired temperature and when there is no demand for hot water.

CE282-13, Part I

C404.7 (New), IPC Chapter 2, IPC [E]607.2.1.1 (New)

Proposed Change as Submitted

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

PART I – IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C404.7 Demand recirculation controls. A water distribution system having one or more recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe shall be a *demand recirculation water system.* Pumps shall have controls that comply with both of the following:

1. The control shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.

2. The control shall limit the water temperature increase in the cold water piping to not more than 10ºF (5.6 ºC) greater than the initial temperature of the water in the piping and limits the temperature entering the cold water piping to 102ºF (38.9 ºC).

Public Comment 2:

Greg Towsley, Grundfos representing self, requests Approval as Modified by this Public Comment

Modify the proposal as follows:

[E] 607.2.1.1 Demand recirculation controls. A water distribution system having one or more recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe shall be a demand recirculation water system. Pumps shall have controls that comply with both of the following:

1. The control shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture, or sensing the flow of hot or tempered water to a fixture fitting or appliance.

2. The control shall limit ~~the water temperature increase in the cold water piping to not more than 10ºF (5.6 ºC) greater than the initial temperature of the water in the piping and limits the~~ temperature of the water entering the cold water piping to ~~102ºF (38.9 ºC)~~ 104°F (40°C).

CE282-13, Part II

C404.7 (New), IPC Chapter 2, IPC [E]607.2.1.1 (New)

Proposed Change as Submitted

Proponent: Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

PART II-IPC

Add new text as follows:

[E] 607.2.1.1 Demand recirculation controls. A water distribution system having one or more recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe shall be a *demand recirculation water system.* Pumps shall have controls that comply with both of the following:

1. The control shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture or sensing the flow of hot or tempered water to a fixture fitting or appliance.

2. The control shall limit the water temperature increase in the cold water piping to not more than 10ºF (5.6 ºC) greater than the initial temperature of the water in the piping and limits the temperature entering the cold water piping to 102ºF (38.9 ºC).

Add definition as follows:

DEMAND RECIRCULATION WATER SYSTEM. A water distribution system where one more pumps prime the service hot water piping with heated water upon demand for hot water.

Public Comment 2:

Greg Towsley, Grundfos, representing self, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

[E] 607.2.1.1 Demand recirculation controls. A water distribution system having one or more recirculation pumps that pump water from a heated water supply pipe back to the heated water source through a cold water supply pipe shall be a demand recirculation water system. Pumps shall have controls that comply with both of the following:

1. The control shall start the pump upon receiving a signal from the action of a user of a fixture or appliance, sensing the presence of a user of a fixture, or sensing the flow of hot or tempered water to a fixture fitting or appliance.

2. The control shall limit ~~the water temperature increase in the cold water piping to not more than 10ºF (5.6 ºC) greater than the initial temperature of the water in the piping and limits~~ the temperature of the water entering the cold water piping to ~~102ºF (38.9 ºC)~~ 104°F (40°C).

CE283-13, Part I

C404.7 (NEW), Table C407.5.1(1), Chapter 5, R403.4.3 (NEW) (N1103.5 (NEW)), Chapter 5, IRC P2903.11 (NEW)

NOTE: PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS ON THE CONSENT AGENDA, PART II IS REPRODUCED ONLY FOR INFORMATION PURPOSES FOLLOWING ALL OF PART III.

Proposed Change as Submitted

Proponent: Gerald Van Decker, RenewABILTY Energy Inc., representing self (gerald@renewability.com), Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

PART I IECC-COMMERCIAL PROVISIONS

Revise as follows:

C404.7 Drain water heat recovery units. Drain water heat recovery units shall comply with CSA 55.2. Potable water-side pressure loss shall be less than 10 psi at maximum design flow. For Group R occupancies, the efficiency of drain water heat recovery unit efficiency shall be in accordance with CSA 55.1.

TABLE C407.5.1(1)

SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS BUILDING COMPONENT	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
Service water weating[f,g,h,↓]	Fuel type: same as proposed Efficiency: in accordance with Table C404.2 Capacity: same as proposed Where a service water hot water system does not exist or is not specified in the proposed design,	As proposed For Group R, as proposed multiplied by SWHF For other than Group R, as proposed multiplied by efficiency as provided by the manufacturer of the DWHR unit.

	a service hot water heating shall not be modeled.	As proposed

(Portions of Table not shown remain unchanged)

j. SWHF means service water heat recovery factor. DWHR means drain water heat recovery. The SWHF shall be applied as follows:

= (1 – (DWHR unit efficiency x 0.36)) where potable water from the DWHR unit supplies not less than 1 shower and not greater than 2 showers, of which the drain water from the same showers flows through the DWHR unit.

= (1 – (DWHR unit efficiency x 0.33))

where potable water from the DWHR unit supplies not less than 3 showers and not greater than 4 showers, of which the drain water from the same showers flows through the DWHR unit.

= (1 – (DWHR unit efficiency x 0.26))

where potable water from the DWHR unit supplies not less than 5 showers and not greater than 6 showers, of which the drain water from the same showers flows through the DWHR unit.

= 1.0

where the other conditions are not met.

Add new standards to Chapter 5 as follows:

CSA

CSA 55.1-2012 Test method for measuring efficiency and pressure loss of drain water heat recovery units

CSA 55.2-2012 Drain water heat recovery units

CE283-13, Part III

C404.7 (NEW), Table C407.5.1(1), Chapter 5, R403.4.3 (NEW) (N1103.5 (NEW)), Chapter 5, IRC P2903.11 (NEW)

NOTE: PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS ON THE CONSENT AGENDA, PART II IS REPRODUCED FOR INFORMATION PURPOSES FOLLOWING ALL OF PART III.

Proposed Change as Submitted

THIS IS A 3 PART CODE CHANGE PROPOSAL. PART I WILL BE HEARD BY THE IECC-COMMERCIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE. PART II WILL BE HEARD BY THE IECC-RESIDENTIAL ENERGY CONSERVATION CODE DEVELOPMENT COMMITTEE. PART III WILL BE HEARD BY THE IRC-PLUMBING COMMITTEE. SEE THE TENTATIVE HEARING ORDERS FOR THESE COMMITTEES.

Proponent: Gerald Van Decker, RenewABILTY Energy Inc., representing self (gerald@renewability.com), Gary Klein, Affiliated International Management, LLC, representing self, (gary@aim4sustainability.com)

PART III IRC-P

Add new text as follows:

P2903.11 Drain water heat recovery units. Drain water heat recovery units shall be in accordance with Section N1103.4.3

Public Comment:

Gary Klein, Affiliated International Management, LLC, representing self; Gerald Van Decker, RenewABILITY Energy Inc, representing self, request Approval as Modified by this Public Comment.

Modify proposal as follows:

P2903.11 Drain water heat recovery units. Drain water heat recovery units that are installed for heat recovery shall ~~be in accordance with~~ meet the requirements of Section N1103.4.3.

CE284-13

C404.8 (NEW), C408.1, C408.2, C408.2.3.2, C408.2.4, C408.2.4.1, C408.2.5.2, C408.2.5.4

Proponent: Jeremiah Williams / U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C404.8 Service water heating systems commissioning and completion requirements. *Service water heating systems*, swimming pool water heating systems, spa water heating systems and the controls for those systems shall be commissioned and completed in accordance with Section C408.2.

C408.1 General. This section covers the commissioning of the building mechanical systems in Section C403, service water heating systems in Section C404, and electrical power and lighting systems in Section C405.

C408.2 Mechanical systems and service water heating systems commissioning and completion requirements. Prior to passing the final mechanical and plumbing inspections, the *registered design professional* shall provide evidence of mechanical systems and service water heating systems *commissioning* and completion in accordance with the provisions of this section. Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

Exception: The following systems are exempt from the commissioning requirements:

1. Mechanical systems and service water heating systems in buildings where the total ~~mechanical~~ equipment capacity is less than 480,000 Btu/h (140 690 W) cooling capacity and 600,000 Btu/h (175 860 W) combined service water heating and space heating capacity.
2. Systems included in Section C403.3 that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units.

C408.2.3.2 Controls. HVAC and service water heating 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.

C408.2.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and certified by the *registered design professional* or *approved agency* and provided to the building owner. The report shall be organized with mechanical and service hot water findings in separate sections to allow independent review. The report shall be identified as “Preliminary Commissioning Report” and shall identify:

1. Itemization of deficiencies found during testing required by this section that have not been corrected at the time of report preparation.
2. Deferred tests that cannot be performed at the time of report preparation because of climatic conditions.
3. Climatic conditions required for performance of the deferred tests.

C408.2.4.1 Acceptance of report. *Buildings*, or portions thereof, shall not pass the final mechanical and plumbing inspections, until such time as the *code official* has received a letter of transmittal from the *building* owner acknowledging that the *building* owner has received the Preliminary Commissioning Report.

C408.2.5.2 Manuals. An operating and maintenance manual shall be provided and include all of 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. Name and address of at least one service agency.
4. HVAC and service hot water 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 system programming instructions.
5. A narrative of how each system is intended to operate, including recommended setpoints.

C408.2.5.4 Final commissioning report. A report of test procedures and results identified as "Final Commissioning Report" shall be delivered to the building owner ~~and shall include.~~ The report shall be organized with mechanical system and service hot water system findings in separate sections to allow independent review. The report shall include the following:

1. Results of functional performance tests.
2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
3. 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.

CE285-13, Part I

C202, C405.1, R202 (IRC N1109.1) R404.1 (IRC N1104.1)

NOTE: PART II DID NOT RECEIVE A PUBLIC COMMENT AND IS ON THE CONSENT AGENDA, PART II IS REPRODUCED ONLY FOR INFORMATION PUSPOSES FOLLOWING ALL OF PART I.

Proposed Change as Submitted

Proponent: Deborah Frankhouser, Four Point Lighting Design, representing the International Association of Lighting Designers (deborah@fourpointlighting.com)

PART I – IECC-COMMERCIAL PROVISIONS

Revise as follows:

C405.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior applications, electrical energy consumption, and minimum acceptable lighting equipment for exterior applications.

Exception: Dwelling units within commercial buildings shall not be required to comply with Sections C405.2 through C405.5 provided that they comply with Section R404.1. ~~not less than 75 percent of the permanently installed light fixtures, other than low voltage lighting, shall be fitted for, and contain only, high efficacy lamps.~~

Delete definition without substitution as follows:

SECTION C202

GENERAL DEFINITIONS

~~**HIGH-EFFICACYLAMPS.** Compact fluorescent lamps, T-8 or smaller diameter fluorescent lamps, or lamps with a minimum efficacy of:~~

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

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

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

CE287-13

C202 (New), C405.2, C405.2.1, C405.2.1.1, C405.2.2, C405.2.2.1, C405.2.1.1, C405.2.1.2, C405.2.2, C405.2.2.1, C405.2.2.3, C405.2.2.3.1, C405.2.2.3.2, C405.2.2.3.3, C405.2.3, C405.2.4

Proposed Change as Submitted

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C405.2 Lighting Controls (Mandatory). Lighting systems shall be provided with controls as specified in Sections C405.2.1, C405.2.2, C405.2.3, ~~and~~ C405.2.4, and C405.2.5.

Exceptions: Lighting controls are not required for the following:

1. Areas designated as security or emergency areas that are required to be continuously lighted;

2. Stairways and corridors; and

3. Emergency egress lighting that is normally off.

~~**C405.2.1 Manual lighting controls.** All buildings shall include manual lighting controls that meet the requirements of Sections C405.2.1.1 and C405.2.1.2.~~

~~**C405.2.2.2**~~ **C405.2.1 Occupant sensors sensor controls.** *Occupant* sensors *sensor controls* shall be installed in all classrooms, conference/meeting rooms, employee lunch and break rooms, private offices, restrooms, storage rooms and janitorial closets, and other spaces 300 square feet (28 m^2) or less that are enclosed by floor-to-ceiling height partitions. ~~These automatic control devices shall be installed to~~

C405.2.1.1 Occupant sensor control function. Occupant sensor controls shall comply with the following:

1. Automatically turn off lights within 30 minutes of all occupants leaving the space; and

2. Shall either be manual on or shall be controlled to automatically turn the lighting on to not more than 50 percent power; and

3. Shall incorporate a *manual control* to allow occupants to turn lights off.

Exception: Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants

~~**C405.2.1.1 Interior lighting controls.** Each area enclosed by walls or floor-to-ceiling partitions shall have at least one manual control for the lighting serving that area. The required controls shall be located within the area served by the controls or be a remote switch that identifies the lights served and indicates their status.~~

~~**Exceptions:**~~

~~1. Areas designated as security or emergency areas that need to be continuously lighted.~~

~~2. Lighting in stairways or corridors that are elements of the means of egress.~~

~~C405.2.2 Additional lighting~~ Time switch controls. ~~Each area that is required to have a manual control shall also have controls that meet the requirements of Sections C405.2.2.1, C405.2.2.2 and C405.2.2.3.~~ Each area of the building that is not provided with *occupant sensor controls* complying with Section C405.2.1.1 shall be provided with *time switch controls* complying with Section C405.2.2.1.

Exceptions: Where a *manual control* provides light reduction in accordance with Section C405.2.2.2, automatic controls additional lighting controls need not be provided shall not be required for the following:

1. *Sleeping units*.
2. Spaces where patient care is directly provided.
3. Spaces where an automatic shutoff would endanger occupant safety or security.
4. Lighting intended for continuous operation.

C405.2.2.1 Automatic Time switch control ~~devices~~ function. ~~Automatic time switch controls shall be installed to control lighting in all areas of the building.~~ Each space provided with *time switch controls* shall also be provided with a *manual control* for light reduction in accordance with Section C405.2.2.2. *Time switch controls* shall include an override switching device that complies with the following:

~~**Exceptions:**~~

~~1. Emergency egress lighting does not need to be controlled by an automatic time switch.~~

~~2. Lighting in spaces controlled by occupancy sensors does not need to be controlled by automatic time switch controls.~~

~~The automatic time switch control device shall include an override switching device that complies with the following:~~

1. The override switch shall be a *manual control* ~~in a readily accessible location;~~

~~2. The override switch shall be located where the lights controlled by the switch are visible; or the switch shall provide a mechanism which announces the area controlled by the switch;~~

~~3. The override switch shall permit manual operation;~~

2.4. The override switch, when initiated, shall permit the controlled lighting to remain on for a maximum duration of 2 hours; and

3. Any individual override switch shall control the lighting for a maximum area of 5,000 square feet (465 m^2).

Exceptions:

1. Within malls, arcades, auditoriums, single tenant retail spaces, industrial facilities and arenas:

    1. 1.1. The time limit shall be permitted to exceed 2 hours provided the override switch is a captive key device; and

    2. 1.2. The area controlled by the override switch is permitted to exceed 5,000 square feet (465 m^2), but shall not exceed 20,000 square feet (1860 m^2).

2. Where provided with *manual control*, the following areas are not required to have light reduction control:

    2.1. Spaces that have only one luminaire with a rated power of less than 100 watts;

    2.2. Spaces that use less than 0.6 watts per square foot (6.5 W/m^2); and

    2.3. Corridors, equipment rooms, public lobbies, electrical or mechanical rooms.

~~**C405.2.1.2**~~ **C405.2.2.2 Light reduction controls.** ~~Each area that is required to have a manual control shall also allow the occupant to~~ Spaces required to have light reduction controls shall have a *manual control* that allows the occupant to reduce the connected lighting load in a reasonably uniform pattern by at least 50 percent. Lighting reduction shall be achieved by one of the following or other *approved* methods:

1. Controlling all lamps or luminaires;

2. Dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps;

3. Switching the middle lamp luminaires independently of the outer lamps; or

4. Switching each luminaire or each lamp.

Exception: Light reduction controls ~~need not be provided in the following areas and spaces:~~ are not required in daylight zones with *daylight responsive controls* complying with C405.3.2.

~~1. Areas that have only one luminaire, with rated power less than 100 watts.~~

~~2. Areas that are controlled by an occupant-sensing device.~~

~~3. Corridors, equipment rooms, storerooms, restrooms, public lobbies, electrical or mechanical rooms.~~

~~4. Sleeping unit (see Section C405.2.3).~~

~~5. Spaces that use less than 0.6 watts per square foot (6.5 W/m^2).~~

~~6. Daylight spaces complying with Section C405.2.2.3.2.~~

C405.2.2.3 Manual controls. *Manual controls* for lights shall meet the following requirements:

1. Shall be readily accessible to occupants; and

2. Shall be located where the controlled lights are visible; or the control shall identify the area served by the lights and indicate their status.

~~**C405.2.2.3**~~ **C405.3 Daylight zone control.** *(Portions of text not shown remains unchanged)*

~~**C405.2.2.3.1**~~ **C405.3.1 Manual daylight controls.** *(Portions of text not shown remains unchanged)*

~~**C405.2.2.3.2 Automatic daylight controls.**~~ **C405.3.2 Daylight responsive controls.** *(Portions of text not shown remains unchanged)*

~~**C405.2.2.3.3**~~ **C405.3.3 Multi-level lighting controls.** *(Portions of text not shown remains unchanged)*

~~**C405.2.3**~~ **C405.2.4 Specific application controls.** *(Portions of text not shown remains unchanged)*

~~**C405.2.4**~~ **C405.2.5 Exterior lighting controls.** *(Portions of text not shown remains unchanged)*

Add new definitions as follows:

SECTION C202

GENERAL DEFINITIONS

TIME SWITCH CONTROL. An automatic control device or system that controls lighting or other loads, including switching off, based on time schedules.

OCCUPANT SENSOR CONTROL. An automatic control device or system that detects the presence or absence of people within an area and causes lighting, equipment, or appliances to be regulated accordingly.

DAYLIGHT RESPONSIVE CONTROL. A device or system that provides automatic control of electric light levels based on the amount of daylight in a space.

Public Comment 1:

Jack Bailey, One Lux Studio, representing International Association of Lighting Designers, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C405.2 Lighting controls (Mandatory). Lighting systems shall be provided with controls as specified in Sections C405.2.1, C405.2.2, C405.2.3, C405.2.4, and C405.2.5.

Exceptions: Lighting controls are not required for the following:

1. Areas designated as security or emergency areas that are required to be continuously lighted;

2. Emergency egress lighting that is normally off; and

~~2. Stairways and corridors; and~~

3. Interior exit stairways, interior exit ramps, and exit passageways.

(Portions of proposal not shown remain unchanged)

Public Comment 2:

Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C405.2.1 Occupant sensor controls. *Occupant sensor controls* shall be installed to control lights in the following space types:

1. Classrooms/lecture/training rooms,

2. Conference/meeting ~~rooms~~/multi-purpose rooms,

3. Copy/print rooms,

4. Lounges,

5. Employee lunch and break rooms,

6. Private offices,

7. Restrooms,

8. Storage rooms, and

9. Janitorial closets,

10. Locker rooms,

11. Other spaces 300 square feet (28 m^2) or less that are enclosed by floor-to-ceiling height partitions.

(Portions of proposal not shown remain unchanged)

CE290 – 13

C405.2.2

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C405.2.2 Additional lighting controls. Each area that is required to have a manual control shall also have controls that meet the requirements of Sections C405.2.2.1, C405.2.2.2 and C405.2.2.3.

Exception: Additional lighting controls need not be provided in the following spaces:

1. *Sleeping units*.
2. Spaces where patient care is directly provided.
3. Spaces where an automatic shutoff would endanger occupant safety or security.
4. Lighting intended for continuous operation
5. Shop and laboratory classrooms.

CE291 – 13

C405.2.2.1

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C405.2.2.1 Automatic time switch controls devices. Automatic time switch controls shall be installed to control lighting in all areas of the building.

Exceptions:

1. Emergency egress lighting does not need to be controlled by an automatic time switch.
2. Lighting in spaces controlled by occupancy sensors does not need to be controlled by automatic time switch controls.

~~The~~ Automatic time switch controls ~~device~~ shall comply with the following:

1. Have a minimum 7 day clock;
2. Be capable of being set for 7 different day types per week;

3. Incorporate an automatic holiday "shut-off" feature, which turns off all controlled lighting loads for at least 24 hours and then resumes normally scheduled operations.
4. Have program back-up capabilities, which prevent the loss of program and time settings for at least 10 hours, if power is interrupted; and
5. Include an override switch device that complies with the following:
   5.1. The override switch shall be in a readily accessible location;
   5.2. The override switch shall be located where the lights controlled by the switch are visible; or the switch shall provide a mechanism which announces the area controlled by the switch;
   5.3. The override switch shall permit manual operation;
   5.4. The override switch, when initiated, shall permit the controlled lighting to remain on for a maximum of 2 hours; and
   5.5. Any individual override switch shall control the lighting for a maximum area of 5,000 square feet (465 m^2).

   Exception: Within malls, arcades, auditoriums, single tenant retail spaces, industrial facilities and arenas:
   1. The time limit shall be permitted to exceed 2 hours provided the override switch is a captive key device; and
   2. The area controlled by the override switch is permitted to exceed 5,000 square feet (465 m^2), but shall not exceed 20,000 square feet (1860 m^2).

CE292-13

C405.2.2.2

Proposed Change as Submitted

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C405.2.2.2 Occupancy sensors. Occupancy sensors shall be installed in all classrooms, conference/meeting rooms, employee lunch and break rooms, private offices, restrooms, warehouse spaces, storage rooms and janitorial closets, and other spaces 300 square feet (28 m^2) or less enclosed by floor-to-ceiling height partitions. These automatic control devices shall be installed to automatically turn off lights within 30 minutes of all occupants leaving the space, and shall either be manual on or shall be controlled to automatically turn the lighting on to not more than 50 percent power.

Exception: Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants

Public Comment:

Tim Nogler, Washington State Building Code Council, requests Approval as Modified by this

Public Comment.

Modify the proposal as follows:

C405.2.2.2 Occupancy sensors. Occupancy sensors shall be installed in all classrooms, conference/meeting rooms, employee lunch and break rooms, private offices, restrooms, ~~warehouse spaces,~~ storage rooms and janitorial closets, and other spaces 300 square feet (28 m^2) or less enclosed by floor-to-ceiling height partitions.. ~~These~~ The automatic control devices in these spaces shall be installed to automatically turn off lights within 30 minutes of all occupants leaving the space, and shall either be manual on or shall be controlled to automatically turn the lighting on to not more than 50 percent power. In aisle ways and open areas in warehouses, lighting shall be controlled with occupancy sensors that automatically reduce lighting power by at least 50 percent when the areas are unoccupied. The occupancy sensors in warehouses shall control lighting in each aisle way independently, and shall not control lighting beyond the aisle way being controlled by the sensor.

> **Exception:** Full automatic-on controls shall be permitted to control lighting in public corridors, stairways, restrooms, warehouses, primary building entrance areas and lobbies, and areas where manual-on operation would endanger the safety or security of the room or building occupants.

CE294-13

C202, Figure C405.1 (NEW), Figure C405.2 (NEW), C405.2.2.3, C405.2.2.3.1 (NEW), C405.2.2.3.2 (NEW), C405.2.2.3.3 (NEW), Figure C405.3 (NEW), Figure C405.4 (NEW)

Proposed Change as Submitted

Proponent: Jack Bailey, One Lux Studio, representing International Association of Lighting Designers (jbailey@oneluxstudio.com), Jim Edelson, New Buildings Institute (jim@newbuildings.org)

Revise as follows:

~~**C405.2.2.3 Daylight zone control.** Daylight zones shall be designed such that lights in the daylight zone are controlled independently of general area lighting and are controlled in accordance with either Section C405.2.2.3.1 or Section C405.2.2.3.2. Each daylight control zone shall not exceed 2,500 square feet (232 m^2). 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 (4572 mm) from the perimeter shall be controlled separately from daylight zones adjacent to vertical fenestration.~~

~~**Exception:** Daylight zones enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.~~

C405.2.2.3 Daylight responsive controls. *Daylight responsive controls* complying with Section C405.2.2.3.1 shall be provided to control the electric lights within *daylight zones* in the following spaces:

1. Spaces with a total of more than 150 watts of *general lighting* within sidelight *daylight zones* complying with Section C405.2.2.3.2*. General lighting* does not include lighting that is required to have specific application control in accordance with Section C405.2.3.

2. Spaces with a total of more than 150 watts of *general lighting* within toplight *daylight zones* complying with Section C405.2.2.3.3.

   Exceptions: Daylight responsive controls are not required for the following:

   1. Spaces in health care facilities where patient care is directly provided.

   2. Dwelling units and sleeping units.

   3. Lighting that is required to have specific application control in accordance with Section C405.2.3.

C405.2.2.3.1 Daylight responsive control function. Where required, *daylight responsive controls* shall be provided within each space for control of lights in that space and shall comply with all of the following:

1. Lights in toplight *daylight zones* in accordance with Section C405.2.2.3.3 shall be controlled independently of lights in sidelight *daylight zones* in accordance with Section C405.2.2.3.2;

2. *Daylight responsive controls* within each space shall be configured so that they can be calibrated from within that space by authorized personnel;

3. Calibration mechanisms shall be *readily accessible*;

4. When located in offices, classrooms, laboratories, and library reading rooms, *daylight responsive controls* shall dim lights continuously from full light output to 10 percent of full light output or lower;

5. *Daylight responsive controls* shall be capable of a complete shut off of all controlled lights; and

6. Lights in sidelight *daylight zones* in accordance with Section C405.2.2.3.2 facing different cardinal orientations (i.e. within 45 degrees of due north, east, south, west) shall be controlled independently of each other.

Exception: Up to 150 watts of lighting in each space is permitted to be controlled together with lighting in a daylight zone facing a different cardinal orientation.

C405.2.2.3.2 Sidelight daylight zone. The sidelight *daylight zone* is the floor area adjacent to vertical *fenestration* which complies with all of the following:

1. Where the *fenestration* is located in a wall, the *daylight zone* shall extend laterally to the nearest full height wall, or up to 1.0 times the height from the floor to the top of the *fenestration*, and longitudinally from the edge of the fenestration to the nearest full height wall, or up to 2 feet (610 mm), whichever is less, as indicated in Figure C405.1;

2. Where the *fenestration* is located in a rooftop monitor, the *daylight zone* shall extend laterally to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 1.0 times the height from the floor to the bottom of the *fenestration*, whichever is less, and longitudinally from the edge of the *fenestration* to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 0.25 times the height from the floor to the bottom of the *fenestration*, whichever is less, as indicated in Figures C405.2 and C405.3;

3. The area of the *fenestration* is at least 24 square feet;

4. The distance from the *fenestration* to any building or geological formation which would block access to daylight is greater than the height from the bottom of the *fenestration* to the top of the building or geologic formation; and

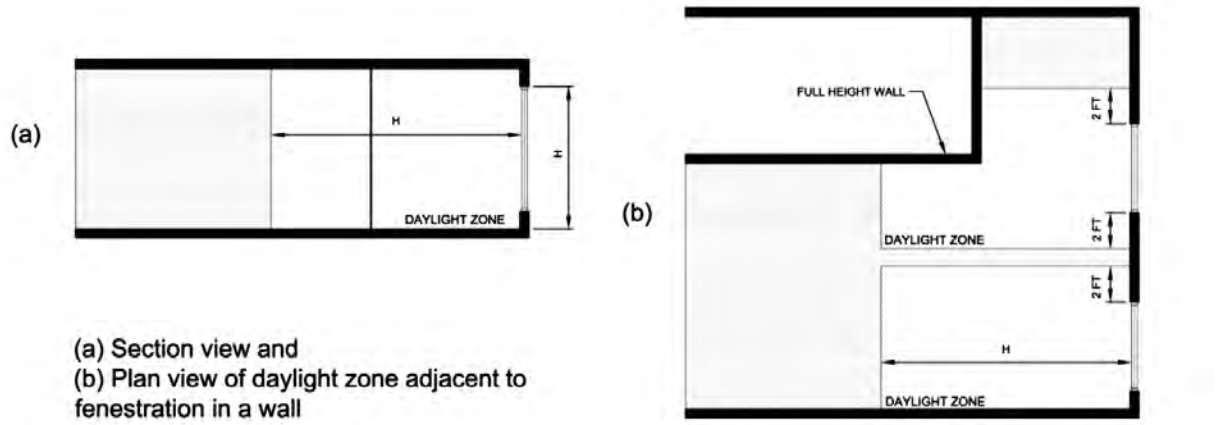
5. Where located in existing buildings, the *visible transmittance* of the *fenestration* is no less than 0.25.

C405.2.2.3.3 Toplight daylight zone. The toplight *daylight zone* is the floor area underneath a roof *fenestration* assembly which complies with all of the following:

1. The *daylight zone* shall extend laterally and longitudinally beyond the edge of the roof *fenestration* assembly to the nearest obstruction that is taller than 0.7 times the ceiling height, or up to 0.7 times the ceiling height, whichever is less, as indicated in Figure C405.4;

2. No building or geological formation blocks direct sunlight from hitting the roof *fenestration* assembly at the peak solar angle on the summer solstice; and

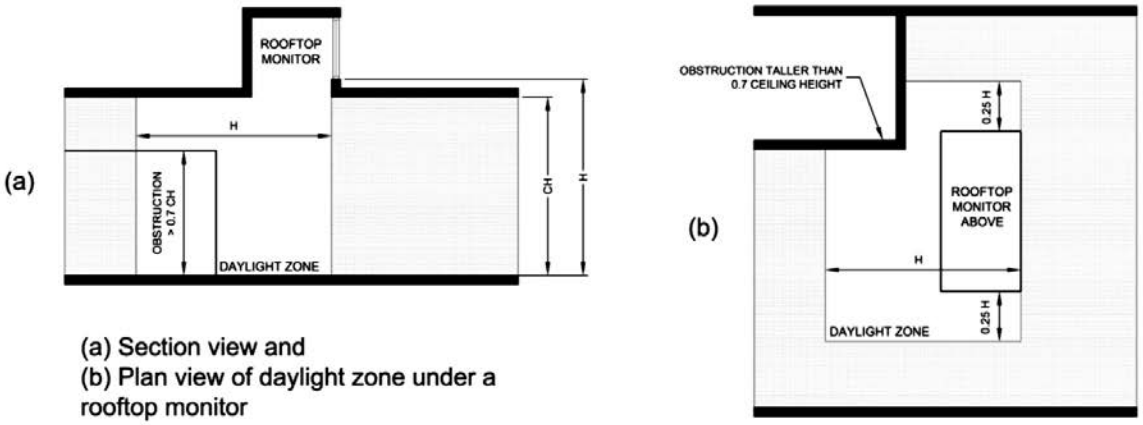
3. Where located in existing buildings, the product of the *visible transmittance* of the roof *fenestration* assembly and the area of the rough opening of the roof fenestration assembly, divided by the area of the daylight zone is no less than 0.008.



(a) Section view and
(b) Plan view of daylight zone adjacent to fenestration in a wall

FIGURE C405.1

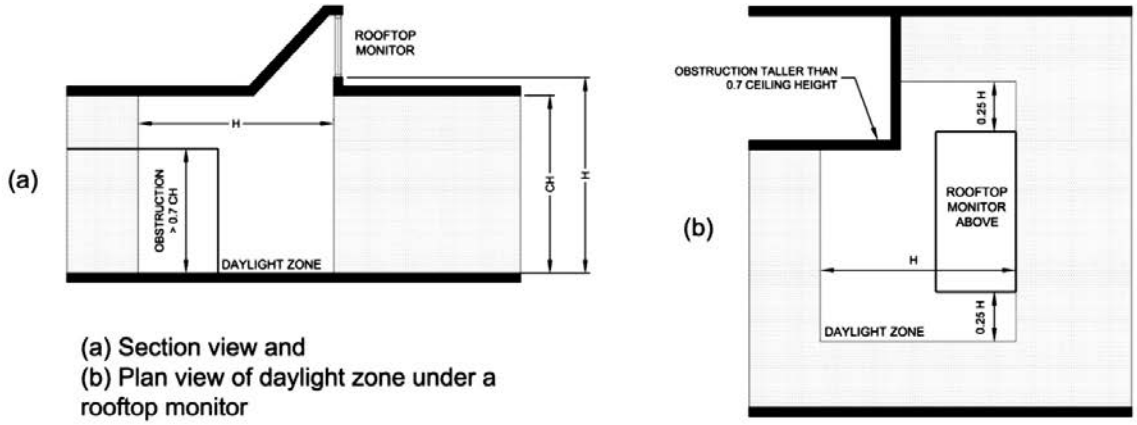
***DAYLIGHT ZONE* ADJACENT TO FENESTRATION IN A WALL**



(a) Section view and
(b) Plan view of daylight zone under a rooftop monitor

FIGURE C405.2

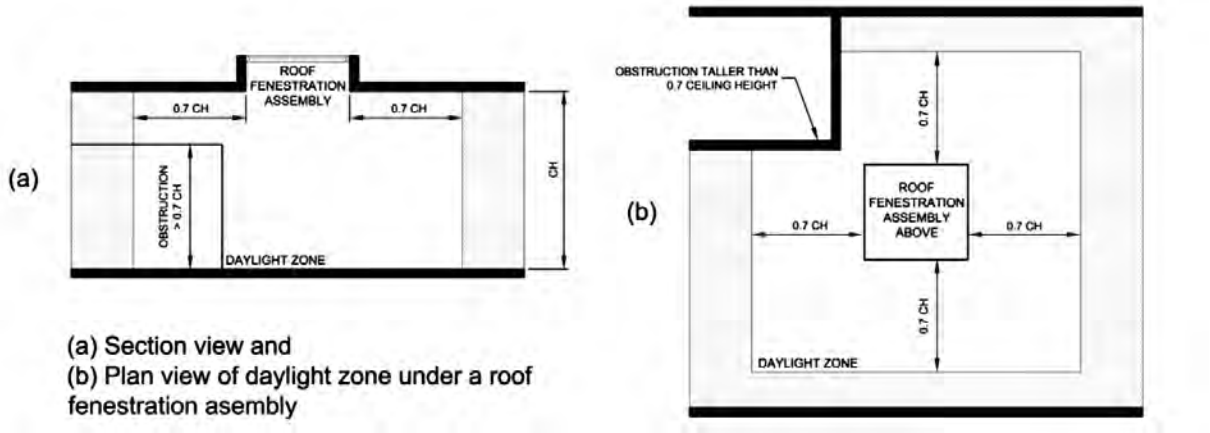
***DAYLIGHT ZONE* UNDER A ROOFTOP MONITOR**



(a) Section view and
(b) Plan view of daylight zone under a rooftop monitor

FIGURE C405.3

***DAYLIGHT ZONE* UNDER A SLOPED ROOFTOP MONITOR**



(a) Section view and
(b) Plan view of daylight zone under a roof fenestration asembly

FIGURE C405.4

***DAYLIGHT ZONE* UNDER A ROOF FENESTRATION ASSEMBLY**

Revise definitions as follows:

SECTION C202

GENERAL DEFINITIONS

DAYLIGHT RESPONSIVE CONTROL. A device or system that provides automatic control of electric light levels based on the amount of daylight in a space.

DAYLIGHT ZONE. That portion of a building's interior floor area that is illuminated by natural light.

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 (4572 mm) 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 2 feet (610 mm) 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.~~

Public Comment 1:

Jack Bailey, One Lux Studio, representing International Association of Lighting Designers; Jim Edelson, New Buildings Institute, Glenn Heinmiller, Lam Partners, representing self, request

Approval as Modified by this Public Comment.

Modify the proposal as follows:

C405.2.2.3 Daylight Responsive Controls. *Daylight responsive controls* complying with Section C405.2.2.3.1 shall be provided to control the electric lights within *daylight zones* in the following spaces:

1. Spaces with a total of more than 150 watts of *general lighting* within sidelight *daylight zones* complying with C405.2.2.3.2*. General lighting* does not include lighting that is required to have specific application control in accordance with C405.2.3.

2. Spaces with a total of more than 150 watts of *general lighting* within toplight *daylight zones* complying with C405.2.2.3.3.

Exceptions:

1. Spaces in health care facilities where patient care is directly provided.

2. Dwelling units and sleeping units.

3. Lighting that is required to have specific application control in accordance with C405.2.3.

4. Sidelight *daylight zones* on the first floor above grade in Group A-2 and Group M occupancies.

C405.2.2.3.1 Daylight responsive control function. Where required, *daylight responsive controls* shall be provided within each space for control of lights in that space and shall comply with all of the following:

4. Where located in offices, classrooms, laboratories, and library reading rooms, *daylight responsive controls* shall dim lights continuously from full light output to 10 15 percent of full light output or lower

C405.2.2.3.2 Sidelight Daylight Zone. The sidelight *daylight zone* is the floor area adjacent to vertical *fenestration* which satisfies the following criteria:

5. Where located in existing buildings, the *visible transmittance* of the *fenestration* is no less than 0.25 0.20.

(Portions of proposal not shown remain unchanged)

Public Comment 3:

Duane Jonlin, City of Seattle, Department of Planning and Development, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**C405.2.2.3.1 Manual daylighting controls.** Manual controls shall be installed in daylight zones unless automatic controls are installed in accordance with Section C405.2.3.5.~~

~~**C405.2.2.3.2 Automatic daylighting controls.** Set point and other controls for calibrating the lighting control device shall be readily accessible.~~

~~Daylighting controls device shall be capable of automatically reducing the lighting power in response to available daylight by either one of the following methods:~~

~~1. Continuous dimming using dimming ballasts and daylight-sensing automatic controls that are capable of reducing the power of general lighting in the daylit zone continuously to less than 35 percent of rated power at maximum light output.~~

~~2. Stepped dimming using multi-level switching and daylight-sensing controls that are capable of reducing lighting power automatically. The system shall provide a minimum of two control channels per zone and be installed in a manner such that at least one control step is between 50 percent and 70 percent of design lighting power and another control step is no greater than 35 percent of design power.~~

~~**C405.2.2.3.3 Multi-level lighting controls.** Where 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. Where the daylit illuminance in the space is greater than the rated illuminance of the general lighting of daylight zones, the general lighting shall be automatically controlled so that its power draw is no greater than 35 percent 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.~~

C402.3 Fenestration (Prescriptive). Fenestration shall comply with Table C402.3. ~~Automatic daylighting~~ Daylight responsive controls specified by this section shall comply with Section ~~C405.2.2.3.3~~. C405.2.2.3

C402.3.2.1 Lighting controls in daylight zones under skylights. All lighting in the daylight zone shall be controlled ~~by multilevel lighting~~ daylight responsive controls that comply with Section ~~C405.2.2.3.3.~~ C405.2.2.3

Exceptions (Remain unchanged.)

CE299-13

C405.2.3

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C405.2.3 Specific application controls. Specific application controls shall be provided for the following:

1. Display and accent light shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space

2. Lighting in cases used for display case purposes shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.

3. Hotel and motel sleeping units and guest suites shall have a master control device ~~at the main room entry that controls all permanently installed luminaires and switched receptacles~~ that is capable of switching off all installed luminaires and switched receptacles within 20 minutes after all occupants leave the room.

Exception: Lighting and switched receptacles controlled by captive key systems.

4. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided the control device is readily accessible.

5. Lighting for nonvisual applications, such as plant growth and food warming, shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.

6. Lighting equipment that is for sale or for demonstrations in lighting education shall be controlled by a dedicated control which is independent of the controls for other lighting within the room or space.

CE303-13

C405.2.4

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Delete and substitute as follows:

~~**C405.2.4 Exterior lighting controls.** Lighting not designated for dusk-to-dawn operation shall be controlled by either a combination of a photosensor and a time switch, or an astronomical time switch. Lighting designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photosensor. All time switches shall be capable of retaining programming and the time setting during loss of power for a period of at least 10 hours.~~

C405.2.4 Exterior lighting controls. Exterior lighting shall be controlled by either an astronomical time switch or a photo sensor and a time switch. Time switches shall be capable of retaining programming and the time setting for at least 10 hours without power.

> **Exception:** Lighting designed for dusk to dawn operation shall be permitted to have a photo sensor without a time switch.

CE304-13

C405.2.4

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Delete and substitute as follows:

~~**C405.2.4 Exterior lighting controls.** Lighting not designated for dusk-to-dawn operation shall be controlled by either a combination of a photosensor and a time switch, or an astronomical time switch. Lighting designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photosensor. All time switches shall be capable of retaining programming and the time setting during loss of power for a period of at least 10 hours~~

C405.2.4 Exterior lighting controls. Lighting for exterior applications other than emergency lighting that is intended to be automatically off during building operation, lighting specifically required to meet health and life safety requirements or decorative gas lighting systems shall:

1. Be provided with a control that automatically turns off the lighting as a function of available daylight.

2. Where lighting the building façade or landscape the lighting shall have controls that automatically shut off the lighting as a function of dawn/dusk and a set opening and closing time.

3. Where not covered in Item 2 the lighting shall have controls configured to automatically reduce the connected lighting power by at least 30 percent from no later than 12 midnight to 6 a.m. or from one hour after business closing to one hour before business opening or during any period when no activity has been detected for a time of no longer than 15 minutes.

All time switches shall be able to retain programming and the time setting during loss of power for a period of at least ten hours.

Exception: Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.

CE308-13

C405.3

Proposed Change as Submitted

Proponent: Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers (glenn@lampartners.com)

Delete without substitution as follows:

~~**C405.3 Tandem wiring (Mandatory).** The following luminaires located within the same area shall be tandem wired:~~

~~1. Fluorescent luminaires equipped with one, three or odd-numbered lamp configurations, that are recess- mounted within 10 feet (3048 mm) center-to-center of each other.~~

~~2. Fluorescent luminaires equipped with one, three or any odd-numbered lamp 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.~~

Public Comment:

Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C405.1 General (Mandatory). This section covers lighting system controls, ~~the connection of ballasts~~, the maximum lighting power for interior and exterior applications, electrical energy consumption, and minimum acceptable lighting equipment for exterior applications.

CE309-13

C405.5.1

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C405.5.1 Total connected interior lighting power. The total connected interior lighting power ~~(watts)~~ shall be ~~the sum of the watts of all interior lighting equipment as determined in accordance with Sections C405.5.1.1 through C405.5.1.4~~ determined in accordance with Equation 4-6.

TCLP = [SL + LV + LTPB + Other] (**Equation 4-6)**

where:

TCLP = total connected lighting power (watts)

SL = labeled wattage of luminaires for screw in lamps

LV = wattage of the transformer supplying low-voltage lighting

LTPB = wattage of line-voltage lighting tracks and plug-in busways as the specified wattage of the luminaires but at least 30 W/lin. ft. (100 W/lin m), or the wattage limit of the system's circuit breaker, or the wattage limit of other permanent current limiting devices on the system

Other = the wattage of all other luminaires and lighting sources not covered above and associated with interior lighting verified by data supplied by the manufacturer or other *approved* sources.

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 partitions.

14. Furniture mounted supplemental task lighting that is controlled by automatic shutoff.

CE310-13

C405.5.1, C405.5.3 (NEW), Table C405.5.2(1), Table C405.5.2(2)

Proposed Change as Submitted

Proponent: Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers (glenn@lampartners.com)

Revise as follows:

C405.5.1 Total connected interior lighting power. The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment as determined in accordance with Sections C405.5.1.1 through C405.5.1.4.

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, provided that the lighting complies with Section R404.1.

   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.

1.7. Mirror lighting in dressing rooms.

(Portions of text not shown remains unchanged)

C405.5.3 Additional interior lighting power. Where using the Space-by-Space Method, an increase in the interior lighting power allowance is permitted for specific lighting functions. Additional power shall be permitted only where the specified lighting is installed and automatically controlled, separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose. An increase in the interior lighting power allowance is permitted in the following cases:

1. For spaces in which lighting is specified to be installed in addition to the general lighting for the purpose of decorative appearance or for highlighting art or exhibits, provided that the additional lighting power shall not exceed 1.0 W/ft^2 of such spaces.

TABLE C405.5.2(1)

INTERIOR LIGHTING POWER ALLOWANCES: BUILDING AREA METHOD BUILDING AREA TYPE	**LPD (w/ft2)**
Automotive facility	~~0.9~~ 0.80
Convention center	~~1.2~~ 1.01
Courthouse	~~1.2~~ 1.01

BUILDING AREA TYPE	**LPD (w/ft2)**
Dining: bar lounge/leisure	~~1.3~~ 1.01
Dining: cafeteria/fast food	~~1.4~~ 0.9
Dining: family	~~1.6~~ 0.95
Dormitory	~~1.0~~ 0.57
Exercise center	~~1.0~~ 0.84
Fire station	~~0.8~~ 0.67
Gymnasium	~~1.1~~ 0.94

Health care clinic	~~1.0~~ 0.90
Hospital	~~1.2~~ 1.05
Hotel/Motel	~~1.0~~ 0.87
Library	~~1.3~~ 1.19
Manufacturing facility	~~1.3~~ 1.17
~~Motel~~	~~1.0~~
Motion picture theater	~~1.2~~ 0.76
Multifamily	~~0.7~~ 0.51
Museum	~~1.1~~ 1.02
Office	~~0.9~~ 0.82
Parking garage	~~0.3~~ 0.21
Penitentiary	~~1.0~~ 0.81
Performing arts theater	~~1.6~~ 1.39
Police station	~~1.0~~ 0.87
Post office	~~1.1~~ 0.87
Religious building	~~1.3~~ 1.0
Retail	~~1.4~~ 1.26
School/University	~~1.2~~ 0.87
Sports arena	~~1.1~~ 0.91
Town hall	~~1.1~~ 0.89

BUILDING AREA TYPE	**LPD (w/ft2)**
Transportation	~~1.0~~ 0.70
Warehouse	~~0.6~~ 0.66
Workshop	~~1.4~~ 1.19

TABLE C405.5.2(2)

INTERIOR LIGHTING POWER ALLOWANCES:

SPACE-BY-SPACE METHOD COMMON SPACE-BY-SPACE TYPES	**LPD (w/ft2)**
Atrium ~~First~~ that is < 40 feet in height	0.03 per ft. in total height ~~ht.~~
Atrium - ~~Above~~ that is > 40 feet in height	0.40 + 0.02 per ft. in total height ~~ht.~~
Audience/seating area - permanent For auditorium For performing arts theater For motion picture theater	~~0.9~~ 0.63 ~~2.6~~ 2.43 ~~1.2~~ 1.14
Classroom/lecture/training	~~1.30~~ 1.24
Conference/meeting/multipurpose	~~1.2~~ 1.23
Copy/Print room	0.72
Corridor/transition	~~0.7~~ 0.66
Computer Room	1.71
Dining area Bar/lounge/leisure dining Family dining area Cafeteria/Fast Food Dining	~~1.40~~ 1.07 ~~1.40~~ 0.89 0.65
Dressing/fitting room in performing arts theater	~~1.1~~ 0.61
Electrical/mechanical	~~1.10~~ 0.42
Emergency Vehicle Garage	0.56
Food preparation	~~1.20~~ 1.21
Laboratory for classrooms	~~1.3~~ 1.43
Laboratory for medical/industrial/research	~~1.8~~ 1.81
Laundry/Washing area	0.60
Loading Dock (interior)	0.47
Lobby	~~1.10~~ 0.90
Lobby for performing arts theater	~~3.3~~ 2.00
Lobby for motion picture theater	~~1.0~~ 0.59
Lobby - elevator	0.64
Lobby for Hotel	1.06

Locker room	~~0.80~~ 0.75

Lounge/ ~~recreation~~ Breakroom	~~0.8~~ 0.73
Office- enclosed	~~1.1~~ 1.11
Office- open plan	~~1.0~~ 0.98
Pharmacy Area	1.68
Restroom	~~1.0~~ 0.98
Sales area	~~1.6~~ [a] 1.44
Stairway	~~0.70~~ 0.69
Storage	~~0.8~~ 0.63
Vehicular Maintenance Area	0.67
Workshop	~~1.60~~ 1.59
BUILDING SPECIFIC SPACE-BY-SPACE TYPES	
Courthouse/police station/penitentiary	~~1.90~~ 1.72
Courtroom	~~1.1~~ 0.81
Confinement cells	~~1.3~~
~~Judge chambers~~	~~0.5~~ 0.28
Penitentiary audience seating	~~1.3~~ 1.34
Penitentiary classroom	~~1.1~~ 0.96
Penitentiary dining	
Automotive- service/repair	0.70
Bank/office- banking activity area	~~1.5~~ 1.01
Dormitory living quarters bedrooms	~~1.10~~ 0.38
Gymnasium/fitness center	~~0.9~~ 0.72
~~Fitness~~ Exercise area	~~0.40~~ 0.65
Gymnasium audience/seating	~~1.40~~ 1.2
Playing area	

Healthcare clinic/hospital	~~1.00~~ 0.99
Corridors/transition	~~1.7~~ 1.66
~~Exam/treatment~~	~~2.70~~
~~Emergency~~	~~0.80~~
Public and staff lounge	~~1.40~~ 0.74
Medical supplies	~~0.9~~ 0.88
Nursery	~~1.00~~ 0.71
Nurse station	~~0.90~~ 0.91
Physical therapy	~~0.70~~ 0.62
Patient room	~~1.20~~
~~Pharmacy~~	~~1.3~~ 1.51
Radiology/imaging	~~2.20~~ 2.48
Operating room	~~1.2~~ 1.15
Recovery	~~0.8~~ 0.92
Lounge/Breakroom	~~0.60~~
~~Laundry - washing~~	
~~Hotel~~	~~1.30~~
~~Dining area~~	~~1.10~~
~~Guest rooms~~	~~2.10~~
~~Hotel lobby~~	~~1.20~~
~~Highway lodging dining~~	~~1.10~~
~~Highway lodging guest rooms~~	

Library	~~1.70~~ 1.71
Stacks	~~1.10~~
~~Card file and cataloguing~~	~~1.20~~ 1.06
Reading area	
Manufacturing	~~0.40~~ 0.41
Corridors/transition	~~1.3~~ 1.29

Detailed manufacturing	~~1.0~~ 0.74
Equipment room	~~1.1~~ 1.05
Extra high bay (>50-foot floor-ceiling height)	~~1.20~~ 1.23
High bay (25-- 50-foot floor-ceiling height)	~~1.2~~ 1.19
Low bay(< 25-foot floor-ceiling height)	
Museum	~~1.00~~ 1.05
General exhibition	~~1.70~~ 1.02
Restoration	
Parking garage - garage areas	~~0.2~~ 0.19
Convention center	~~1.50~~ 1.45
Exhibit space	~~0.90~~ 0.82
Audience/seating area	
Fire stations	~~0.80~~
~~Engine room~~	~~0.30~~ 0.22
Fire Station Sleeping Quarters	
Post office Sorting area	~~0.9~~ 0.94
Religious building	~~0.60~~ 0.64
Fellowship hall	~~2.40~~ 1.53
Audience seating	~~2.40~~ 1.53
Worship pulpit/choir	
Retail	~~0.9~~ 0.71
Dressing/fitting area	~~1.6~~ 1.10
Mall concourse	~~1.6~~ 1.59
Sales area	
Sports arena	~~0.4~~ 0.43
Audience seating	~~0.7~~ 1.20
~~Court sports~~ Playing area - Class 4	~~1.2~~ 1.80
~~Court sports~~ Playing area - Class 3	~~1.9~~ 2.40
~~Court sports~~ Playing area - Class 2	~~3.0~~ 3.68

~~Court sports~~ Playing area - Class 1 ~~Ring sports area~~	~~2.7~~
Transportation Air/train/bus baggage area Airport concourse Terminal - ticket counter	~~1.00~~ 0.53 ~~0.60~~ 0.36 ~~1.50~~ 0.80
Warehouse Fine material storage small hand-carried items Medium/bulky material, palletized items	~~1.40~~ 0.95 ~~0.60~~ 0.58

Public Comment:

Steve Ferguson, ASHRAE, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

TABLE C405.5.2(2)

INTERIOR LIGHTING POWER ALLOWANCES:

~~SPACE-BY-SPACE METHOD COMMON SPACE-BY-SPACE TYPES~~	~~LPD (w/ft2)~~
~~Atrium -that is < 40 feet in height~~	~~0.03 per ft. in total height ht.~~
~~Atrium - that is > 40 feet in height~~	~~0.40 + 0.02 per ft. in total height ht.~~
~~Audience/seating area - permanent~~ ~~For auditorium~~ ~~For performing arts theater~~ ~~For motion picture theater~~	~~0.63~~ ~~2.43~~ ~~1.14~~
~~Classroom/lecture/training~~	~~1.24~~
~~Conference/meeting/multipurpose~~	~~1.23~~
~~Copy/Print room~~	~~0.72~~

~~Corridor/transition~~	~~0.66~~
~~Computer Room~~	~~1.71~~
~~Dining area~~ ~~Bar/lounge/leisure dining~~ ~~Family dining area~~ ~~Cafeteria/Fast Food Dining~~	~~1.07~~ ~~0.89~~ ~~0.65~~
~~Dressing/fitting room in performing arts theater~~	~~0.61~~
~~Electrical/mechanical~~	~~0.42~~
~~Emergency Vehicle Garage~~	~~0.56~~
~~Food preparation~~	~~1.21~~
~~Laboratory for classrooms~~	~~1.43~~
~~Laboratory for medical/industrial/research~~	~~1.81~~
~~Laundry/Washing area~~	~~0.60~~
~~Loading Dock (interior)~~	~~0.47~~
~~Lobby~~	~~0.90~~
~~Lobby for performing arts theater~~	~~2.00~~
~~Lobby for motion picture theater~~	~~0.59~~
~~Lobby - elevator~~	~~0.64~~
~~Lobby for Hotel~~	~~1.06~~
~~Locker room~~	~~0.75~~
~~Lounge/Breakroom~~	~~0.73~~
~~Office- enclosed~~	~~1.11~~
~~Office- open plan~~	~~0.98~~
~~Pharmacy Area~~	~~1.68~~
~~Restroom~~	~~0.98~~
~~Sales area~~	~~1.44~~
~~Stairway~~	~~0.69~~
~~Storage~~	~~0.63~~
~~Vehicular Maintenance Area~~	~~0.67~~
~~Workshop~~	~~1.59~~
~~BUILDING SPECIFIC SPACE-BY-SPACE TYPES~~	
~~Courthouse/police station/penitentiary~~ ~~Courtroom~~ ~~Confinement cells~~ ~~Penitentiary audience seating~~	~~1.72~~ ~~0.81~~ ~~0.28~~ ~~1.34~~

~~Penitentiary classroom~~	~~0.96~~
~~Penitentiary dining~~	
~~Bank/office- banking activity area~~	~~1.01~~
~~Dormitory bedrooms~~	~~0.38~~
~~Gymnasium/fitness center~~	~~0.72~~
~~Exercise area~~	~~0.65~~
~~Gymnasium audience/seating~~	~~1.2~~
~~Playing area~~	

~~Healthcare clinic/hospital~~	~~0.99~~
~~Corridors/transition~~	~~1.66~~
~~Exam/treatment~~	~~0.74~~
~~Medical supplies~~	~~0.88~~
~~Nursery~~	~~0.71~~
~~Nurse station~~	~~0.91~~
~~Physical therapy~~	~~0.62~~
~~Patient room~~	~~1.51~~
~~Radiology/imaging~~	~~2.48~~
~~Operating room~~	~~1.15~~
~~Recovery~~	~~0.92~~
~~Lounge/Breakroom~~	
~~Library~~	~~1.71~~
~~Stacks~~	~~1.06~~
~~Reading area~~	
~~Manufacturing~~	~~0.41~~
~~Corridors/transition~~	~~1.29~~
~~Detailed manufacturing~~	~~0.74~~
~~Equipment room~~	~~1.05~~
~~Extra high bay (>50-foot floor-ceiling height)~~	~~1.23~~
~~High bay (25-- 50-foot floor-ceiling height)~~	~~1.19~~

~~Low bay(< 25-foot floor-ceiling height)~~	
~~Museum~~ ~~General exhibition~~ ~~Restoration~~	~~1.05~~ ~~1.02~~
~~Parking garage - garage areas~~	~~0.19~~
~~Convention center~~ ~~Exhibit space~~ ~~Audience/seating area~~	~~1.45~~ ~~0.82~~
~~Fire Station Sleeping Quarters~~	~~0.22~~
~~Post office Sorting area~~	~~0.94~~
~~Religious building~~ ~~Fellowship hall~~ ~~Audience seating~~ ~~Worship pulpit/choir~~	~~0.64~~ ~~1.53~~ ~~1.53~~
~~Retail~~ ~~Dressing/fitting area~~ ~~Mall concourse~~ ~~Sales area~~	~~0.71~~ ~~1.10~~ ~~1.59~~
~~Sports arena~~ ~~Audience seating~~ ~~Playing area - Class 4~~ ~~Playing area - Class 3~~ ~~Playing area - Class 2~~ ~~Playing area - Class 1~~	~~0.43~~ ~~1.20~~ ~~1.80~~ ~~2.40~~ ~~3.68~~
~~Transportation~~ ~~Air/train/bus baggage area~~ ~~Airport concourse~~ ~~Terminal - ticket counter~~	~~0.53~~ ~~0.36~~ ~~0.80~~
~~Warehouse~~ ~~small hand-carried items~~	~~0.95~~ ~~0.58~~

~~Medium/bulky material, palletized items~~	

TABLE C405.5.2(2)

INTERIOR LIGHTING POWER ALLOWANCES:

SPACE-BY-SPACE METHOD Common Space Types[a]	**LPD (watts/sq.ft)**
Atrium	
… that is < 20' in height	0.03 per foot in total height
… that is ≥ 20' and ≤ 40' in height	0.03 per foot in total height
… that is > 40' in height	0.40 + 0.02 per foot in total height
Audience Seating Area	
... in an auditorium	0.63
... in a convention center	0.82
... in a gymnasium	0.65
... in a motion picture theater	1.14
... in a penitentiary	0.28
... in a performing arts theater	2.43
... in a religious building	1.53
... in a sports arena	0.43
... otherwise	0.43
Banking Activity Area	1.01
Breakroom (See Lounge/Breakroom)	
Classroom/Lecture Hall/Training Room	
… in a penitentiary	1.34
... otherwise	1.24
Conference/Meeting/Multipurpose Room	1.23
Confinement Cells	0.81

Copy/Print Room	0.72
Corridor[b]	
… in a Facility for the Visually Impaired (and not used primarily by the staff)[c]	0.92
… in a hospital	0.79
… in a manufacturing facility	0.41
… otherwise	0.66
Courtroom	1.72
Computer Room	1.71
Dining Area	
… in a penitentiary	0.96
… in a Facility for the Visually Impaired (and not used primarily by the staff)[c]	1.9
… in Bar/Lounge or Leisure Dining	1.07
… in Cafeteria or Fast Food Dining	0.65
… in Family Dining	0.89
… otherwise	0.65
Electrical/Mechanical Room	0.42
Emergency Vehicle Garage	0.56
Food Preparation Area	1.21
Guest Room	0.47
Laboratory	
… in or as a classroom	1.43
… otherwise	1.81
Laundry/Washing Area	0.6
Loading Dock, Interior	0.47
Lobby	
… in a Facility for the Visually Impaired (and not used primarily by the staff)[c]	1.8
… for an elevator	0.64

… in a hotel	1.06
… in a motion picture theater	0.59
… in a performing arts theater	2
… otherwise	0.9
Locker Room	0.75
Lounge/Breakroom	
… in a healthcare facility	0.92
… otherwise	0.73
Office	
… enclosed and <= 250 sq.ft	1.11
… enclosed and > 250 sq.ft	1.11
… open plan	0.98
Parking Area, Interior	0.19
Pharmacy Area	1.68
Restroom	
… in a Facility for the Visually Impaired (and not used primarily by the staffs[c]	1.21
… otherwise	0.98
Sales Area	1.59
Seating Area, General	0.54
Stairway	See space containing stairway
Stairwell	0.69
Storage Room	
… < 50 sq.ft	0.63
… >= 50 sq.ft and <= 1,000 sq.ft	0.63
… otherwise	0.63
Vehicular Maintenance Area	0.67
Workshop	1.59

Building Type Specific Space Types[a]	**LPD** **(watts/sq.ft)**
Facility for the Visually Impaired[c]	
… in a chapel (and not used primarily by the staff)	2.21
… in a recreation room (and not used primarily by the staff)	2.41
Automotive (See Vehicular Maintenance Area above)	
Convention Center - Exhibit Space	1.45
Dormitory - Living Quarters	0.38
Fire Station - Sleeping Quarters	0.22
Gymnasium/Fitness Center	
… in an Exercise Area	0.72
… in a Playing Area	1.2
Healthcare Facility	
… in an Exam/Treatment Room	1.66
… in an Imaging Room	1.51
….in a Medical Supply Room	0.74
… in a Nursery	0.88
… in a Nurse's Station	0.71
… in an Operating Room	2.48
… in a Patient Room	0.62
… in a Physical Therapy Room	0.91
… in a Recovery Room	1.15
Library	
… in a Reading Area	1.06
… in the Stacks	1.71

Manufacturing Facility	
… in a detailed manufacturing area	1.29

... in an Equipment Room	0.74
... in an Extra High Bay Area	1.05
(> 50' floor-to-ceiling height)	
... in a High Bay Area	1.23
(25-50' floor-to-ceiling height)	
... in a Low Bay Area	1.19
(< 25' floor-to-ceiling height)	
Museum	
... in a General Exhibition Area	1.05
... in a Restoration Room	1.02
Performing Arts Theater - Dressing Room	0.61
Post Office - Sorting Area	0.94
Religious Buildings	
... in a Fellowship Hall	0.64
... in a Worship/Pulpit/Choir Area	1.53
Retail Facilities	
... in a Dressing/Fitting Room	0.71
... in a Mall Concourse	1.1
Sports Arena - Playing Area	
... for a Class I facility	3.68
... for a Class II facility	2.4
... for a Class III facility	1.8
... for a Class IV facility	1.2
Transportation Facility	
... in a baggage/carousel Area	0.53
... in an Airport Concourse	0.36
... at a Terminal Ticket Counter	0.8
Warehouse - Storage Area	

...for medium to bulky, palletized items	0.58
... for smaller, hand-carried items	0.95

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

b. In corridors, the extra LPD allowance is not based on the RCR and shall be permitted when the width of the corridor is less than 8 feet

c. A 'Facility for the Visually Impaired' is a facility that is licensed or will be licensed by local or state authorities for either senior long-term care, adult daycare, senior support and/or people with special visual needs.

(Portions of the proposal not shown remain unchanged)

CE312-13

C405.5.1

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C405.5.1 Total connected interior lighting power. The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment as determined in accordance with Sections C405.5.1.1 through C405.5.1.4

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. Lighting in *sleeping units* ~~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 reg-istered 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 partitions.

14. Furniture mounted supplemental task lighting that is controlled by automatic shutoff.

CE314 – 13

C405.5.1

Proponent: Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers (glenn@lampartners.com)

Revise as follows:

C405.5.1 Total connected interior lighting power. The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment as determined in accordance with Sections C405.5.1.1 through C405.5.1.4.

Exceptions:

11. Lighting *approved* because of safety or emergency considerations, ~~inclusive of exit lights.~~

15. Exit signs.

(Portions of text not shown remains unchanged)

CE316 – 13

C405.5.2.1 (NEW), C405.5.2.2 (NEW), Table C405.5.2(2)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C405.5.2 Interior lighting power. The total interior lighting power allowance (watts) is determined according to Table C405.5.2(1) using the Building Area Method, or Table C405.5.2(2) using the Space-by-Space Method, for all areas of the building covered in this permit.

C405.5.2.1 Building area method. For the Building Area Method, the interior lighting power allowance is the floor area for each building area type listed in Table C405.5.2(1) times the value from Table C405.5.2(1) for that area. For the purposes of this method, an "area" shall be defined as all contiguous spaces that accommodate or are associated with a single building area type as listed in Table C405.5.2(1). Where this method is used to calculate the total interior lighting power for an entire building, each building area type shall be treated as a separate area.

C405.5.2.2 Space by space method. For the Space-by-Space Method, the interior lighting power allowance is determined by multiplying the floor area of each space times the value for the space type in Table C405.5.2(2) that most closely represents the proposed use of the space, and then summing the lighting power allowances for all spaces. Tradeoffs among spaces are permitted.

Exception: Additional lighting installed to highlight specific merchandise is permitted in accordance with the following:

1. The highlight lighting is switched or dimmed on circuits different from the circuits for general lighting.
2. The allowed lighting power shall be the smaller of the following:
   2.1, The actual wattage of the lighting equipment installed specifically for the merchandise; or
   2.2. The additional lighting determined in accordance with Equation 4-7.

$$ARSA = 500 \text{ watts} + (\text{Retail Area 1} \times 0.6\ W/ft^2) + (\text{Retail Area 2} \times 0.6\ W/ft^2) + (\text{Retail Area 3} \times 1.4\ W/ft^2) + (\text{Retail Area 4} \times 2.5\ W/ft^2) \quad \textbf{(Equation 4-7)}$$

where:
ARSA =Additional interior retail sale lighting power allowance
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

Other merchandise categories are permitted to 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 code official.

3. The additional power determined in Item 2, shall be added to the interior lighting power determined for sales areas in Table C 405.5.2(2)

TABLE C405.5.2(2)
INTERIOR LIGHTING POWER ALLOWANCES:
SPACE-BY-SPACE METHOD

(Portions of Table not shown remain unchanged)

~~a. 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 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 = 500 watts + (Retail Area 1 × 0.6 W/ft2) + (Retail Area 2 × 0.6 W/ft2) + (Retail Area 3 × 1.4 W/ft2) + (Retail Area 4 × 2.5 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 are permitted to 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.~~

CE317 – 13

C405.5.3 (New), Table C405.5.2(2)

Proponent: Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers (glenn@lampartners.com)

Revise as follows:

C405.5.3 Additional interior lighting power. Where using the Space-by-Space Method, an increase in the interior lighting power allowance is permitted for specific lighting functions. Additional power shall be permitted only where the specified lighting is installed and automatically controlled, separately from the general lighting, to be turned off during nonbusiness hours. This additional power shall be used only for the specified luminaires and shall not be used for any other purpose. An increase in the interior lighting power allowance is permitted in the following case:

1. For lighting equipment to be installed in sales areas specifically to highlight merchandise, the additional lighting power shall be determined in accordance with Equation 4-X Additional Interior Lighting Power Allowance = 500 watts + (Retail Area 1 × 0.6 W/ft^2) + (Retail Area 2 × 0.6 W/ft^2) + (Retail Area 3 × 1.4 W/ft^2) + (Retail Area 4 × 2.5 W/ft^2). Equation 4-x

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 are permitted to 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 code official.

TABLE C405.5.2(2)
INTERIOR LIGHTING POWER ALLOWANCES:
SPACE-BY-SPACE METHOD

(Portions of table not shown remain unchanged)

~~a. 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 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 = 500 watts + (Retail Area 1 × 0.6 W/ft²) + (Retail Area 2 × 0.6 W/ft²) + (Retail Area 3 × 1.4 W/ft²) + (Retail Area 4 × 2.5 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 are permitted to 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.

CE319-13

C405.6, C405.6.1, C405.6.2

Proposed Change as Submitted

Proponent: Glenn Heinmiller, Lam Partners, International Association of Lighting Designers (glenn@lampartners.com)

Revise as follows:

C405.6 Exterior lighting (Mandatory). Where the power for exterior lighting is supplied through the energy service to the building, all exterior lighting~~, other than low-voltage landscape lighting,~~ shall comply with Sections C405.6.1 and C405.6.2.

Exception: Where *approved* because of historical, safety, signage or emergency considerations.

~~**C405.6.1 Exterior building grounds lighting.** All exterior building grounds luminaires that operate at greater than 100 watts shall contain lamps having a minimum efficacy of 60 lumens per watt unless the luminaire is controlled by a motion sensor or qualifies for one of the exceptions under Section C405.6.2.~~

C405.6.2 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 permitted in Table C405.6.2(2) for the applicable lighting zone. Tradeoffs are allowed only among exterior lighting applications listed in Table C405.6.2(2), Tradable Surfaces section. The lighting zone for the building exterior is deter- mined from Table C405.6.2(1) unless otherwise specified by the local jurisdiction. ~~Exterior lighting for all applications (except those included in the exceptions to Section C405.6.2) shall comply with the requirements of Section C405.6.1.~~

Exception: Lighting used for the following exterior applications is exempt where 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;
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.

Public Comment:

Glenn Heinmiller, Lam Partners, representing International Association of Lighting Designers, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

C405.1 General (Mandatory). This section covers lighting system controls, the connection of ballasts, the maximum lighting power for interior <u>and exterior</u> applications, electrical energy consumption, ~~and minimum acceptable lighting equipment for exterior applications.~~

CE320 – 13

Table C405.6.2(1)

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows: TABLE C405.6.2(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 <u>not classified as lighting zone 1, 2 or 4.</u>
4	High-activity commercial districts in major metropolitan areas as designated by the local land use planning authority

CE321 – 13

Table C405.6.2(2)

Proponent: Jack Bailey, One Lux Studio, representing International Association of Lighting Designers (jbailey@oneluxstudio.com)

Revise as follows:

TABLE C405.6.2(2) INDIVIDUAL LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

		LIGHTING ZONES			
		Zone 1	Zone 2	Zone 3	Zone 4
Base Site Allowance (Base allowance is usable in tradable or nontradable surfaces.)		500 W	600 W	750 W	1300 W
Tradable Surfaces (Lighting power densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs and outdoor sales areas are tradable.)	**Uncovered Parking Areas**				
	Parking areas and drives	0.04 W/ft^2	0.06 W/ft^2	0.10 W/ft^2	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	0.4 W/ft^2
	Sales Canopies				
	Free-standing and attached	0.6 W/ft^2	0.6 W/ft^2	0.8 W/ft^2	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	0.7 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	30 W/linear foot
Nontradable 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 allowance otherwise permitted in the "Tradable Surfaces" section of this table.)	Building facades	No allowance	~~0.1 W/ft² for each illuminated wall or surface or 2.5 W/linear foot for each illuminated wall or surface length~~ 0.075 W/ft² of gross above-grade wall area	~~0.15 W/ft² for each illuminated wall or surface or 3.75 W/linear foot for each illuminated wall or surface length~~ 0.113 W/ft² of gross above-grade wall area	~~0.2 W/ft² for each illuminated wall or surface or 5.0 W/linear foot for each illuminated wall or surface length~~ 0.15 W/ft² of gross above-grade wall area
	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/ft² of covered and uncovered area	0.75 W/ft² of covered and uncovered area	0.75 W/ft² of covered and uncovered area	0.75 W/ft² of covered and uncovered area
	Loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.5 W/ft² of covered and uncovered area	0.5 W/ft² of covered and uncovered area	0.5 W/ft² of covered and uncovered area	0.5 W/ft² 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

CE322 – 13

C405.7

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C405.7 Electrical energy consumption (mandatory). ~~In buildings having individual~~ Every dwelling unit~~s, provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units~~ in Use Group R-2 buildings shall have a separate electrical meter.

CE329-13

C405.8 (NEW), Table C405.8 (NEW)

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C405.8 Electrical transformers (Mandatory). Electric transformers shall meet the minimum efficiency requirements of Table C405.8 as tested and rated in accordance with the test procedure listed in DOE 10 CFR 431. The efficiency shall be verified through certification under an approved certification program or, where no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the transformer manufacturer.

Exceptions: The following transformers are exempt:

1. Transformers that meet the Energy Policy Act of 2005 exclusions based on the DOE 10 CFR 431 definition of special purpose applications.
2. Transformers that meet the Energy Policy Act of 2005 exclusions that are not to be used in general purpose applications based on information provided in DOE 10 CFR 431
3. Transformers that meet the Energy Policy Act of 2005 exclusions with multiple voltage taps where the highest tap is at least 20 percent more than the lowest tap.
4. Drive transformers
5. Rectifier transformers
6. Auto-transformers
7. Uniterruptible power system transformers
8. Impendance transformers
9. Regulating transformers
10. Sealed and nonventilating transformers
11 Machine tool transformer
12. Welding transformer

13. Grounding transformer

15. Testing transformer

TABLE C405.8

Minimum Nominal Efficiency Levels for 10 CFR 431 Low Voltage Dry-Type Distribution Transformers			
Single Phase Transformers		**Three Phase Transformers**	
kVA[a]	**Efficiency (%)**[b]	**kVA**[a]	**Efficiency (%)**[b]
15	97.7	15	97.0
25	98.0	30	97.5
37.5	98.2	45	97.7
50	98.3	75	98.0
75	98.5	112.5	98.2
100	98.6	150	98.3
167	98.7	225	98.5
250	98.8	300	98.6
333	98.9	500	98.7
		750	98.8
		1000	98.9

a. kiloVolt-Amp rating.

b. Nominal efficiencies shall be established in accordance with the DOE 10 CFR 431 test procedure for low voltage dry-type transformers.

Add new definitions as follows:

LOW VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMER: A transformer that is air-cooled, does not use oil as a coolant, has an input voltage less than or equal to 600 Volts, and is rated for operation at a frequency of 60 Hertz

CE331-13

C405.8 (NEW), Table C405.8(1) (NEW), Table C405.8(2) (NEW), C405.8(3) (NEW), Table C405.8(4) (NEW), Chapter 5

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C405.8 Electrical motors (Mandatory). Electric motors shall meet the minimum efficiency requirements of Tables C405.8 (1) through C405.8 (4) when tested and rated in accordance with the DOE 10 CFR 431. The efficiency shall be verified through certification under an approved certification program or, where no certification program exists, the equipment efficiency ratings shall be supported by data furnished by the motor manufacturer.

Table C405.8 (1)

Minimum Nominal Full-Load Efficiency for 60 HZ NEMA *General Purpose Electric Motors*

***(Subtype I)* Rated 600 Volts or Less (Random Wound)**[a]

	Open Drip-Proof Motors			Totally Enclosed Fan-Cooled Motors		
Number of Poles ⇒	**2**	**4**	**6**	**2**	**4**	**6**
Synchronous Speed (RPM) ⇒	**3600**	**1800**	**1200**	**3600**	**1800**	**1200**

Motor Horsepower						
1	77.0	85.5	82.5	77.0	85.5	82.5
1.5	84.0	86.5	86.5	84.0	86.5	87.5
2	85.5	86.5	87.5	85.5	86.5	88.5
3	85.5	89.5	88.5	86.5	89.5	89.5
5	86.5	89.5	89.5	88.5	89.5	89.5
7.5	88.5	91.0	90.2	89.5	91.7	91.0
10	89.5	91.7	91.7	90.2	91.7	91.0
15	90.2	93.0	91.7	91.0	92.4	91.7
20	91.0	93.0	92.4	91.0	93.0	91.7
25	91.7	93.6	93.0	91.7	93.6	93.0
30	91.7	94.1	93.6	91.7	93.6	93.0
40	92.4	94.1	94.1	92.4	94.1	94.1
50	93.0	94.5	94.1	93.0	94.5	94.1
60	93.6	95.0	94.5	93.6	95.0	94.5
75	93.6	95.0	94.5	93.6	95.4	94.5
100	93.6	95.4	95.0	94.1	95.4	95.0
125	94.1	95.4	95.0	95.0	95.4	95.0
150	94.1	95.8	95.4	95.0	95.8	95.8
200	95.0	95.8	95.4	95.4	96.2	95.8
250	95.0	95.8	95.4	95.8	96.2	95.8
300	95.4	95.8	95.4	95.8	96.2	95.8
350	95.4	95.8	95.4	95.8	96.2	95.8
400	95.8	95.8	95.8	95.8	96.2	95.8
450	95.8	96.2	96.2	95.8	96.2	95.8
500	95.8	96.2	96.2	95.8	96.2	95.8

Table C405.8 (2)

Minimum Nominal Full-Load Efficiency of *General Purpose Electric Motors (Subtype II)* and all Design B motors greater than 200 horsepower[a]

	Open Drip-Proof Motors				Totally Enclosed Fan Cooled Motors			
Number of Poles ==>	**2**	**4**	**6**	**8**	**2**	**4**	**6**	**8**
Synchronous Speed (RPM)==>	**3600**	**1800**	**1200**	**900**	**3600**	**1800**	**1200**	**900**
Motor Horsepower								
1	NR	82.5	80.0	74.0	75.5	82.5	80.0	74.0
1.5	82.5	84.0	84.0	75.5	82.5	84.0	85.5	77.0
2	84.0	84.0	85.5	85.5	84.0	84.0	86.5	82.5
3	84.0	86.5	86.5	86.5	85.5	87.5	87.5	84.0
5	85.5	87.5	87.5	87.5	87.5	87.5	87.5	85.5
7.5	87.5	88.5	88.5	88.5	88.5	89.5	89.5	85.5
10	88.5	89.5	90.2	89.5	89.5	89.5	89.5	88.5
15	89.5	91.0	90.2	89.5	90.2	91.0	90.2	88.5
20	90.2	91.0	91.0	90.2	90.2	91.0	90.2	89.5
25	91.0	91.7	91.7	90.2	91.0	92.4	91.7	89.5
30	91.0	92.4	92.4	91.0	91.0	92.4	91.7	91.0
40	91.7	93.0	93.0	91.0	91.7	93.0	93.0	91.0
50	92.4	93.0	93.0	91.7	92.4	93.0	93.0	91.7
60	93.0	93.6	93.6	92.4	93.0	93.6	93.6	91.7
75	93.0	94.1	93.6	93.6	93.0	94.1	93.6	93.0
100	93.0	94.1	94.1	93.6	93.6	94.5	94.1	93.0
125	93.6	94.5	94.1	93.6	94.5	94.5	94.1	93.6
150	93.6	95.0	94.5	93.6	94.5	95.0	95.0	93.6
200	94.5	95.0	94.5	93.6	95.0	95.0	95.0	94.1
250	94.5	95.4	95.4	94.5	95.4	95.0	95.0	94.5
300	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR

350	95.0	95.4	95.4	NR	95.4	95.4	95.0	NR
400	95.4	95.4	NR	NR	95.4	95.4	NR	NR
450	95.8	95.8	NR	NR	95.4	95.4	NR	NR
500	95.8	95.8	NR	NR	95.4	95.8	NR	NR

Table C405.8 (3)

Minimum Average Full Load Efficiency for Polyphase *Small Electric Motors*[a]

Open Motors			
Number of Poles ==>	**2**	**4**	**6**
Synchronous Speed (RPM)		**3600 1800 1200**	
Motor Horsepower			
0.25	65.6	69.5	67.5
0.33	69.5	73.4	71.4
0.50	73.4	78.2	75.3
0.75	76.8	81.1	81.7
1	77.0	83.5	82.5
1.5	84.0	86.5	83.8
2	85.5	86.5	N/A
3	85.5	86.9	N/A

Add new definitions as follows:

GENERAL PURPOSE ELECTRIC MOTOR (SUBTYPE I): A motor which is designed in standard ratings with either:

1. Standard operating characteristics and standard mechanical construction for use under usual service conditions, such as those specified in NEMA MG1, paragraph 14.02, “Usual Service Conditions,” and without restriction to a particular application or type of application; or

2. Standard operating characteristics or standard mechanical construction for use under unusual service conditions, such as those specified in NEMA MG1, paragraph 14.03, “Unusual Service

Conditions," or for a particular type of application, and which can be used in most general purpose applications.

General purpose electric motors (subtype I) are constructed in NEMA T-frame sizes, or IEC metric equivalent, starting at 143T.

GENERAL PURPOSE ELECTRIC MOTOR (SUBTYPE II). A motor incorporating the design elements of a general purpose electric motor (subtype I) that is configured as one of the following:

1. A U-frame motor
2. A Design C motor
3. A close-coupled pump motor
4. A footless motor
5. A vertical, solid-shaft, normal-thrust motor (as tested in a horizontal configuration)
6. An 8-pole motor (900 rpm)
7. A polyphase motor with voltage of not more than 600 volts (other than 230 or 460 volts)

SMALL ELECTRIC MOTOR. A general purpose, alternating current, single speed induction motor.

Add new standard to Chapter 5 as follows:

DOE

10 CFR 431 Subpart B, App B, Uniform Test Method for Measuring Nominal Full Load Efficiency of Electric Motors.

NEMA National Electrical Manufacturers Association

1300 North 17th Street, Suite 1752

Rosslyn, VA 22209

MG1-2011 Motors and Generators.

CE332-13

C405.8 (NEW), C405.8.1 (NEW)

Proposed Change as Submitted

Proponent: Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development (WABO TCD)

Add new text as follows:

C405.8 Variable speed escalators and moving walks. Escalators and moving walks shall be capable of reducing their operating speed to no more than 15 feet per minute when no passengers have been detected for a period of time not exceeding three times the amount of time required to transfer a passenger between landings.

> **Exception:** A power factor controller that reduces operating voltage in response to light loading conditions is permitted to be provided in place of the variable speed function.

C405.8.1 Regenerative drive. An escalator designed either for one-way down operation only or for reversible operation shall have a variable frequency regenerative drive that supplies electrical energy to the building electrical system when the escalator is loaded with passengers whose combined weight exceeds 750 pounds.

Public Comment:

Lee Kranz, City of Bellevue, WA, representing Washington Association of Building Officials Technical Code Development Committee, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

~~**C405.8 Variable speed escalators and moving walks.** Escalators and moving walks shall be capable of reducing their operating speed to no more than 15 feet per minute when no passengers have been detected for a period of time not exceeding three times the amount of time required to transfer a passenger between landings.~~

> ~~**Exception:** A power factor controller that reduces operating voltage in response to light loading conditions is permitted to be provided in place of the variable speed function.~~

~~**C405.8.1**~~ **C405.8 Regenerative drive.** An escalator designed either for one-way down operation only or for reversible operation shall have a variable frequency regenerative drive that supplies electrical energy to the building electrical system when the escalator is loaded with passengers whose combined weight exceeds 750 pounds.

CE333-13

C405 (NEW), C405.1 (NEW), C405.2 (NEW), Chapter 5

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Add new text as follows:

C405 Vertical and horizontal transportation systems and equipment. Vertical and horizontal transportation systems and equipment shall comply with this section.

C405.1 Elevator cabs. For the luminaires in each elevator cab, not including signals and displays, the sum of the lumens divided by the sum of the watts shall be no less than 35 lumens per watt. Ventilation fans in elevators that do not have their own air conditioning system shall not consume more than 0.33 watts/cfm at the maximum rated speed of the fan. Controls shall be provided that will de-energize ventilation fans and lighting systems when the elevator is stopped, unoccupied and with its doors closed for over 15 minutes.

C405.2 Escalators and moving walks. Escalators and moving walks shall comply with ASME A17.1/CSA B44 and shall have automatic controls configured to reduce speed to the minimum permitted speed in accordance with ASME A17.1/CSA B44 or applicable local code when not conveying passengers.

Add new standard to Chapter 5 as follows:

ASME

ASME/A17.1/CSA B44-2010 Safety Code for Elevators and Escalators

CE336 – 13

C406.1.1 (NEW)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

SECTION C406
ADDITIONAL EFFICIENCY PACKAGE OPTIONS

C406.1 Requirements. Buildings shall comply with at least one of the following:

1. Efficient HVAC Performance in accordance with Section C406.2.
2. Efficient Lighting System in accordance with Section C406.3.
3. On-Site Supply of Renewable Energy in accordance with Section C406.4.

C406.1.1. Tenant spaces. Except where an entire building is in compliance with Section C406.4, individual tenant spaces shall comply with either Section C406.2 or Section C406.3. ~~unless documentation can be provided that demonstrates compliance with Section C406.4 for the entire building~~

CE337-13

C202 (New), C406.1, C406.2, Table C406.2(1), Table C406.2(2), Table C406.2(3), Table C406.2(4), Table C406.2(5), Table C406.2(6), Table C406.2(7), C406.3, C406.4, C406.5 (New), C406.6 (New), C406.8 (New), C406.8.1 (New)

Proposed Change as Submitted

Proponent: Eric Makela, Britt/Makela Group, Inc., representing Northwest Energy Codes Group (eric@brittmakela.com), Jim Edelson, New Buildings Institute

Revise as follows:

C406.1 Requirements. Buildings shall comply with at least one of the following:

1. More efficient HVAC equipment performance in accordance with Section C406.2.
2. Reduced efficient lighting power density system in accordance with Section C406.3.
3. Enhanced lighting controls in accordance with Section C406.4
4. On-site supply of renewable energy in accordance with Section C406.5.
5. Provision of a dedicated outdoor air system for certain HVAC equipment in accordance with Section C406.6.
6. High efficiency service water heating in accordance with Section C406.8.

C406.2. More efficient HVAC equipment performance. Equipment shall exceed the minimum efficiency requirements listed in Tables C403.2.3(1) through 403.2.3(7) by 10 percent in addition to the requirements of Section C403. Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10 percent. *Variable refrigerant flow systems* shall exceed the energy efficiency provisions of ANSI/ASHRAE/IES 90.1 by 10 percent. Equipment not listed in Tables C403.2.3(1) through 403.2.3(7) shall be limited to 10 percent of the total building system capacity.

~~**TABLE C406.2(1) UNITARY AIR CONDITIONERS AND CONDENSING UNITS, ELECTRICALLY OPERATED, EFFICIENCY REQUIREMENTS**~~

~~**TABLE C406.2(3) PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINALHEAT PUMPS**~~

~~**TABLE C406.2(4) WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS, EFFICIENCY REQUIREMENTS**~~

~~**TABLE C406.2(5) BOILER, EFFICIENCY REQUIREMENTS**~~

~~**TABLE C406.2(6) CHILLERS—EFFICIENCY REQUIREMENTS**~~

~~**TABLE C406.2(7) ABSORPTION CHILLERS—EFFICIENCY REQUIREMENTS**~~

C406.3 Reduced lighting power density The total interior lighting power (watts) of the building shall be determined by using 90 percent of the lighting power values in Table C405.5.2(1)~~the reduced whole building interior lighting power in Table C406.3 times the floor area of the building types.~~ or by using 90 percent of the interior lighting power allowance calculated by the Space by Space method in section C405.5.2.

C406.4 Enhanced digital lighting controls. Interior lighting in the building shall have the following enhanced lighting controls which shall be located, scheduled, and operated in accordance with Section C405.2.2.

1. Luminaires shall be capable of continuous dimming.
2. Luminaires shall be capable of being addressed individually. Where individual addressability is not available for the luminaire class type, a controlled group of no more than 4 luminaries shall be allowed.
3. No more than 8 luminaires shall be controlled together in a *daylight zone*
4. Fixtures shall be controlled through a digital control system that includes the following function:
    - 1.1. Control reconfiguration based on digital addressability
    - 1.2. Load shedding
    - 1.3. Individual user control of overhead general illumination in open offices
    - 1.4. Occupancy sensors shall be capable of being reconfigured through the digital control system.

5. Construction documents shall include submittal of a Sequence of Operations, including a specification outlining each of the functions in Item 4 of Section C406.4.
6. Functional testing of lighting controls shall comply with Section 408.

~~C406.4~~ C406.5 **On-site renewable energy** Total minimum ratings of on-site renewable energy systems shall comply with one of the following:

1. Provide not less than 1.75 btu's, or not less than 0.50 watts, per square foot of conditioned floor area.
2. Provide not less than 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4;

C406.6 Dedicated outdoor air system. Buildings covered by Section C403.4 shall be equipped with an independent ventilation system designed to provide no less than the minimum 100 percent outdoor air to each individual occupied space as specified by the *International Mechanical Code*, to each individual occupied space. The ventilation system shall be capable of total energy recovery. The HVAC system shall include supply-air temperature controls that automatically reset the supply-air temperature in response to representative building loads, or to outdoor air temperatures. The controls shall reset the supply air temperature at least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

C406.7 Reduced energy use in service water heating. Buildings shall be of the following types to use this compliance method:

1. Group R-1, Boarding houses, Hotels or motels;
2. Group I-2, Hospitals, mental hospitals, and nursing homes;
3. Group A-2, Restaurants and Banquet halls or buildings containing food preparation areas;
4. Group F, Laundries;
5. Group R-2 Buildings with residential occupancies;
6. Group A-3 Health clubs and spas; or
7. Buildings showing a service hot water load of 10 percent or more of total building energy loads as shown with an energy analysis as described in Section C407.

C406.7.1 Load fraction. The building service water heating system shall have one or more of the following that are sized to provide at least 60 percent of hot water requirements, or sized to provide 100 percent of hot water requirements if the building must otherwise comply with Section C403.4.6:

1. Waste heat recovery from service hot water, heat recovery chillers, building equipment, process equipment, or a combined heat and power system.
2. Solar water heating systems.

Add new definition as follows:

SECTION C202
GENERAL DEFINITIONS

VARIABLE REFRIGERANT FLOW SYSTEM. An engineered direct expansion (DX) refrigerant system that incorporates a common condensing unit, at least one variable capacity compressor, a distributed refrigerant piping network to multiple indoor fan heating and cooling units each capable of individual zone temperature control, through integral zone temperature control devices and common communications network. Variable refrigerant flow utilizes three or more steps of control on common inter-connecting piping.

Public Comment 1:

Eric Makela, Britt/Makela Group, representing Northwest Energy Codes Group; Jim Edelson, New Buildings Institute, request Approval as Modified by this Public Comment.

Modify the proposal as follows:

C401.2 Application. Commercial buildings shall comply with one of the following:

1. The requirements of ANSI/ASHRAE/IESNA 90.1.
2. The requirements of Sections C402, C403, C404 and C405. In addition, commercial buildings shall comply with ~~either~~ Section ~~C406.2, C406.3 or C406.4~~ Section C406, and tenant spaces shall comply with Section C406.1.1.
3. The requirements of Section C407, C402.4, C403.2, C404, C405.2, C405.3, C405.4, C405.6 and C405.7. The building energy cost shall be equal to or less than 85 percent of the standard reference design building.

~~Individual tenant spaces shall comply with either Section C406.2 or Section C406.3 unless documentation can be provided that demonstrates compliance with Section C406.4 for the entire building.~~

C406.1.1 Tenant Spaces. Tenant spaces shall comply with Section C406.2, C406.3, C406.4, C406.6 or C406.7. Alternatively tenant spaces shall comply with Section C406.5 when the entire building is in compliance.

~~**C406.3 Efficient Lighting System** Whole building lighting power density shall comply with the requirements of Section C406.3.1.~~

~~**C 406.3.1**~~ **C406.3 Reduced lighting power density** The total interior lighting power (watts) of the building shall be determined by using 90 percent of the lighting power values in Table C405.5.2(1) times the floor area of the building types or by using 90 percent of the interior lighting power allowance calculated by the Space by Space method in section C405.5.2.

~~**TABLE C406.3**~~
~~**REDUCED INTERIOR LIGHTING POWER**~~

CE339 – 13

C406.2, Table C406.2(7)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

C406.2 Efficient HVAC performance. Equipment shall meet the minimum efficiency requirements of Tables C406.2(1) through ~~C406.2(7)~~ C406.2(6) in addition to the requirements in Section C403. This section shall only be used where the equipment efficiencies in Tables C406.2(1) through ~~C406.2(7)~~ C406.2(6) are greater than the equipment efficiencies listed in Table C403.2.3(1) through ~~403.2.3(7)~~ 403.2.3(6) for the equipment type.

~~TABLE C406.2(7)~~

~~ABSORPTION CHILLERS EFFICIENCY REQUIREMENTS EQUIPMENT TYPE~~	~~MINIMUM EFFICIENCY FULL LOAD COP (IPLV)~~
~~Air cooled, single effect~~	~~0.60, allowed only in heat recovery applications~~
~~Water cooled, single effect~~	~~0.70, allowed only in heat recovery applications~~
~~Double effect - direct fired~~	~~1.0 (1.05)~~
~~Double effect - indirect fired~~	~~1.20~~

CE345 – 13

C407.4.1, C407.6

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Revise as follows:

C407.4.1 Compliance report. ~~Compliance software tools shall generate~~ Permit submittals shall include 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 C407.5.1(1). The inspection checklist shall show the estimated annual energy consumption 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.

C407.6 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.~~ 1. Building operation for a full calendar year (8,760 hours).

~~3.~~ 2. 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.~~ 3. Ten or more thermal zones.

~~5.~~ 4. Thermal mass effects.

~~6.~~ 5. Hourly variations in occupancy, illumination, receptacle loads, thermostat settings, mechanical ventilation, HVAC equipment availability, service hot water usage and any process loads.

~~7.~~ 6. Part-load performance curves for mechanical equipment.

~~8.~~ 7. Capacity and efficiency correction curves for mechanical heating and cooling equipment.

~~9.~~ 8. Printed *code official* inspection checklist listing each of the *proposed design* component characteristics from Table C407.5.1(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.).

CE347 – 13

Table C407.5.1(1)

Proponent: Dr. Thomas D. Culp, Birch Point Consulting LLC, representing the Glazing Industry Code Committee (culp@birchpointconsulting.com)

Revise as follows:

TABLE C407.5.1(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 C405.5.2 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	As proposed
	Gross area: same as proposed	As proposed
	U-factor: from Table C402.1.2	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, above-grade	Type: Mass wall if proposed wall is mass; otherwise steel-framed wall	As proposed
	Gross area: same as proposed	As proposed
	U-factor: from Table C402.1.2	As proposed
	Solar absorptance: 0.75	As proposed
	Emittance: 0.90	As proposed
Walls, below-grade	Type: Mass wall	As proposed
	Gross area: same as proposed	As proposed
	U-Factor: from Table C402.1.2 with insulation layer on interior side of walls	As proposed
Floors, above-grade	Type: joist/framed floor	As proposed
	Gross area: same as proposed	As proposed
	U-factor: from Table C402.1.2	As proposed
Floors, slab-on-grade	Type: Unheated	As proposed
	F-factor: from Table C402.1.2	As proposed
<u>Opaque</u> Doors	Type: Swinging	As proposed
	Area: Same as proposed	As proposed
	U-factor: from Table C402.2	As proposed

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
~~Glazing~~ Vertical Fenestration other than Opaque Doors	Area 1. The proposed glazing area; where the proposed glazing area is less than 40 percent of above-grade wall area. 2. 40 percent of above-grade wall area; where the proposed glazing area is 40 percent or more of the above-grade wall area.	As proposed
	U-factor: from Table C402.3	As proposed
	SHGC: from Table C402.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used	As proposed
	External shading and PF: None	As proposed
Skylights	Area 1. The proposed skylight area; where the proposed skylight area is less than 3 percent of gross area of roof assembly. 2. 3 percent of gross area of roof assembly; where the proposed skylight area is 3 percent or more of gross area of roof assembly	As proposed
	U-factor: from Table C402.3	As proposed
	SHGC: from Table C402.3 except that for climates with no requirement (NR) SHGC = 0.40 shall be used.	As proposed
Lighting, interior	The interior lighting power shall be determined in accordance with Table C405.5.2. 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 C405.6.2(2). Areas and dimensions of tradable and nontradable surfaces shall be the same as proposed.	As proposed
Internal gains	Same as proposed	Receptacle, motor and process loads shall be 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 be 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-dependent 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 C403.2.5.
Heating systems	Fuel type: same as proposed design	As proposed

BUILDING COMPONENT CHARACTERISTICS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN
	Equipment type[a]: from Tables C407.5.1(2) and C407.5.1(3)	As proposed
	Efficiency: from Tables C403.2.3(4) and C403.2.3(5)	As proposed
	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 heating load hours and no larger heating capacity safety factors are provided than in the proposed design.	As proposed
Cooling systems	Fuel type: same as proposed design	As proposed
	Equipment type[c]: from Tables C407.5.1(2) and C407.5.1(3)	As proposed
	Efficiency: from Tables C403.2.3(1), C403.2.3(2) and C403.2.3(3)	As proposed
	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.	As proposed
	Economizer[d]: same as proposed, in accordance with Section C403.4.1.	As proposed
Service water heating	Fuel type: same as proposed	As proposed
	Efficiency: from Table C404.2	As proposed
	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

a. Where no heating system exists or 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.
b. 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.
c. 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.
d. If an economizer is required in accordance with Table C403.3.1(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 C403.4.1.

CE348 – 13

Table C407.5.1(1)

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

TABLE C407.5.1(1)

SPECIFICATIONS FOR THE STANDARD REFERENCE AND PROPOSED DESIGNS	STANDARD REFERENCE DESIGN	PROPOSED DESIGN

BUILDING COMPONENT CHARACTERISTICS		
Cooling systems	Fuel type: same as proposed design	As proposed
	Equipment type[c]: from Tables C407.5.1(2) and C407.5.1(3)	As proposed
	Efficiency: from Tables C403.2.3(1), C403.2.3(2) and C403.2.3(3)	As proposed
	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.	As proposed
	Economizer[d]: same as proposed, in accordance with Section C403.4.1 C403.3.1.	As proposed

(Portions of Table not shown remain unchanged)

a. Where no heating system exists or 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.

b. 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.

c. 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.

d. If an economizer is required in accordance with Table C403.3.1(1), and if no economizer exists or is specified in the proposed design, then a supply air economizer shall be provided in the reference design in accordance with Section ~~C403.4.1~~ C403.3.1

CE349 – 13

C407.6.3 (NEW)

Proponent: Tim Nogler, Washington State Building Code Council (tim.nogler@des.wa.gov)

Add new text as follows:

C407.6.3 Exceptional calculation methods. When the simulation program does not model a design, material, or device of the *proposed design*, an exceptional calculation method shall be used where approved by the *code official*. Where there are multiple designs, materials, or devices that the simulation program does not model, each shall be calculated separately and exceptional savings determined for each. At no time shall the total exceptional savings constitute more than half of the difference between the baseline building performance and the proposed building performance. All applications for approval of an exceptional method shall include:

1. Step-by-step documentation of the exceptional calculation method performed detailed enough to reproduce the results;
2. Copies of all spreadsheets used to perform the calculations;

3. A sensitivity analysis of energy consumption when each of the input parameters is varied from half to double the value assumed;
4. The calculations shall be performed on a time step basis consistent with the simulation program used;
5. The performance rating calculated with and without the exceptional calculation method.

CE351 – 13

C408.2, C408.2.1, C408.2.2.1, C408.2.2.2, C408.3.1

Proponent: Brenda A. Thompson, Clark County Development Services, Clark County, Nevada, representing Sustainable/Energy/High Performance Code Action Committee (bat@clarkcounty.gov)

Revise as follows:

SECTION C408
SYSTEM COMMISSIONING

C408.1 General. This section covers the commissioning of the building mechanical systems in Section C403 and electrical power and lighting systems in Section C405.

C408.2 Mechanical systems commissioning and completion requirements. Prior to passing the final mechanical inspection, the *registered design professional* or *approved agency* shall provide evidence of mechanical systems *commissioning* and completion in accordance the provisions of this section. Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

Exception: The following systems are exempt from the commissioning requirements:

1. Mechanical systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h (140 690 W) cooling capacity and 600,000 Btu/h (175 860 W) heating capacity.
2. Systems included in Section C403.3 that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units.

C408.2.1 Commissioning plan. A *commissioning plan* shall be developed by a *registered design professiona*l or approved *agency* and shall include the following items:

1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
2. A listing of the specific equipment, appliances or systems to be tested and a description of the tests to be performed.
3. Functions to be tested, including, but not limited to calibrations and economizer controls.
4. Conditions under which the test will be performed~~. At a minimum,~~ Testing shall affirm winter and summer design conditions and full outside air conditions.
5. Measurable criteria for performance.

C408.2.2 Systems adjusting and balancing. 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 the tolerances provided in the product specifications. Test and balance activities shall include air system and hydronic system balancing.

C408.2.2.1 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 (0.74 kW), fan speed shall be adjusted to meet design flow conditions.

Exception: Fans with fan motors of 1 hp (0.74 kW) or less are not required to be provided with a means for air balancing.

C408.2.2.2 Hydronic systems balancing. Individual hydronic heating and cooling coils shall be equipped with means for balancing and measuring flow. 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 capability to measure pressure across the pump, or test ports at each side of each pump.

Exceptions: The following equipment are not required to be equipped with means for balancing or measuring flow:

1. Pumps with pump motors of 5 hp (3.7 kW) or less.
2. Where throttling results in no greater than five percent of the nameplate horsepower draw above that required if the impeller were trimmed.

C408.2.3 Functional performance testing. Functional performance testing specified in Sections C408.2.3.1 through C408.2.3.3 shall be conducted.

C408.2.3.1 Equipment. Equipment functional performance testing shall demonstrate the installation and operation of components, systems, and system-to-system interfacing relationships in accordance with approved plans and specifications such that operation, function, and maintenance serviceability for each of the commissioned systems is confirmed. Testing shall include all modes and *sequence of operation*, including under full-load, part-load and the following emergency conditions:

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 restoration of power.

Exception: Unitary or packaged HVAC equipment listed in Tables C403.2.3(1) through C403.2.3(3) that do not require supply air economizers.

C408.2.3.2 Controls. 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.

C408.2.3.3 Economizers. Air economizers shall undergo a functional test to determine that they operate in accordance with manufacturer's specifications.

C408.2.4 Preliminary commissioning report. A preliminary report of commissioning test procedures and results shall be completed and certified by the *registered design professional* or *approved agency* and provided to the building owner. The report shall be identified as "Preliminary Commissioning Report" and shall identify:

1. Itemization of deficiencies found during testing required by this section that have not been corrected at the time of report preparation.
2. Deferred tests that cannot be performed at the time of report preparation because of climatic conditions.
3. Climatic conditions required for performance of the deferred tests.

C408.2.4.1 Acceptance of report. *Buildings*, or portions thereof, shall not pass the final mechanical inspection until such time as the *code official* has received a letter of transmittal from the *building* owner acknowledging that the *building* owner has received the Preliminary Commissioning Report.

C408.2.4.2 Copy of report. The *code official* shall be permitted to require that a copy of the Preliminary Commissioning Report be made available for review by the *code official*.

C408.2.5 Documentation requirements. The *construction documents* shall specify that the documents described in this section be provided to the *building* owner within 90 days of the date of receipt of the *certificate of occupancy*.

C408.2.5.1 Drawings. *Construction documents* shall include the location and performance data on each piece of equipment.

C408.2.5.2 Manuals. An operating and maintenance manual shall be provided and include all of 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. Name and address 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 system programming instructions.
5. A narrative of how each system is intended to operate, including recommended setpoints.

C408.2.5.3 System balancing report. A written report describing the activities and measurements completed in accordance with Section C408.2.2.

C408.2.5.4 Final commissioning report. A report of test procedures and results identified as "Final Commissioning Report" shall be delivered to the building owner and shall include:

1. Results of functional performance tests.
2. Disposition of deficiencies found during testing, including details of corrective measures used or proposed.
3. 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.

C408.3 Lighting system functional testing. Controls for automatic lighting systems shall comply with Section C408.3.

C408.3.1 Functional testing. Testing shall ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. The construction documents shall state the party who will conduct the required functional testing. Where required by the code official, an approved party independent from the design or construction of the project shall be responsible for the functional testing and shall provide documentation to the code official certifying that the installed lighting controls meet the provisions of Section C405. Where occupant sensors, time switches, programmable schedule controls, photosensors or daylighting controls are installed, the following procedures shall be performed:

1. Confirmation that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance.
2. Confirmation that the time switches and programmable schedule controls are programmed to turn the lights off.
3. Confirmation that the placement and sensitivity adjustments for photosensor controls reduce electric light based on the amount of usable daylight in the space as specified.

CE352 – 13

C408.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C408.2 Mechanical systems commissioning and completion requirements. Prior to ~~passing~~ the final mechanical inspection, the *registered design professional* shall provide evidence of mechanical systems *commissioning* and completion in accordance the provisions of this section.
Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

Exception: The following systems are exempt from the commissioning requirements:
1. Mechanical systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h (140 690 W) cooling capacity and 600,000 Btu/h (175 860 W) heating capacity.
2. Systems included in Section C403.3 that serve dwelling units and sleeping units in hotels, motels, boarding houses or similar units

CE353 – 13

C408.2

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C408.2 Mechanical systems commissioning and completion requirements. Prior to passing the final mechanical inspection, the *registered design professional* shall provide evidence of mechanical systems *commissioning* and completion in accordance the provisions of this section.
Construction document notes shall clearly indicate provisions for *commissioning* and completion requirements in accordance with this section and are permitted to refer to specifications for further requirements. Copies of all documentation shall be given to the owner and made available to the *code official* upon request in accordance with Sections C408.2.4 and C408.2.5.

Exceptions: The following systems are exempt ~~from the commissioning requirements:~~
1. Mechanical systems in buildings where the total mechanical equipment capacity is less than 480,000 Btu/h (140 690 W) cooling capacity and 600,000 Btu/h (175 860 W) heating capacity.
2. Systems included in Section C403.3 that serve <u>individual</u> dwelling units and sleeping units ~~in hotels, motels, boarding houses or similar units~~

CE354 – 13

C408.2.2.1

Proponent: Amanda Hickman, InterCode Incorporated, representing AMCA International (Amanda@InterCodeinc.com)

Revise as follows:

C408.2.2.1 Air system balancing. Each supply air outlet and *zone* terminal device shall be equipped with means for air balancing in accordance with the requirements of Chapter 6 of the *International*

Mechanical Code. Discharge dampers used for air system balancing 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 (0.74 kW), fan speed shall be adjusted to meet design flow conditions.
Exception: Fans with fan motors of 1 hp (0.74 kW) or less.

CE355-13

C408.2.4.1

Proposed Change as Submitted

Proponent: Jeremiah Williams, U.S. Department of Energy (jeremiah.williams@ee.doe.gov)

Revise as follows:

C408.2.4.1 Acceptance of report. *Buildings,* or portions thereof, shall not be considered acceptable for a final inspection pursuant to Section C104.3 ~~pass the final mechanical inspection~~ until ~~such time as~~ the *code official* has received a letter of transmittal from the *building* owner acknowledging that the *building* owner has received the Preliminary Commissioning Report.

CE356-13

C408.2.5.2

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C408.2.5.2 Manuals. An operating and maintenance manual shall be provided and include all of 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. Name and address 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 system programming instructions.
5. Submittal data indicating all selected options for each piece of lighting equipment and lighting controls.
6. Operation and maintenance manuals for each piece of lighting equipment. Required routine maintaince actions, cleaning and recommended relamping shall be clearly identified.
7. A schedule for inspecting and recalibrating all lighting controls.
8. A narrative of how each system is intended to operate, including recommended setpoints.

CE357-13

C408.3.1

Proposed Change as Submitted

Proponent: Steve Ferguson, American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) (sferguson@ashrae.org)

Revise as follows:

C408.3.1 Functional testing. Testing shall ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. ~~The construction documents shall state the party who will conduct the required functional testing.~~ Where required by the code official, an approved ~~party~~ individual independent from the design or construction of the project shall be responsible for the functional testing and shall provide documentation to the code official certifying that the installed lighting controls meet the provisions of Section C405.

Where occupant sensors, time switches, programmable schedule controls, photosensors or daylighting controls are installed, the following procedures shall be performed:

1. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance.
    1.1. For projects with up to seven occupancy sensors, all occupancy sensors shall be tested
    1.2. For projects with more than seven the following shall be verified:
        1.2.1. Status indicator (as applicable) operates correctly
        1.2.2. The controlled lights turn off or down to the permitted level within the required time,
        1.2.3. For auto-on occupant sensors, the lights do turn on to the permitted level when someone enters the space,
        1.2.4. For manual on sensors, the lights turn on only when manually activated
        1.2.5. The lights are not incorrectly turned on by movement in nearby areas or by HVAC operation
2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.
3. Confirm that all control devices for daylight controls have been properly located, field-calibrated, and set for design set points and threshold light levels. All daylight control devices shall only be readily accessible to authorized personnel. ~~the placement and sensitivity adjustments for photosensor controls reduce electric light based on the amount of usable daylight in the space as specified.~~

Public Comment 1:

Steve Ferguson, ASHRAE, requests Approval as Modified by this Public Comment.
Modify the proposal as follows:

C408.3.1 Functional testing. Testing shall ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. Where required by the code official, an approved individual independent from the design or construction of the project shall be responsible for the functional testing and shall provide documentation to the code official certifying that the installed lighting controls meet the provisions of Section C405.

Where occupant sensors, time switches, programmable schedule controls, photosensors or daylighting controls are installed, the following procedures shall be performed:

1. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance.

1.1 For projects with up to seven occupancy sensors, all occupancy sensors shall be tested. For projects with more than seven, at least one of each sensor type and the sensors in one of each distinct room or space type shall be tested

1.2 For all sensors required to be tested by item 1.1, ~~projects with more than seven~~ the following shall be verified:

1.2.1 Status indicators operate correctly

1.2.2 The controlled lights turn off or down to the permitted level within the required time,

1.2.3 For auto-on occupant sensors, the lights do turn on to the permitted level when someone enters the space,

1.2.4 For manual on sensors, the lights turn on only when manually activated

1.2.5 The lights are not incorrectly turned on by movement in nearby areas or by HVAC operation

2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.

3. Confirm that all control devices for daylight controls have been properly located, field-calibrated, and set for design set points and threshold light levels. All daylight control devices shall only be readily accessible to authorized personnel.

Public Comment 2:

Eric Makela, Britt/Makela Group, representing Northwest Energy Codes Group, requests Approval as Modified by this Public Comment.

Modify the proposal as follows:

Add to Section C202 General Definitions

REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

Revise as follows:

~~**C408.3.1 Functional testing.** Testing shall ensure that control hardware and software are calibrated, adjusted, programmed and in proper working condition in accordance with the construction documents and manufacturer's installation instructions. The construction documents shall state the party who will conduct the required functional testing. Where required by the code official, an approved party individual independent from the design or construction of the project shall be responsible for the functional testing and shall provide documentation to the code official certifying that the installed lighting controls meet the provisions of Section C405.~~

C408.3.1 Functional testing. Prior to passing final inspection, the *registered design professional* shall provide evidence that the lighting control systems have been tested to ensure that control hardware and software are calibrated, adjusted, programmed, and in proper working condition in accordance with the construction documents and manufacturer's installation instructions Functional testing shall comply with Section C408.3.1.1 to C408.3.1.2 for the applicable control type.

C408.3.1.1 Occupancy sensors Where *occupancy sensor*s are provided, the following procedures shall be performed:

1. Certify that the occupancy sensor has been located and aimed in accordance with manufacturer recommendations

2. For projects with seven or fewer *occupancy sensors* each sensor shall be tested.

3. For projects with more than seven *occupancy sensors*, testing shall be done for each unique combination of sensor type and space geometry. Where multiples of each unique combination of sensor type and space geometry are provided no fewer than the greater of one, or 10 percent of each combination, shall be tested unless the code official or design professional require a higher percentage to be tested. Where 30 percent or more of the tested controls fail, all remaining identical combinations shall be tested.

For each occupancy sensor to be tested, verify the following:

3.1 Where occupancy sensors include status indicators, verify correct operation.

3.2 The controlled lights turn off or down to the permitted level within the required time.

3.3 For auto-on *occupancy sensors*, the lights turn on to the permitted level when an occupant enters the space.

3.4 For manual on sensors, the lights turn on only when manually activated.

3.5 The lights are not incorrectly turned on by movement in adjacent areas or by HVAC operation.

C408.3.1.2 Automatic time switches. Where automatic time switches are provided, the following procedures shall be performed:

1. Confirm that the automatic time switch control is programmed with accurate weekday, weekend, and holiday schedules.
2. Provide documentation to the owner of automatic time switch programming including weekday, weekend, holiday schedules, and set-up and preference program settings.
3. Verify the correct time and date in the time switch.
4. Verify that any battery back-up is installed and energized.
5. Verify that the override time limit is set to no more than 2 hours.
6. Simulate occupied condition. Verify and document the following:
   6.1 All lights can be turned on and off by their respective area control switch.
   6.2 The switch only operates lighting in the enclosed space in which the switch is located.
7. Simulate unoccupied condition. Verify and document the following:
   7.1 All non-exempt lighting turns off.
   7.2. Manual override switch allows only the lights in the enclosed space where the override switch is located to turn on or remain on until the next scheduled shut off occurs.
8. Additional testing as specified by the registered design professional.

C408.3.1.3 Daylight Controls Where daylighting controls are provided, the following procedures shall be performed:

1. All control devices have been properly located, field-calibrated and set for accurate set points and threshold light levels.
2. Daylight controlled lighting loads adjust to light level set points in response to available daylight.
3. The locations of calibration adjustment equipments are readily accessible only to authorized personnel.

C408.3.2 Documentation Requirements. The *construction documents* shall specify that *documents* certifying that the installed lighting controls meet documented performance criteria of Section C405 be provided to the *building* owner within 90 days from the date of receipt of the *certificate of occupancy*. ~~Where occupant sensors, time switches, programmable schedule controls, photosensors or daylighting controls are installed, the following procedures shall be performed:~~

~~1. Confirm that the placement, sensitivity and time-out adjustments for occupant sensors yield acceptable performance.~~

~~1.1. For projects with up to seven occupancy sensors, all occupancy sensors shall be tested~~

~~1.2. For projects with more than seven the following shall be verified:~~

~~1.2.1. Status indicator (as applicable) operates correctly~~

~~1.2.2. The controlled lights turn off or down to the permitted level within the required time,~~

~~1.2.3. For auto-on occupant sensors, the lights do turn on to the permitted level when someone enters the space,~~
~~1.2.4. For manual on sensors, the lights turn on only when manually activated~~
~~1.2.5. The lights are not incorrectly turned on by movement in nearby areas or by HVAC operation~~

~~2. Confirm that the time switches and programmable schedule controls are programmed to turn the lights off.~~

~~3. Confirm that all control devices for daylight controls have been properly located, field-calibrated, and set for design set points and threshold light levels. All daylight control devices shall only be readily accessible to authorized personnel. the placement and sensitivity adjustments for photosensor controls reduce electric light based on the amount of usable daylight in the space as specified.~~

CE362 –13

C403.2.5 (New), R403.2 (New) (IRC N1103.2 (New))

Proponent: Julius Ballanco, P.E, JB Engineering and Code Consulting, P.C. representing self (JBEngineer@aol.com)

PART I IECC-COMMERCIAL PROVISIONS

Add new text as follows:

C403.2.5 Hot water boiler outdoor temperature setback control. Hot water boilers that supply heat to the building through one- or two-pipe heating systems shall have an outdoor setback control that lowers the boiler water temperature based on the outdoor temperature.

CE363 –13

C404.3

Proponent: Julius Ballanco, PE. JB Engineering and Code Consulting, PC, representing self (JBEngineer@aol.com)

Delete without substitution as follows:

~~**C404.3 Temperature controls.** Service water-heating equipment shall be provided with controls to allow a setpoint of 110°F (43°C) for equipment serving dwelling units and 90°F (32°C) for equipment serving other occupancies. The outlet temperature of lavatories in public facility rest rooms shall be limited to 110°F (43°C).~~