The 2015 IECC
What Are The Changes?

Industry Services Division

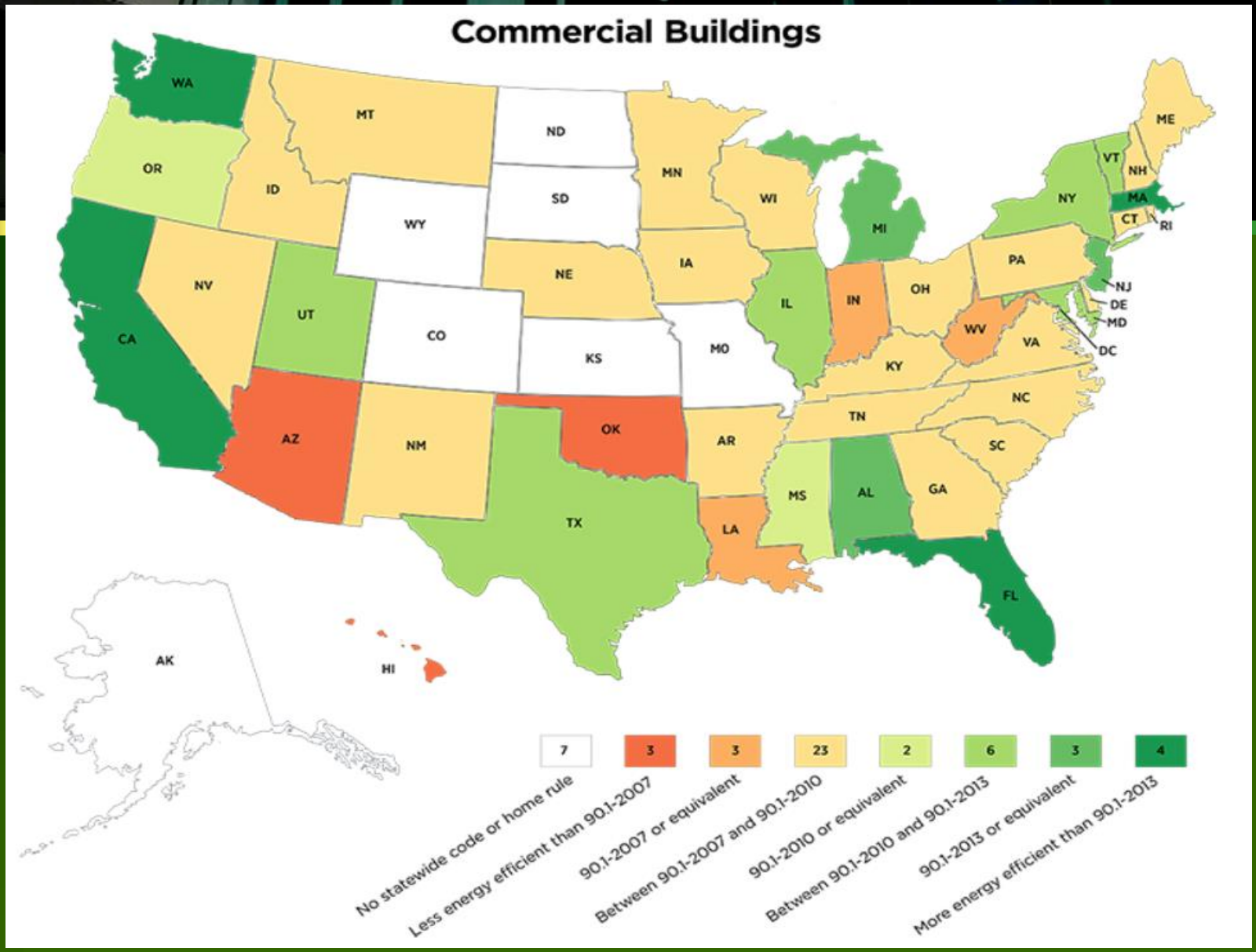
Dept. of Safety & Professional Services

Randy Dahmen, PE

Tom Westlund, Architect/HVAC Designer

- The following discussion addresses changes to various topics as addressed in the 2015 IECC and WI amendments as contained in SPS Chapter 363

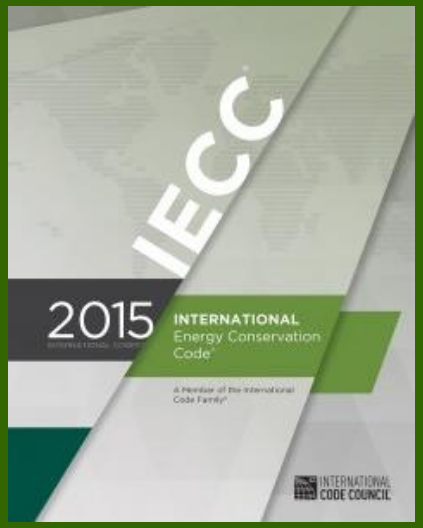
- Only those rules for Climate Zones 6 & 7 (Wisconsin) have been addressed



As of December 2017

New 2015 IECC Code Layout

- The Code is divided into two (2) sets of provisions:
  - IECC Commercial Provisions (C)
  - IECC Residential Provisions (R)



2015 IECC Layout & Structure Commercial Provisions

- The requirements for *Commercial Provisions* (All commercial bldgs inclusive of those residential bldgs 4 stories or more) are found in the "C" section with Chapters 1-6:
  - Scope and Administration
  - Definitions
  - General Requirements
  - Commercial Energy Efficiency
  - Existing Buildings
  - Referenced Standards

2015 IECC Layout & Structure Residential Provisions

- The requirements for *Residential Provisions* (All residential buildings 3 stories or less above grade w/ 3 dwelling units or more) are found in the "R" section with Chapters 1-6:
  - Scope and Administration
  - Definitions
  - General Requirements
  - Commercial Energy Efficiency
  - Existing Buildings
  - Referenced Standards

WI Amendments
SPS 363.0100

- The sections in this chapter are generally numbered to correspond to the numbering used in the IECC, with:
  - a 0 to the right of the decimal point referring to the Commercial Provisions (C), and
  - a 5 to the right of the decimal point referring to the Residential Provisions (R) of the IECC.
    - *i.e. SPS 363.0101 refers to section IECC C101 and SPS 363.5101 refers to section IECC R101.*

Fenestration Product Rating
IECC C303.1.3/R303.1.3

- U-factors of fenestration products (windows, floors and skylights) to be determined in accordance with NFRC 100.
  - Exception: Where required, garage door U-factors shall be determined in accordance with either NFRC 100 or ANSI /DASMA 105

Insulated Siding
IECC C303.1.4.1/R303.1.3.4.1

- Thermal resistance (R-value) of insulated siding to be determined per ASTM C1363, with installation in accordance with manufacturer's instructions.

Default Glazed Fenestration
C303.1.3 (3), R303.1.3(3)

- Visible Transmittance (VT) requirements added.
- VT is the ratio of visible light entering the space through the fenestration product assembly to the incident visible light. Expressed as number between 0 & 1. A ”0” is opaque; a “1” is totally transparent.

C303.1.3 (3) AND R303.1.3 (3) Default glazed fenestration SHGC and VT included

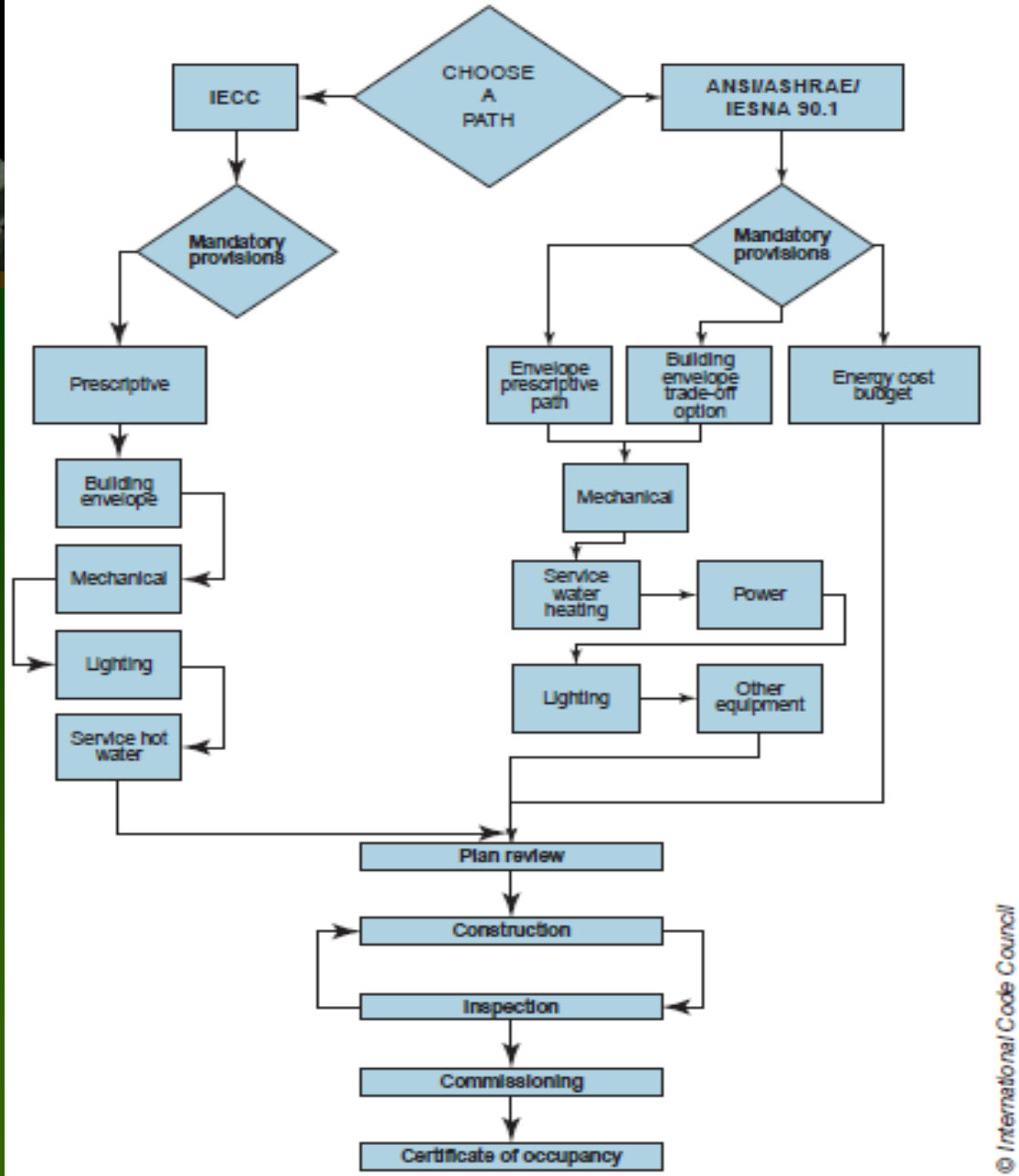
	Single Glazed		Double Glazed		Glazed Block
	Clear	Tinted	Clear	Tinted	
SHGC	0.8	0.7	0.7	0.6	0.6
VT	0.6	0.3	0.6	0.3	0.6

Application
C401.2/SPS 363.0401(4)

- Commercial Bldgs to comply with one (1):
  - ASHRAE 90.1-2013
  - IECC via Section C402-C405
  - The requirements of Sections C402.5, C403.2, C404, C405.2 through C405.4, C405.6 & C407. The building energy cost shall be equal to less than the standard reference design building.

Application
C401.2/ASHRAE 90.1-2013 /SPS 363.0401(2)

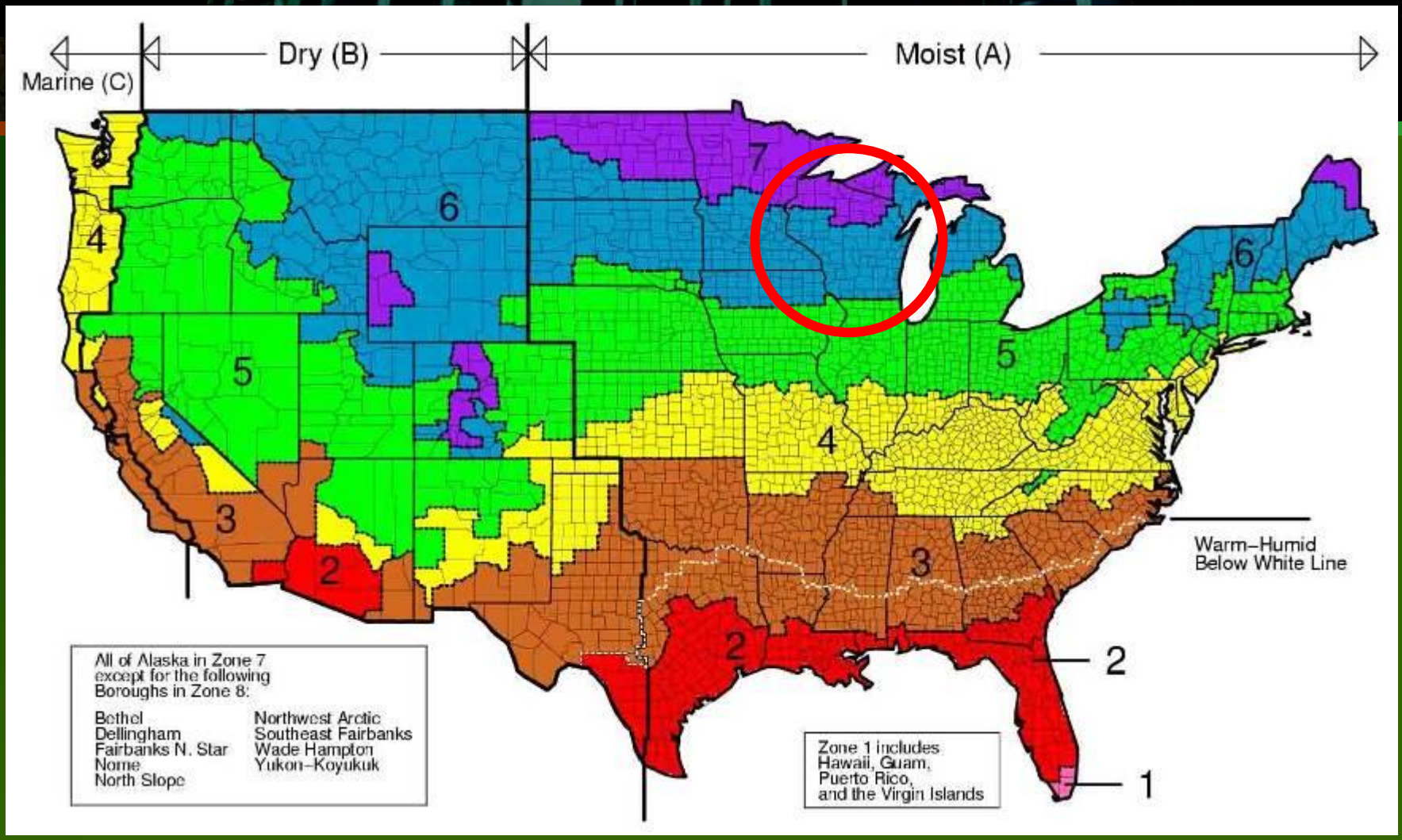
- Section 8.4.2 automatic receptacle controls are NOT included.
- Section 8.4.3.1 Monitoring substituted with: A measurement device shall be installed in new buildings to monitor total electrical energy use. For buildings with tenants, total electrical energy shall be monitored for the total building or for each individual tenant



Compliance options for existing buildings, do not include Additional efficiency package options or the Total building performance path.

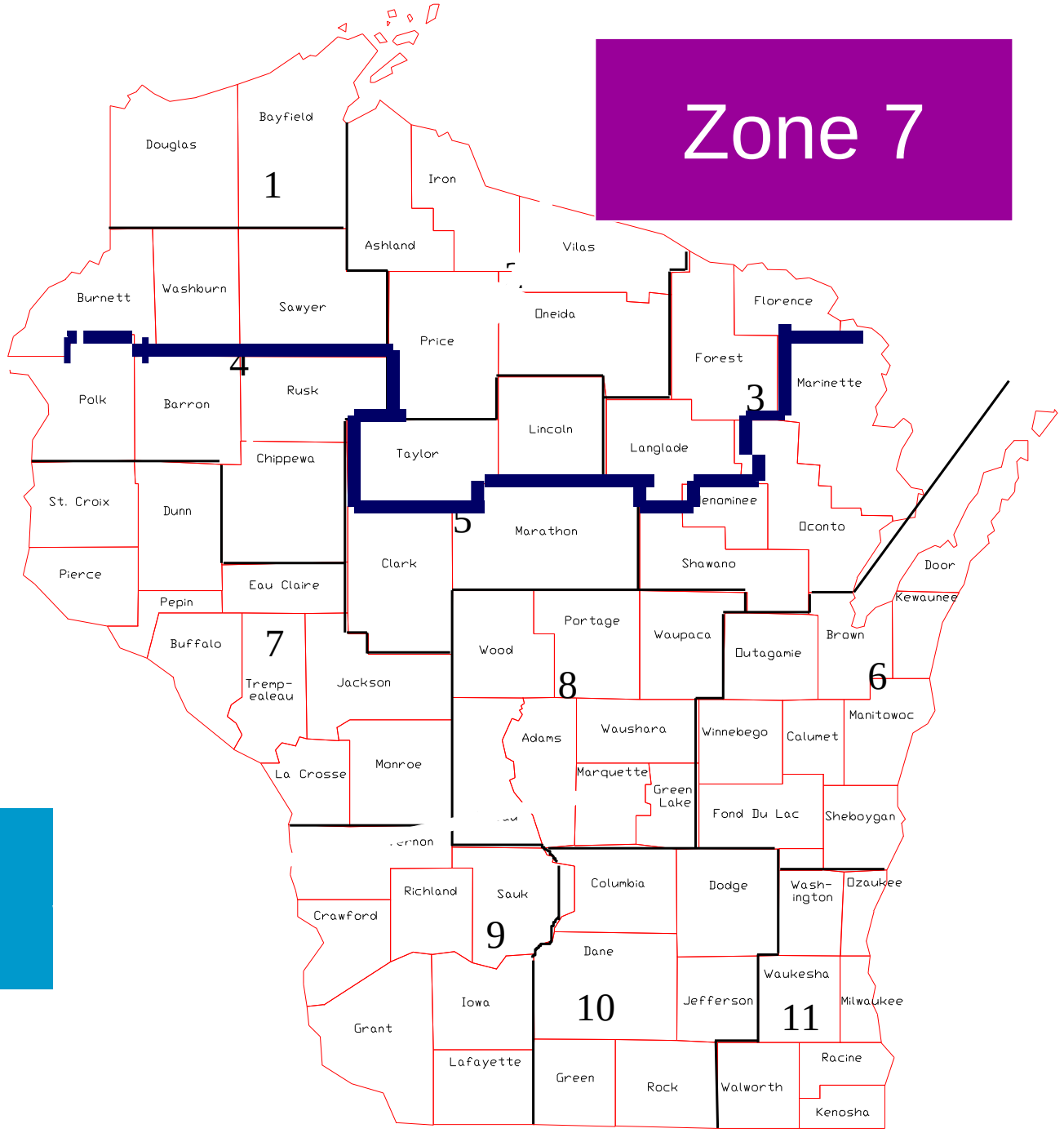
- General layout of code compliance for Existing Commercial Buildings
- One must use prescriptive requirements of IECC or ASHRAE 90.1-2013

Climate Zones—2015 IECC - C301.1



Determining Your Climate Zone is the First Step in the Process—Wisconsin is in Zones 6A & 7

Zone 7



Zone 6A

Compliance Options for 2015 IECC

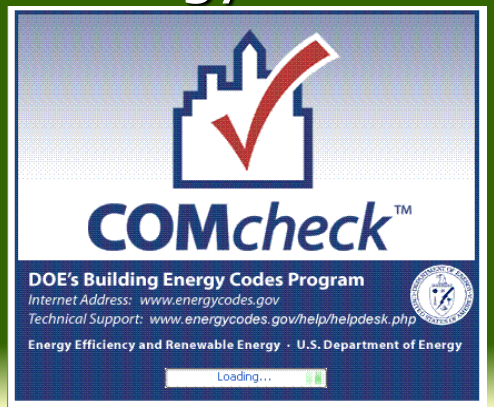
PRESCRIPTIVE

- 2015 IECC
  - (Must use 2009 IECC Tables 502.2(1) & 502.1.2 for Opaque Assys for the bldg envelope instead of 2015 IECC Tables C402.1.3 & C402.1.4)
  - Must use 2015 IECC version for lighting with WI amendments
- ASHRAE 90.1-2013
  - Must use Tables 5.5 for building envelope
  - Must use Chapter 8 for lighting with WI amendments

Compliance Options for 2015 IECC

PERFORMANCE APPROACH

- 2015 IECC
  - Comcheck-Set for "IECC 2015" per SPS 363.0405 or
  - Apply IECC C407 "Total Building Performance"
- ASHRAE 90.1-2013
  - Comcheck-Set for "90.1 (2013) Standard" per SPS 363.0405 or
  - Apply ASHRAE "Energy Cost Budget Method"



Prescriptive & Performance

SPS 363.0401(4)

- SPS 363.0401(4) does NOT require that IECC C406 requiring "Additional Efficiency Package Options" be met.

- Must address:
  - C402 Envelope
  - C403 Mechanical
  - C404 Lighting
  - C405 Service Water Heating

Performance

- Total Building Performance
  - Apply SPS 363.0407 -- The requirements in IECC section C403.2.7 *(energy recovery ventilation system requirements)* are NOT required to be demonstrated as means of compliance with this section.
  - Use of IECC section C407 requires the total building energy cost to be equal to or less than the standard reference design building, as required under IECC section C401.2 item 3.

Low-Energy Buildings
C402.1.1

- Low energy buildings, or portions separated by building thermal envelope assemblies complying with this section are exempt of the thermal envelope requirements of the code.
  - Bldgs with peak design rate of energy usage < 3.4 Btu/h*sf or 1.0 W/sf of floor area
  - Bldgs that do not contain conditioned space
  - *Greenhouses*

Equipment Buildings
C402.1.2

- Equipment Bldgs exempt from the building thermal envelope provisions include:
  - Separate buildings with floor area ≤ 500 sf
  - Bldgs housing electronic equipment with installed equipment power ≥ 7 W/sf and not intended for human occupancy
  - Buildings w/heating capacity < 17,000 Btu/hr & a heating thermostat set point restricted to ≤ 50°F

Equipment Buildings
C402.1.2

- Equipment Bldgs exempt from the building thermal envelope provisions include (continued):
  - Bldgs with average wall & roof U-factor < 0.12 (> R-8.33) in Climate Zones 6-8

Compliance with Chapter 5 Prescriptive Approach (2009)

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS - OPAQUE ASSEMBLIES

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
Roofs																
Insulation entirely above deck	R-15ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci
Metal buildings (with R-5 thermal blocks[a, b])	R-19	R-19	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-19	R-13 + R-13	R-19	R-13 + R-13	R-19	R-13 + R-19	R-19	R-13 + R-19	R-19 + R-10	R-11 + R-19	R-19 + R-10
Attic and other	R-30	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R- 38	R-38	R-38	R-38	R-38	R-38	R-49	R-49
Walls, Above Grade																
Mass	NR	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci[c]	R-11.4ci	R-11.4ci	R-13.3 ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building[b]	R-16	R-16	R-16	R-16	R-19	R-19	R-19	R-19	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci
Metal framed	R-13	R-13	R-13	R-13+ 7.5ci	R-13 + R-3.8ci	R-13 + R-7.5ci	R-13 + 7.5	R-13 + R-7.5ci	R-13 + R-7.5 ci	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-7.5 ci	R-13 + R-18.8ci
Wood framed and other	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13+ R-3.8ci	R-13 + R-3.8ci	R-13 + 3.8	R-13 + 7.5	R-13 + R-7.5	R-13+ R-7.5ci	R-13 +7.5ci	R-13 + R-15.6ci	R-13 + 15.6ci
Walls, Below Grade																
Below grade wall[d]	NR	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	NR R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-7.5ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-6.3ci	R-8.3ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-14.6ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing Steel/(wood)	NR	NR	R-19	R-30	R-19	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	NR	R-10 for 24 in. below	NR	R-10 for 24 in. below	R-10 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 24 in. below
Heated slabs	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-7.5 for 12 in. below	R-10 for 24 in. below	R-10 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-15 for 24 in. below	R-20 for 48 in. below	R-20 for 24 in. below	R-20 for 48 in. below	R-20 for 48 in. below	R-20 for 48 in. below
Opaque doors																
Swinging	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.70	U – 0.50	U –0.50	U – 0.50	U – 0.50	U – 0.50
Roll-up or sliding	U – 1.45	U – 1.45	U – 1.45	U – 1.45	U – 1.45	U – 1.45	U –0.50	U – 0.50	U –0.50	U – 0.50	U – 0.50	U – 0.50	U – 0.50	U – 0.50	U – 0.50	U – 0.50

Specific Insulation Requirements (Prescriptive) C402.2 (2015)

CLIMATE ZONE	6		7	
	All other	Group R	All other	Group R
Insulation entirely above roof deck	R-30ci	R-30ci	R-35ci	R-35ci
Metal buildings[a, b]	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-49	R-49	R-49	R-49
Mass	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci
Metal building	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-19.5ci
Metal framed	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci
Wood framed and other	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci
Below-grade wall[d]	R-7.5ci	R-7.5ci	R-10ci	R-10ci
Mass[e]	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci
Joist/framing	R-30	R-30[f]	R-30[f]	R-30[f]
Unheated slabs	R-10 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 24″ below
Heated slabs[f]	R-15 for 36″ below	R-20 for 48″ below	R-20 for 24″ below	R-20 for 48″ below
Nonswinging	R-4.75	R-4.75	R-4.75	R-4.75

Compare the minimum requirements in 2009 IECC (previous slide) to the minimum values as associated with the 2015 IECC

Compliance with Chapter 5 Prescriptive Approach (2009) 502.3

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
***U*-factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain wall/storefront *U*-factor	1.0	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
SHGC-all frame types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.
PF = Projection factor (see Section 502.3.2).
a. All others includes operable windows, fixed windows and nonentrance doors.

Bldg Envelope Fenestration Maximum U-Factor & SHGC Requirements C402.4 (2015)

C402.4 Fenestration Requirements

Table C402.4
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4	5	6	7
Vertical fenestration							
***U*-factor**							
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77
SHGC							
Orientation	SEW/N	SEW/N	SEW/N	SEW/N	SEW/N	SEW/N	SEW/N
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
0.2 ≤ 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
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
Skylights							
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR

Compare 2009 IECC (previous slide) to the 2015 IECC

Fenestration-Prescriptive (Max Area)
C402.4.1

- Percentage of Vertical Fenestration Area to Gross Wall Area
  - ≤ 30% maximum above grade wall area allowed
  - In Climate Zones 1-6, ≤ 40% maximum above–grade wall area permitted when criteria (on next screen) is met.
- Percentage of Skylight area to Gross Roof Area
  - ≤ 3% maximum of gross roof area allowed
  - ≤ 5% maximum of gross roof area allowed w/daylight responsive controls

Increased Vertical Fenestration with Daylighting Controls *C402.4.1.1*

Up to 40% vertical fenestration area allowed in Climate zones 1-6 if:
All of the following are to be met

- No less than 50% of the net floor area is within a daylight zone in buildings 2 stories or less
- No less than 25% of the net floor area is within a daylight zone in buildings with 3 or more stories
- Daylight responsive controls are installed in daylight zones
- VT of vertical fenestration is ≥ 1.1 times SHGC

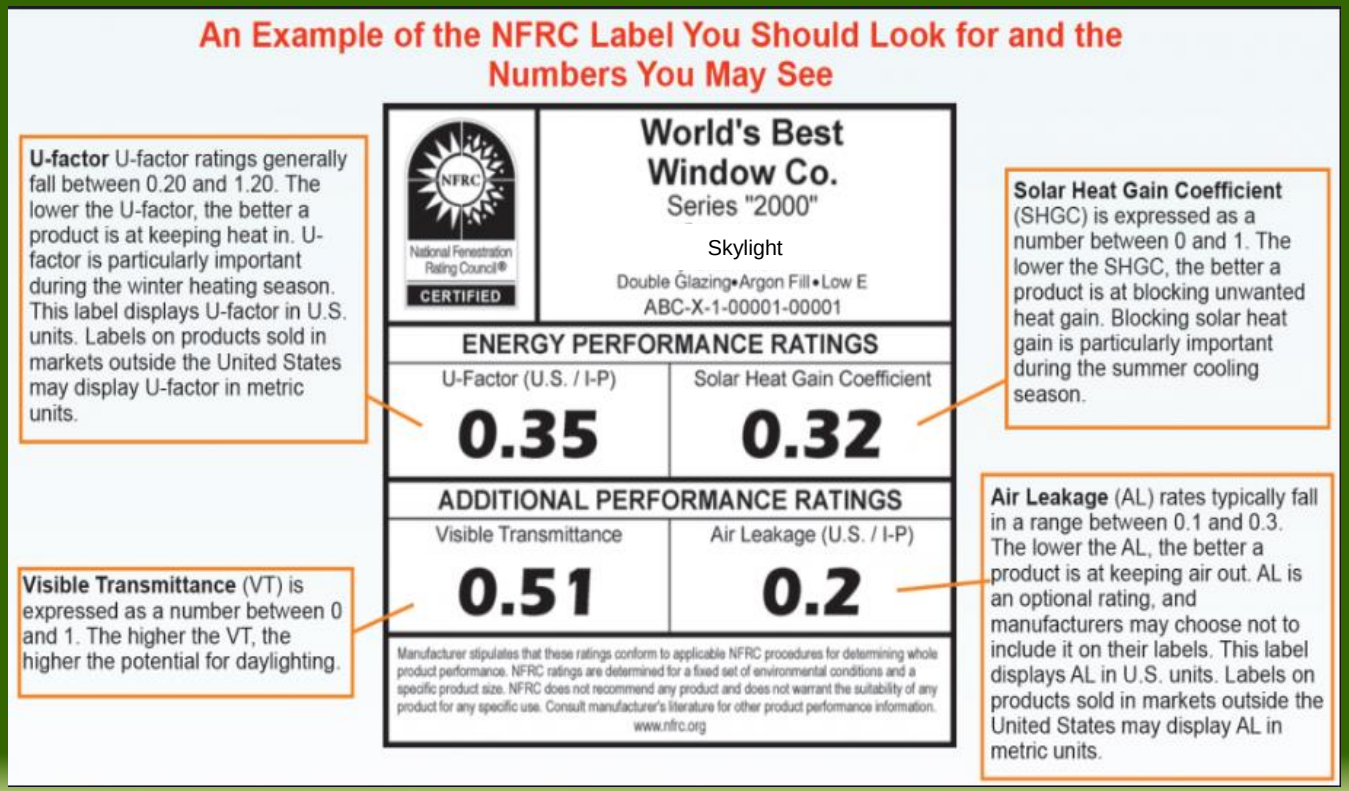
Exception:
Fenestration that is outside the scope of NFRC 200 isn't required to comply with VT

Increased Skylight Area with Daylight Responsive Controls (Prescriptive)
C402.5.1.2

- Skylight area permitted to be ≤ 5% of the roof area provided daylight responsive controls complying with Section 405.2.3.1 are installed

Increased Skylight SHGC
C402.4.3.1

- In Climate Zones 1-6, skylights allows ≤ 0.6 SHGC where located above daylight zones provided with automatic daylighting controls.



Increased Skylight U-Factor
C402.4.3.2

- Where skylights are installed above daylight zones provided with daylight responsive controls, a maximum U-factor of 0.75 shall be permitted in Climate Zones 4-8.

Air Barrier Construction
C402.5.1.1

- Continuous air barrier to be constructed to meet:
  - Must be continuous for all assys involving the thermal envelope of the bldg
  - Air barrier joints & seams to be sealed including sealing transition in places and changes in materials
  - Penetrations of the air barrier shall be caulked gasketed or otherwise sealed in manner compatible w/the construction materials
  - Recessed lighting fixtures to maintain air barrier

Air Barrier Compliance Options

C402.5.1.2

Air Barrier Compliance Materials
C402.5.1.2.1

- Use of listed materials below are deemed to comply with the air barrier requirements provided joints are sealed and assy installed per there manufacturer's instructions
  - Plywood ≥ 3/8" thick
  - Oriented strand board ≥ 3/8" thick
  - Extruded polystyrene insulation board ≥ ½" thick
  - Foil back polyisocyanurate insulation board ≥ ½" thick
  - Closed cell spray foam w/ density of 1.5 pcf & ≥ 1-1/2" thick

Air Barrier Compliance Materials
C402.5.1.2.1

- Open-cell spray foam w/ density between 0.4 & 1.5 pcf & ≥ 4.5” thick
- Exterior/interior gypsum board ≥ ½” thick
- Cement board ≥ ½” thick
- Built-up roofing membrane
- Modified bituminous roof membrane
- Fully adhere single-ply roof membrane
- Portland cement/sand parge, or gypsum plaster ≥ 5/8 thick
- Cast-in place and precast concrete

Air Barrier Compliance Materials
C402.5.1.2.1

- Fully grouted concrete
- Fully grouted concrete block masonry
- Sheet steel or aluminum
- Solid or hollow masonry constructed of clay or shale masonry units

Air Barrier Compliance Assemblies
C402.5.1.2.2

- Assemblies will be recognized as being in compliance if listed testing is met per this section with one (1) of the assemblies below:
  - Concrete masonry walls coated with either 1 application of block filler or 2 applications of paint or sealing
  - Masonry walls constructed of clay or shale masonry units with a nominal width of 4” or more
  - A portland cement/sand parge, stucco or plaster > 1/2” in thickness

Air Barrier Building Testing Alternative

C402.5

Thermal envelope of buildings must comply with either the materials or assemblies provision **OR** be tested in accordance with ASTM E 779 at a pressure differential of 0.3 inch water gauge or equivalent method approved by code official

Building thermal envelope with a tested air leakage rate of ≤ 0.40 cfm/ft² complies with air leakage requirements

Air Leakage of Fenestration

C402.5.2

Fenestration Assembly	Maximum Rate (cfm/ft²)	Test Procedure
Windows, sliding glass doors and swinging doors	**0.20**	AAMA/WDMA/CSA 101/I.S.2/A440 or NFRC 400
Skylights - with condensation weepage openings	0.30	
Skylights – all other	0.20	
Curtain walls and storefront glazing	0.06	NFRC 400 or ASTM E283 at 1.57 psf
Commercial glazed swinging entrance doors	1.00	
Revolving doors	1.00	
Garage doors	0.4	ANSI/DASMA 105, NFRC 400, or ASTM E283 at 1.57 psf
Rolling doors	1.00	
High-speed doors	1.30	

Exceptions

- Field-fabricated fenestration assemblies
- Fenestration in buildings that comply with the air barrier testing alternative

Rooms Containing Fuel-Burning Appliances
C402.5.3 & R402.4.4

- Where open combustion air ducts provide combustion air to open combustion space conditioning fuel burning appliances, the appliances & combustion air openings shall be located outside of the building thermal envelope or enclosed in a room isolated from inside the thermal envelope.
- Exceptions:
  - Direct vent appliance with both intake & exhaust pipe installed to the outside
  - Fireplaces & stoves

Rooms Containing Fuel-Burning Appliances
C402.5.3

- Doors into the room to be fully gasketed.
- Any water lines & ducts in the room insulated per C403.
- Combustion air duct to be insulated to minimum R-8 when passing through a conditioned space.

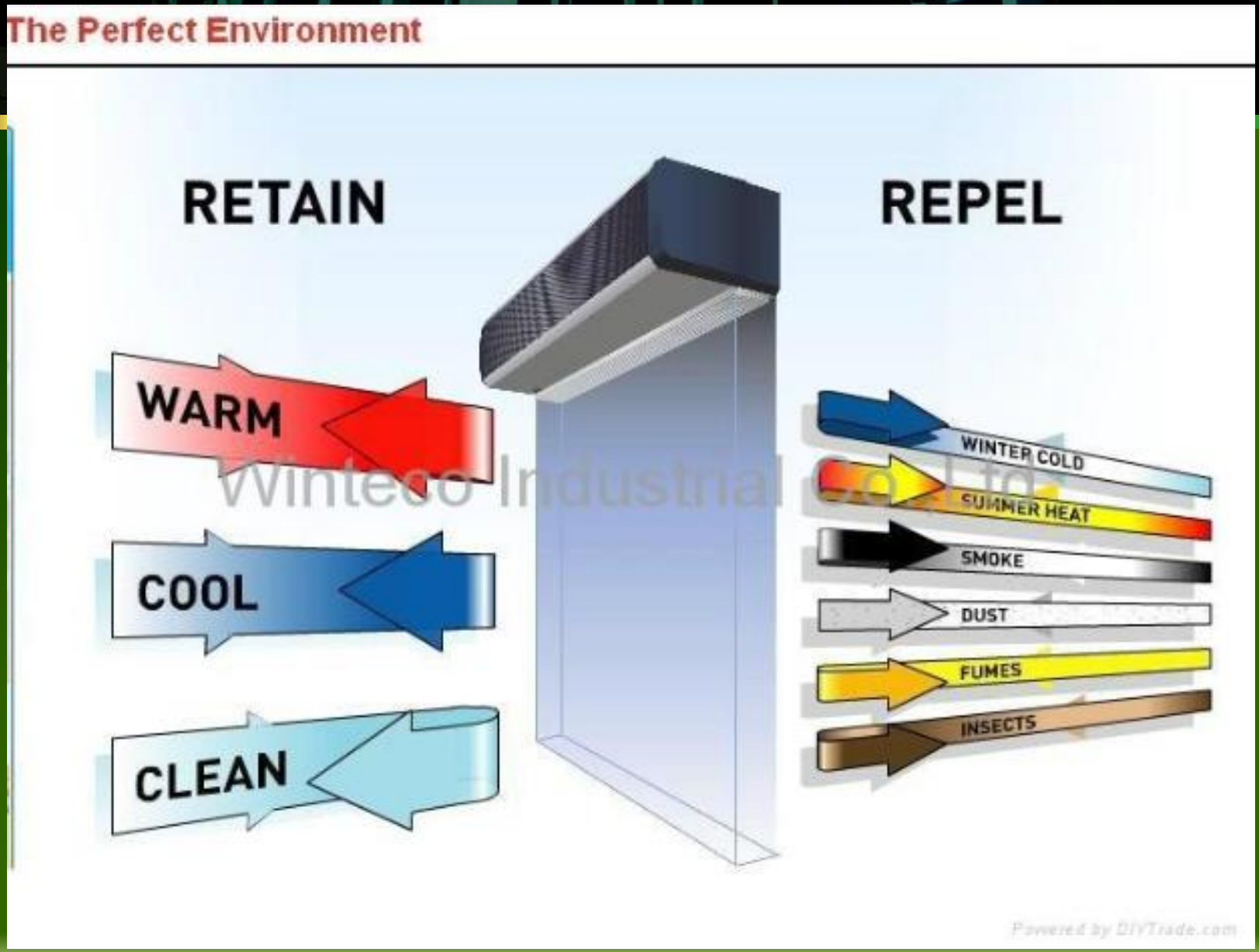
Doors & Access Openings
C402.5.4

- Doors & access openings from conditioned space to shafts, chutes, stairways, and elevator lobbies not within the scope of the fenestration assemblies in Section C402.5.2 to be gasketed, weatherstripped, or sealed
- **Exceptions**:
  - Door openings required to be comply with IBC 716 or 716.4
  - Doors or door openings required to comply with UL 1784

Vestibules
C402.5.7

- Bldg entrances to be protected with enclosed vestibules
  Exceptions:
  - Doors not intended for public use
  - Doors that open directly from a space less than 3,000 sf
  - Revolving doors
  - Doors that have an air curtain with a velocity ≥ 6.56 ft/s at the floor that have been tested per ANSI/AMCA 220, with manual or automatic controls per C408.2.3

Vestibules
C402.5.7



- Example of an air curtain installed in the field

Building Mechanical Systems
C403.2.1/SPS 363.0403(1) & (2)

- Design heating & cooling loads shall be determined in accordance with SPS 363.0302 and Table 363.0302.

- Heating & cooling equipment and systems shall be sized to provide the minimum space and system loads calculated in accordance with s. SPS 363.0302

Minimum Efficiency Requirements
C403.2.3(1)

- New minimum equipment efficiencies are addressed for multitudes of HVAC equipment types

- Equipment not meeting the minimum efficiency requirements of the code may still be available & sold for installation, although such equipment would not be code compliant *(Be careful !!)*

Table C403.2.3(2) Mandatory

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE
Air cooled (Cooling mode)	< 65,000 Btu/h	Split system	13.0 SEER (before Jan. 1, 2016) 14.0 SEER (as of Jan. 1, 2016)	AHRI 210/240
		Single package	13.0 SEER (before Jan. 1, 2016) 14.0 SEER (as of Jan. 1, 2016)	
	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	11.0 EER (before Jan. 1, 2016) 11.2 IEER (as of Jan. 1, 2010)	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Split system and single package	9.3 EER (before Jan. 1, 2010) 10.6 EER (as of Jan. 1, 2010)	AHRI 340/360
	≥ 240,000 Btu/h	Split system and single package	9.0 EER 9.2 IPLV (before Jan. 1, 2010) 9.5 EER 9.2 IPLV (as of Jan. 1, 2010)	
Through-the-Wall (Air cooled, cooling mode)	<30,000 Btu/h	Split System	10.9 SEER (Before January 23, 2010) 12.0 SEER (as of January 23rd 2010)	AHRI 210/240
		Single Package	10.6 SEER (Before January 23, 2010) 12.0 SEER (as of January 23rd 2010)	
Water Source (Cooling Mode)	< 17,000 Btu/h	86° F Entering Water	11.2 EER	AHRI/ASHRAE 13256-1

Automatic Start Capabilities
C403.2.4.2.3

- Automatic start controls required for each HVAC system.
- Controls capable of automatically adjusting daily start time to bring each space to designed occupied temperature immediately prior to scheduled occupancy

Programmable thermostat with automatic start capability

Controls (Mandatory)
C403.2.4.3

- Stairway & shaft vent dampers to be installed with automatic controls configured to open up on activation of any fire alarm initiating device of the building's fire alarm system or the interruption of power to the damper
  - ✓ **Exceptions:**
    - Gravity dampers permitted in buildings < 3 stories
    - Gravity dampers permitted for outside air intake or exhaust airflows of 300 cfm (0.14m3/s) or less

Zone Isolation
C403.2.4.4/SPS 363.0403(7)

- The requirements in IECC section C403.2.4.4 are NOT included

- *The section requiring that the HVAC systems serving zones that are over 25,000 sf in floor area or that span more than one floor & are designed to operate or be occupied nonsimultaneously be divided into isolation areas has been removed*

Freeze Protection System Controls
C403.2.4.6

Systems such as heat tracing of outdoor piping and heat exchangers, including self-regulated heat tracing to include:

- Automatic controls configured to shut off the system when outdoor air temperatures are > 40°F OR
- When conditions of the protected fluid will prevent freezing

Economizer Fault Detection & Diagnostics
C403.2.4.7

- Air cooled unitary direct expansion units & Variable Refrigerant Flow (VRF) units equipped with an economizer **must include a Fault Detection and Diagnostics (FDD) system** complying with the following:
  - Outside air, supply air & return air temperature sensors must be permanently installed
  - Temperature sensors must have an accuracy of +/- 2°F over the range of 40° to 80°F
  - Refrigerant pressure sensors, where used, must have an accuracy of +/- 3% of full scale

Economizer Fault Detection & Diagnostics
C403.2.4.7

- Air cooled unitary direct expansion units & VRF units equipped with an economizer **must include a Fault Detection and Diagnostics (FDD) system** complying with the following:
  - Unit controller must be capable of providing system status, manually initiating each operating mode & reporting faults to a fault management application
  - FDD system must be capable of detections air temperature sensor fault, economizer faults, damper not modulating and excess outdoor air.

Hot Water Boiler Outdoor Temperature Set-Back Control
C403.2.5

- Hot water boilers which supply to the building via 1 & 2 pipe heating systems require an outdoor setback control that lowers the boiler water temperature based on the outdoor temperatures.

Demand Control Ventilation
C403.2.6.1/SPS 363.0403(8)

- Demand Controlled Ventilation (DCV):
  - A ventilation system capability that provides for the automatic reduction of outdoor air intake below design rates when the actual occupancy of spaces served by the system is less than design occupancy

Demand Control Ventilation
C403.2.6.1/SPS 364.0403(8)

- Demand Control Ventilation shall be provided for spaces larger than 500 sf & with an average occupant load of 40 people (same as 2009 IECC) per 1,000 sf of floor area and served by one or more of the following:
  - An air-side economizer requires automatic modulating control for the outside air damper
  - A design outdoor airflow > 3,000 cfm

Demand Controlled Ventilation
C403.2.6.1

Exceptions:

- ✓ Systems with energy recovery per C403.2.6
- ✓ Multiple zone systems without direct digital control of single zones communicating with central control panel
- ✓ Systems with design outdoor airflow < 1,200 cfm
- ✓ Spaces where supply airflow rate minus any makeup or outgoing transfer air requirement < 1,200 cfm
- ✓ Ventilation provided for process loads only

Enclosed Parking Garage Ventilation C403.2.6.2

- Enclosed parking garages used for storing or handling automobiles operating under their own power shall employ contamination sensing devices & automatic controls configured to stage fans or modulate fan average airflow rates to ≤ 50% of design capacity, or intermittently operate fans ≤ 20% of the occupied time or as required to maintain acceptable contaminant levels per the IMC

Enclosed Parking Garage Ventilation C403.2.6.2

- Failure of contamination devices to cause the exhaust fans to operate continuously at design airflow.
- Exceptions:
  - Garage w/total exhaust capacity < 22,500 cfm with ventilation systems that do not utilize heating or mechanical cooling
  - Garages that have a garage area to ventilation system motor nameplate power ratio that exceed 1,125 cfm/hp and do not utilize heating or mechanical cooling

Energy Recovery Ventilation Systems
C403.2.7

- Where the supply airflow rate of a fan system exceeds the values specified in Table C403.2.7(1) & (2), the system shall include an energy recovery system.

TABLE C403.2.7(1) ENERGY RECOVERY REQUIREMENT (Ventilation systems operating less than 8,000 hours per year) (333 days/year)

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	NR	NR
1B, 2B, 5C	NR	NR	NR	NR	≥ 26,000	≥ 12,000	≥ 5,000	≥ 4,000
6B	≥ 28,000	≥ 26,5000	≥ 11,000	≥ 5,500	≥ 4,500	≥ 3,500	≥ 2,500	≥ 1,500
1A, 2A, 3A, 4A, 5A, 6A	≥ 26,000	≥ 16,000	≥ 5,500	≥ 4,500	≥ 3,500	≥ 2,000	≥ 1,000	> 0
7, 8	≥4500	≥ 4,000	≥ 2,500	≥ 1,000	> 0	> 0	> 0	> 0

Energy Recovery Ventilation Systems
C403.2.7

- Where the supply airflow rate of a fan system exceeds the values specified in Table C403.2.7(1) & (2), the system shall include an energy recovery system.

TABLE C403.2.7(2) ENERGY RECOVERY REQUIREMENT (Ventilation systems operating not less than 8,000 hours per year) (333 days/year)

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)							
3C	NR	NR	NR	NR	NR	NR	NR	NR
1B, 2B, 3B, 4C, 5C	NR	≥19,500	≥ 9,000	≥5,000	≥ 4,000	≥ 3,000	≥1,500	> 0
1A, 2A, 3A, 4B, 5B	≥ 2,500	≥ 2,000	≥ 1,000	≥500	≥ 0	> 0	> 0	> 0
4A, 5A, 6A, 6B, 7, 8	> 0	> 0	> 0	> 0	> 0	> 0	> 0> 0	> 0

Energy Recovery Ventilation Systems
C403.2.7

- Exceptions
  - Where prohibited by IMC 514
  - Lab fume hood systems that meet criteria
  - Systems serving spaces are heated< 60°F and not cooled
  - Cooling energy recovery in Climate Zones 6B & 7
  - Systems requiring dehumidification that employ energy recovery in series w/cooling coil
  - Where largest source of air exhausted at a single location at the building exterior is less than 75% of the design outdoor air flow rate

Energy Recovery Ventilation Systems
C403.2.7

- Exceptions (continued)
  - Systems expected to operate < 20 hrs/week at outdoor air percentage covered Table 403.2.7(1)
  - Systems exhausting toxic, flammable, paint or corrosive fumes or dust
  - Commercial kitchen hoods used for collecting and removing grease vapor and smoke

Kitchen Exhaust Systems
C403.2.8

- Replacement air introduced directly into exhaust hood cavity must be ≤ 10% of hood exhaust airflow rate. Conditioned supply air delivered to any space must not exceed the greater of:
  - Ventilation rate required to meet the space heating or cooling load
  - Hood exhaust flow minus available transfer air from adjacent space

Kitchen Exhaust Systems
C403.2.8

- Where the total kitchen airflow rate is >5,000 cfm, each hood **MUST** be a factory built, commercial exhaust hood listed by a nationally recognized testing laboratory in compliance with UL 710

Kitchen Exhaust Systems
C403.2.8

- Each hood must comply with one of the following:
  - Not <50% of replacement air may be transfer air that would be exhausted
  - Demand ventilation systems on not < 75% of the exhaust air that are capable of not < a 50% reduction in exhaust and replacement air system airflow rates
  - Listed energy recovery devices with a sensible heat recovery effectiveness of not <40% on not <50% of total exhaust airflow (typically type II comm'l hood)
    - Exception: Where not <75% of all replacement air is transfer air that would otherwise be exhausted

Duct & Plenum Insulation
C403.2.9

- Return air ducts and plenums Climates Zones 6/7 require:
  - Minimum R-6 where located in unconditioned spaces
  - Minimum R-12 insulation outside the building or within a building envelope assembly

Minimum Piping Insulation
IECC 403.2.10/SPS 363.0403(9)

Substitute 2009 IECC Table 503.2.8 for IECC Table C403.2.10

MINIMUM PIPE INSULATION[a]
(thickness in inches)

FLUID	NOMINAL PIPE DIAMETER	
	≤ 1.5″	> 1.5″
Steam	$1\frac{1}{2}$ (R-5.5)	3 (R-11.1)
Hot water	$1\frac{1}{2}$ *(R-5.5)*	2 (R-7.4)
Chilled water, brine or refrigerant	$1\frac{1}{2}$ *(R-5.5)*	$1\frac{1}{2}$ (R-5.5)

Piping Insulation Exceptions

C403.2.10

Exceptions:

- ✓ Piping internal to HVAC equipment *(including fan coil units)* factory installed and tested
- ✓ Piping for fluid in temperature range

  –60° < temp < 105° F
- ✓ Piping for fluid not heated or cooled by electricity or fossil fuels
- ✓ Strainers, control valves, and balancing valves associated with piping ≤ 1" in diameter
- ✓ ****Exception for Direct buried piping for fluids < 60ºF removed via SPS 363.0403(9)(b)**

Mechanical Systems Commissioning & Completion Requirements
IECC 403.2.11/SPS 364.0403(14)

- The requirements of IECC section C403.2.11 are not included as part of the chs. SPS 361 to 366

- *This section required mechanical system commissioning & completion requirements*

Walk-in Coolers, Walk-in Freezers, Refrigerated Warehouse Coolers & Refrigerated Warehouse Freezers C403.2.15 & C403.2.16/SPS 363.0403(12)

- The requirements in IECC C403.2.15 and C403.2.16 are not included as part of chs. SPS 361 to 366
  - *The section required special requirements for walk-in coolers, walk-in freezers, refrigerated warehouse coolers & refrigerated warehouse freezers*

Refrigerated Display Cases
C403.2.17

- Refrigerated display cases to be addressed by an option listed below:
  - Lighting to be controlled by time switch controls to turn off lights during nonbusiness hours w/maximum 1 hr override
  - Motion sensor controls that reduce lighting by >50% within 3 minutes after the area within sensor range is vacated

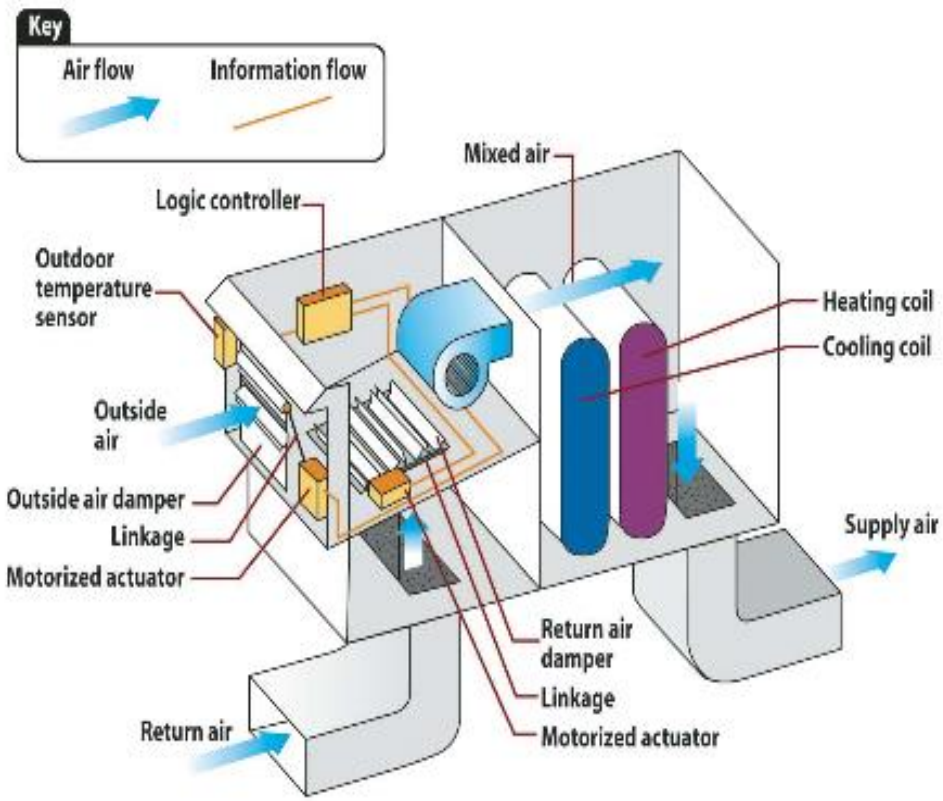
Refrigerated Display Cases
C403.2.17

As well as:

- 2) 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) Antisweat heater controls shall reduce the energy use of the antisweat heater as a function of the relative humidity in the air outside the door or to the condensation on the inner glass pane.

Simple HVAC Systems & Equipment
C403.3



Must include economizers based on WI amendments

Capable of providing 100% outdoor air even if additional mechanical cooling required (integrated economizer)

Must provide a means to relieve excess outdoor air

Simple HVAC Systems & Equipment
C403.3/SPS 363.0403(4)

- Supply air economizers shall be provided on the following cooling systems:
- (Where a single room or space is supplied by multiple air systems, the ***AGGREGATE*** capacity of those systems shall be used in applying this requirement)
  - (a) All package roof top units
  - (b) All other cooling systems ≥ 54,000 btu/h (ie. split systems)

Economizers
C403.3

- Each cooling system that has a fan shall include either an air or water economizer complying with Section C403.3.1 through C403.3.4
- Exceptions:
  - Where > 25% of the air designed to be supplied by the system is to spaces that are designed to be humidified above 35°F dew point temperature to satisfy process needs
    - *Example: Computer rooms specifically used for main frames, etc.*

Economizers
C403.3

- Exceptions:
  - Systems that serve residential spaces where the system capacity is < 5 times the requirement listed in Table C403.3.(1)

TABLE C403.3(1)
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	1,250,000 Btu/h
3a, 3b, 3c, 4a, 4b, 4c	720,000 Btu/h	940,000 Btu/h
5a, 5b, 5c, 6a, 6b, 7, 8	1,320,000 Btu/h	1,720,000 Btu/h

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

Economizers
C403.3

- Exceptions:
  - Systems expected to operate < 20 hrs per week

If a building is intended to meet this exception, a letter from the owner providing justification deemed reasonable by the Dept. on the building's use shall be provided by the submitter of the cooling system design

Economizers
C403.3

- Exceptions:
  - Where the use of outdoor air for cooling will affect supermarket open refrigerated casework systems

Economizers
C403.3

- Exceptions:
  - Chilled water cooling systems that are passive (without a fan) or use induction where the total chilled water system capacity less the capacity of the fan units with air economizers is less than the minimum specified in Table C403.3.1

TABLE C403.3(1)
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	1,250,000 Btu/h
3a, 3b, 3c, 4a, 4b, 4c	720,000 Btu/h	940,000 Btu/h
5a, 5b, 5c, 6a, 6b, 7, 8	1,320,000 Btu/h	1,720,000 Btu/h

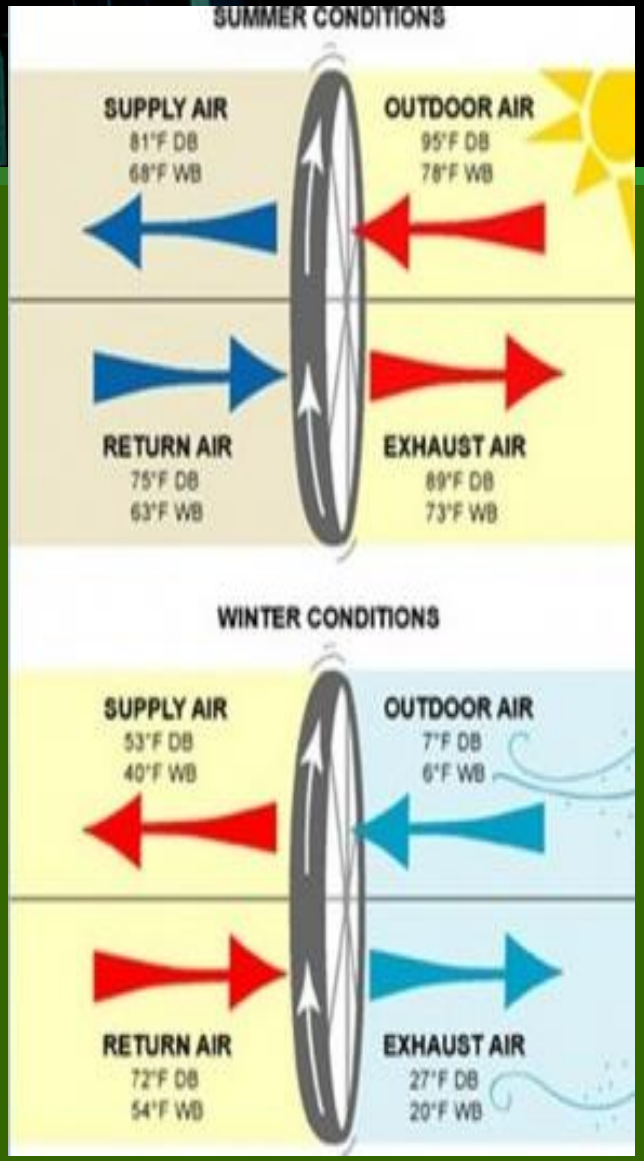
For SI:1 British thermal unit per hour = 0.2931 W.

Economizers
C403.3

- Exceptions:
  - Systems that include a heat recovery system *(for service water heating)* in accordance with C403.4.5

Controls:

- 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 C403.3



Integrated Economizer Control
C403.3.1

- Economizer systems shall be integrated with the mechanical cooling system & be capable of providing partial cooling even where additional mechanical cooling is required to provide the remainder of the cooling load.
- Systems to include:

  1. Unit controls have cooling capacity control interlocked w/the air economizer control such that the outdoor air damper is at the 100% 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 < 45°F

Integrated Economizer Control
C403.3.1

- Systems to include:

  2. Direct expansion (DX) units that control ≥ 75,000 Btu/h of rated capacity of the capacity of the mechanical cooling directly based on occupied space temperatures shall have no fewer than 2 stages of mechanical cooling capacity

  3. Other DX units, including that control space temperature by modulating the airflow to the space, shall be in accordance with Table C403.3.1

TABLE C403.3(1)
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	1,250,000 Btu/h
3a, 3b, 3c, 4a, 4b, 4c	[illegible] Btu/h	940,000 Btu/h
5a, 5b, 5c, 6a, 6b, 7, 8	1,320,000 Btu/h	1,720,000 Btu/h

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

Air Economizers
C403.3.3

- Air economizer systems shall be capable of modulating outdoor air & return air dampers to provide up to 100% of the design supply air quantity as outdoor air for cooling

Air Economizers
C403.3.3

- Economizer dampers to be capable of being sequenced with mechanical cooling equipment & shall not be controlled by only mixed-air temperature
  - Exceptions: The use of mixed air temperature limit control shall be permitted for systems controlled from space temperature (such as single-zone systems)

Air Economizers
C403.3.3

- Air economizers shall be capable of automatically reducing outdoor air intake to the design minimum outdoor air quantity when the outdoor air intake will no longer reduce cooling energy usage. High limit shutoff control types for specific climates shall be chosen from Table C403.3.3.3

- See Table C403.3.3

TABLE C403.3.3.3
HIGH-LIMIT SHUTOFF CONTROL SETTING FOR AIR ECONOMIZERS[b]

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	$T_{OA} > 70°F$	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 temperatures	All	$h_{OA} > 28$ 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
Differential enthalpy with fixed dry-bulb temperature	All	$h_{OA} > h_{RA}$ or $T_{OA} > 75°F$	Outdoor air enthalpy exceeds return air enthalpy or Outdoor air temperature exceeds 75°F

For SI: 1 foot = 305 mm, °C = (°F - 32)/1.8, 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. Devices with selectable setpoints shall be capable of being set to within 2°F and 2 Btu/lb of the setpoint listed.

Water-Side Economizers
C403.3.4

- Water economizer systems shall be capable of cooling supply air by indirect evaporation and providing up to 100% of the expected system cooling load at outdoor air temperatures $\leq$ 50°F dry bulb/45°F wet bulb
  - Exceptions

Variable Air Volume Fan Control
C403.4.1.2

- Sensors used to control VAV fans
  - Placed so that the controller setpoint is ≤ 1.2 inches w.c.
- Sensors installed downstream of major duct splits
  - At least one sensor to be located on each major branch so that static pressure can be maintained in each branch

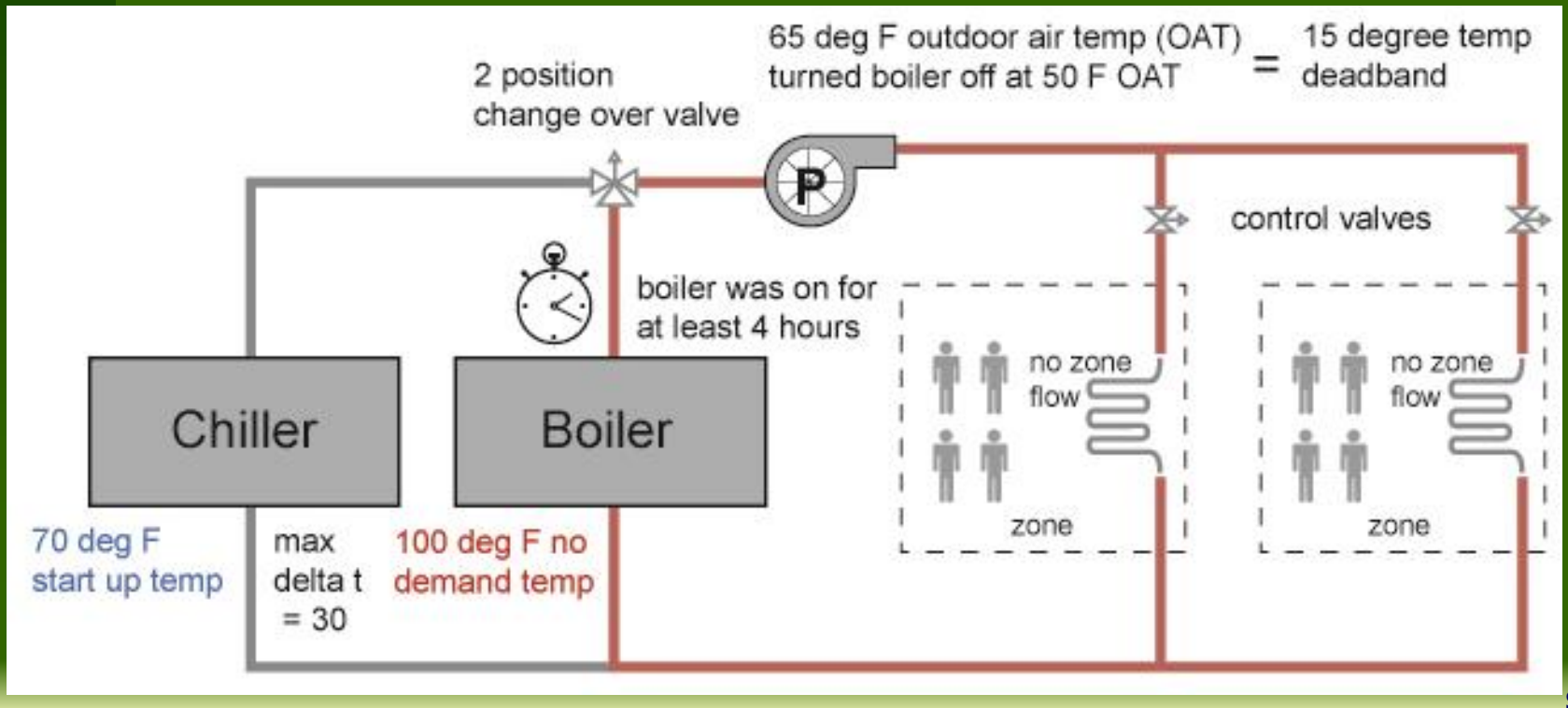
Hydronic Systems
C403.4.2

3-Pipe System – Not allowed

- ✓ Can't use a common return

2-Pipe Changeover System

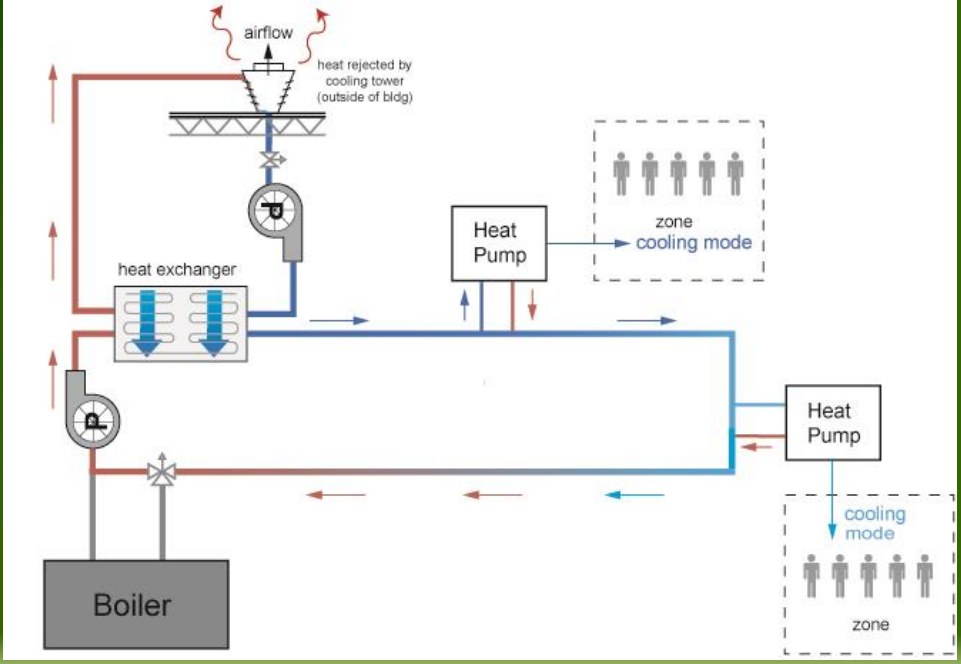
- ✓ Dead band between changeover ≥ 15ºF outside temperature



Hydronic Water Loop Heat Pump Systems
C403.4.2.3

Temperature dead band of at least 20ºF *(C403.4.2.3.1)*

- ✓ **Exception**:
  - Where system loop temp optimization controller is installed and can determine the most efficient operating temp to be based on real time conditions of demand & capacity



Example:

Heat rejection off below 75ºF loop temperature.

Boiler off above 55ºF loop temperature

75ºF - 55ºF =

20ºF dead band

Hydronic (water loop) Heat Rejection System
C403.4.2.3.2.2/SPS 363.0403(5)

- For climate zones 6 & 7 as indicated in IECC Figure C301.1 and Table C301.1, if an open circuit cooling tower is used, then a separate heat exchanger shall be required 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 & providing an automatic valve to stop the flow of fluid.

Boiler Turndown
C403.4.2.5/SPS 363.0403(13)

- The requirements in IECC section C403.4.2.5 are NOT included as part of chs. SPS 361 to 366

- *This section required the use of multiple single input boilers, one or more modulating boilers or a combination of single input and modulating boilers if the boiler system design input was ≥1,000,000 btu/h.*

Heat Rejection Equipment
C403.4.3

Each tower fan powered by a motor ≥ 7.5 hp must include variable speed or two speed fan

- ✓ Have controls to 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 condensers & chillers tested and rated in accordance with Tables C403.2.3(6) & C403.2.3(7)

Fraction Hp Fan Motors
C403.4.4.4

Motors for fans not <1/12 hp & <1 hp must:

- Be electronically commutated motors
- **OR**
- Have a minimum efficiency of 70%
- **AND**
- 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 instead of a varying motor speed is permitted.

There are 3 exceptions

Service Water Heating
C404

Min. Performance of Water Heating Equipment *(C404.2)*
Heat Traps *(C404.3)* *(Deleted by WI Amendment)*
Piping Insulation *(C404.4)*
Efficient Piping*(C404.5)*
Circulation & Temperature Maintenance *(C404.6)*
Demand Recirculation *(C404.7)*
Drain Heat Recovery*(C404.8)*
Pools and Spas *(C404.9)* *(Amended by WI Amendment)*
Portable Spas *(C404.10)*
SWH Commissioning*(C404.11)*

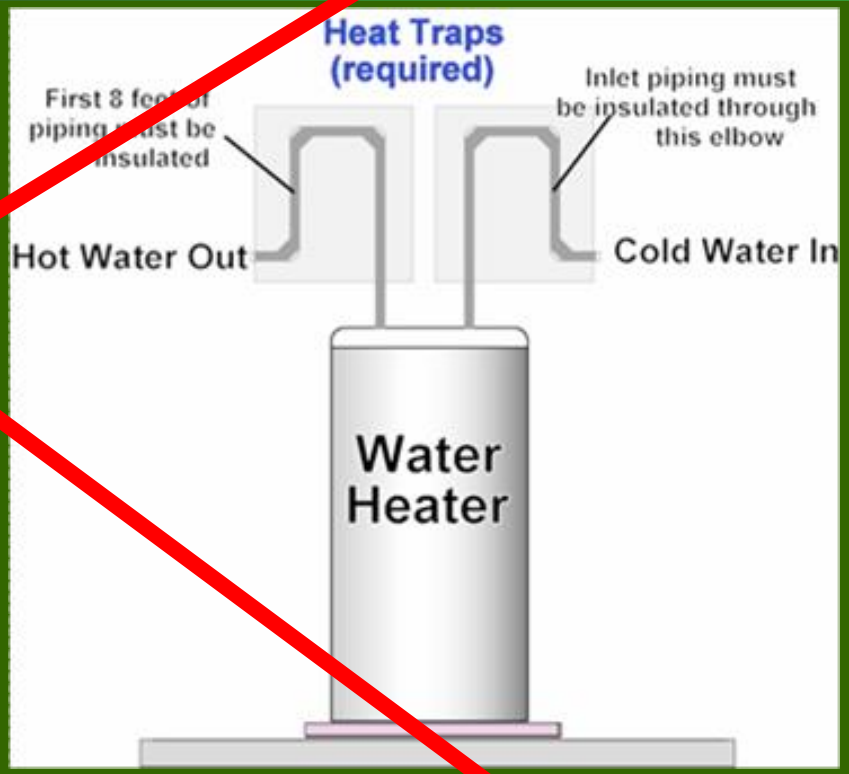
Service Water Heating
C404.2

Table C404.2 Minimum Performance of Water-Heating Equipment

- ✓ Water Heater Types Covered
  - Electric Storage
  - Gas and Oil Storage
  - Instantaneous Water Heaters – Gas & Oil
  - Hot water boilers – gas and oil
  - Pool heaters
  - Unfired storage tanks

Heat Traps

C404.3/SPS 363.0404(2)



Heat traps are **NOT** a requirement of this code

Service Water Heating Time Switches
C404.9.2/SPS 363.0404(3)

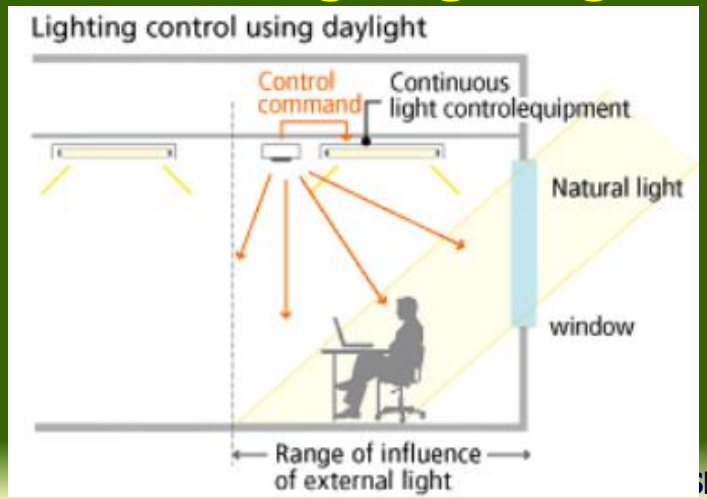
- The requirements in IECC section C404.9.2 are not included as part of this chapter
  - *The need for installation of time switches on service water heating appliances has been deleted*

Service Water Heating Commissioning
C404.11/SPS 363.0404(4)

- The requirements of IECC section C405 are not included as part of chs. SPS 361 to 366.
  - *This section would have required Service Water-Heating System Commissioning*

Daylight Responsive Control
SPS 363.0202(2)/C405

- "Daylight responsive control" means a device or system that provides the automatic control of lamps and luminaires located in daylight zone only *or a manual control of lamps or luminaires located in daylight zone only in such manner that at least 50% of the lamps are controlled in a reasonably uniform illumination pattern per IECC C405.2.2.2, with the capability for the lamps to be operated at 100% or 0% of their design lighting* capability



Daylighting Zones
SPS 363.0404(1)(a)

- Daylight zones in any interior enclosed space >250 sf & a lighting density > 0.6 W/ft^2 shall have at least one control that meets all of the following requirements:
  - 1. Controls only luminaires in the daylight zones.
  - 2. Controls at least 50% of the lamps or luminaires in the daylight zone, in a manner described in IECC section C405.2.2.1.

Daylighting Zones
SPS 363.0202(1)/363.0404(1)(a)

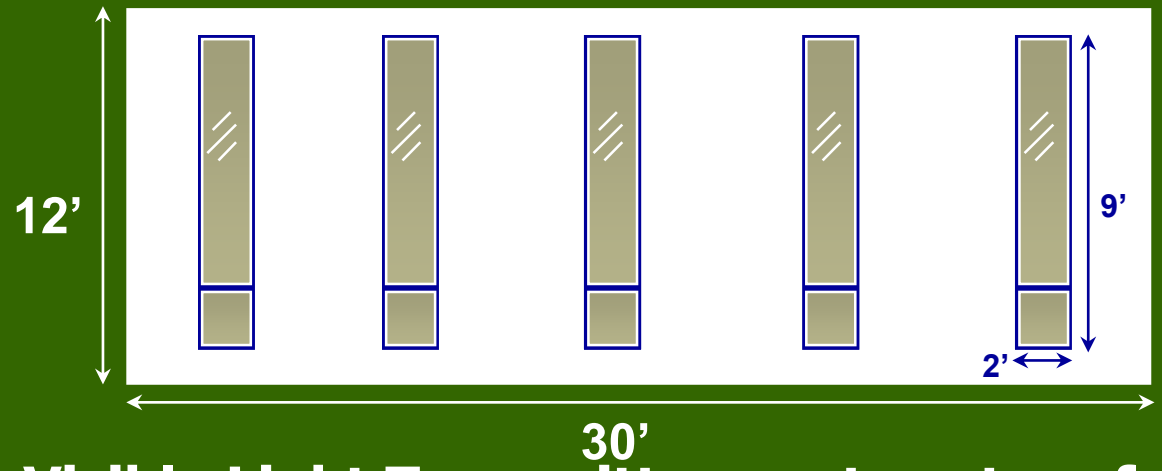
- *Exceptions.* The requirements of this subsection do not apply to any of the following:
  - 1. Daylight zones where the *effective aperture (EF)* of glazing is ≤ 0.1 for vertical glazing & 0.01 for horizontal glazing.
    - Windows (EF) = Visible Light Transmittance x (window area/wall area) ratio
    - Skylight (EF) = Well Efficiency x skylight area x 0.85/gross exterior roof area
  - 2. Daylight zones where existing adjacent structures or natural objects obstruct daylight to the extent that effective use of daylighting is not feasible.

Daylighting Zones
SPS 363.0202(1)/363.0404(1)(a)

- Daylight Zone:
  - Effective Aperture Example:

Wall Area = 30 x 12 = 360ft²
Glazing Area = 2′ x 9′ x 5 = 90ft²

Window Visible Light Trans. = 0.47 (PPG Solar Bronze)



EA = 0.47 x 90/360 = 0.12 (Daylit area controls required)

VLT = Visible Light Transmittance at center of glass – see glass manufacturer's website

Occupant Sensor Controls
SPS 363.0405(3)/C405.2.1

- Lighting systems shall be provided with controls as specified in sections C405.2.2, C405.2.3, C405.2.4 and C405.2.5.
  - *The need for installing occupant sensor controls as addressed in C405.2.1 in specific space types has been removed*

Automatic Time Switch Control Devices
C405.2.2.1

- The automatic time switch control device shall include an override switching device that complies with the following:
  - Be in a readily accessible location;
  - Be located where lights controlled by switch are visible; or the switch shall provide mechanism which announces area controlled;
  - Permit manual operation;
  - Permit controlled lighting to remain for max. 2 hrs; &
  - Override switches shall control area of $\leq$ 5,000 sf

Automatic Time Switch Control Devices
C405.2.2.1

- Exception:
  - Within malls, arcades, auditoriums, single tenant retail spaces, industrial facilities & arenas:
    - Permitted to be >2 hrs provided the override switch is a captive key device; and
    - The area controlled by the override switch may be > 5,000 sf, but must be *≤ 20,000 sf* (was 25,000 sf).

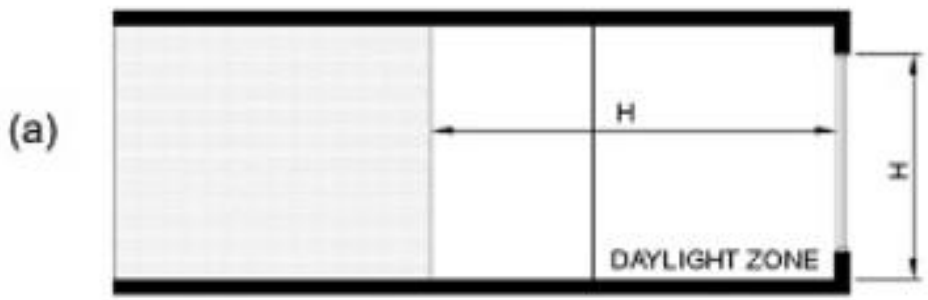
Specific Application Controls
C405.2.3

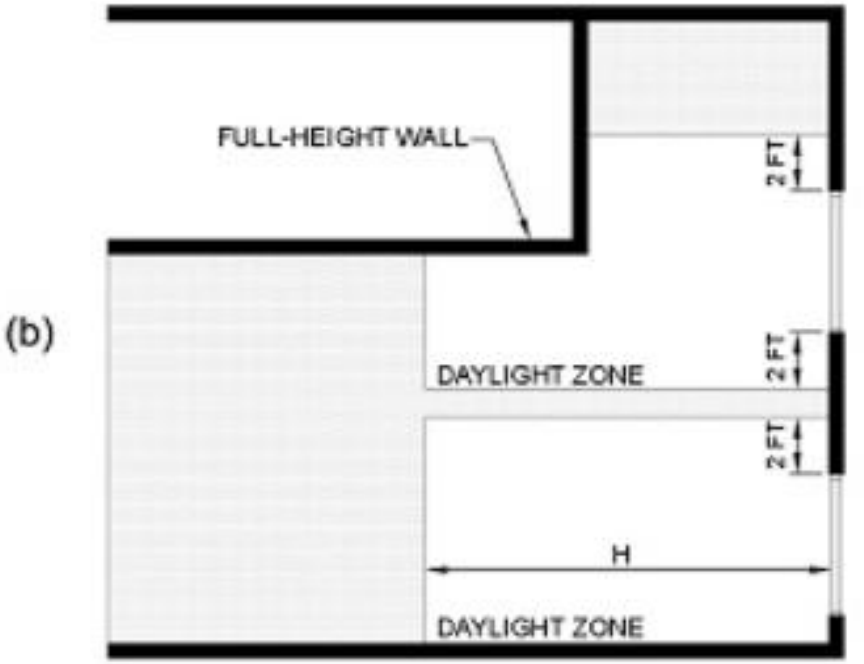
- Display and accent lighting to be independently controlled
- Lighting in display cases to be independently controlled
- Hotel & motel sleeping units & guest suites require master control at the main room entry which controls all permanently installed luminaires & switch receptacles
- Supplemental task lighting (ie. under–cabinet lighting) controlled by control on luminaire or wall
- Lighting for plant growth, to be independently controlled
- Lighting for sale or demonstrations to independently controlled

Sidelight Daylight Zone
C405.2.3.2 Item 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, & longitudinally from the edge of the fenestration to the nearest full-height wall, or up to 2 ft, whichever is less…

Sidelight Daylight Zone
C405.2.3.2



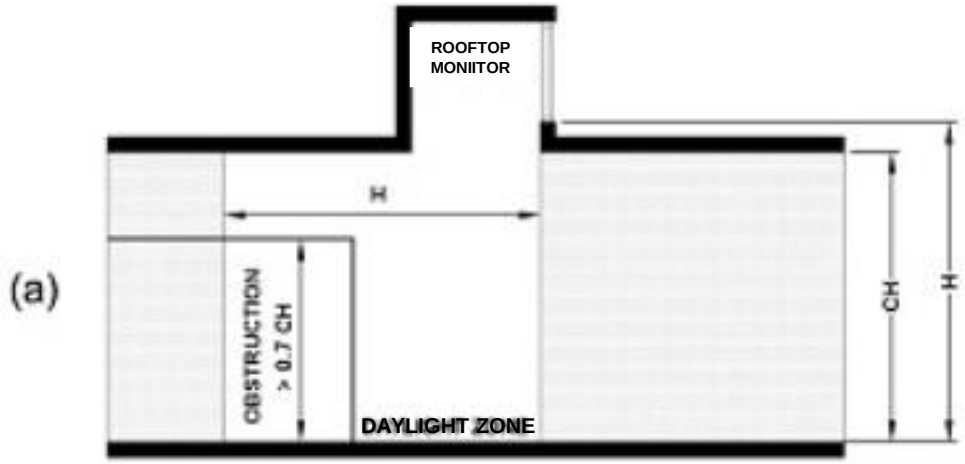


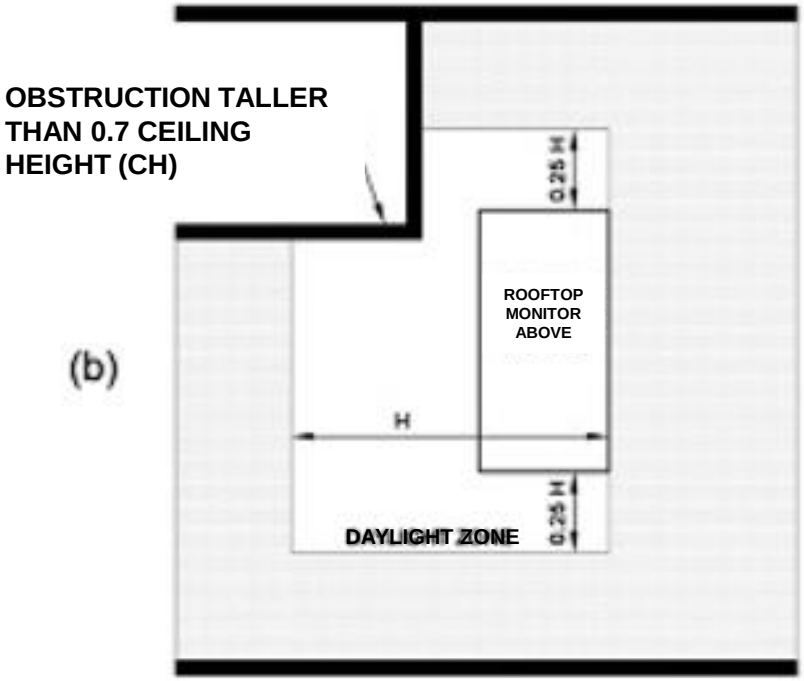
(a) Section view
(b) Plan view of daylight zone next to sidelight

Rooftop Monitor Daylight Zone
C405.2.3.2 Item 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…

Rooftop Monitor Daylight Zone
C405.2.3.2 Item 2



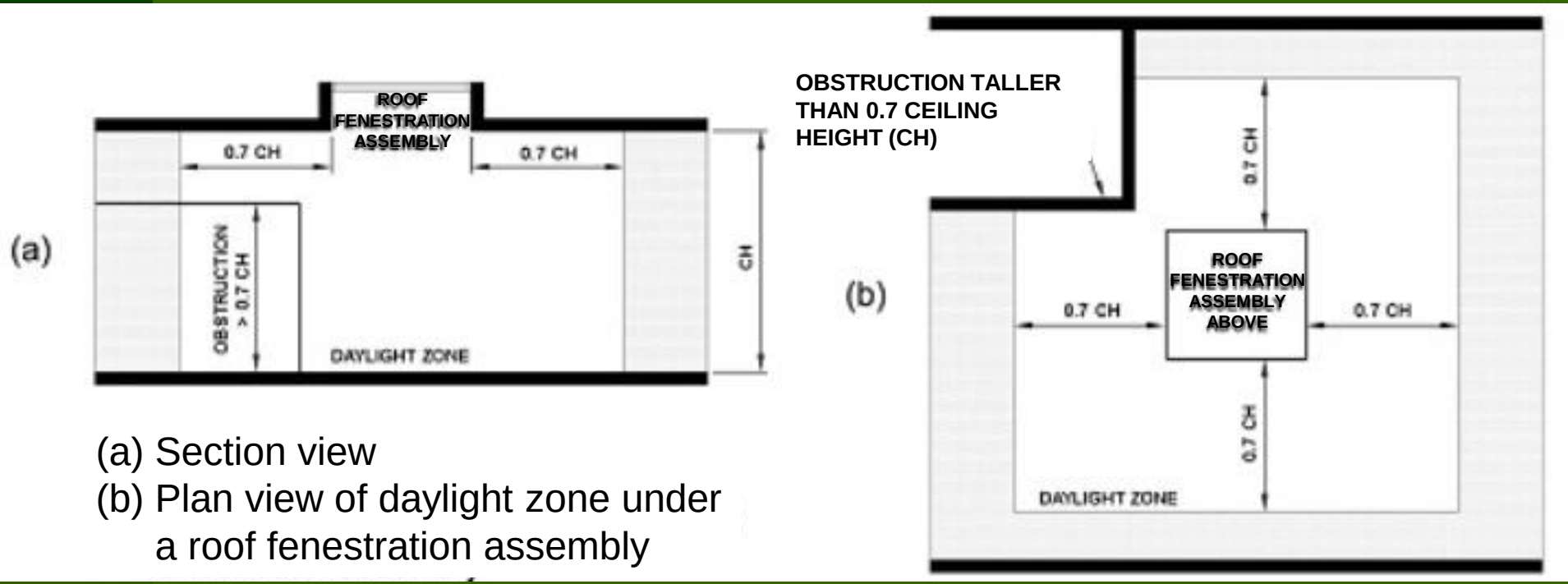


(a) Section view
(b) Plan view of daylight zone under a rooftop monitor

Toplight Daylight Zone
C405.2.3.3

- The toplight zone is the floor area underneath a roof fenestration assembly which complies with all of the following:
  - The daylight zone shall extend laterally & 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…

Toplight Daylight Zone
C405.2.3.3



(a) Section view
(b) Plan view of daylight zone under a roof fenestration assembly

Interior Lighting Power
C405.4.2

Two methods to determine allowance:

Building Area Method

- Floor area for each building area type x value for the area
- "area" defined as all contiguous spaces that accommodate or are associated with a single building area type as per the table
- When used for an entire building, each building area type to be treated as a separate area

Space-by-Space Method

- Floor area of each space x value for the area
- Then sum the allowances for all the spaces
- Tradeoffs among spaces are allowed

Interior Lighting Power Allowances Building Area/Space-By-Space
C405.4.2(1) & (2)

TABLE 505.5.2
INTERIOR LIGHTING POWER ALLOWANCES

LIGHTING POWER DENSITY	
Building Area Type[a]	(W/ft^2)
Automotive Facility	0.9
Convention Center	1.2
Court House	1.2
Dining: Bar Lounge/Leisure	1.3
Dining: Cafeteria/Fast Food	1.4
Dining: Family	1.6
Dormitory	1.0
Exercise Center	1.0
Gymnasium	1.1
Healthcare—clinic	1.0
Hospital	1.2
Hotel	1.0
Library	1.3
Manufacturing Facility	1.3

The Allowances for use with the 2015 IECC are reduced from those in 2009 IECC

BUILDING AREA TYPE	LPD (w/ft^2)
Automotive facility	0.80
Convention center	1.01
Courthouse	1.01
Dining: bar lounge/leisure	1.01
Dining: cafeteria/fast food	0.9
Dining: family	0.95
Dormitory	0.57
Exercise center	0.84
Fire station	0.67
Gymnasium	0.94
Health care clinic	0.90
Hospital	1.05
Hotel/Motel	0.87
Library	1.19
Manufacturing facility	1.17
Motion picture theater	0.76

IECC 2009 → IECC 2015

Space-By-Space ONLY Merchandise Allowances

C405.5.2(2) footnotes

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 = ~~1006~~ 500 watts + (Retail Area 1 × 0.6 W/ft^2) + (Retail Area 2 × 0.6W/ft^2) + (Retail Area 3 × 1.4 W/ft^2)+ (Retail Area 4 × 2.5 W/ft^2)

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.

Exterior Lighting Controls
C405.2.5

- Lighting for exterior applications lighting specifically required to meet health & life safety requirements (other than emergency lighting that is intended to be automatically off during building operation), or decorative gas lighting systems shall:

Exterior Lighting Controls
C405.2.5

- 1. Provide control that automatically turns off the lighting as a function of light available
- 2. Provide controls that automatically shut off the lighting as a function of dawn/dusk and pre-set opening/closing time
- 3. If not covered in 2., the lighting shall have controls configured to automatically reduce the connected lighting power by not less than 30% for not later than midnight to 6 am, from one hour after business closing to one hour before business opening or during any period when activity has not been detected for a time longer than 15 minutes.

Individual Lighting Power Allowances For Bldg Exteriors

IECC Table C405.5(2)

TABLE C405.5(2)
INDIVIDUAL LIGHTING POWER ALLOWANCES FOR BUILDING EXTERIORS

Base Site Allowances Reduced

		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	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				

Electrical Transformers

C405.7

Electrical transformers must meet the minimum efficiency requirements of Table C405.7 as tested in accordance with DOE 10 CFR 431 and verified through certification under an approved certification program or data furnished by the manufacturer.

Exceptions:

- Transformers that meet the Energy Policy Act of 2005 exclusions based on the DOE 10 CFR 431 definition of special purpose applications
- 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 DOF 10 CFR 431
- Transformers that meet the Energy Policy Act of 2005 exclusions with multiple voltage taps where the highest tap is at least 20% > than lowest tap
- The following transformers: Drive, Rectifier, Auto-transformers, Uninterruptible power system, Impendance, Regulating, Sealed and nonventilating, machine tool, welding, grounding and testing.

Electrical Motors
C405.8

- Electrical motors must meet the minimum efficiency requirements of Table C405.8(1) through C405.8(4) when tested & rated in accordance with the DOE 10 CFR 431.
- The efficiency will be verified through certification under an approved certification program, or where a certification program does not exist, the equipment efficiency ratings shall be supported by data furnished by the motor manufacturer

Vertical and Horizontal Transportation Systems and Equipment

C405.9

Elevator Cabs (C405.9.1)

- For the luminaires in each elevator cab, not including signals and displays, the sum of the lumens divided by the sum of the watts must be > 35 lumens per watt
- Ventilation fans in elevators that do not have their own air-conditioning system must not consume more than 0.33 watts/cfm at max rated speed of fan.
- Controls will de-energize ventilation fans and lighting systems when elevator is stopped, unoccupied and with its doors closed for over 15 minutes.

Escalators and Moving Walks (C405.9.2)

- Must comply with ASME A17.1/CSA B44
- Must have automatic controls configured to reduce speed to the minimum permitted
- Regenerative Drive (405.9.2.1). 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 escalator is loaded with passengers whose weight > 750 pounds

Additional Efficiency Requirements
C406

- The requirements in IECC section 406 are not included as part of SPS 361 to 366.
  - *The need to address additional efficiency requirements has been deleted*

Total Building Performance
IECC C407.1/SPS 363.0407(1) /C401.2/SPS 363.0401(4)

- **SPS 363.0407 Total building performance. (1)** Mandatory requirements. The requirements in IECC section C403.2.7 (Energy Recovery Ventilation Systems) are not required to be demonstrated as means of compliance with this section.

- ***Note:*** *Use of IECC section C407 requires that the total building energy cost be less than the standard reference design building, as per SPS 363. required under IECC section C401.2 item 3. (85% criteria removed)*

System Commissioning
IECC C408.1/SPS 363.0408

- The requirements of IECC section C408 are not included as part of chs. SPS 361 to 366
  - *The need to commission HVAC and lighting systems has been deleted*

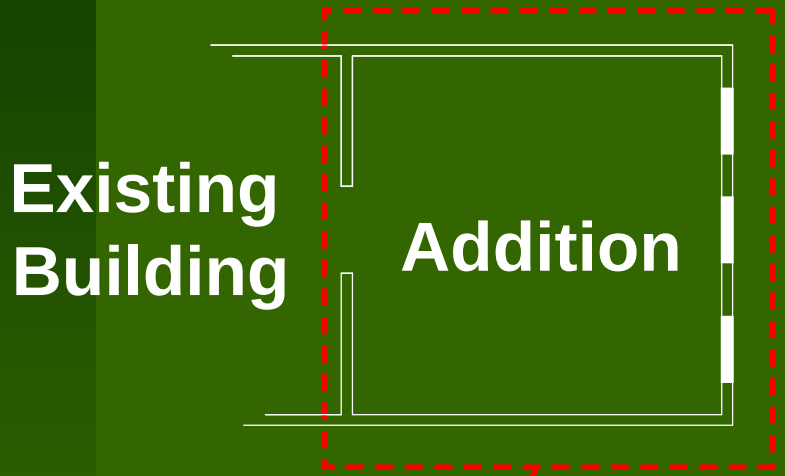
Existing Building Code-Additions
C502.1

- Additions to meet code.
- An addition can comply with current code if the addition alone complies, OR
- The existing building and addition may comply with this code as a single building

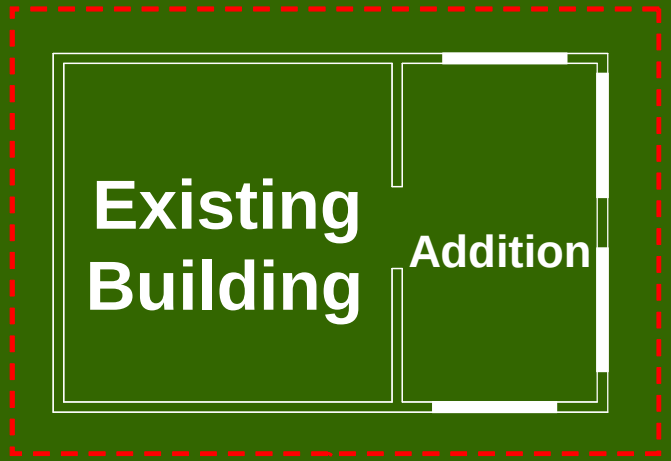
Concept is applicable to building envelope, building mechanical systems, service water heating systems, pools & in ground spas, interior lighting & exterior lighting

Scope & Application

- Compliance Options for Additions:



Treat Addition As a Stand-Alone Building



Demonstrate Compliance For the Entire Building

Existing Building Code-Alterations
C503.1

- Alterations to any building or structure shall comply with the requirements of the code for new construction
- Unaltered portions of the existing building or building system are not required to comply with current code

Existing Building Code-Alterations
C503.1

- The following don't need to comply for new construction provided the energy use of the building is not increased.
  - Storm windows installed over existing fenestration
  - Surface applied window film installed on existing single pane fenestration assemblies reducing solar heat gain…
  - Existing ceiling, wall or floor cavities exposed during construction, provided that these cavities are filled with insulation.
    - *Note that the code does not define the minimum R-value required.*

Existing Building Code-Alterations
C503.1

- Construction where the existing roof, wall or floor cavity is not exposed
- Roof recover
- Air barriers not required for roof recover or roof replacement if there is no alterations, renovations or repairs to the remainder of the bldg envelope
- Alteration that replaces < 50% of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power

Existing Building Code-Alterations
C503.2

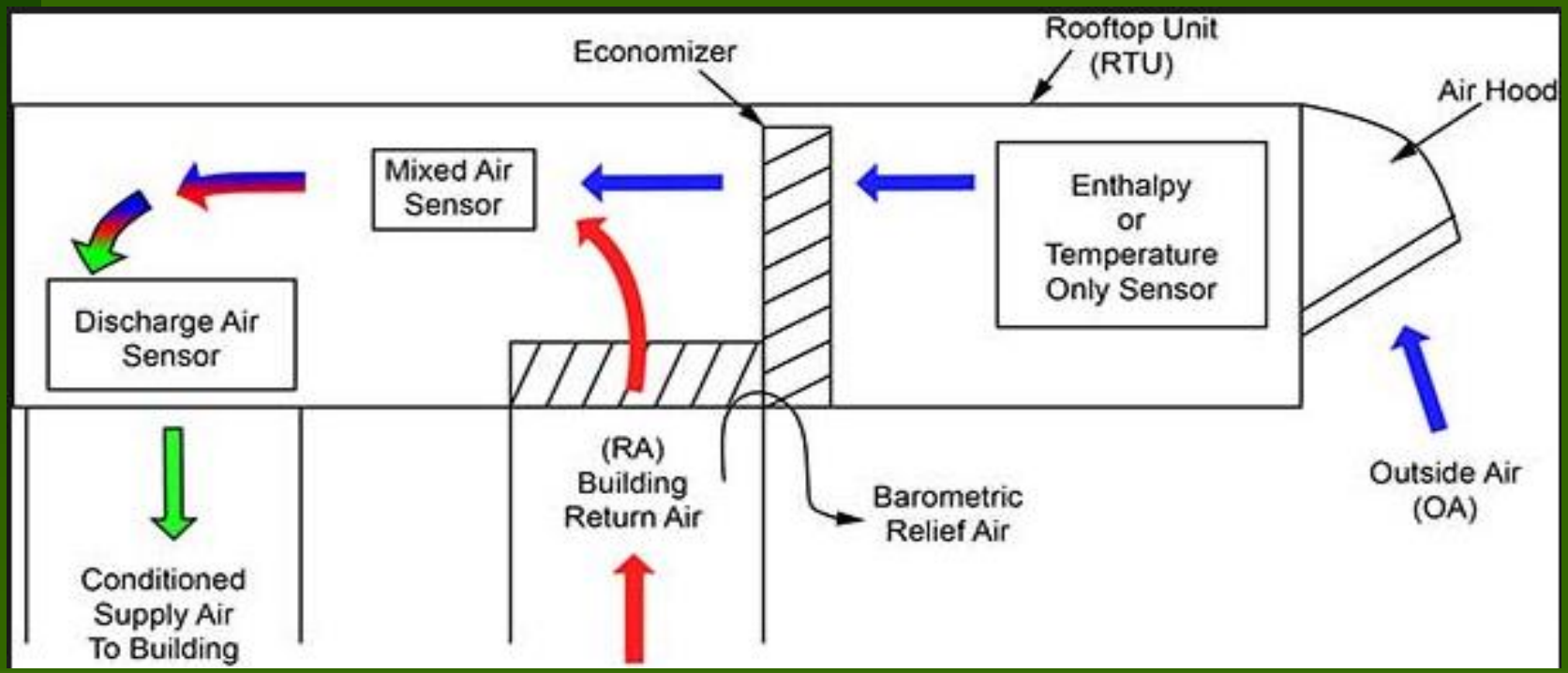
- Any nonconditioned or low–energy space that is altered to become conditioned space shall be required to be brought to full compliance with this code.

Building Envelope-Roof Replacement
C503.3.1

- Roof replacement to meet Tables C402.1.3 & C402.1.4 where the existing roof assembly is part of the building thermal envelope *AND* contains insulation entirely above the roof deck

Heating & Cooling Systems - Alteration Economizers
C403.4.1

- New cooling systems that are part of alteration shall comply with Section C403.3 for economizers (requirements as associated with adopted code)



Lighting Systems - Alterations
C503.6/SPS 363.0503

- New light systems that part of the alteration shall comply with Section C405

- Exception:
  - Alterations that replace < 50% of the luminaires in a space, provided that such alterations do not increase the installed interior lighting power.

Change in Occupancy
C505.1

- 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. (ie. S-1 warehouse to M-mercantile)

- Where the use in a space changes from one use in Table C405.4.2(1) or (2) to another use in the Interior Lighting Power Allowance Tables, the installed lighting wattage shall comply with Section 405.4.

Change in Occupancy
C505.1

- Example:
  - Using the **Building Area Method**, a family restaurant (1.6 w/sf) that is converted into a bar lounge (1.3 w/sf) WITHOUT ANY CHANGES TO THE BUILDING is required to meet the new lower lighting budget numbers
  - However, if the **Space-by-Space Method** is chosen, both occupancies have a lighting density of 1.4 w/sf, no modifications required

Residential (Low Rise <3 Stories Above Grade) IECC "R" Chapters

- The requirements in IECC sections R101 and R103 to R109 are not included as part of this chapter

Certificate
IECC 401.3/SPS 363.5401

2009 IECC Energy Efficiency Certificate

Insulation Rating	R-Value
Above-Grade Wall	21.00
Below-Grade Wall	0.00
Floor	5.00
Ceiling / Roof	49.00
Ductwork (unconditioned spaces):	_____

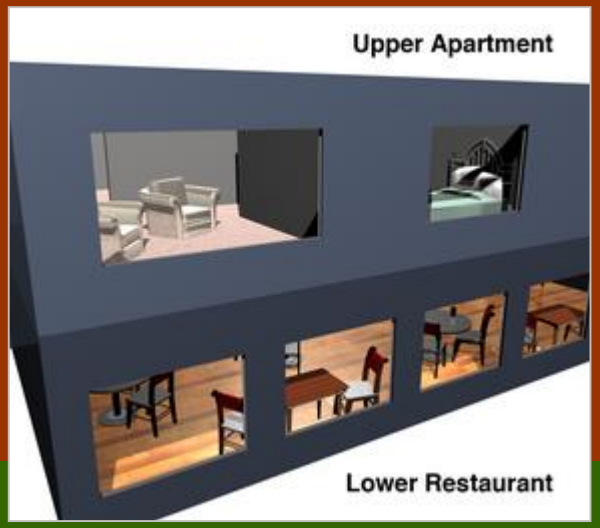
Glass & Door Rating	U-Factor	SHGC
Window	0.32	
Door	0.32	

Heating & Cooling Equipment	Efficiency
Heating System:_____	_____
Cooling System:_____	_____
Water Heater:_____	_____

- A permanent certificate completed by the building or registered posted on the wall addressing R-values & U-factors for building assemblies, type of heating system and its efficiency is NOT required

Mixed Use Buildings

- Mixed occupancies
  - Treat the residential occupancy under the applicable residential code
  - Treat the commercial occupancy under the commercial code



Insulation & Fenestration Requirements by Component (Low rise Residential)

- Insulation and Fenestration Requirements: Substitute 2009 Table 402.1.1 for 2015 IECC Table R402.1.2
- Equivalent U-Factors: Substitute 2009 Table 402.1.3 for 2015 IECC Table R402.1.4
- Air Leakage: Substitute 2009 IECC sections 402.4.1, 402.4.2, 402.4.2.1 and 402.4.2.2 for IECC sections R402.4.0, R402.4.2, R402.4.2.2 and R402.4.1.2
- Air Barrier & Insulation Inspection Component Table: Substitute 2009 IECC Table 402.4.2 for IECC Table 402.4.1.1

Compliance Options for 2015 IECC

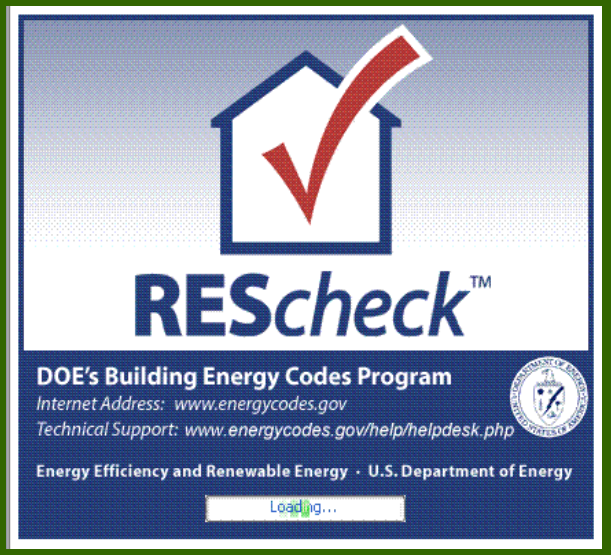
PRESCRIPTIVE

- 2015 IECC
  - Insulation and Fenestration Requirements: Substitute 2009 Table 402.1.1 for 2015 IECC Table R402.1.2 or
  - Equivalent U-Factors: Substitute 2009 Table 402.1.3 for 2015 IECC Table R402.1.4

Compliance Options for 2015 IECC

PERFORMANCE APPROACH

- 2015 IECC
  - Rescheck-Set for "IECC 2015" per SPS 363.5405 or
  - Apply IECC R405 "Simulated Performance Alternative"



Insulation & Fenestration Requirements by Component – (2009)

Table 402.1.1
Insulation and Fenestration Requirements by Component[a]

CLIMATE ZONE	FENESTRATION U-FACTOR[b]	SKYLIGHT[b] U-FACTOR	GLAZED FENESTRATION[b,e] SHGC	CEILING R-VALUE	WOOD FRAME WALL R-VALUE	MASS WALL R-VALUE[i]	FLOOR R-VALUE	BASEMENT[c] WALL R-VALUE	SLAB[d] R-VALUE & DEPTH	CRAWL SPACE[c] WALL R-VALUE
1	1.20	0.75	0.30	30	13	3 / 4	13	0	0	0
2	0.65[j]	0.75	0.30	30	13	4 / 6	13	0	0	0
3	0.50[j]	0.65	0.30	30	13	5 / 8	19	5 / 13[f]	0	5 / 13
4 except Marine	0.35	0.60	NR	38	13	5 / 10	19	10 / 13	10, 2ft	10 / 13
5 and Marine 4	0.35	0.60	NR	38	20 or 13+5[h]	13 / 17	30[g]	10 / 13	10, 2 ft	10 / 13
6	0.35	0.60	NR	49	19 or 13+5[h]	15 / 19	30[g]	15 / 19	10, 4 ft	10 / 13
7 and 8	0.35	0.60	NR	49	21	19 / 21	38[g]	15 / 19	10, 4 ft	10 / 13

[a] *R*-values are minimums, *U*-factors and SHGC are maximums, R-19 batts compressed into a nominal 2 x 6 framing cavity such that the *R*-value is reduced by R-1 or more shall be marked with the compressed batt *R*-value in addition to the full thickness *R*-value.
[b] The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration.
[c] "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
[d] R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.
[e] There are no SHGC requirements in the Marine Zone.
[f] Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.
[g] Or insulation sufficient to fill the framing cavity, R-19 minimum.
[h] "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
[i] The second *R*-value applies when more than half the insulation is on the interior of the mass wall.
[j] For impact rated fenestration complying with Section R301.2.1.2 of the *IRC* or Section 1608.1.2 of the *IBC*, maximum *U*-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

Insulation & Fenestration Requirements by Component – (2015)
R402.1.2

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

CLIMATE ZONE	FENESTRATION *U*-FACTOR[b]	SKYLIGHT[b] *U*-FACTOR	GLAZED FENESTRATION SHGC[b, e]	CEILING *R*-VALUE	WOOD FRAME WALL *R*-VALUE	MASS WALL *R*-VALUE[i]	FLOOR *R*-VALUE	BASEMENT[c] WALL *R*-VALUE	SLAB[d] *R*-VALUE & DEPTH	CRAWL SPACE[c] WALL *R*-VALUE
1	NR	0.75	0.25	30	13	3/4	13	0	0	0
2	0.40	0.65	0.25	38	13	4/6	13	0	0	0
3	0.35	0.55	0.25	38	20 or 13+5[h]	8/13	19	5/13[f]	0	5/13
4 except Marine	0.35	0.55	0.40	49	20 or 13+5[h]	8/13	19	10 /13	10, 2 ft	10/13
5 and Marine 4	0.32	0.55	NR	49	20 or 13+5[h]	13/17	30[g]	15/19	10, 2 ft	15/19
6	0.32	0.55	NR	49	20+5 or 13+10[h]	15/20	30[g]	15/19	10, 4 ft	15/19
7 and 8	0.32	0.55	NR	49	20+5 or 13+10[h]	19/21	38[g]	15/19	10, 4 ft	15/19

For SI: 1 foot = 304.8 mm.

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

b. The fenestration *U*-factor column excludes skylights. The SHGC column applies to all glazed fenestration. Exception: Skylights may be excluded from glazed fenestration SHGC requirements in climate zones 1 through 3 where the SHGC for such skylights does not exceed 0.30.

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

d. R-5 shall be added to the required slab edge *R*-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Climate Zones 1 through 3 for heated slabs.

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

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

g. Or insulation sufficient to fill the framing cavity, R-19 minimum.

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

i. The second *R*-value applies when more than half the insulation is on the interior of the mass wall.

Access Hatches & Doors
R402.2.4

- Access doors from conditioned spaces to unconditioned spaces such as attics and crawl spaces to be weather stripped & insulated to level equivalent to the insulation on the surrounding surfaces….
- Exception:
  - Vertical doors that provide access from conditioned to unconditioned spaces shall be permitted to meet the fenestration requirements of Table R402.1.2 based on the applicable Climate Zone…

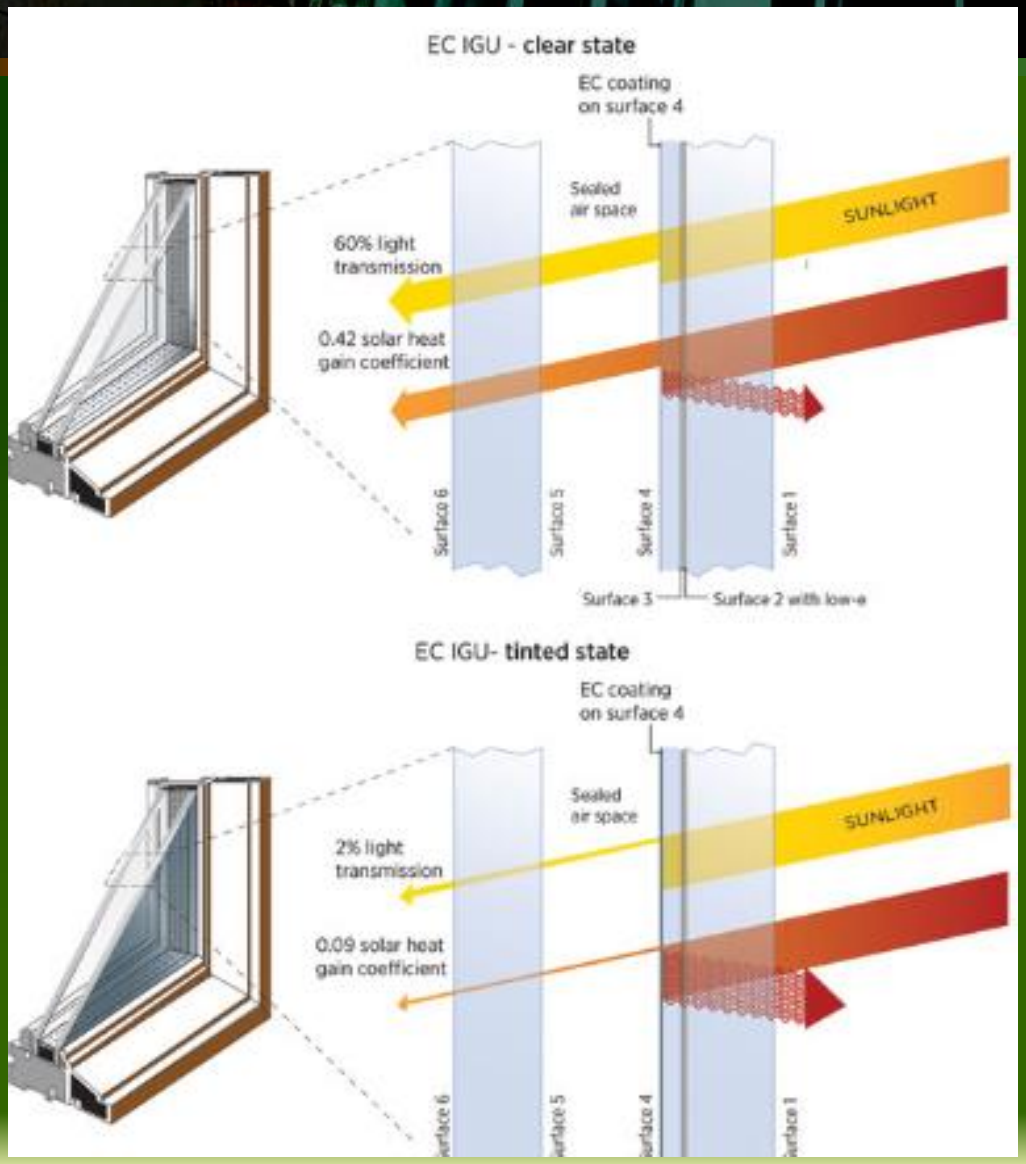
Access Hatches & Doors
R402.2.4

- The added exception means that these types of doors, such as attic kneewall doors & other vertical attic access doors, do not have to be insulated to the same level as the surrounding wall, as long as they meet the fenestration U-factor requirements of Table R402.1.2

Glazed Fenestration SHGC
R402.3.2

- Dynamic glazing permitted to satisfy the SHGC requirements provided the ratio of the higher to lower labeled SHGC is $\geq$2.4, and the dynamic glazing is automatically controlled to modulate the amount of solar gain into the space in multiple steps.

Glazed Fenestration SHGC
R402.3.2



- 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 R402.1.1

Ducts Insulation
R403.3.1

- Supply & return ducts in attics (or outside bldg):
  - Minimum R-8 where duct is ≥ 3” in diameter
  - Minimum R-6 where duct is < 3” in diameter
- Supply & return ducts in other portions of the building:
  - Minimum R-6 where duct is ≥ 3” in diameter
  - Minimum R-4.2 where duct is < 3” in diameter

Sealing
IECC R403.3.2/ SPS 363.5403

- All ducts, air handlers, and filter boxes shall be sealed. Joints and seams shall comply with IMC section 603.9

Protection of Piping Insulation
R403.4.1/SPS 363.0403(3)

The requirements in IECC section R403.4.1 are not included as part of the chs. SPS 361 to 366

- *The need for protect piping insulation in residential buildings been removed*

Heat Trace Systems
R403.5.1.2

- Controls to automatically adjust the energy input to the heat tracing to maintain the designed water temperature in the piping in accordance with the times when heated water is used in the occupancy

General Lighting
R404.1/SPS 363.0404

- *50%* (changed from 75%) of the permanently installed light fixtures (other than low-voltage lighting) as located within commercial buildings w/residential occupancies require high-efficacy lamps.

- Examples of low efficacy, low voltage & high efficacy lamps

General Lighting
R404.1

- *"High-Efficacy Lamps"* ***Compact fluorescent lamps, T-8 or smaller diameter linear fluorescent lamps, or lamps with a minimum efficacy based on lamp wattage***

Lamp Wattage	***Efficacy***
> 40 watts	*60 lumens/watt*
15-40 watts	*50 lumens/watt*
< 15 watts	*40 lumens/watt*

Review ICC Codes & Standards Online

- To review the 2009 ICC codes & Standards On-line– Go to:
- http://codes.iccsafe.org/
  - Click on "I-Codes" and year "2009"

- To review the 2015 ICC codes & Standards On-line– Go to:
- http://codes.iccsafe.org/
  - Click on "I-Codes" and year "2015"

Review Archived WI Commercial Building Codes Online

- http://dsps.wi.gov/Programs/Industry-Services/Industry-Services-Programs/Commercial-Buildings/Commercial-Buildings-Admin-Code/Commercial-Building-Code-Archive/

Questions?

Thanks for Listening!