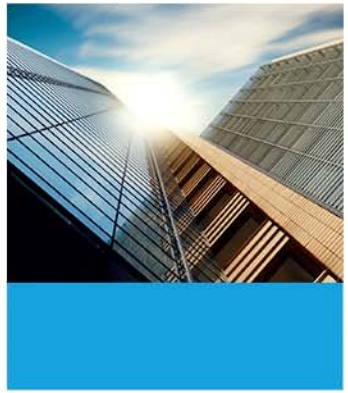


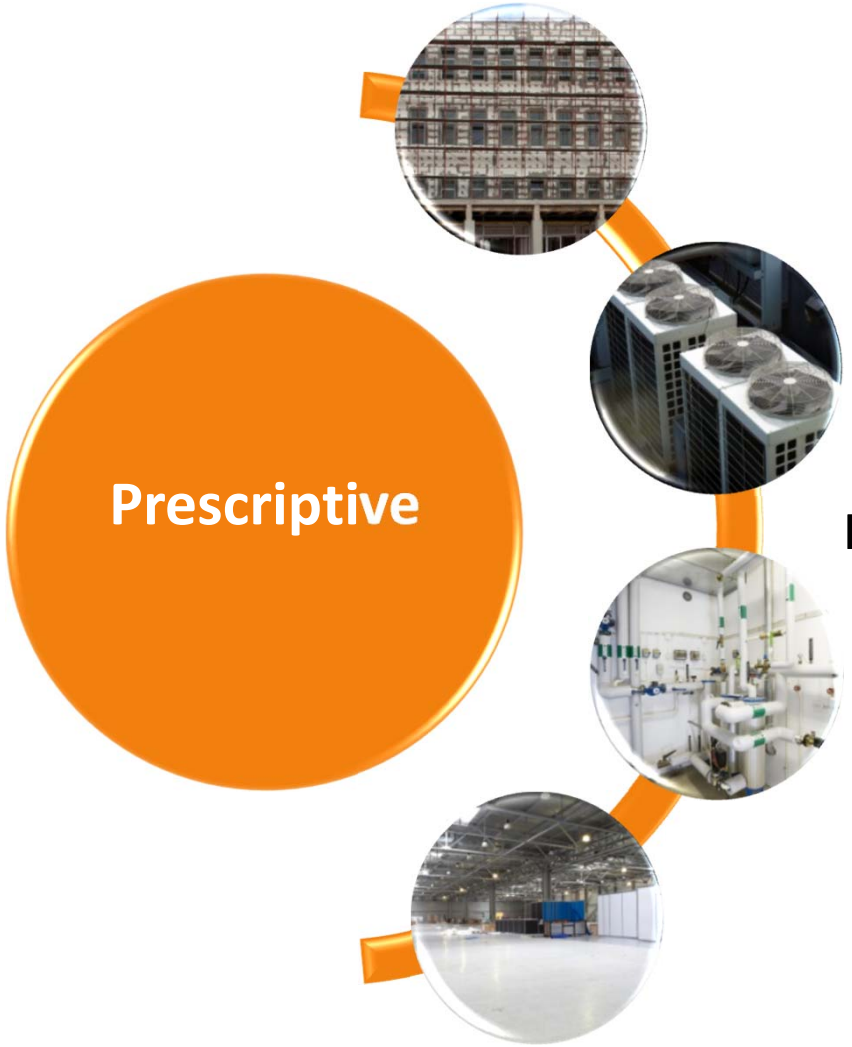

2015 IECC Commercial Significant Changes

Eric Makela, Cadmus

Compliance Options For 2015 IECC

- Prescriptive
- Performance Approach
- ASHRAE 90.1-2013

2015 IECC – Option: Prescriptive

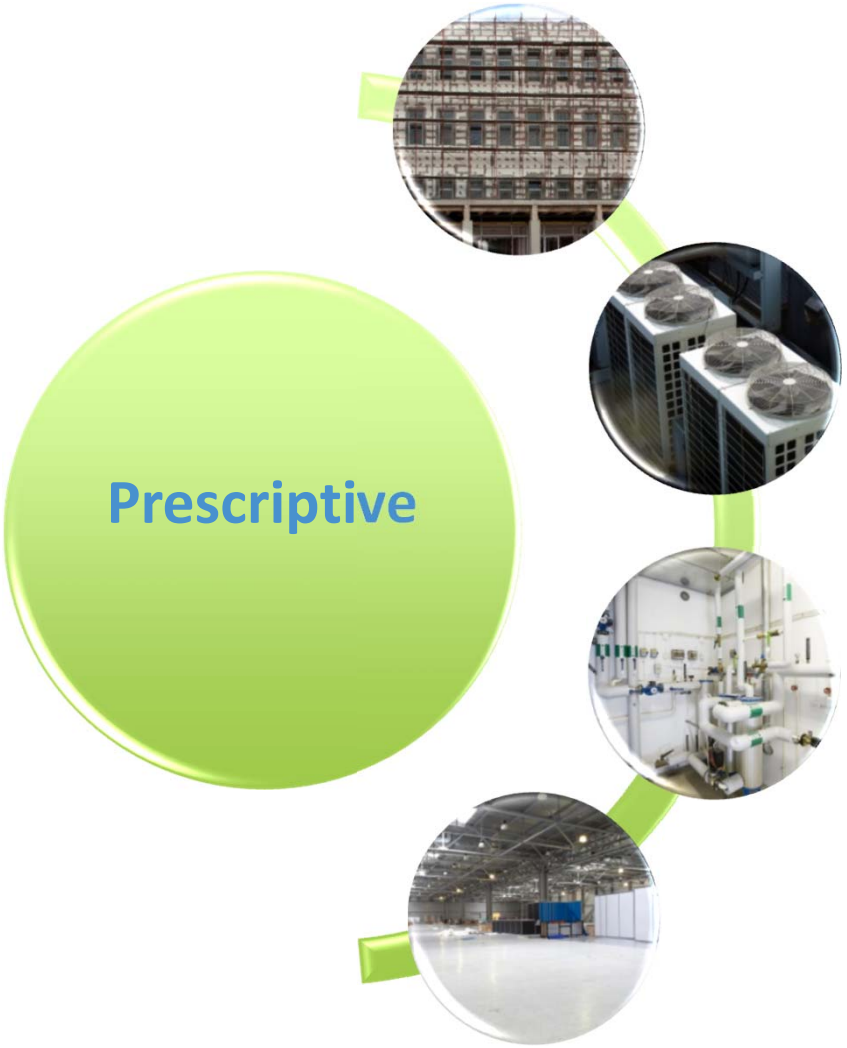


Prescriptive

Pick One

- C406.2 – Eff. HVAC Performance
- C406.3 – Reduced LPD
- C406.4 – Digital Lighting Controls
- C406.5 – On-Site Renewable Energy
- C406.6 – Outdoor Air System
- C406.7 – Reduced Energy Use in SWH

2012 IECC – Option: Prescriptive



Pick One

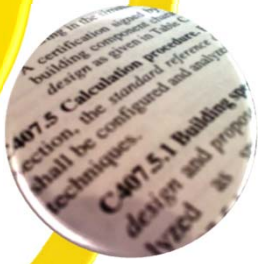
- C406.2 – Eff. HVAC Performance
- C406.3 – Eff. Lighting Systems
- C406.4 – On-site Renewable Energy

2015 IECC – Option: Performance

C407 Total Building Performance

C402.5 – Air Leakage

Performance Approach



C403.2 – Provisions applicable to all mechanical systems

C404 – SWH

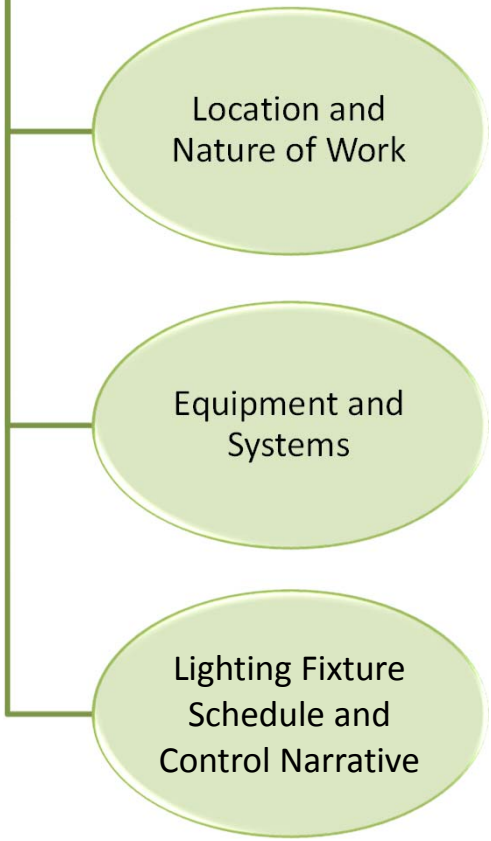
Lighting Mandatory Sections

- C405.2
- C405.3
- C405.4
- C405.6
- C405.7
- C405.8
- C405.9

2015 IECC Scope and Administration Major Changes

Construction Documents (C103)

Construction Documents must be drawn to scale and include:



Code Official Discretion:

- **Prepared by Registered Design Professional**
- **Electronic Media Documents Permitted**

Inspections (C103)

Construction or work for which a permit is required is subject to inspection by the code official or designated agent. Construction must be kept accessible and exposed for inspection until approved

Required Inspections

- Footing and foundation inspection
- Framing and rough-in inspection
- Plumbing rough-in inspection
- Mechanical rough-in inspection
- Electrical rough-in inspection
- Final inspection

2015 IECC Commercial Envelope Major Changes

Low-Energy Buildings

C402.1.1

Low-energy buildings, or portions of low-energy buildings separated from the remainder of the building by *building thermal envelope* assemblies complying with this section shall be exempt from requirements of Section C402.

- **Those with a peak design rate of energy usage less than 3.4 Btu/h x ft² (10.7 W/m²) or 1.0 watt per square foot (10.7 W/m²) of floor area**
- **Those that do not contain *conditioned space***
- **Green houses**

Equipment Buildings
C402.1.2

Buildings that comply with the following are exempt from the *building thermal envelope* provisions:

- Separate buildings with floor area not more than 500ft² (50m²)
- Buildings intended to house electronic equipment with installed equipment power totaling not less than 7W/ft² (75W/m²) and not intended for human occupancy
- Buildings with a heating capacity not greater than (17,000 Btu/hr)(5kW) and a heating thermostat set point that is restricted to not more than 50°F
- Buildings with an average wall and roof U-factor less than 0.2 in CZ1-5 and less than .12 in CZ6-8
- Buildings that comply with the roof solar reflectance and thermal emittance provisions for CZ1

Table 402.1.3

Climate Zone	3		5 & Marine 4	
	All Other	Group R	All Other	Group R
Roofs				
Insulation Entirely Above Deck	R-20ci	R-20ci	R-25ci	R-25ci
Metal Buildings(with R-5 thermal blocks	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-49
Walls, Above Grade				
Mass	R-7.6ci	R-7.6ci	R-11.4ci	R-13.3ci
Metal Building	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci
Metal Framed	R-13+R-7.5ci	R-13+R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci
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-3.8ci
Below Grade Walls				
Below-Grade Wall	NR	NR	R-7.5ci	R-7.5ci

Table 402.1.3 (cont'd)

Climate Zone	3		5 & Marine 4	
	All Other	Group R	All Other	Group R
Floors				
Mass	R-10ci	R-10ci	R-10ci	R-12.5ci
Joist/Framing	R-30	R-30	R-30	R-30
Slab on Grade Floors				
Unheated Slabs	NR	NR	R-10 for 24"below	R-10 for 24"below
Heated Slabs	R-10 for 24" below	R-10 for 24" below	R-15 for 36"below	R-15 for 36"below
Opaque Doors				
Swinging	U-0.61	U-0.61	U-0.37	U-0.37
Roll-up or Sliding	R-4.75	R-4.75	R-4.75	R-4.75

Building Envelope

- Cool Roofs
- Required in CZ 1-3 for roofs ≤ 2:12
- Roofs can qualify using one of four minimum roof reflectance and emittance options
- Several exceptions

Three-year aged solar reflectance[b] of 0.55 and three-year aged thermal emittance[c] of 0.75
Three-year-aged solar reflectance index[d] of 64

2015 High Albedo Roofs – Exceptions *C402.3*

- Portions of roofs that include or are covered by:
  - PV systems or components
  - Solar air or water heating systems or components
  - Roof gardens or landscaped roofs
  - Above-roof decks or walkways
  - Skylights
  - HVAC systems, components, and other opaque objects mounted above the roof
- **Portions of roofs shaded during peak sun angle on the summer solstice by permanent features of the building or adjacent buildings**
- Portion of roofs that are ballasted with a minimum stone ballast of 17 lbs/sq ft or 23 psf pavers.
- Roofs, where a minimum of 75% of the roof area complies with one or more of the exceptions to this section.

2012 High Albedo Roofs – Exceptions
C402.2.1.1 (cont'd)

- Portions of roofs that include or are covered by:
  - PV systems or components
  - Solar air or water heating systems or components
  - Roof gardens or landscaped roofs
  - Above-roof decks or walkways
  - Skylights
  - HVAC systems, components, and other opaque objects mounted above the roof
- Portions of roofs shaded during peak sun angle on June 21 by permanent features of the building or adjacent buildings
- Ballasted roofs with minimum stone ballast of 17 lbs/ft^2 or 23 lbs/ft^2 pavers
- Roofs, where a minimum of 75% of the roof area meets one of the above exceptions

2015 Compliance
Chapter 4 Prescriptive Approach

Table C402.4
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4	5	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 (on next side)								
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

2015 Compliance
Chapter 4 Prescriptive Approach (cont'd)

Table C402.4
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

SHGC														
Climate Zone	1		2		3		4 except marine		5 and marine 4		6		7	
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

2012 Compliance
Chapter 4 Prescriptive Approach

Table C402.3 BUILDING ENVELOPE REQUIREMENTS: FENESTRATION								
CLIMATE ZONE	1	2	3	4	5	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								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
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

Vertical Fenestration Requirement

C402.4.1 – Prescriptive (Max area)

- Percentage of Vertical Fenestration Area to Gross Wall Area

  - **Allowed up to 30% maximum of above-grade wall area**
  - **In Climate Zones 1-6, up to 40% maximum of above-grade wall area permitted with daylight controls**

2015 Increased Vertical Fenestration with Daylighting Controls *C402.4.1.1*

Up to 40% vertical fenestration area allowed in Climate zones 1-6 if:

- 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

2012 Increased Vertical Fenestration with Daylighting Controls *C402.3.1.1*

Up to 40% vertical fenestration area allowed in Climate zones 1-6, only if-

- No less than 50% of the conditioned floor area is within a daylight zone
- Automatic daylighting 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

Minimum Skylight Fenestration Area

- Limited to ≤ 3% of Roof Area (C402.4.1)
- Up to 5% allowed if automatic daylighting controls installed in daylight zones under skylights (C402.4.1.2)

C402.4.2

- In certain types of enclosed spaces > 2,500 ft² directly under a roof with not less than 75% of the ceiling area with a ceiling height > 15 ft
  - total daylight zone under skylights to not be < half the floor area and must provide either
    - A minimum skylight area to daylight zone under skylights of not less than 3% where all skylights have a VT of at least 0.40 **OR**
    - A minimum skylight effective aperture of at least 1%

Exceptions

- Climate zones 6-8
- Spaces with LPDs < 0.5 W/ft2
- Documented shaded spaces
- Daylight area under rooftop monitors is > 50% of floor area
- Spaces where total area minus area of daylight zones adjacent to vertical fenestration is less than 2,500ft² and where lighting is controlled per C405.2.5

2012 Skylight Minimum Fenestration Area

C402.3.1 Prescriptive

- Limited to ≤ 3% of Roof Area
- Up to 5% allowed if automatic daylighting controls installed in daylight zones under skylights

2012 Minimum Skylight Fenestration Area *C402.3.2*

- In certain types of enclosed spaces > 10,000 ft_2 directly under a roof with ceiling heights > 15 ft
  - total daylight zone under skylights to not be < ½ the floor area and to provide a minimum skylight area to daylight zone of either
    - Minimum of 3% of roof area with a skylight VLT at least 0.40 **OR**
    - Provide a minimum skylight effective aperture of at least 1%

Exceptions

- Climate zones 6-8
- Spaces with LPDs < 0.5 W/ft_2
- Documented shaded spaces
- Daylight area under rooftop monitors is > 50% of floor area

Mandatory Requirements

Thermal envelope air leakage
Air barriers
Fenestration air leakage
Rooms containing fuel-burning appliances
Doors and access openings to shafts, chutes, stairways and elevator lobbies
Air intakes, exhaust openings, stairways and shafts
Loading dock weatherseals
Vestibules
Recessed lighting

2015 IECC Commercial Mechanical Major Changes

HVAC Load Calculations

C403.2.1 Mandatory

Heating and cooling load sizing calculations required	ASHRAE/ACCA Standard 183		
	Other approved computation procedures – using design parameters specified in Chapter 3	Exterior design conditions	Specified by ASHRAE
		Interior design conditions	Specified by Section 302 of the IECC
		≤ 72°F for heating load	
		≥ 75oF for cooling load	

Table 403.2.3(2) Mandatory

EQUIPMENT TYPE	SIZE CATEGORY	Heating Section Type	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY		TEST PROCEDURE
				Before 1/1/2016	As of 1/1/2016	
Air cooled, (Cooling mode)	< 65,000 Btu/h	All	Split system	13.0 SEER	14.0 SEER	AHRI 210/240
			Single package	13.0 SEER	14.0 SEER	
	≥ 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	
		All other	Split system and single package	10.8 EER 11.0 IEER	10.8 EER 11.8 IEER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric Resistance (or None)	Split system and single package	10.6 EER 10.78 IEER	10.6 EER 11.6 IEER	AHRI 340/360
		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 9.4 IEER	
Through-the-Wall (Air cooled, cooling mode)	<30,000 Btu/h	All	Split System			AHRI 210/240
			Single Package			

Economizer Fault Detection and Diagnostics C403.2.4.7

Air-cooled unitary direct-expansion units and VRF units equipped with an economizer must include a fault detection and diagnostics (FDD) system complying with the following:

- Outside air, supply air and 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
- Unit controller must be capable of providing system status, manually initiating each operating mode and reporting faults to a fault management application
- FDD system must be capable of detecting air temperature sensor fault, economizer faults, damper not modulating and excess outdoor air

Enclosed Parking Garage Ventilation Controls

C403.2.6.2

Enclosed parking garages used for storing or handling automobiles operating under their own power must employ contamination-sensing devices and 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 in accordance with IMC.

Exceptions:

- Garages with total exhaust capacity <22,500cfm 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 exceeds 1,125 cfm/hp and do not utilize heating or mechanical cooling

2015 Demand Controlled Ventilation

C403.2.6.1 Mandatory

DCV must be provided for each zone with spaces > 500 ft² and the average occupant load > 25 people/1000 ft² of floor area where the HVAC system has:

- An air-side economizer,
- Automatic modulating control of the outdoor air damper, or
- A design outdoor airflow > 3,000 cfm

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

Energy Recovery Ventilation Systems

C403.2.7 Mandatory

Applies to fan systems with supply airflow rates > values in

Table C403.2.7(1) &

Table C403.2.7(2)

Exhaust air recovery efficiency must be ≥ 50%

When an air economizer is required, a bypass or controls that permit operation of economizer per C403.3 must be included

2015 Energy Recovery Ventilation Systems

C403.2.7(1) Mandatory

CLIMATE ZONE	VENTILATIONS SYSTEMS OPERATING < 8,000 hours per year							
	≥ 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	≥ 26,500	≥ 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	≥ 4,500	≥ 4,000	≥ 2,500	≥ 1,000	**> 0**	**> 0**	**> 0**	**> 0**

2015 Energy Recovery Ventilation Systems

C403.2.7(2) Mandatory

CLIMATE ZONE	VENTILATIONS SYSTEMS OPERATING ≥ 8,000 hours per year							
	≥ 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

2012 Energy Recovery Ventilation Systems

C403.2.6 Mandatory

CLIMATE ZONE	PERCENT (%) OUTDOOR AIR AT FULL DESIGN AIRFLOW RATE					
	≥ 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	≥ 5000	≥ 5000
1B, 2B, 5C	NR	NR	≥ 26000	≥ 12000	≥ 5000	≥ 4000
6B	≥ 11000	≥ 5500	≥ 4500	≥ 3500	≥ 2500	≥ 1500
1A, 2A, 3A, 4A, 5A, 6A	≥ 5500	≥ 4500	≥ 3500	≥ 2000	≥ 1000	≥0
7, 8	≥ 2500	≥ 1000	> 0	> 0	> 0	> 0

Kitchen Exhaust Systems

C403.2.8 Mandatory

Replacement air introduced directly into exhaust hood cavity must not 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

Where total kitchen hood exhaust airflow rate is > 5,000cfm, each hood must be a factory built commercial exhaust hood

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

Exception: Where not <75% of all replacement air is transfer air that would otherwise be exhausted

Duct and Plenum Insulation and Sealing

C403.2.9 Mandatory

Required for Supply and Return Ducts and Plenums Ducts

- **Located in Unconditioned Space – R6 Insulation**
- **Ducts Located Outside the Building Envelope – R8 Insulation in CZ 1-4 and R12 in CZ 5-8**
- **Located in Envelope Assembly – Must Be Separated from Building Exterior with R8 Insulation in CZ 1-4 and R12 in CZ 5-8**

Exceptions
- Ducts Located within Equipment
- Maximum Design Temperature Difference (Interior – Exterior) is < 15°F

Mechanical Systems Commissioning and Completion *C403.2.11* Mandatory

HVAC & Service Water Heating

Applies to buildings with a total building equipment capacity ≥

- 480,000 Btu/h cooling capacity, or
- 600,000 Btu/h heating capacity

Requires:

- Commissioning plan
- Systems adjusting and balancing
- Functional performance testing
  - Equipment
  - Controls
  - Economizers
- Preliminary commissioning report
- Construction documents and O&M Manuals
- Final commissioning report and air balancing report

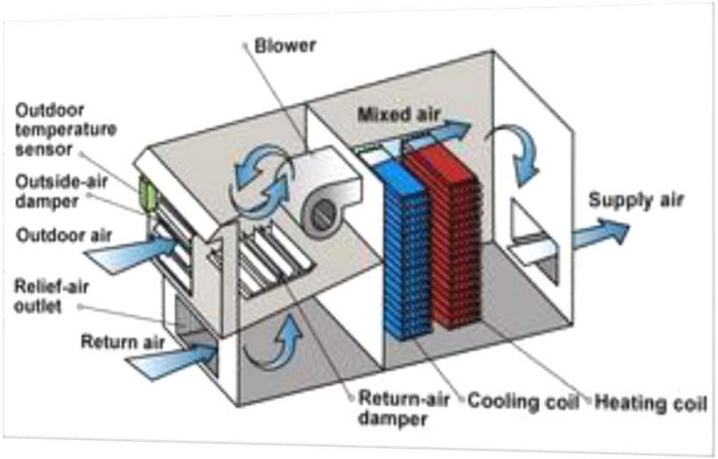
Simple HVAC Systems & Equipment

C403.3

Must include economizers dependent on climate zone

Capable of providing 100-percent outdoor air even if additional mechanical cooling is required *(integrated economizer)*

Must provide a means to relieve excess outdoor air



2015
Economizers C403.3

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 cooling systems ≥ 54,000 Btu/h[a]

[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

2012
Economizers C403.3.1

Table C403.3.1(1)

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 cooling systems ≥ 33,000 Btu/h[a]

[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

Economizers

Trade-off high cooling efficiency for economizer

Table C403.3(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

Fractional hp Fan Motors

C403.4.4.4

Motors for fans not < 1/12 hp and <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.

Exceptions:

- Motors in the airstream within fan coils and terminal units that only provide heating to the space served
- Motors in space-conditioning equipment that comply with Section 403.2.3 or C403.2.12
- Motors that comply with Section C405.8

Refrigeration Systems
C403.2.14-.17

Refrigeration Equipment Performance

- Sets maximum kWh/day for the following type of refrigeration equipment
  - Commercial refrigeration e.g refrigerators and freezers with solid or transparent doors
  - Commercial refrigerators and freezers
- Walk-in Coolers, freezers, refrigerated warehouse freezers
  - Automatic door closers
  - Minimum envelope insulation levels
  - Double or triple-pane glass with inert gas or heat-reflective treated glass for reach-in doors
  - Fan motor requirements for evaporator and condenser motors
  - High efficacy lighting
- Refrigerated Display Cases
  - Lights controlled by automatic time switch or occupancy sensor
  - Temperature based defrost termination and anti-sweat controls

2015 IECC Service Water Heating Major Changes

Efficient Heated Water Supply Piping

C404.5

- Sets maximum pipe length from the hot water source to the termination of the fixture supply pipe.
  - Maximum allowable pipe length method
    - Based on termination type
  - Maximum allowable pipe volume method
    - Sets the maximum volume of water between the heated water source and the fixture based on fixture type
    - Public lavatory faucet – not more than 2 ounces
    - Other plumbing fixtures – not more than 0.5 gallons

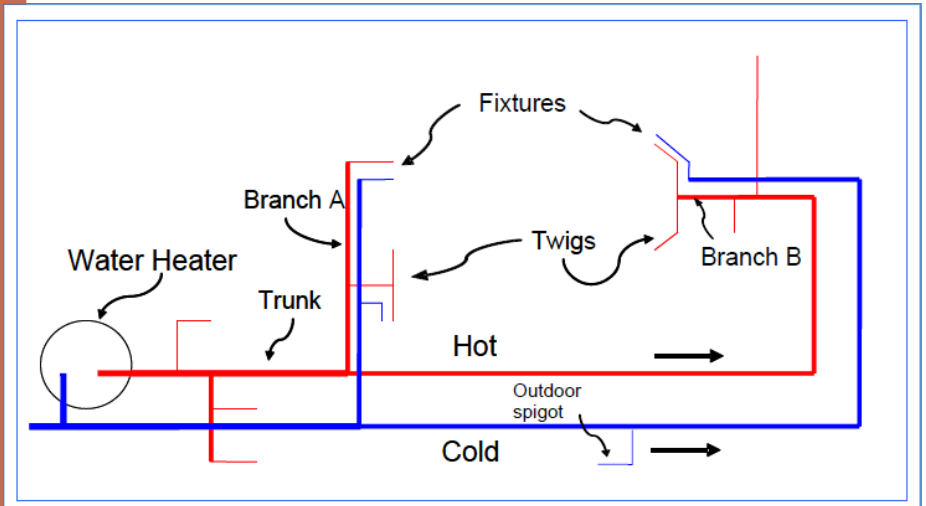


Figure 1: Conventional Single Trunk, Double Branch and Twig Plumbing Layout with Separate Hot and Cold Water Supply Lines to individual fixtures.

Demand Recirculation Controls

C404.7

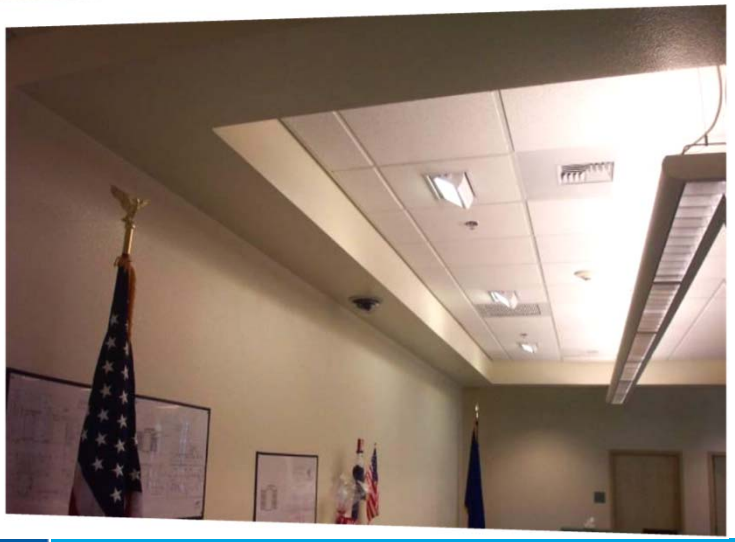
A ***demand recirculation water system*** is a water distribution system with one or more recirculation pumps that pump water from a heated-water supply pipe back to the heated-water source through a cold water supply pipe.

Pumps must have controls that:

- 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
- Limit the temperature of the water entering the cold-water piping to 104°F

2015 IECC COMMERCIAL LIGHTING REQUIREMENTS MAJOR CHANGES

What's Covered Under Electrical Power and Lighting Systems Requirements



Mandatory Interior Lighting requirements

*Required Controls *Wattage/Efficiency Limits

Interior Lighting Power Allowances (watts/ft2)

Exterior Lighting Controls

*Required Controls *Lamp Efficiency

Exterior Lighting Power Allowances (watts/ft2)

Electric Metering

Interior Lighting Controls

C405.2

Lighting systems must have the following controls:

- Occupant sensor controls (C405.2.1)
- Time-switch controls (C405.2.2)
- Daylight-responsive controls (C405.2.3)
- Specific application controls (C405.2.4)
- Exterior lighting controls (C405.2.5)

Exemptions:

- Security or emergency areas that must be continuously lighted
- Interior exit stairways, interior exit ramps and exit passageways
- Emergency egress lighting that is normally off

Occupant Sensor Controls

C405.2.1

The following space types must have occupant sensor controls installed to control lights:

- Classrooms/lecture/training rooms
- Conference/meeting/multipurpose rooms
- Copy/print rooms
- Lounges
- Employee lunch and break rooms
- Private offices
- Restrooms
- Storage rooms
- Janitorial closets
- Locker rooms
- Other spaces 300ft² or less that are enclosed by floor-to-ceiling height partitions
- Warehouses

Occupant sensors for all spaces except warehouses must:

1. Automatically turn off lights within 30 minutes of all occupancies leaving space
2. Be manual on or controlled to automatically turn lighting on to not more than 50% power
3. Include manual control to allow occupants to turn lights off

In warehouses,
Lighting in aisle-ways and open areas must be individually controlled with occupant sensors that automatically reduce lighting power by >50% when areas are unoccupied

Time-switch Control Function

C405.2.2

Each area that is not provided with occupant sensor controls must have time-switch controls

Exceptions: Automatic controls are not required in sleeping areas, spaces where patient care is directly provided, spaces where auto lighting would endanger safety or security, lighting intended for continuous operation, shop and laboratory classrooms

Time-switch Control Function (C405.2.2.1)
Each space with time-switch controls must also have a manual control for lighting reduction and include an override switching device that:

- Has a minimum 7-day clock
- Is capable of being set for 7 different day types/week
- Incorporates an automatic holiday "shutoff"
- Has program backup capabilities
- Permits controlled lighting to be on for less than 2 hours
- Controls lighting for areas <5,000 ft²

Exceptions to Time-switch Control Functions:

1. Within malls, arcades, auditoriums, single-tenant retail spaces, industrial facilities and arenas the time limit may be greater than 2 hours if override switch is captive key device and may control area >5,000 ft² and <20,000 ft²
2. Where provided with manual control, the following are not required to have lighting reduction control: spaces that have only 1 luminaire with rated power <100W; spaces that use less than 0.6 W/ft²; corridors, equipment rooms, public lobbies, electrical or mechanical rooms

Interior Lighting Control

C405.2.2.2 Light-Reduction Controls

Light Reduction Controls must allow the occupant to reduce connected lighting

By at least 50%

In a reasonably uniform illumination pattern

Lighting reduction must be achieved by one of the following:

- Controlling all lamps or luminaires
- Dual switching
- Switching the middle lamp luminaires independently of the outer lamps
- Switching each luminaire or lamp

Exception: Light reduction controls not required in daylight zones with daylight responsive controls complying with Section C405.2.3.

Daylight-Responsive Controls

C405.2.3

Daylight-responsive controls must be provided to control electric lights within daylights zones in:

- **Spaces with total of more than 150W of general lighting within sidelight daylight zones**
- **Spaces with total of more than 150W of general lighting within top-light daylight zones**

Daylight Responsive Control Function

C405.2.3.1

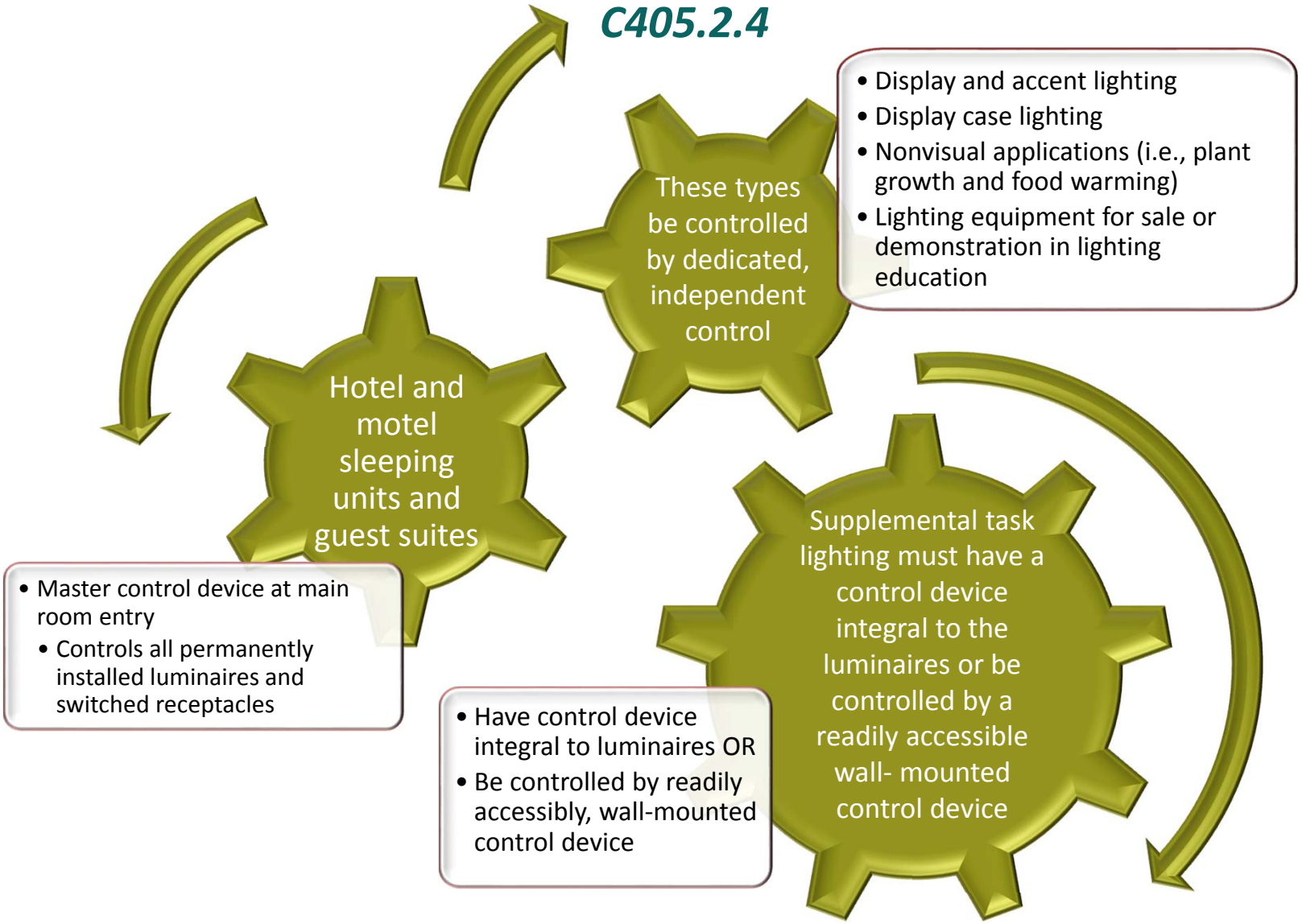
Daylight-responsive controls must comply with the following:

- **Lights in top-light daylight zones controlled independently of lights in sidelight daylight zones**
- **Daylight responsive controls calibrated from within**
- **Calibration mechanisms readily accessible**
- **Where located in offices, classrooms, laboratories and library reading rooms, daylight responsive controls must dim lights continuously from full light output to < 15% of full light output**
- **Capable of a complete shutoff of all controlled lights**
- **Lights in sidelight daylight zones facing different cardinal orientations must be controlled independently of each other**

Exception: Up to 150W in each space permitted to be controlled together with lighting in a daylight zone facing different cardinal direction

Specific Application Controls

C405.2.4



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

Building Area Method Table (Partial)

C405.4.2(1)

Building Area Type	LPD (w/ft2)	LPD (w/ft2)
	2015	2012
Office	0.82	0.9
Retail	1.26	1.4
Convention Center	1.01	1.2
Dining: Bar lounge/leisure	1.01	1.3
Dining: Family	0.95	1.6
Exercise Center	0.84	1.0
Fire Station	0.67	0.8
Gymnasium	0.94	1.1
Health Care Clinic	0.90	1.
Hospital	1.05	1.2
Hotel/Motel	0.87	1.0
Library	1.3	1.3
School/University	0.87	1.2
Sports Arena	0.91	1.1

Space-By-Space Method Table (Partial)

C405.4.2(2)

Common Space-By-Space Types	LPD (w/ft2)	LPD (w/ft2)
	2015	2012
Office (Enclosed Plan/Open Plan)	1.11 / 0.98	1.1 / 1.0
Retail (Dressing / Mall Concourse / Sales)	0.71 / 1.10 / NA	0.90 / 1.60 / 1.60
Atrium First 40 ft in height	0.03 per ft. in total height	0.03 per ft. Height
Atrium Above 40ft in height	0.40 + 0.02 per ft. in total height	0.02 per ft. Height
Audience/seating area		
For Auditorium	0.63	0.9
For Performing Arts Theatre	2.43	2.6
For Motion Picture Theatre	1.14	1.2
Class Room/Lecture/Training	1.24	1.3
Conference/Meeting/Multipurpose	1.23	1.2
Corridor	0.66	0.7
Dining Area		
In a penitentiary	0.96	NA
In a facility for the visually impaired	1.90	NA
Bar/Lounge/Leisure Dining	1.07	1.4
Family Dining Area	0.89	1.4
Electrical/Mechanical	0.95	1.10

Additional Retail Lighting Power Allowance

Table C405.5.2(2) – Footnotes

Additional Interior Lighting Power Allowance =

500 watts +

(Retail Area 1 x 0.6 W/ft2) +

(Retail Area 2 x 0.6 W/ft2) +

(Retail Area 3 x 1.4 W/ft2) +

(Retail Area 4 x 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.

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 DOE 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, Impendence, Regulating, Sealed and non-ventilating, machine tool, welding, grounding and testing.

Electrical Motors

C405.8

Electrical motors must 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 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

2015 IECC Commercial Additional Requirements

Additional Efficiency Requirements

One Additional Efficiency Feature Must Be Selected to Comply with the IECC

- **More efficient HVAC**
- **Reduced lighting power density**
- **Enhanced lighting controls**
- **On-site renewable energy**
- **Dedicated outdoor air system**
- **High-efficiency SWH**


High Efficiency HVAC


Onsite Renewables

2012 Additional Efficiency Requirements

One Additional Efficiency Feature Must Be Selected to Comply with the IECC

More efficient lighting system (consistent with 90.1-2010)	More efficient HVAC system	Installation of onsite renewables • 3% of the regulated energy

More Efficient HVAC Equipment Performance C406.2

- Equipment must exceed minimum efficiency requirements listed in Tables C403.2.3(1) through C403.2.3(7) by 10% in addition to requirements of Section C403
- Where multiple performance requirements are provided, equipment must exceed all requirements by 10%
- Variable refrigerant flow systems must exceed ASHRAE 90.1 by 10%
- Equipment not listed in table is limited to 10% of the total building system capacity

High Efficiency HVAC

Reduced Lighting Power Density
C406.3

Total interior lighting power of building must be determined using 90% of lighting power values specified in Tables C405.4.2(1) times the floor area for building types OR by using 90% of the interior lighting power allowance calculated by the space-by-space method

Enhanced Digital Lighting Controls
C406.4

Interior lighting in the building must have the following controls:

- Luminaires must be capable of continuous dimming
- Luminaires must be capable of being addressed individually
- Not more than 8 luminaires may be controlled together in a daylight zone
- Fixtures must be controlled through a digital control system
- Construction documents must include submittal of a Sequence of Operations
- Functional testing of lighting controls must comply with Section 408

On-Site Renewable Energy

C406.5

Provide not less than 0.5 watts per square foot of conditioned floor area

Provide ≥ 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4

2012 On-Site Renewable Energy

C406.5

Option 1:

Provide ≥ 1.75 btu's, or 0.50 watts, per square foot of conditioned floor area.

Option 2:

Provide ≥ 3 percent of the energy used within the building for building mechanical and service water heating equipment and lighting regulated in Chapter 4

Dedicated Outdoor Air Systems
C406.6

- Buildings covered by Section C403.4 shall be equipped with an independent ventilation system designed to provide > the minimum 100% outdoor air to each occupied space.
- Ventilation system must be capable of total energy recovery
- HVAC system must include supply-air temperature controls that automatically reset supply-air temperature in response to building loads or outdoor air temperatures
- Controls must reset the supply-air temperature at least 25% of the difference between the design supply-air temperature and design room-air temperature.

Reduced Energy Use in SWH
C406.7

Buildings must be of the following types to use this compliance option:

- Group R-1: Boarding houses, hotels or motels
- Group 1-2: Hospitals, psychiatric hospitals and nursing homes
- Group A-1: Restaurants and banquet halls or buildings containing food preparation areas
- Group F: Laundries
- Group R-2: Buildings with residential occupancies
- Group A-3: Health clubs and spas
- Buildings showing a service hot water load of 10% or more of total building energy loads

Load Fraction (C406.7.1)

Building SWH system must have one or more of the following that are sized to provide not less than 60% of hot water requirements or sized to provide 100% of hot water requirements if the building otherwise complies with C403.4.7:

- Waste heat recovery from SWH, heat recovery chillers, building equipment, process equipment, or a combined heat and power system
- Solar water-heating systems

CADMUS

Eric Makela

Senior Associate, Energy Services

208-629-1447

Eric.Makela@cadmusgroup.com

Facebook.com/CadmusGroup

@CadmusGroup

Linkedin.com/company/the-cadmus-group

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

2012 SHGC Adjustment C402.3.3.1

- When PF ≥ 0.2, the required maximum SHGC in Table C402.3 must be adjusted by multiplying the required maximum SHGC by the multiplier in Table C402.3.3.1

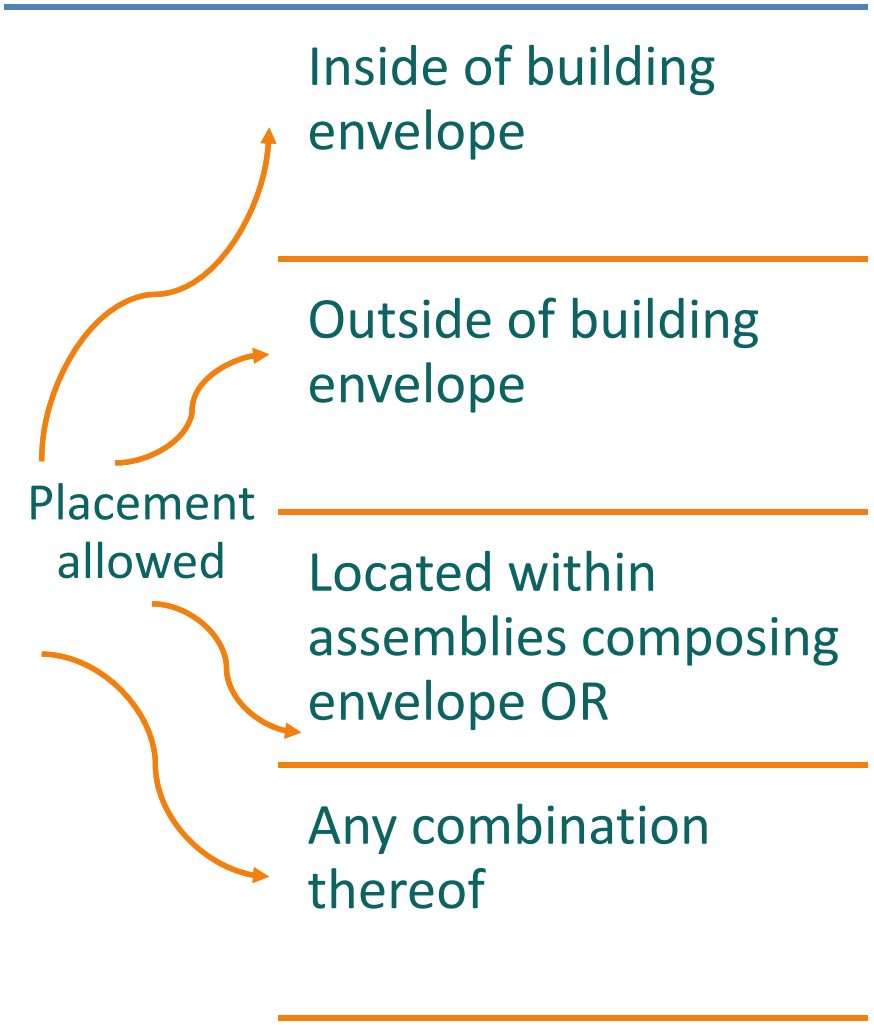
Table C402.3.3.1 SHGC ADJUSTMENT MULTIPLIERS		
PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
0.2 ≤ PF < 0.5	1.1	1.2
PF ≤ 0.5	1.2	1.6

Air Barriers and Construction

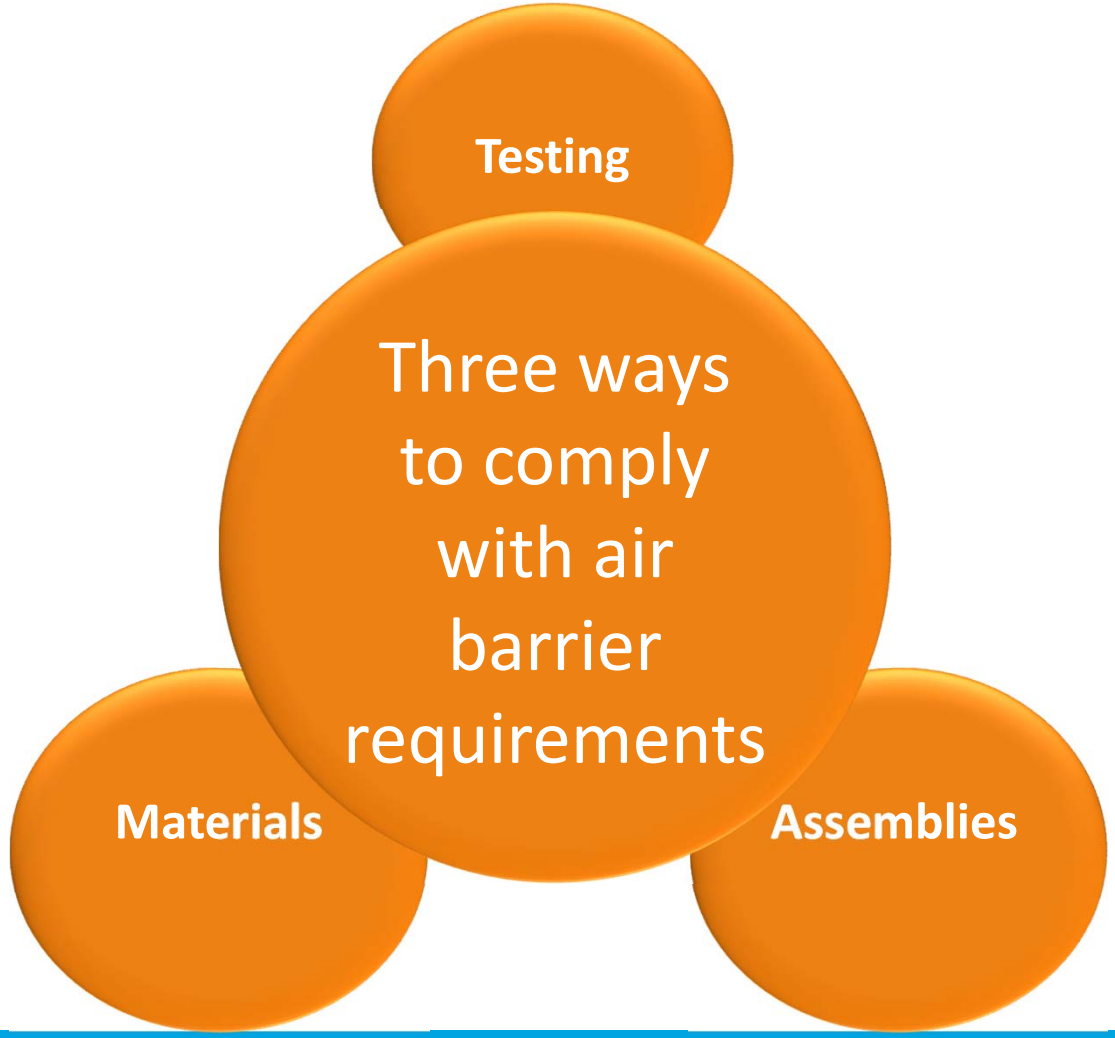
C402.5.1 and C402.5.1.1

Air barrier requirements:

- Continuous for all assemblies part of the thermal envelope and across joints and assemblies
- Joints and seams to be sealed and securely installed
- Penetrations and joints and seals associated with penetrations must be sealed in a manner compatible with construction material and location
- Recessed lighting to comply with C402.5.7. Where similar objects are installed that penetrate the air barrier, make provisions to maintain integrity of air barrier



Air Barrier Compliance Options C402.5.1.2



Air Barrier Materials (Compliance) C402.5.1.2.1

Materials

Materials with air permeability ≤ 0.004 cfm/ft² under pressure differential of 0.3 inches w.g. when tested in accordance with ASTM E 2178 comply with materials provision.

The following materials meet this requirement:

Materials	Thickness (Minimum)
Plywood	3/8 in.
Oriented strand board .	3/8 in
Extruded polystyrene insulation board	½ in
Foil-back polyisocyanurate insulation board.	½ in
Closed-cell spray foam with minimum density of 1.5 pcf	1-1/2 in
Open-cell spray foam with density between 0.4 and 1.5 pcf	4.5 in
Exterior or interior gypsum board	½ in
Cement board	½ in
Built up roofing membrane	
Modified bituminous roof membrane	
Fully adhered single-ply roof membrane	
Portland cement/sand parge or gypsum plaster	5/8 in
Cast-in-place and precast concrete	
Fully grouted concrete block masonry	
Sheet metal or aluminum	
Solid or hollow masonry constructed of clay or shale masonry units	

Barrier Assemblies (Compliance)

C402.5.1.2.2

Assemblies

Assemblies of materials and components (sealants, tapes, etc.) with average air leakage ≤ 0.04 cfm/ft$_2$ under pressure differential of 0.3 in. w.g. tested in accordance with ASTM E 2357, 1677 or 283 comply with assemblies provision.

These following assemblies meet this requirement:

- **Concrete masonry walls coated with either one application of block filler or two applications of a paint or sealer coating**
- **Masonry walls constructed of clay or shale masonry units with a nominal width of 4 in or more**
- **Portland cement/sand parge, stucco or plaster minimum ½ thick**

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

Piping Insulation

C403.2.10 Mandatory

All piping serving heating or cooling systems must be insulated in accordance with Table C403.2.10

Minimum Pipe Insulation

(thickness in inches)

Fluid Operating Temperature Range and Usage (°F)	Insulation Conductivity		Nominal Pipe or Tube Size (inches)				
	Conductivity Btu * in/(h*ft^2* °F)	Mean Rating Temperature, °F	< 1	1 to <1 ½	1½ 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	50	0.5	1.0	1.0	1.0	1.5

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
- ✓ Direct buried piping for fluids ≤ 60° F

Pools and In-ground Permanently Installed Spas

C404.9 Mandatory

Heaters *(C404.9.1)*

- The electric power to all heaters shall be controlled by a readily accessible on-off switch that is an integral part of the heater, mounted on the exterior of the heater, or external to and within 3 feet of the heater
- Operation of such switch shall not change the setting of the heater thermometer. Such switches shall be in addition to a circuit breaker for the power to the heater
- Natural gas or LPG fired pool heaters will not have continuously burning pilot lights

Time switches or other control method *(C404.9.2)*

- Automatic controls required to turn heaters and pumps on a preset schedule
- **Exceptions**
  - Where public health standards require 24 hour operation
  - Where pumps are required to operate solar and waste heat recovery pool heating systems
- Note: heaters, pumps and motors with built-in timers meet this requirement

Covers

C404.7.3

Heated pools and inground permanently installed spas required to have a cover

- ✓ Cover must be vapor retardant

Exception

✓Pools deriving > 70% energy for heating from site-recovered energy