2018 International Energy Conservation Code

Commercial Building Envelope Requirements

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Housekeeping

- All participants are muted.
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Questions

- Please feel free to submit questions in chat throughout the presentation. They will be answered during specified breaks during the presentation.
- We can stay on longer than the originally scheduled end time to answer questions.
- An FAQ document will be uploaded to the video events page.

Why Energy Codes?

- Energy Codes set minimum efficiency requirements for new and renovated buildings, assuring reductions in energy use and emissions over the life of the building. Energy Codes are a subset of building codes, which establish baseline requirements and govern building construction.
- Code buildings are more comfortable and cost-effective to operate, assuring energy, economic and environmental benefits.
- The relationship between the IBC and the IECC
  - IECC addresses only energy topics
  - IBC addresses all topics (structural, plumbing, etc.) in One book

- IECC addresses both residential and commercial construction; IBC addresses all of the subsets of commercial construction

Structure of the 2018 IECC

<u>Commercial Section</u>

Ch. 1 Scope and Application/ Administration and Enforcement

Ch. 2 Definitions

Ch. 3 General Requirements

Ch. 4 Commercial Energy Efficiency

Ch. 5 Existing Buildings

Ch. 6 Referenced Standards Index

- What are Commercial Buildings?
  - All buildings other than:
    - One- and two-family dwellings, townhouses of any size and R-2, R-3, R-4 ≤ 3 stories
    - All buildings that are not “residential” by definition; are “commercial”

Commercial Buildings Can Be Complicated!

Mixed Use Buildings

- Treat the residential portion of the building under applicable residential code
- Treat the commercial portion of the building under applicable commercial code
- Code Official has the final authority regarding compliance materials, software, worksheets, compliance options

Exempt Buildings

- Buildings or portions of buildings that are separated from remainder of building by building thermal envelope assemblies complying with C402 **are exempt** from the Envelope provisions if:
  - Peak design rate of energy < 3.4 Btu/h/ft^2 or 1.0 watt/ft^2 of floor area for space conditioning purposes, **OR**
  - Those portions or building that do not contain conditioned space, **OR**
  - Greenhouses

Equipment Buildings

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

- Separate building with floor area < 500 ft^2 (50 m^2)
- Intended to house electronic equipment with installed equipment power totaling > 7 watts/ft^2 (75W/m^2)
- Heating system capacity < 17,000 Btu/hr (5 kW) and a heating thermostat set point that is restricted to < 50ºF
- Average wall and roof U-factor < 0.200 in Climate Zones 1-5

Structure of the 2018 IECC

IECC Terminology

- Prescriptive
  - Required but can be reduced or eliminated in trade for compensating improvements elsewhere
- Mandatory
  - Required and cannot be traded down, even in the simulated performance path
- Climate Specific Requirements
  - Roofs
  - Above Grade Walls
  - Foundations
    - Basements
    - Slabs
    - Crawlspaces
  - Windows, Skylights, and Doors
    - Solar Heat Gain Coefficients

Mandatory Requirements (*apply everywhere*)

- Infiltration Control
- Duct Insulation, Sealing & Testing, No Use of Building Cavities
- HVAC Controls
- Piping Insulation & Circulating Service Hot Water Requirements
- Equipment Sizing
- Dampers
- Lighting

Some Elements Have “Hard Limits”

- AKA “Trade-Off Limits” or “Backstops”
- A Prescriptive Requirement that can only be traded so far

IECC Commercial Compliance Paths/Options

Prescriptive

- Section C402 – Envelope
- Section C403 – Mechanical
- Section C404 – Service Water Heating
- Section C405 – Lighting

Section C406 – At Least One Required

- C406.2 - Eff. HVAC Performance
- C406.3 - Reduced Lighting Power
- C406.4 - Enhanced Lighting Controls
- C406.5 -On-Site Renewable Energy
- C406.6 - Dedicated Outdoor Air System
- C406.7 - High Eff. Service Hot Water
- C406.8 - Enhanced Building Envelope
- C406.9 – Reduced Air Infiltration

~~ASHRAE 90.1-2016~~

~~Simulated Performance~~

- ~~Section C407 – Total Building Performance~~
- ~~Section C402.5 – Air Leakage~~
- ~~Section C403.2 – Mechanical Systems~~
- ~~Section C404 – Service Water Heating~~
- ~~Section C405 – Lighting Mandatory Sections~~
- ~~Building energy cost to be ≤85% of standard reference design~~

Prescriptive Path Approach Compliance

TABLE C402.1.3
OPAQUE THERMAL ENVELOPE INSULATION COMPONENT MINIMUM REQUIREMENTS, R-VALUE METHOD[a, i]

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 roof deck	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings[b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, above grade																
Mass[g]	R-5.7ci[c]	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-19.5ci	R-13 + R-13ci	R-13+ R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5ci	R-13+ R17.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + 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	R-13 + R-7.5ci or R-20 + R-3.8ci	R13 + R-15.6ci or R-20 + R-10ci	R13 + R-15.6ci or R-20 + R-10ci
Walls, below grade																
Below-grade wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Mass[e]	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30[f]	R-30[f]	R-30[f]	R-30[f]	R-30[f]
Slab-on-grade floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-20 for 24" below
Heated slabs[h]	R-7.5 for 12" below + R-5 full slab	R-7.5 for 12" below + R-5 full slab	R-7.5 for 12" below + R-5 full slab	R-7.5 for 12" below + R-5 full slab	R-10 for 24" below + R-5 full slab	R-10 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 24" below + R-5 full slab	R-15 for 36" below + R-5 full slab	R-15 for 36" below + R-5 full slab	R-15 for 36" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab	R-20 for 48" below + R-5 full slab
Opaque doors																
Nonswinging	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 4.88 kg/m^2, 1 pound per cubic foot = 16 kg/m^3.
ci = Continuous insulation, NR = No Requirement, LS = Liner System.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.
b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.4.
c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.
d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.
e. "Mass floors" shall be in accordance with Section C402.2.3.
f. Steel floor joist systems shall be insulated to R-38.
g. "Mass walls" shall be in accordance with Section C402.2.2.
h. The first value is for perimeter insulation and the second value is for slab insulation. Perimeter insulation is not required to extend below the bottom of the slab.
i. Not applicable to garage doors. See Table C402.1.4.

Roof Assemblies

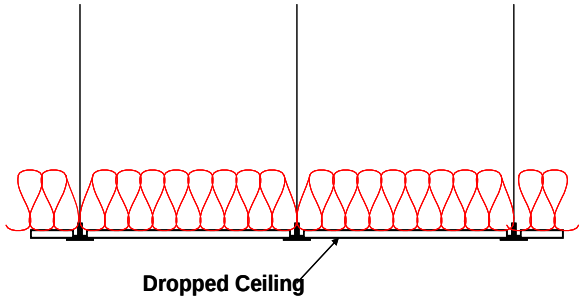
Roof R-values and U-factor requirements are based on assembly type and insulation placement

Climate Zone	Zone 5	
	All other	Group R
Insul. Entirely Above Deck	R-30ci	R-30ci
Metal Buildings [a, b]	R-19+R-11 LS	R-19+R-11 LS
Attics and other	R-38	R-49

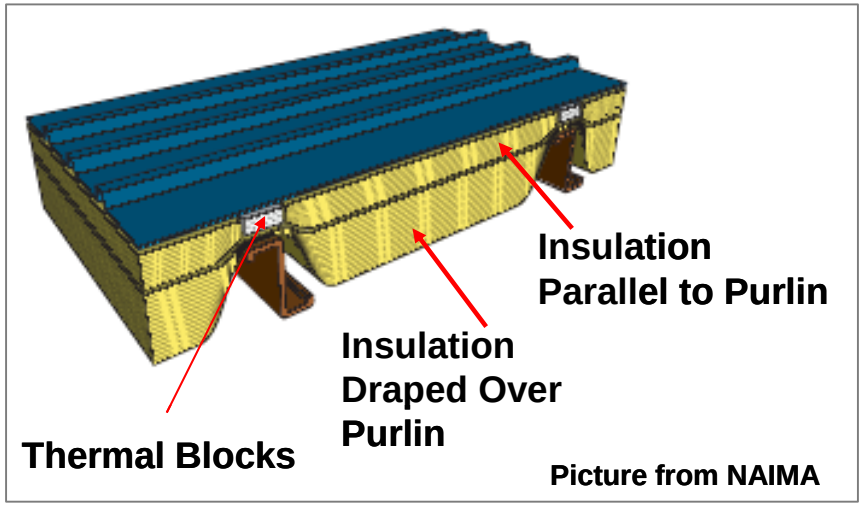
- Continuous Insulation (*CI*)
- Liner System (LS)
- Insulation thickness can vary ≤ 1” and area weighted U-factor meets the requirements of Table C402.1.3

- Skylight curbs to be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less
  - Exception: unit skylight curbs included as a component of a skylight listed and labeled per NRC 100)

Roof Assemblies



- Insulation on suspended ceiling with removable ceiling tiles is not considered for code compliance and not considered part of the minimum thermal resistance of the roof insulation



- Thermal spacer block are required on all metal buildings or must use U-factor Compliance Method

Wall Assemblies

Above-grade walls are those walls covered by Section C402.2.3 on the exterior of the building and completely above grade or walls that are more than 15 % above grade

Climate Zone	Zone 5	
	All other	Group R
Mass	R-11.4ci	R-13.3ci
Metal Buildings	R-13+R-13 ci	R-13+R-13 ci
Metal Framed	R-13+R-7.5 ci	R-13+R-7.5 ci
Wood Framed & Other	R-13+R-3.8 ci OR R-20	R-13+R-3.8 ci OR R-20

- Cavity insulation or cavity plus continuous (ci)
- Continuous insulation not broken up by framing members e.g., rigid board insulation

Photo courtesy of Dow Building Solutions

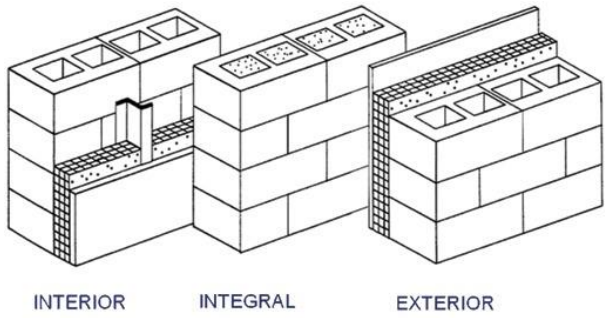


Photo courtesy of Masonry Magazine

Mass walls must comply with one of the following:

- Walls weigh at least 35 lbs/ft^2 of wall surface area
- 25 lbs/ft^2 of wall surface area if material weight is ≤ 120 lb/ft^3
- Heat capacity > 7 Btu/ft^2
- Heat capacity > 5 Btu/ft^2 if the material weight is < 120 pcf

Below Grade Wall Assemblies and Opaque Doors

Below grade walls are a basement or first-story with ≥ 85% below grade

Climate Zone	Zone 5	
	All other	Group R
Below Grade Wall	R-7.5ci	R-7.5ci

- Insulation must extend down 10 ft from the outside finished grade level or to the level of the lowest floor, whichever is less
- Heated slabs installed below grade *(footnoted to Tables C402.1.3 and C402.2.14)*
  - Below grade walls must meet exterior insulation requirements for heated slabs

Climate Zone	Zone 5	
	All other	Group R
Non-swinging	R-4.75	R-4.75

- Non-swinging/Overhead Doors - R-value Tested. Entrance door requirements are included in the Fenestration and SHGC requirements information

Floor Assemblies

Climate Zone	Zone 5	
	All other	Group R
Mass	R-10ci	R-12.5ci
Joist/Framing	R-30	R-30

Joist/Framing (Steel/Wood)

- Insulation installed between framing

Mass Floors

- Materials weighing (of floor surface area) 35 lbs/ft^2, **or**
- 25 lbs/ft^2 if material weight is ≤ 120 lbs/ft^3
- Insulation installed continuously

Floor framing cavity insulation or structural slab insulation should be installed to maintain permanent contact with underside of subfloor decking or structural slabs

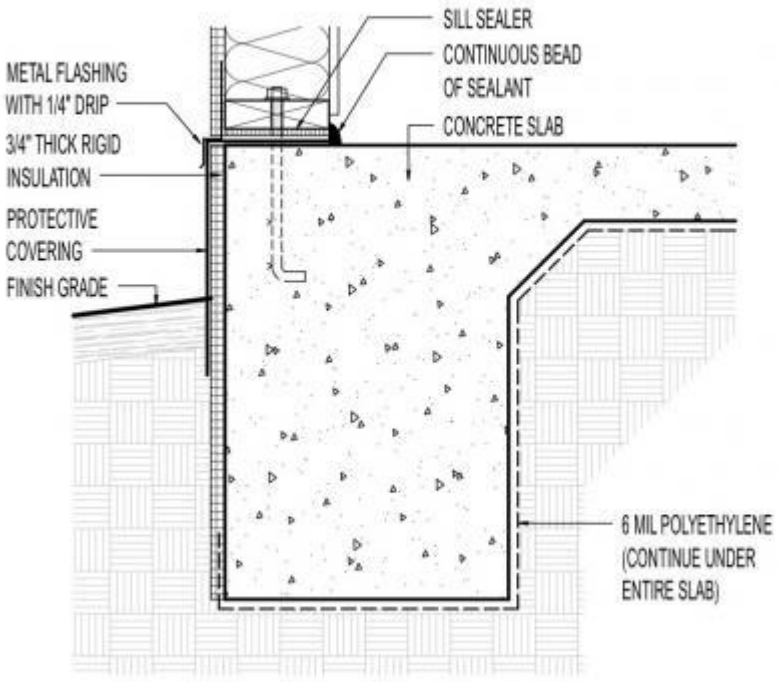
Exceptions:

- Framing cavity insulation or structural slab insulation is permitted to be in contact with top side of sheathing or ci installed on the bottom side of floor where combined with insulation that meets or exceeds R-value in Table for “Metal framed” or “Wood framed and other” values for “Walls, Above Grade” and extends from the bottom to the top of all perimeter floor framing or floor assembly members
- Insulation applied to underside of concrete floor slabs is permitted an airspace of < 1” where it turns up and is in contact with underside of floor under walls associated with the building thermal envelope

Slab Edge Insulation

Climate Zone	Zone 5	
	All other	Group R
Unheated Slabs	R-10 for 24” below	R-10 for 24” below
Heated Slabs	R-15 for 26”” below + R-5 full slab	R-15 for 26”” below + R-5 full slab

<u>Exception</u>: Where slab-on-grade floor is > 24” below finished exterior grade - perimeter insulation is not required



Fenestrations

Percentage of Vertical Fenestration Area to Gross Wall Area

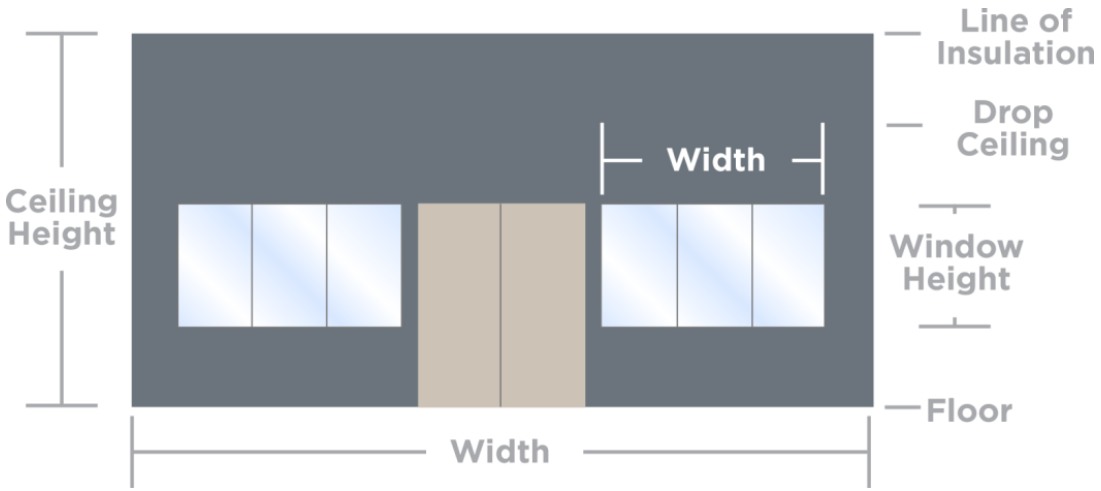
- Allowed up to 30% maximum of above grade wall, not including opaque doors and opaque spandrel panels
  - In Climate Zones 1-6, up to 40% maximum of above grade wall with daylighting controls provided:
    - No less than 50% of the conditioned floor area is within a daylight zone in buildings not greater than 2 stories above grade
    - No less than 25% of the net floor area is within a daylight zone in building ≥ 3 stories above grade
    - Daylight responsive controls complying with C405.2.3.1 are installed in daylight zones
    - VT of vertical fenestration is ≥ 1.1 times SHGC

Climate Zone	Zone 5	
Vertical Fenestration		
	U-factor	
Fixed Fenestration	0.38	
Operable Fenestration	0.45	
Entrance Doors	0.77	
SHGC		
	Orientation	
	SEW	N
PF < 0.2	0.38	0.51
0.2 ≤ PF < 0.5	0.46	0.56
PF ≥ 0.5	0.61	0.61
Skylights		
U-factor	0.50	
SHGC	0.40	

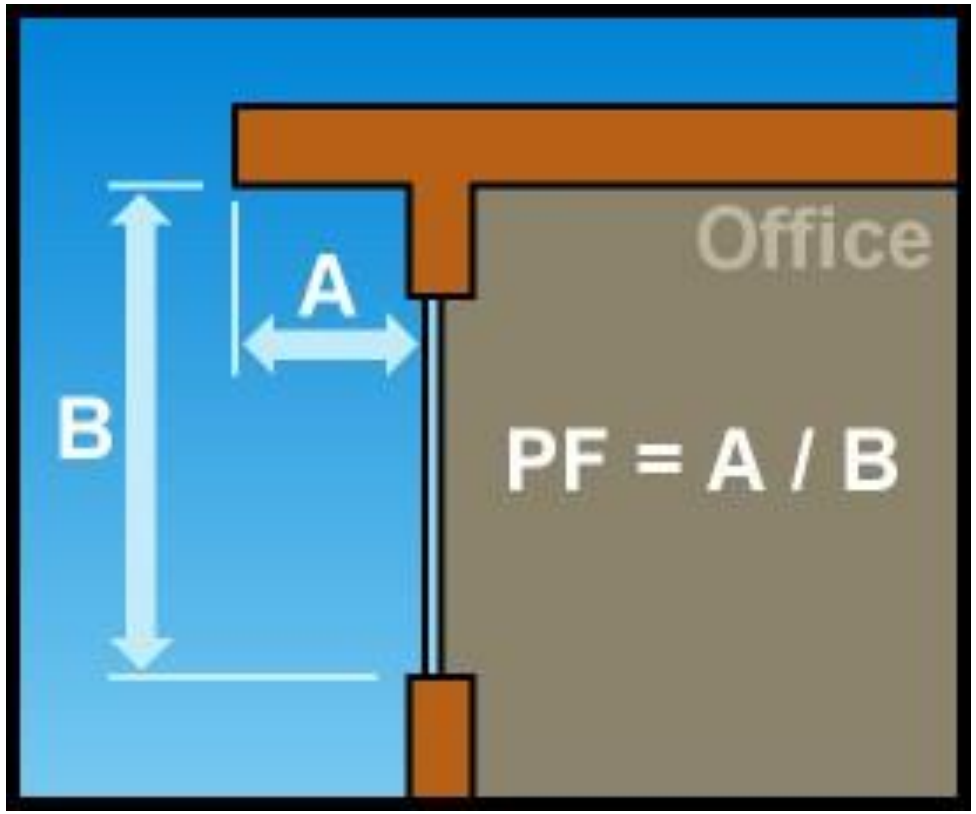
Fenestrations

Percentage of Vertical Fenestration Area to Gross Wall Area – Cont'd

- Based on above-grade wall areas between conditioned and unconditioned space (gross) that are 15% above grade
- Total fenestration area includes frames and glazing but does not include opaque door area



Fenestrations



The Effect of Overhangs on Fenestration SHGC

- Overhangs allow a higher SHGC product to be installed
- Projection factor must be calculated
- When different windows or glass doors have different PFs
    - Evaluate separately

Skylight Minimum Fenestration Area

- Limited to ≤ 3% of Roof Area
- Up to 6% allowed if automatic daylighting controls are installed in toplit zones
- In ***specific types*** of enclosed spaces > 2,500 ft^2 in floor area directly under a roof with > 75% of ceiling area with ceiling height > 15 ft.
  - Total toplit daylight zone to not be < ½ the floor area and provide one of the following
    - Minimum of 3% of skylight area to toplit daylight zone where all skylights that have:
      - a VT not less than 0.40 **OR**
      - Provide a minimum skylight effective aperture of not less than 1%

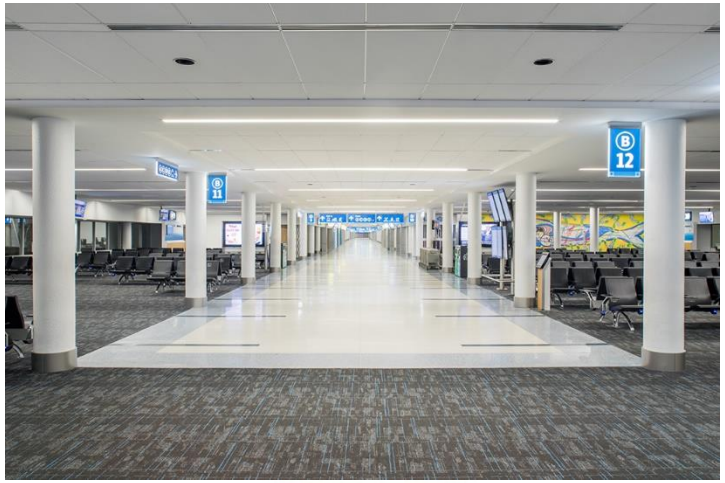
Skylight Minimum Fenestration Area

Specific Spaces used as an office, lobby, atrium, concourse, corridor, storage space, gymnasium/exercise center, convention center automotive service area, space where manufacturing occurs.

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
- Spaces where total area minus area of daylight zones adjacent to vertical fenestration is < 2,500 ft^2 and lighting is controlled per C405.2.5 (Exterior Lighting Controls)

Seattle International Airport



Charlotte International Airport

Skylight Minimum Fenestration Area

Skylights in the space types listed below must have a glazing material or diffuser with a measured haze factor > 90% per ASTM D 1003

- Office, storage, automotive service, manufacturing, nonrefrigerated warehouse, retail store, and distribution/sorting area

Exception:

- Skylights designed and installed to exclude direct sunlight entering the occupied space by use of fixed or automated baffles, or the geometry of skylight and light well

Default U-Factor Option

TABLE C303.1.3(1)
DEFAULT GLAZED WINDOW, GLASS DOOR AND SKYLIGHT *U*-FACTORS

FRAME TYPE	WINDOW AND GLASS DOOR		SKYLIGHT	
	Single	Double	Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

TABLE C303.1.3(2)
DEFAULT OPAQUE DOOR *U*-FACTORS

DOOR TYPE	OPAQUE *U*-FACTOR
Uninsulated Metal	1.20
Insulated Metal (Rolling)	0.90
Insulated Metal (Other)	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

Questions

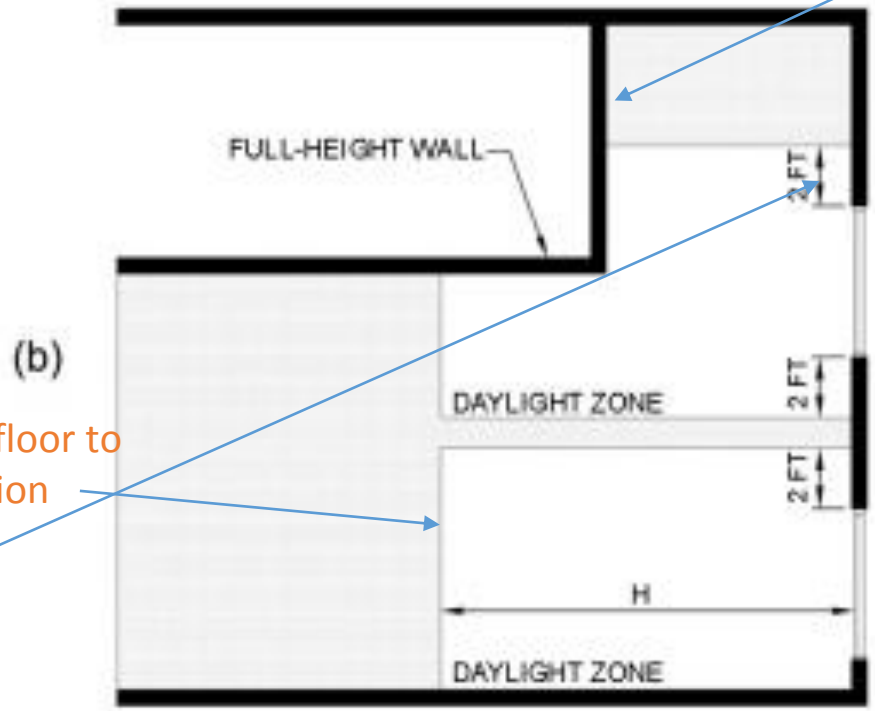
Daylight Zones – Sidelit Zones

Definition: Floor area adjacent to vertical fenestration that complies with ***all*** of the following:

- Fenestration located in a wall:
  - Sidelit zone shall extend laterally to the nearest full-height wall OR
  - < 1.0 x height from the floor to the top of the fenestration, and longitudinally from the edge of the fenestration to the nearest fullheight wall, or up to 2 ft., whichever is less
- Area of fenestration > 24 ft^2
- Distance from fenestration to any building or geological information that would block access to daylight is > than the height from bottom of fenestration to top of building or geologic information
- The visible transmittance of fenestration > 0.20

Daylight Zones – Sidelit Zones

Sidelit zone shall extend laterally to the nearest full-height wall



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

< 1.0 x height from the floor to the top of the fenestration

longitudinally from the edge of the fenestration to the nearest fullheight wall, or up to 2 ft., whichever is less

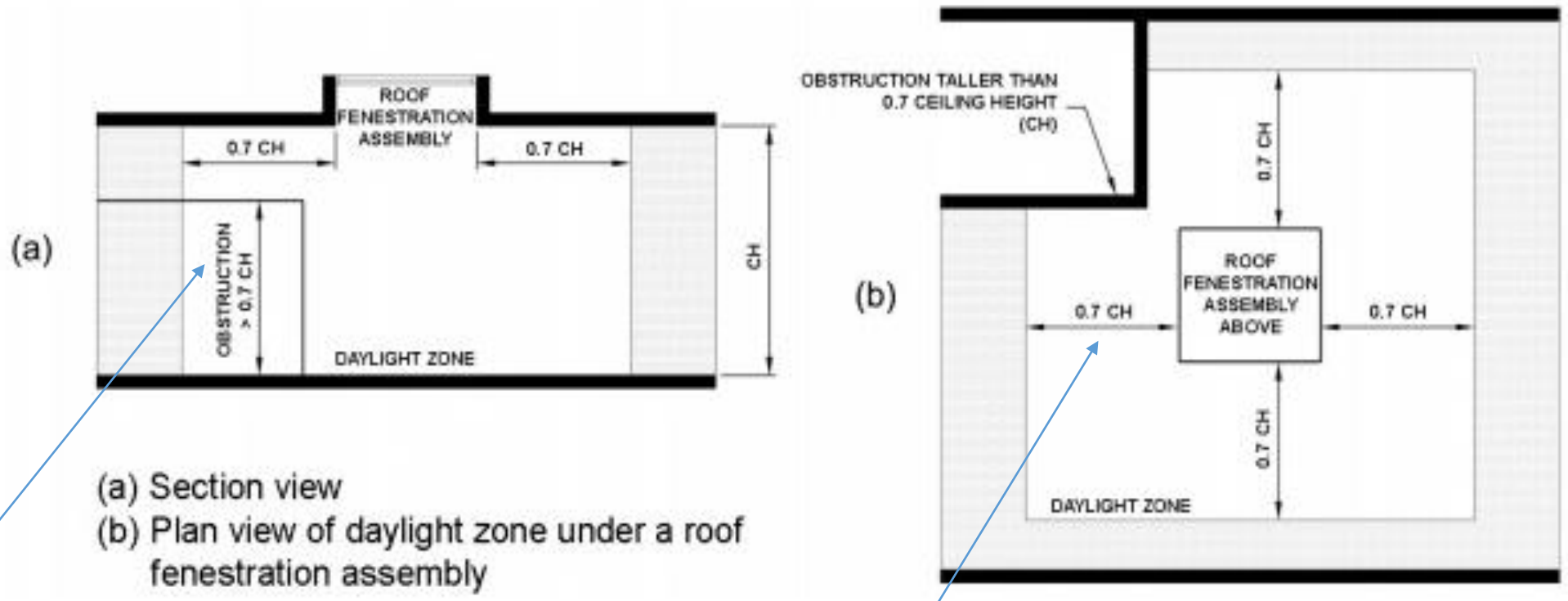
FIGURE C405.2.3.2
SIDELIT ZONE

Daylight Zones – Toplit Zones

Definition: The floor area underneath a roof fenestration assembly that complies with ***all*** of the following:

- Zone shall extend laterally and longitudinally beyond the edge of the roof fenestration assembly to the nearest obstruction that is (taller) > 0.7 x the ceiling height, > 0.7 x the ceiling height, whichever is less
- Where located in rooftop monitor, toplit zone to extend laterally to nearest obstruction taller than 0.7 x the ceiling height, or up to 1.0 times the height from floor to bottom of fenestration, whichever is less, and longitudinally from the edge of the fenestration to the nearest obstruction taller than 0.7 x ceiling height, or up to 0.25 times the height from the floor to bottom of fenestration, whichever is less
- No building or geological formation blocks different sunlight from hitting the roof fenestration assembly at the peak solar angle on the summer solstice
- Where located in existing buildings, visible transmittance of the roof fenestration assembly times the area of the rough opening of the roof fenestration assembly divided by area of daylight zone > 0.008

Daylight Zones – Toplit Zones



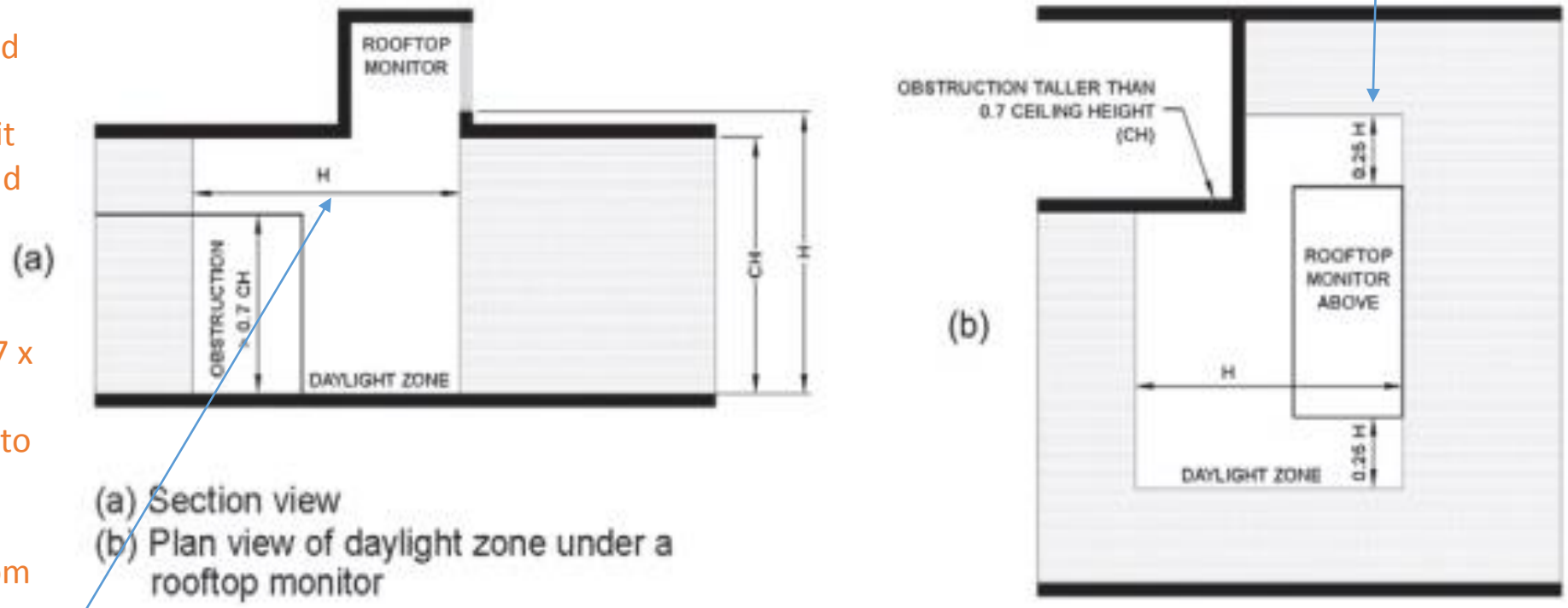
(a) Section view
(b) Plan view of daylight zone under a roof fenestration assembly

Zone shall extend laterally and longitudinally beyond the edge of the roof fenestration assembly to the nearest obstruction that is (taller) > 0.7 x the ceiling height, > 0.7 x the ceiling height, whichever is less

Daylight Zones – Toplit Zones

And longitudinally from the edge of the fenestration to the nearest obstruction taller than 0.7 x ceiling height, or up to 0.25 times the height from the floor to bottom of fenestration, whichever is less

Where located in rooftop monitor, toplit zone to extend laterally to nearest obstruction taller than 0.7 x the ceiling height, or up to 1.0 times the height from floor to bottom of fenestration, whichever is less



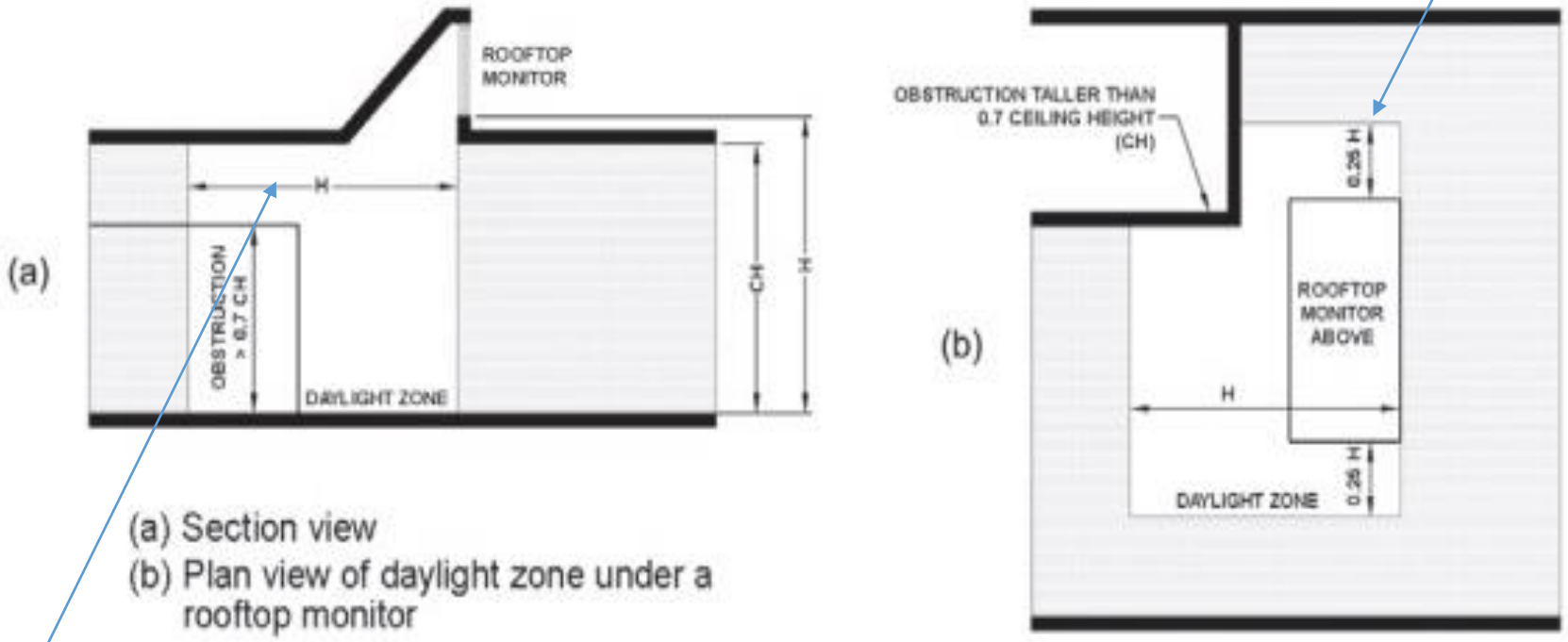
(a) Section view
(b) Plan view of daylight zone under a rooftop monitor

FIGURE C405.2.3.3(2)
DAYLIGHT ZONE UNDER A ROOFTOP MONITOR

Daylight Zones – Toplit Zones

And longitudinally from the edge of the fenestration to the nearest obstruction taller than 0.7 x ceiling height, or up to 0.25 times the height from the floor to bottom of fenestration, whichever is less

Where located in rooftop monitor, toplit zone to extend laterally to nearest obstruction taller than 0.7 x the ceiling height, or up to 1.0 times the height from floor to bottom of fenestration, whichever is less



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

FIGURE C405.2.3.3(3)
DAYLIGHT ZONE UNDER A SLOPED ROOFTOP MONITOR

Mandatory Requirements

- Air Leakage
- Air Barriers
- Fenestration Air Leakage
- Rooms Containing Fuel-Burning Appliances
- Air Intakes, Exhaust Openings, Stairways and Shafts
- Loading Dock Weatherseals
- Vestibules
- Recessed Lighting

Mandatory Requirements – Air Leakage

- Shall be tested in accordance with ASTM E 779 at pressure differential of 0.3 inch water gauge or an equivalent method approved by code official when tested air leakage rate < 0.40 cfm/ft^2 and include *air intakes, exhaust openings, stairway, shaft, loading dock and vestibule requirements.*

OR

- Comply with Sections C402.5.1 thru C402.5.8
  - *Air Intakes, Exhaust Openings, Stairway, and Shafts C402.5.5*
  - *Loading Docks C402.5.6*
  - *Vestibule Requirements C402.5.7*

Mandatory Requirements – Air Barrier Construction

- Continuous air barrier required in Zone 5
- Air barrier placement allowed:
  - Inside of building envelope
  - Outside of building envelope
  - Located within assemblies composing envelope **OR**
  - Any combination thereof
- Continuous for all assemblies part of the thermal envelope and across joints and assemblies
- Joints and seams sealed including sealing transitions in places and changes in materials, securely installed in or on the joint for its entire length to not dislodge, loosen or otherwise impair its ability to resist positive and negative pressure from wind, stack effect and mechanical ventilation

Mandatory Requirements – Air Barrier Construction

- Penetrations of air barrier and air leakage paths to be caulked, gasketed or otherwise sealed in a manner compatible with construction materials and location (sealing to allow for expansion, contraction and mechanical vibration)
- Joints and seams - Sealed in same manner or taped
- Sealing of concealed fire sprinklers where required in a manner recommended by manufacturer
  - Caulking or other adhesive sealants should not be used to fill voids between fire sprinkler cover plates and walls, or ceilings
- Recessed lighting to comply with C402.5.8
- Where similar objects are installed that penetrate the air barrier, make provisions to maintain the air barrier's integrity

Mandatory Requirements – Air Barrier Construction

Two ways to comply with air barrier requirements:

- Materials – C402.5.1.2.1 And/Or
- Assemblies – C402.5.1.2.2
  - Materials with air permeance ≤ 0.004 cfm/ft^2 under pressure differential of 0.3 in. w.g. tested in accordance with ASTM E 2178

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

Mandatory Requirements – Air Assembly Leakage

- 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
- The following assemblies are deemed to comply provided that joints are sealed and Section C402.5.1.1 (Air Barrier Construction) is met:
  - Concrete masonry walls coated with either one application either of block filler or two applications of a paint or sealer coating OR
  - Masonry walls constructed of clay or shale masonry units with a nominal width of ≥ 4” OR
  - Portland cement/sand parge, stucco or plaster > ½” thick

Mandatory Requirements – Air Assembly Leakage

Fenestration Assembly	cfm/ft^2	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 E 283 at 1.57 psf
Commercial glazed swinging entrance doors	1.00	
Power-operated sliding doors and power operated folding doors	1.00	
Revolving doors	1.00	
Garage doors	0.4	ANSI/DASMA 105, NFRC 400, or ASTM E 283 at 1.57 psf
Rolling doors	1.00	
High-speed doors	1.30	

Exceptions:

- Field-fabricated fenestration assemblies
- Fenestration in buildings that meet the building test for air barrier compliance option

Mandatory Requirements – Rooms Containing Fuel-Burning Appliances

- Appliances and combustion air openings to be located outside the building thermal envelope or enclosed in a room isolated from inside the thermal envelope in Climate Zones 3-8, one of the following to comply:
  - Rooms to be sealed and insulated per envelope requirements
  - Doors into the rooms fully gasketed
  - Water lines and ducts insulated
  - Combustion air ducts that pass through conditioned space, insulated to ≥ R-8

Exceptions:

- Fireplaces and stoves complying with 901-905 IMC and Section 2111.14 IBC

Mandatory Requirements

Loading Docks

- Equip cargo door openings and loading door openings with weatherseals to restrict infiltration and provide direct contact with vehicles along top and sides

Air Intakes, Exhaust Openings, Stairways and Shafts

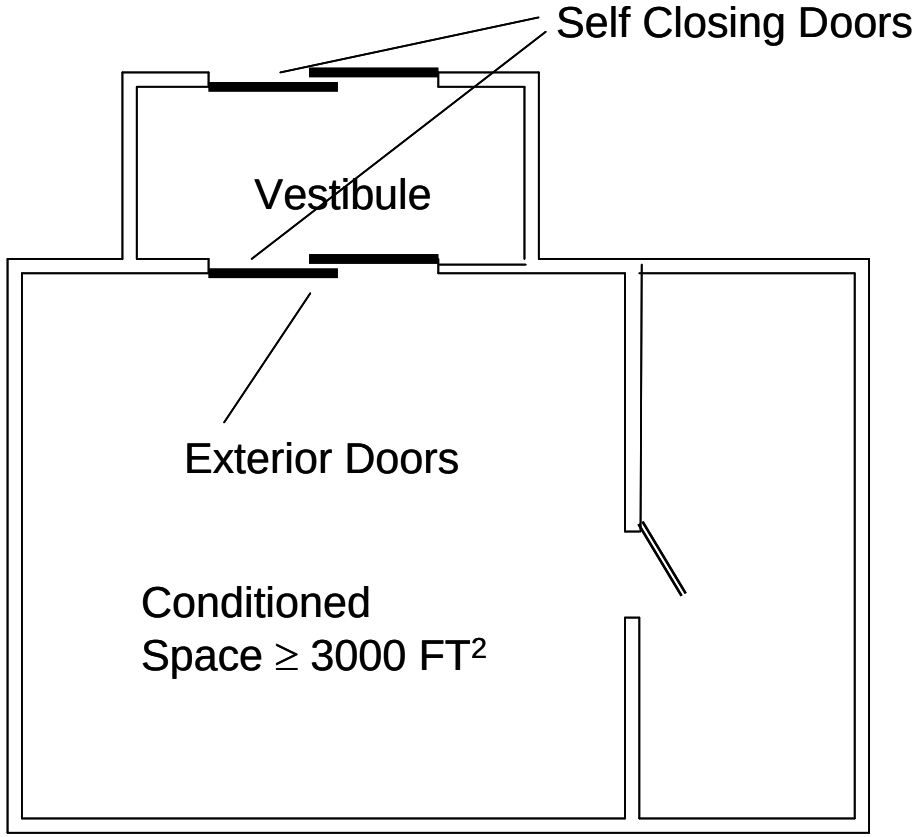
- Openings integral to the building envelope to have dampers per Section C403.7.7 (Shutoff Dampers)

Mandatory Requirements - Vestibules

- Required to reduce infiltration into spaces
- Required on entrance doors leading into spaces ≥ 3,000 ft^2
- Doors must have self-closing devices

Exceptions:

- Buildings in Climate Zones 1 and 2
- Doors from a sleeping unit or dwelling unit
- Revolving doors
- Doors that have an air curtain with velocity > 6.56 ft/second at the floor tested in accordance with ANSI/AMCA 220 installed in accordance with manufacturer's instructions. Manual or automatic controls provided that will operate the air curtain with opening and closing. Air curtain and their controls to comply with Section C408.2.3.



Mandatory Requirements - Recessed Lighting

All recessed luminaires installed in the building thermal envelope shall be Type IC rated to have all of the following:

- Sealed with gasket or caulk between housing and interior wall or ceiling covering AND
- Labeled in accordance with ASTM E 283 to allow ≤ 2.0 cfm of air movement between conditioned and unconditioned spaces

Questions

IECC Commercial Compliance Paths/Options

~~Prescriptive~~

~~Section C402 – Envelope~~

~~Section C403 – Mechanical~~

~~Section C404 – Service Water Heating~~

~~Section C405 – Lighting~~

Section C406 – At Least One Required

- C406.2 - Eff. HVAC Performance
- C406.3 - Reduced Lighting Power
- C406.4 - Enhanced Lighting Controls
- C406.5 -On-Site Renewable Energy
- C406.6 - Dedicated Outdoor Air System
- C406.7 - High Eff. Service Hot Water
- C406.8 - Enhanced Building Envelope
- C406.9 – Reduced Air Infiltration

~~ASHRAE 90.1-2016~~

~~Simulated Performance~~

~~Section C407 – Total Building Performance~~

~~Section C402.5 – Air Leakage~~

~~Section C403.2 – Mechanical Systems~~

~~Section C404 – Service Water Heating~~

~~Section C405 – Lighting Mandatory Sections~~

~~Building energy cost to be ≤85% of standard reference design~~

Additional Efficiency Package Options

- ***One additional*** efficiency feature must be selected to comply with the IECC
  - More efficient HVAC performance
  - Reduced lighting power density system
  - Enhanced lighting controls
  - On-site supply of renewable energy
  - Dedicated outdoor air system
  - More efficient SWH
  - Enhanced Envelope Performance
  - Reduced Air Infiltration

Additional Efficiency Package Options

More efficient HVAC performance

- Per Tables C403.2.3(1) thru C403.2.3(7)
- Only used when efficiencies in the above tables are greater than 10% in addition to the requirements in C403
- Where multiple performance requirements are provided, the equipment shall exceed all requirements by 10%
- Variable refrigerant flow systems exceed energy efficiency provisions of 90.1-2013 by 10%
- Equipment not listed in tables above shall be limited to 10% of total building system capacity

Additional Efficiency Package Options

Reduced lighting power density system

- Whole building LPD determined using 90% of values in Table C405.4.2(1) x floor area for the building types OR
- Using 90% by the space-by-space method in Section C405.4.2
- Determine total LPD of building using reduced whole building interior lighting power in Table 406.3 x floor area for the building types

Table C405.3.2(1)
Interior Lighting Power Allowances
Building Area Method

Building Area Type	2015 LPD	2018 LPD	% Change
Automotive facility	0.80	0.71	-11.3
Convention centre	1.01	0.76	-24.8
Courthouse	1.01	0.90	-10.9
Dining: bar lounge/leisure	1.01	0.90	-10.9
Dining: cafeteria/fast food	0.90	0.79	-12.2
Dining: family	0.95	0.78	-17.9
Dormitory	0.57	0.61	7.0
Exercise Centre	0.84	0.65	-22.6
Fire station	0.67	0.53	-20.9
Gymnasium	0.94	0.68	-27.7
Health care clinic	0.90	0.82	-8.9
Hospital	1.05	1.05	0.0
Hotel/Motel	0.87	0.75	-13.8
Library	1.19	0.78	-34.5
Manufacturing facility	1.17	0.90	-23.1
Motion picture theatre	0.76	0.83	9.2
Multifamily	0.51	0.68	33.3
Museum	1.02	1.06	3.9
Office	0.82	0.79	-3.7
Parking garage	0.21	0.15	-28.6
Penitentiary	0.81	0.75	-7.4

Additional Efficiency Package Options

Enhanced digital lighting controls located and operated in accordance with C405.2.2:

- Luminaires capable of:
  - continuous dimming,
  - being addressed individually OR a controlled group of ≤ 4 luminaires
- ≤ 8 luminaires controlled together in a daylight zone
- Fixtures controlled through digital control system that includes the following functions:
  - Control reconfiguration based on digital addressability
  - Load shedding
  - Individual user control of overhead general illumination in open offices
  - Occupancy sensors capable of being reconfigured through the digital control system
- Construction documents submitted including Sequence of Operations, Specs outlining each function of the fixture requirements above and complete functional testing of the controls

Additional Efficiency Package Options

On-site renewable energy per C406.5 OR

- Total minimum ratings to provide:
  - ≥ 1.75 Btu or ≥ 0.50 watts per ft^2 of conditioned floor area OR
  - ≥ 3% of energy used for mechanical and SWH equipment and lighting

Dedicated outdoor air system per C406.6 OR

- Be equipped with an independent ventilation system designed to provide ≤100% outdoor air to each occupied space
- Ventilation system capable of total energy recovery
- HVAC system include supply-air temperature controls that automatically reset the supply-air temp. in response to building loads or outdoor air temperatures
- Controls reset the supply-air temp. at least 25% of the difference between design supply-air temp. and design room-air temp.

Additional Efficiency Package Options

Reduced energy use in SWH

This compliance method can only be used with the following building types:

- Group R-1: Boarding houses, hotels, or motels
- Group I-2: Hospitals, psychiatric hospitals, and nursing homes
- Group A-2: 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% of total building energy loads as shown with an energy analysis per C407

Load fraction:

Building SWH system has ≥1 of the following sized to provide > 60% of hot water requirements or sized to provide 100% of hot water requirements if building complies with C403.4.7

- Waste heat recovery from service hot water, heat recover chillers, building equipment, process, equipment, or combined heat and power system
- Solar water-heating systems

Additional Efficiency Package Options

Enhanced Envelope Performance

- Total UA of building thermal envelope as designed to be not less than 15% below total UA of building thermal envelope per Section C402.1.5

Reduced Air Infiltration

- Air infiltration verified by whole-building pressurization test, per ASTM E779 or ASTM E1827 and by an independent third party
- Measured air-leakage rate not to exceed 0.25 cfm/ft^2 under pressure differential of 0.3 inches w.c. (75 Pa), with calculated surface area the sum of above- and below-grade building envelope
- Submit report to code official and building owner Including: tested surface area, floor area, air by volume, stories above grade, and leakage rates

Exception: Buildings over 250,000 ft^2 of conditioned floor area don't need testing on whole building, can test representative above-grade sections. Tested areas to total not less than 25% of conditioned floor area.

Contact Information and Questions

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More Information can be found at:

www.iccsafe.org

- click on ‘Online Building Codes’ and select the code you wish to view.”