Commercial Energy Code

IECC vs. ASHRAE

Commercial Energy Code Basics

ComCheck

Instructor: Matt Belcher

Friday, October 17th 9 AM-4 PM

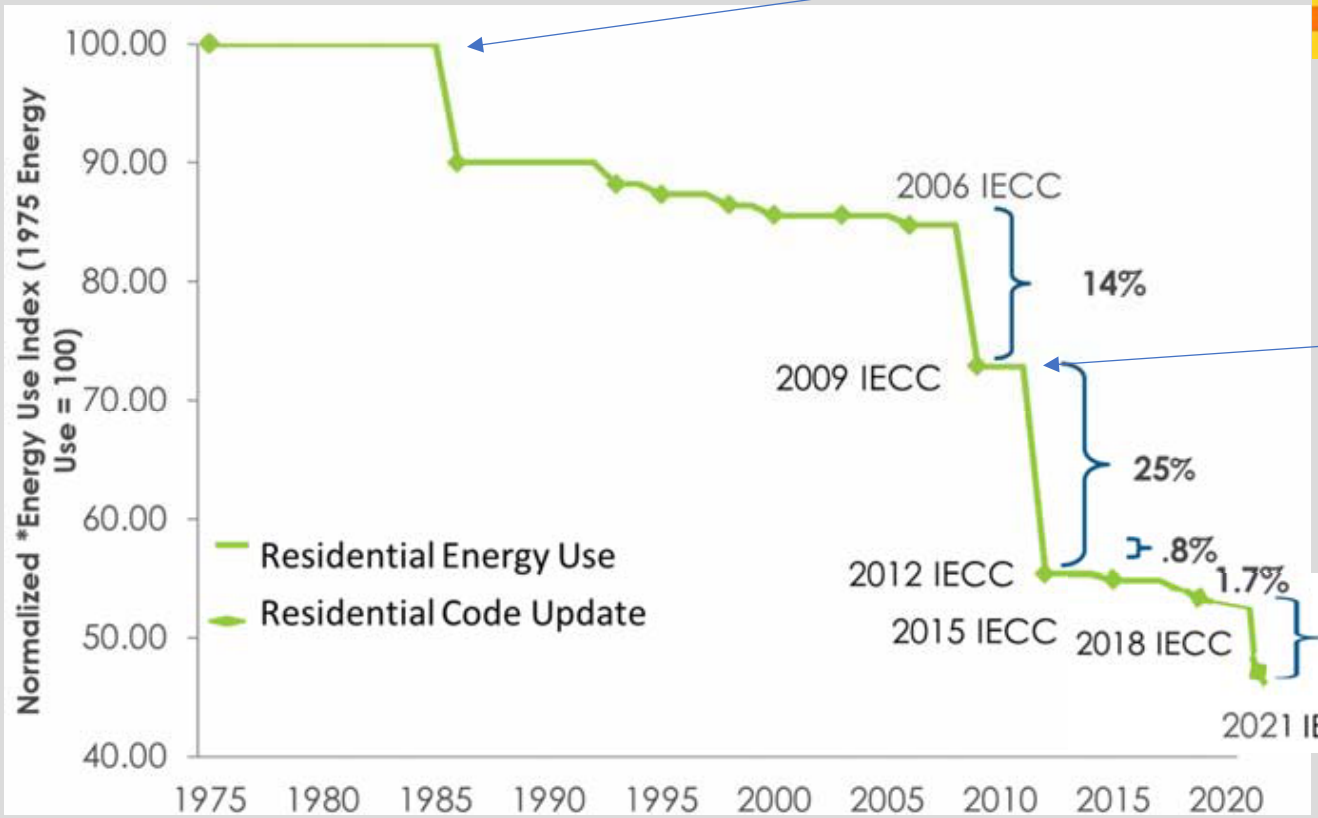
About MEEA

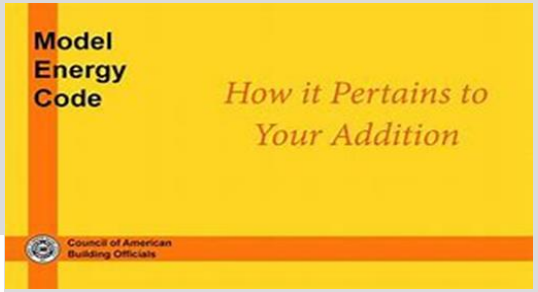
- Nonprofit membership organization with 160+ members, including:
  - Utilities
  - Research institutions
  - State and local governments
  - Energy efficiency-related businesses
- MEEA helps stakeholders understand and implement cost-effective energy efficiency strategies

About Matt/Verdatek Solutions

- 40+ Years in the Building Industry
- Served as a Top Building Codes official in the St. Louis area.
-Director of University of Missouri Columbia High Performance Buildings Research Center. Created and Instructed Curriculum for Students and Industry Professionals.
- Currently Assisting University of Missouri Science & Technology in Building and Energy Code Curriculum and Policy.
-Missouri Technical School (Linn MO) Advisory Board.
-ICC Member serving on 2012, 2015, 2018 and 2024 Energy Code Development Committee. 2021& 2027 Building Code-General Committee
- NAHB Approved Instructor for Advanced Building Science, Advanced Business Management

Energy Code Background





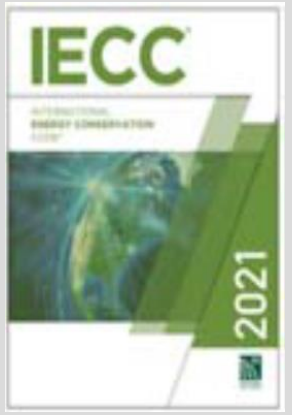
Commercial Energy Codes

Photo: Jonathan Hillyer, 2009

Biggest Changes in IECC 2021

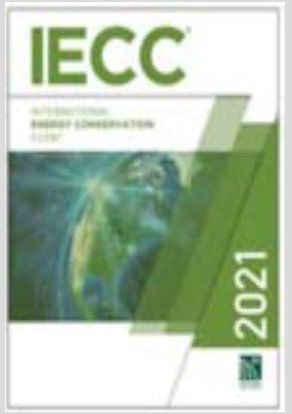
- Redrawn Climate Zones (6 CZ's in MO)
- ASHRAE 90.1 2019 = Alternate Path
- Improved Window U-factors & Wall and Ceiling R-values
- Updated Mechanical/Lighting requirements
- Controls!
- Must choose your Additional Efficiency Package
- Increased Alternative Methods
- ComCheck
- More Focus on Commissioning

Changes in IECC 2021



- **Administrative**
- C102: More Authority for Code Official to approve alternative material(s). (or not!)
- More definition for Code Officials Approval of Above Code Programs. (or not!)
- Information on Construction Documents must include: Energy Compliance Path and Air Sealing Details and Location of Air Barrier.

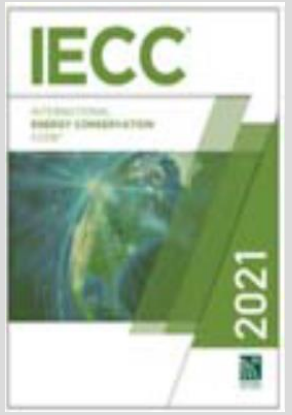
Changes in IECC 2021



- **Definitions Added/Modified:**

- BioGas
- *Biomass*
- *Data Center/Computer Room*
- Direct Digital Control (DDC)
- Enthalpy Recovery Ratio
- Fans: Many Additions and Changes (Energy/Power, Number, etc.)
  Large Diameter Fans
- Fault Detection and Diagnostics (FDD) System

Changes in IECC 2021

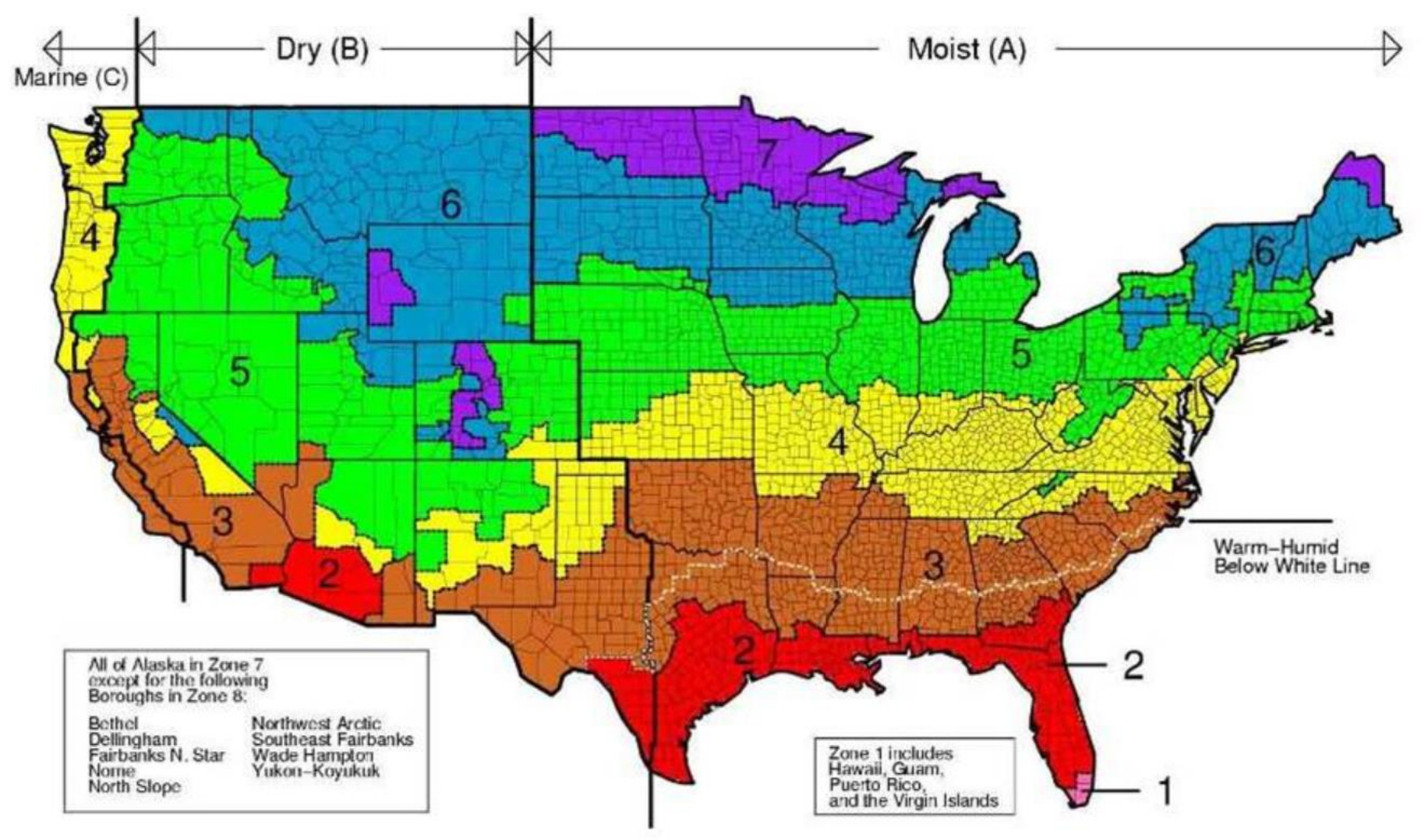


- **Definitions Added/Modified:**

- *Lighting Definition Modification*
- Information Technology Equipment (ITE)
- Internal Curtain System
- *On-Site Renewable Energy*
- *Renewable Energy Resources*
- *Testing Unit Enclosure Area*
- *Thermal Distribution Efficiency (TDE)*
- *Vegetative Roof*
- *Visible Transmittance*

Old 2018 IECC climate zones

MO is CZ4-5

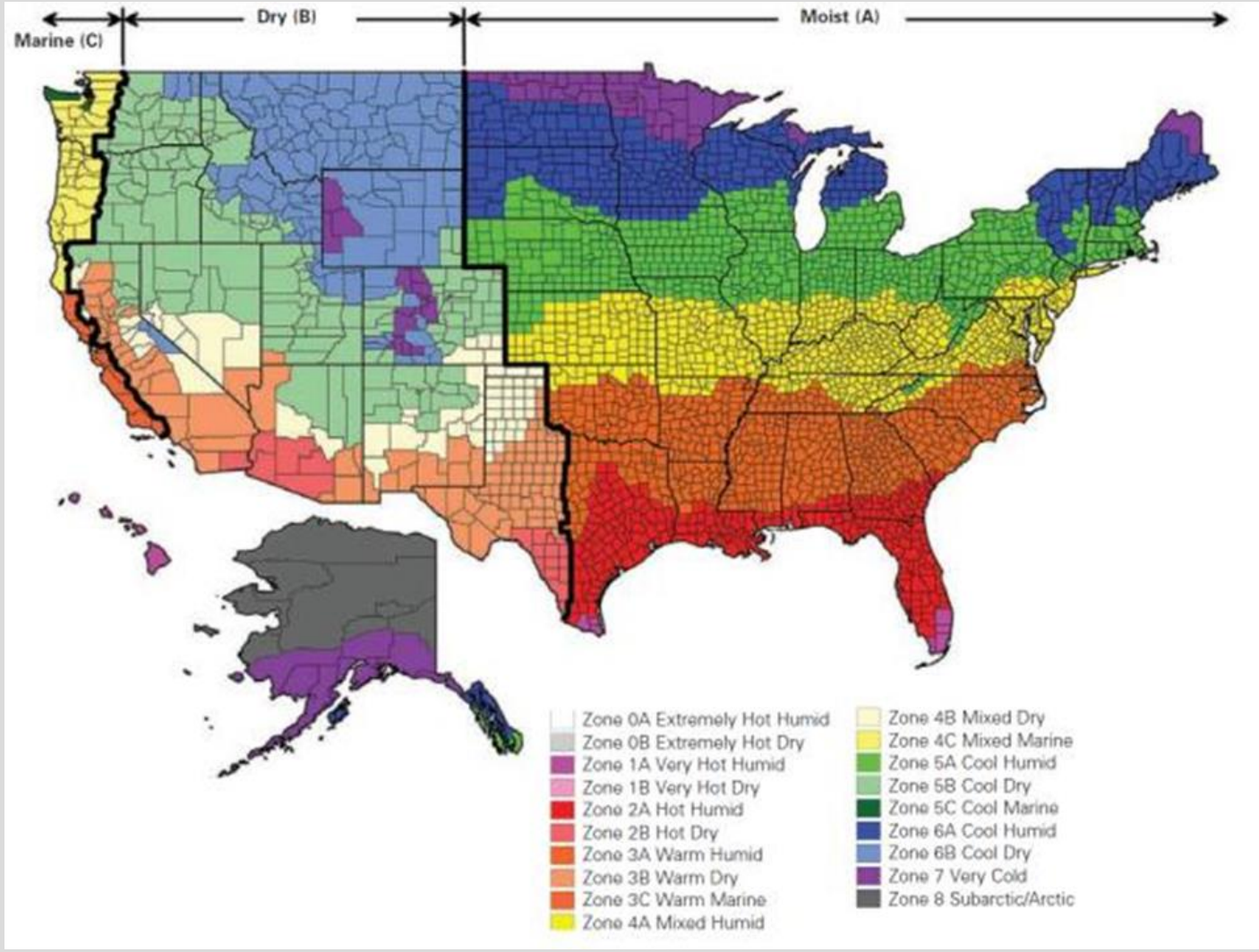


How are envelope requirements determined?

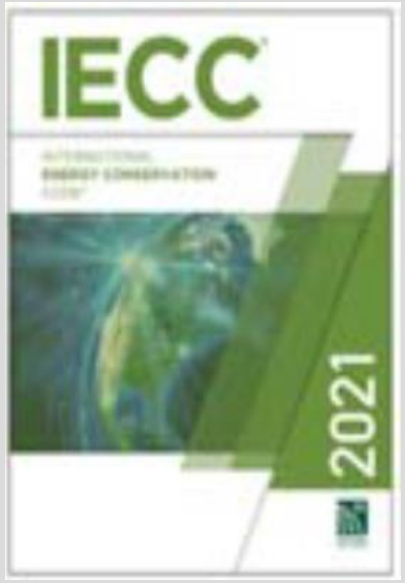
Requirements for building energy codes are linked to the dominate climate within a given jurisdiction, determined by a 30-year average of local surface observations.

Note: Climate zones change! Climate zones change! ASHRAE 90.1-2019 & IECC 2021 have important changes, including a new climate zone (CZ0) and shifts in county designations.

Question: Why should you (or a building owner/operator) care?



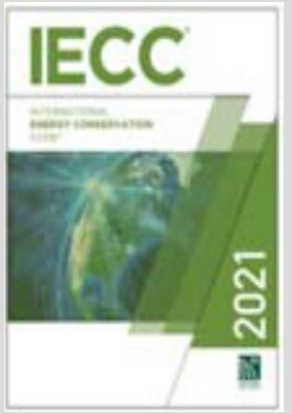
Two Commercial Compliance Options
(new in 2018)



ASHRAE 90.1-2019

Alternative Method to IECC

C401



Thermal Envelope Certificate Required

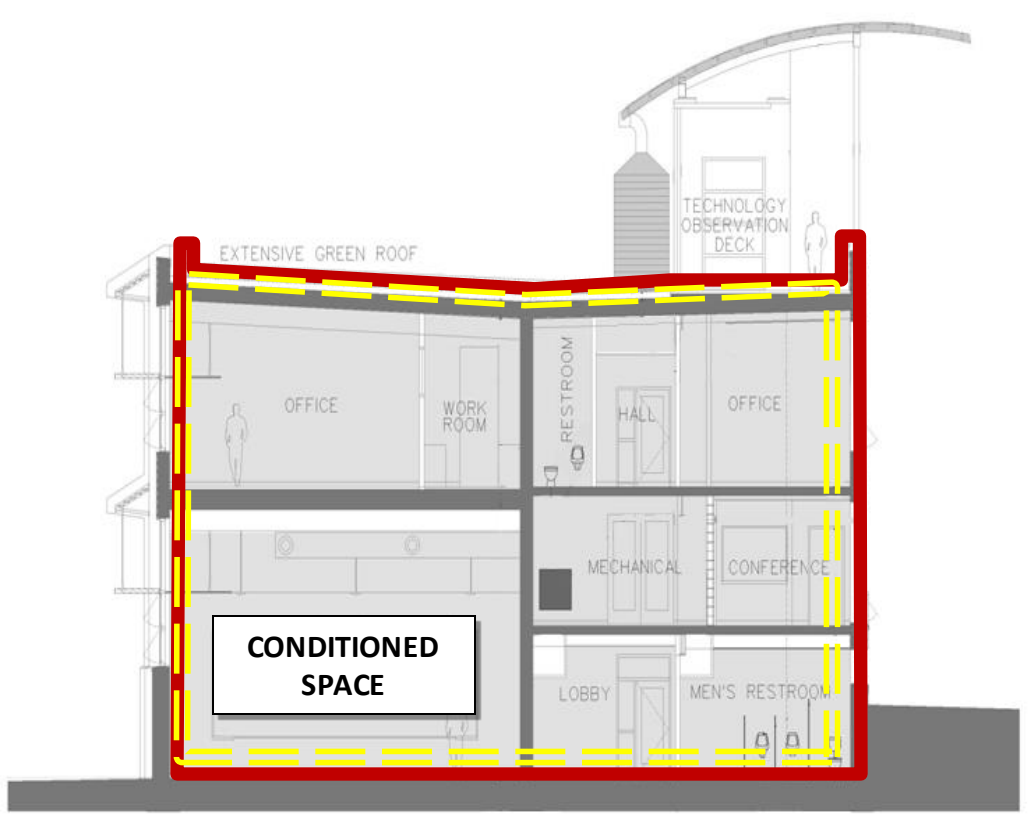
- Completed by an *Approved Party*
- Posted on a wall in the space where space conditioning equipment is located
- Shows R-Values, U-Values, Envelope Leakage Test Results, Etc.

In Addition:

- Updates to Greenhouse Requirements.
- More Insulation Installation requirements.

C402 What is the Building Thermal Envelope?

- These assemblies can comprise the building thermal envelope if they **separate conditioned from unconditioned space or outside air**
  - Roof/Ceiling Assembly
  - Wall Assembly
  - Vertical Fenestration and Skylights
  - Floor Assembly
  - Slab Edge
  - Below-Grade Wall Assembly



Space Conditioning Categories

- Envelope requirements are specified by space-conditioning categories
- Conditioned space must be:
  - a cooled space with a cooling system sensible cooling output capacity larger than 3.4 Btu/h·ft^2 of floor area
  - a heated space with a heating system output capacity larger than that specified in table provided
  - Or, an indirectly conditioned space

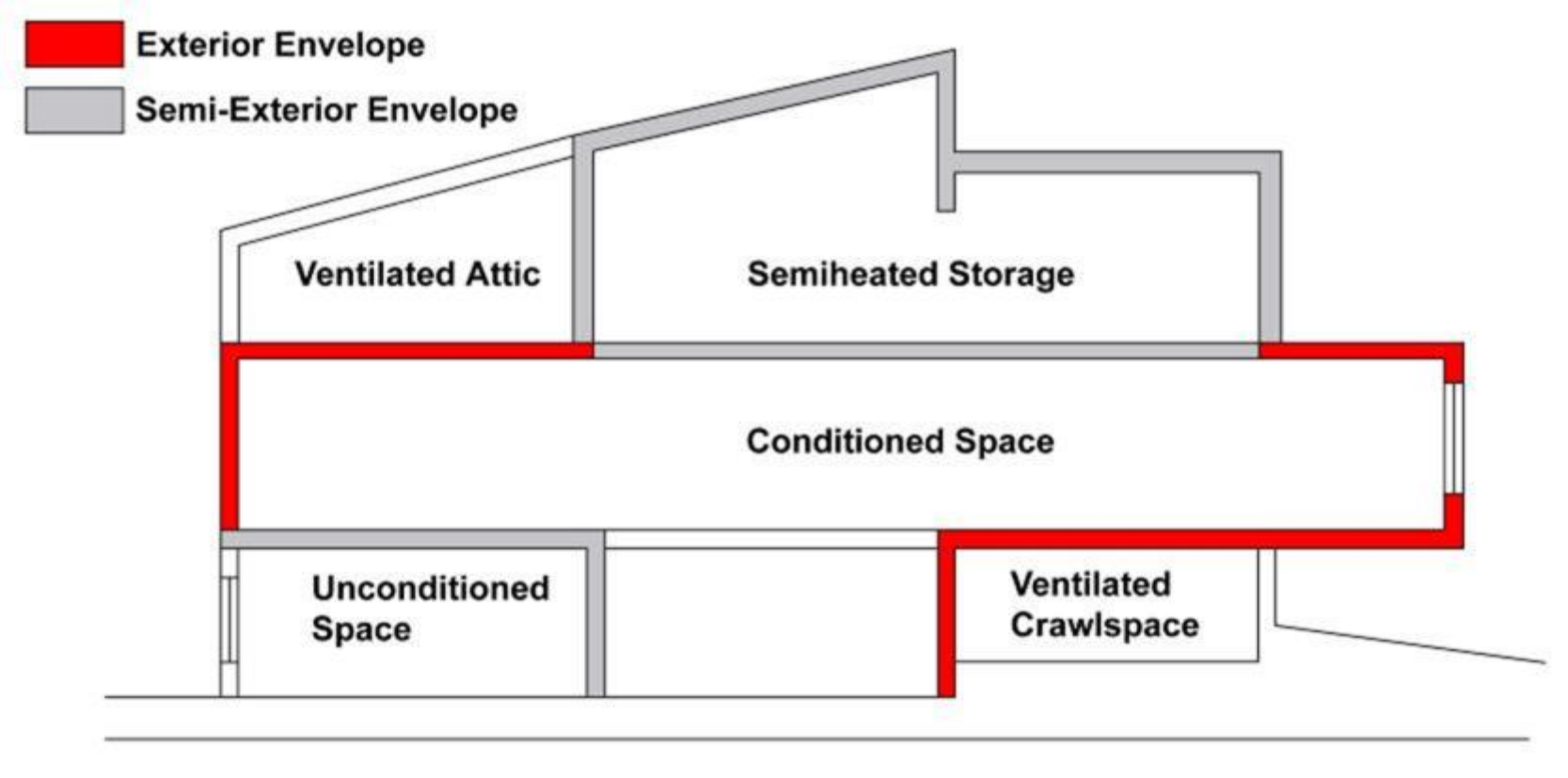
Heating Output, Btu/h·ft^2	Climate Zone
>5	0, 1, 2
>9	3A, 3B
>7	3C
>10	4A, 4B
>8	4C
>12	5
>14	6
>16	7
>19	8

Space Conditioning Categories

Separate envelope component requirements apply to three types of conditioned spaces

- 90.1: *Nonresidential* – IECC: “All other”
- 90.1: *Residential* – IECC: “Group R”
- 90.1: *Semiheated* – spaces are heated, but not to comfort levels, and not cooled.
  (Only if approved by the building official - Uncommon)

Semi-Exterior Envelope



**IECC does not have a definition for semiheated*

Space Conditioning Categories

A semiheated space has a heating system with a capacity ≥ 3.4 Btu/h.ft^2 of floor area but is not conditioned space

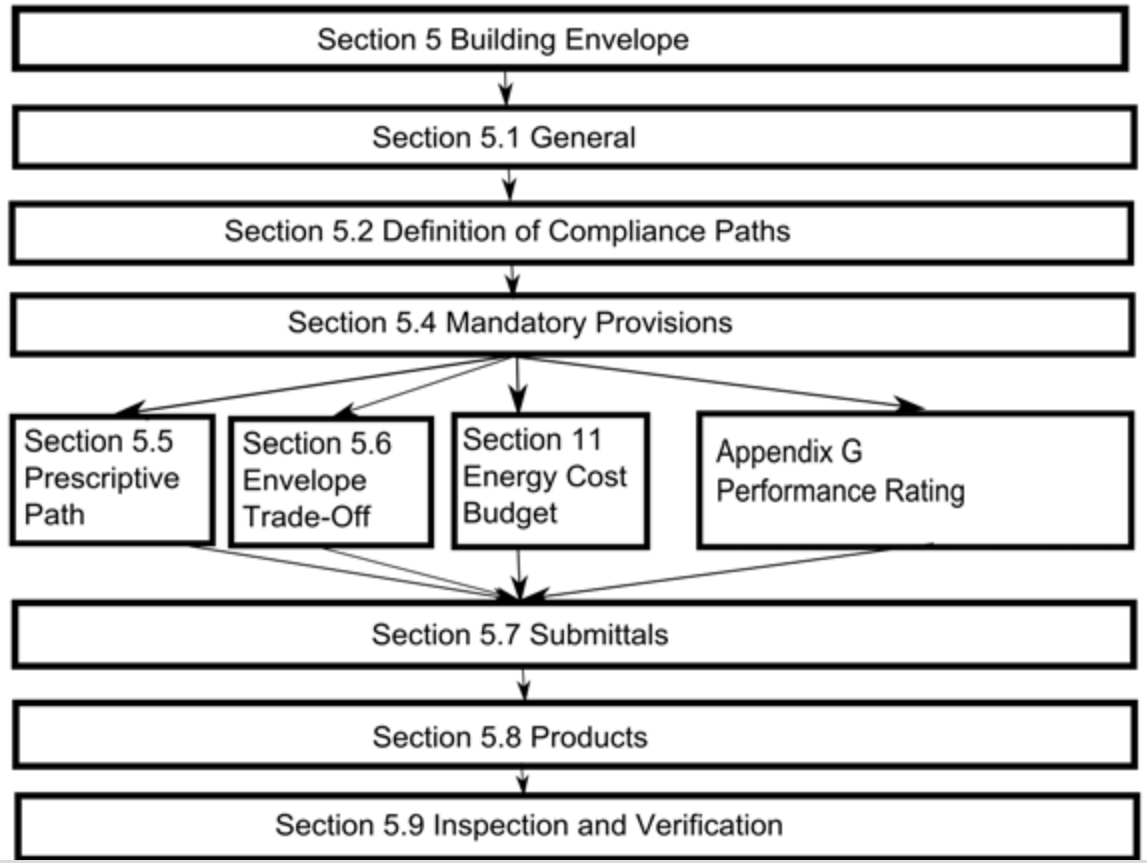
Spaces are assumed to be conditioned space and comply with requirements of conditioned space at time of construction regardless of whether the mechanical or electrical equipment is included in the building permit application or installed at that time

Exceptions:

- Space is designated as semiheated or unconditioned and approved as such by the building official

Compliance Options

- Mandatory provisions apply to all compliance pathways
- Prescriptive is a recipe that you have to follow
- Other pathways require energy modeling



Compliance Options - Prescriptive

- Building must comply with
- C402 Envelope
- C403 Mech
- C404 SWH
- C405 Lighting
- Plus pick one additional efficiency package

Additional Efficiency Package Options

- One additional efficiency feature must be selected to comply with the IECC
- C406.2 More efficient **HVAC** performance, OR
- C406.3 Reduced **lighting** power density system, OR
- C406.4 Enhanced lighting **controls**, OR
- C406.5 On-site supply of **renewable** energy
- C406.6 Dedicated outdoor air system (**DOAS**), OR
- C406.7 More efficient SWH (**hot water**) OR
- C406.8 Enhanced **envelope** performance OR
- C406.9 Reduced air **infiltration**

Compliance Options - Performance

- C407 Total Building Performance
- Building energy cost to be less than 85% of standard reference design building
- C402.5 Air Leakage
- C403.2 Provisions applicable to all mechanical
- C404 SWH
- Mandatory Lighting C405.2, C405.3, C405.4, C405.6

Insulation – prescriptive requirements

Mandatory Provisions - Insulation

- Insulation must be in substantial contact with inside surface in a permanent manner
- No loose-fill insulation in attic when ceiling is steeper than 3:12 slope
- Dams & baffles at eave vents to deflect incoming air
- Recessed equipment – effect on insulation
- Insulation protected from sunlight, moisture, landscaping operations, equipment maintenance, and wind
- Stagger joints of multilayered rigid insulation

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

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7	
	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
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
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-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-49	R-49	R-49	R-49	R-49	R-49	R-60	R-60
Walls, above grade														
Mass[f]	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
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-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-14ci	R-13 + R-17ci	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-10ci	R-13 + R-10ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-12.5ci	R-13 + R-15.6ci
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-7.5ci or R20 + R3.8ci	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	R-13 + R-7.5ci or R-20 + R-3.8ci
Walls, below grade														
Below-grade wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-10ci	R-7.5ci	R-10ci	R-10ci	R-15ci	R-15ci	R-15ci
Floors														
Mass[e]	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-14.6ci	R-16.7ci	R-14.6ci	R-16.7ci	R-16.7ci	R-16.7ci	R-20.9ci	R-20.9ci
Joist/framing	R-13	R-13	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-38	R-38	R-38	R-38
Slab-on-grade floors														
Unheated slabs	NR	NR	NR	NR	NR	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-20 for 24" below	R-20 for 24" below	R-20 for 48" below	R-20 for 24" below	R-20 for 48" bel
Heated slabs[g]	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

TABLE C402.1.4 OPAQUE THERMAL ENVELOPE ASSEMBLY MAXIMUM REQUIREMENTS, *U*-FACTOR METHOD[a, b]

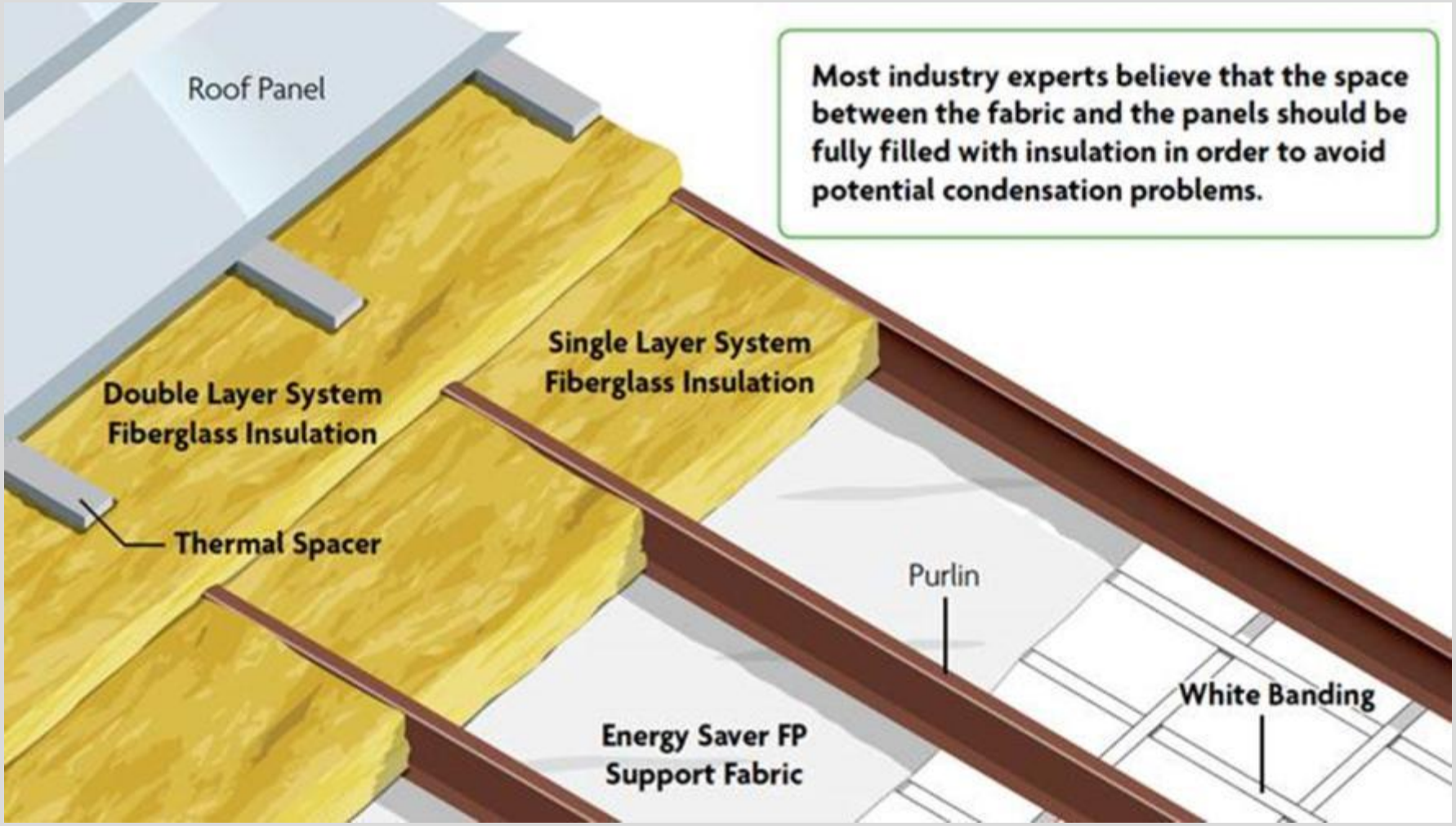
CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above roof deck	U-0.048	U-0.039	U-0.039	U-0.039	U-0.039	U-0.039	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.032	U-0.028	U-0.028	U-0.028	U-0.028
Metal buildings	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.035	U-0.031	U-0.029	U-0.029	U-0.029	U-0.026	U-0.026
Attic and other	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.021	U-0.017	U-0.017	U-0.017	U-0.017
Walls, above grade																
Mass[f]	U-0.151	U-0.151	U-0.151	U-0.123	U-0.123	U-0.104	U-0.104	U-0.090	U-0.090	U-0.080	U-0.080	U-0.071	U-0.071	U-0.071	U-0.037	U-0.037
Metal building	U-0.079	U-0.079	U-0.079	U-0.079	U-0.079	U-0.052	U-0.052	U-0.050	U-0.050	U-0.050	U-0.050	U-0.050	U-0.044	U-0.039	U-0.039	U-0.039
Metal framed	U-0.077	U-0.077	U-0.077	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.055	U-0.055	U-0.049	U-0.049	U-0.049	U-0.042	U-0.037	U-0.037
Wood framed and other[c]	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.064	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.051	U-0.032	U-0.032
Walls, below grade																
Below-grade wall[c]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-1.140[e]	C-0.119	C-0.092	C-0.119	C-0.092	C-0.092	C-0.063	C-0.063	C-0.063	C-0.063	C-0.063
Floors																
Mass[d]	U-0.322[e]	U-0.322[e]	U-0.107	U-0.087	U-0.074	U-0.074	U-0.057	U-0.051	U-0.057	U-0.051	U-0.051	U-0.051	U-0.042	U-0.042	U-0.038	U-0.038
Joist/framing	U-0.066[e]	U-0.066[e]	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.033	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027	U-0.027
Slab-on-grade floors																
Unheated slabs	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.73[e]	F-0.54	F-0.52	F-0.52	F-0.52	F-0.51	F-0.51	F-0.434	F-0.51	F-0.434	F-0.434	F-0.424
Heated slabs	F-0.69	F-0.69	F-0.69	F-0.69	F-0.66	F-0.66	F-0.62	F-0.62	F-0.62	F-0.62	F-0.62	F-0.602	F-0.602	F-0.602	F-0.602	F-0.602
Opaque doors																
Nonswinging door	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31
Swinging door[g]	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Garage door < 14% glazing[h]	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31	U-0.31

Ashrae 90.1-2019 envelope requirements Climate Zone 4

Table 5.5-4 *Building Envelope* Requirements for Climate Zone 4 (A,B,C)*

Opaque Elements	*Nonresidential*		*Residential*		Semiheated	
	Assembly Maximum	Insulation Min. *R-Value*	Assembly Maximum	Insulation Min. *R-Value*	Assembly Maximum	Insulation Min. *R-Value*
Roofs						
Insulation entirely above deck	U-0.032	R-30 c.i.	U-0.032	R-30 c.i.	U-0.093	R-10 c.i.
Metal building[a]	U-0.037	R-19 + R-11 *Ls* or R-25 + R-8 *Ls*	U-0.037	R-19 + R-11 *Ls* or R-25 + R-8 *Ls*	U-0.082	R-19
Attic and other	U-0.021	R-49	U-0.021	R-49	U-0.034	R-30
Walls, above Grade						
Mass	U-0.104	R-9.5 c.i.	U-0.090	R-11.4 c.i.	U-0.580	NR
Metal building	U-0.060	R-0 + R-15.8 c.i.	U-0.050	R-0 + R-19 c.i.	U-0.162	R-13
Steel-framed	U-0.064	R-13 + R-7.5 c.i.	U-0.064	R-13 + R-7.5 c.i	U-0.124	R-13
Wood-framed and other	U-0.064	R-13 + R-3.8 c.i. or R-20	U-0.064	R-13 + R-3.8 c.i. or R-20	U-0.089	R-13
Wall, below Grade						
Below-grade wall	C-0.119	R-7.5 c.i.	C-0.092	R-10 c.i.	C-1.140	NR
Floors						
Mass	U-0.057	R-14.6 c.i.	U-0.051	R-16.7 c.i.	U-0.107	R-6.3 c.i.
Steel joist	U-0.038	R-30	U-0.038	R-30	U-0.052	R-19
Wood-framed and other	U-0.033	R-30	U-0.033	R-30	U-0.051	R-19
Slab-on-Grade Floors						
Unheated	F-0.520	R-15 for 24 in.	F-0.520	R-15 for 24 in.	F-0.730	NR
Heated	F-0.843	R-20 for 24 in.	F-0.688	R-20 for 48 in.	F-0.900	R-10 for 24 in.
Opaque Doors						
Swinging	U-0.370		U-0.370		U-0.370	
Nonswinging	U-0.310		U-0.310		U-0.360	

Metal Building Roof Insulation



IBC 806.5 unvented roof assemblies

- To reduce risk of condensation, install a certain amount of “air-impermeable” insulation before using an “air-permeable” product in an unvented roof assembly

TABLE R806.5
INSULATION FOR CONDENSATION CONTROL

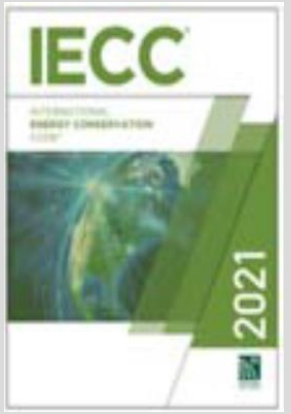
CLIMATE ZONE	MINIMUM RIGID BOARD ON AIR-IMPERMEABLE INSULATION *R*-VALUE[a, b]
2B and 3B tile roof only	0 (none required)
1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

a. Contributes to but does not supersede the requirements in Section N1102.

b. Alternatively, sufficient continuous insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

Table 5.5.3.1.1 – Increased Roof Insulation Values

Roofs	*Nonresidential*		*Residential*	
Opaque Elements	Assembly Maximum	Insulation Min. *R-Value*	Assembly Maximum	Insulation Min. *R-Value*
Climate Zone 0				
Insulation entirely above deck	U-0.027	R-36 c.i.	U-0.027	R-36 c.i.
Metal buildings	U-0.028	R-35		
Climate Zones 1 to 3				
Insulation entirely above deck	U-0.030	R-33 c.i.	U-0.029	R-34 c.i.
Metal buildings	U-0.028	R-35		



Air Barrier

Location now required on Construction Docs. (C102)

Continuous Air Barrier

Continuous air barrier required except in:

- Semiheated spaces in climate zones 0-6
- Single wythe concrete masonry buildings in climate zone 2B
- **The air barrier shall be designed and noted**
- *Air barrier components identified or noted in construction documents*
- Joints, intersections, and penetrations of air barrier components (incl. lighting fixtures) detailed
- Air barrier must extend over all surfaces of building envelope at lowest floor, exterior walls, and ceiling or roof
- Designed to resist positive and negative pressures from wind, stack effect, and mechanical ventilation

Air barrier materials

- Materials that have an air permeance not exceeding 0.004 cfm/ft^2 under a pressure differential of 0.3 in. of water (1.57 psf) when tested in accordance with ASTM E2178. The following materials meet these requirements:

Material	Thickness (minimum)
Plywood	3/8 in.
Oriented strand board	3/8 in.
Extruded polystyrene insulation board	½ in.
Foil-faced urethane insulation board	½ in.
Exterior gypsum sheathing or interior gypsum board	½ in.
Cement board	½ in.
Built up roofing membrane	
Modified bituminous roof membrane	
Single-ply roof membrane	
A Portland cement/sand parge, stucco, or gypsum plaster	½ in.
Cast-in-place and precast concrete	
Sheet metal	
Closed cell 2 lb/ft^3 nominal density spray polyurethane foam	1 in.

Air Barrier Installation

The following areas are to be wrapped, sealed, caulked, gasketed, or taped:

- Joints around fenestration and door frames (both manufactured and site-built)
- Junctions between walls
  - And foundations
  - At building corners
  - And roofs or ceilings
- Penetrations for roofs, walls, and floors
- Building assemblies used as ducts or plenums
- Joints, seams, connections between planes, and other changes in continuous air barrier materials

Recessed equipment

Lighting fixtures; heating, ventilating, and air-conditioning equipment, including wall heaters, ducts, and plenums; and other equipment shall not be recessed in such a manner as to affect the insulation thickness unless:

a) the total combined area affected (including necessary clearances) is less than 1% of the opaque area of the assembly,

b) the entire roof, wall, or floor is covered with insulation to the full depth required, or

c) the effects of reduced insulation are included in calculations using an area-weighted average method and compressed insulation values obtained from Table A9.4.3.

- In all cases, air leakage through or around the recessed equipment to the conditioned space shall be limited in accordance with Section 5.4.3.

Recessed Lighting

All recessed luminaires installed in the building thermal envelope must be IC rated and have the following:

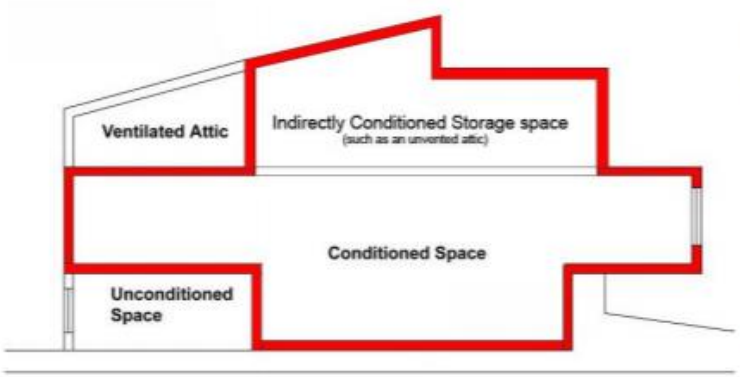
- Sealed with gasket or caulk between housing and interior wall or ceiling covering
- Labeled in accordance with ASTM E 283 to allow ≤2.0 cfm of air movement between conditioned and unconditioned spaces

Major Air Leakage Locations

- Cavities above suspended ceilings
- Plenum return spaces (Highly depressurized)
- Ventilated walls
- Equipment tunnels and chases
- Mechanical rooms and mezzanines
- Unconditioned adjacent space (storage, plant, warehouse, etc.)

Envelope leakage ratio @ 75 Pa "ELR75" – A better metric

- Leakage occurs through shell of building (not through volume)
- Normalizing leakage at 75Pa (0.3 in w.c.) based on shell area is most common for commercial buildings



Building Thermal Envelope

The building thermal envelope is the portion of the building envelope that is comprised of the continuous air barrier and insulation and separates conditioned space from unconditioned space.

Example Calculation

A 7,600 square foot building (First floor: 3,600 square feet and second floor: 4,000 square feet) has a shell area of 13,920 square feet. The blower door test measures a flow of 3,340 CFM_{75}.

What is the Envelope Leakage Ratio at 75 Pa?

ELR75 is calculated by dividing the measured CFM75 by the total shell area of the envelope.

$$\textbf{\textit{Shell Area}} = 4000ft^2 + 4000ft^2 + 5920ft^2 = \mathbf{13,920}ft^2$$

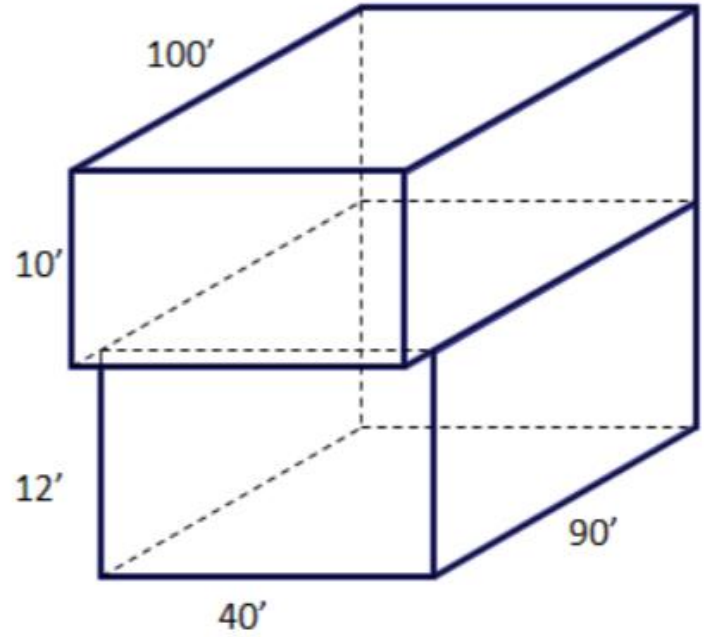
$$\textbf{\textit{BD Fan Flow Measurement}} = \mathbf{3,340}\ \textbf{\textit{CFM}}_{75}$$

$$\textbf{\textit{ELR}}_{75} = \frac{\textbf{\textit{CFM}}_{75}}{\textbf{\textit{Shell Area}}}$$

$$\textbf{\textit{ELR}}_{75} = \frac{3{,}340\ CFM_{75}}{13{,}920\ sf}$$

$$\textbf{\textit{ELR}}_{75} = \mathbf{0.24}$$

Envelope passes program requirement and earns additional points



Verifying an Energy Efficient Building Envelope

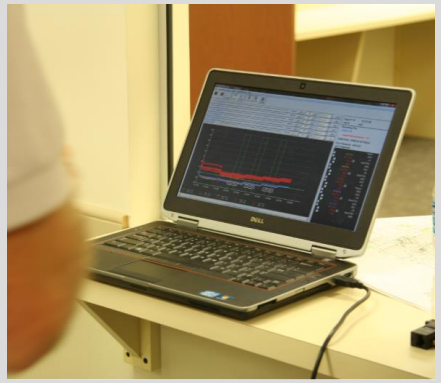
Blower Door Testing – Recognized by IECC

- Prove Air Sealing
- Envelope Integrity

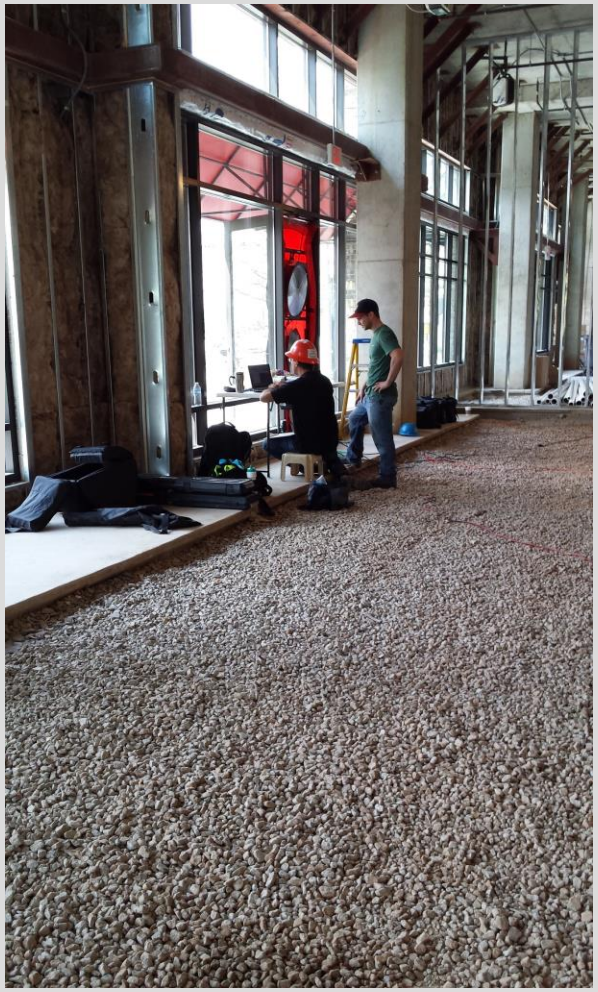
C402.5 Air leakage—thermal envelope (Mandatory). The *thermal envelope* of buildings shall comply with Sections C402.5.1 through C402.5.8, or the building *thermal envelope* shall be tested in accordance with ASTM E 779 at a pressure differential of 0.3 inch water gauge (75 Pa) or an equivalent method approved by the code official and deemed to comply with the provisions of this section when the tested air leakage rate of the building thermal envelope is not greater than 0.40 cfm/ft^2 (0.2 L/s · m^2). Where compliance is based on such testing, the building shall also comply with Sections C402.5.5, C402.5.6 and C402.5.7.

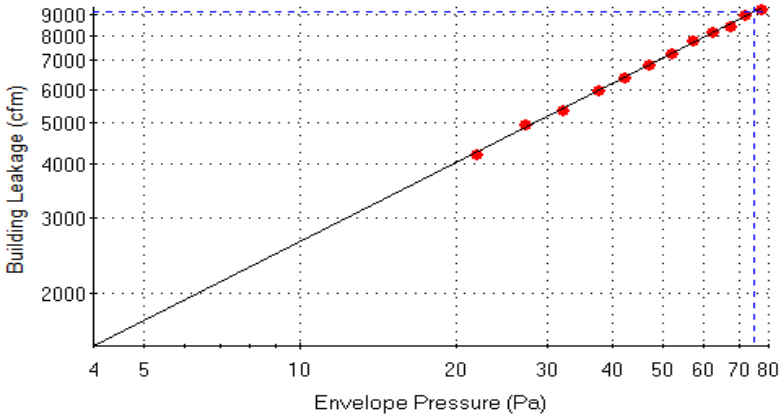
$$ELR_{75} = \frac{CFM_{75}}{\text{shell area}}$$

$$ELR_{75} \leq 0.40$$



Multi-blower door – envelope leakage test





Label	Base?	start	end	nobs	Avg Pressu	Total Flow
pre depress	True	5571	5686	116	1.92	0
-75Pa	False	7414	7443	30	-75.06	9233.5
-70Pa	False	7469	7498	30	-69.94	8950.7
-60Pa	False	9106	9135	30	-59.98	8128.6
-65Pa2	False	9146	9175	30	-65.08	8381.5
-55Pa	False	9196	9225	30	-55.06	7795.6
-50Pa	False	9244	9271	28	-49.76	7255
-45Pa	False	9286	9313	28	-44.85	6837.3
-40Pa	False	9333	9362	30	-39.97	6360.2
-35Pa	False	9390	9419	30	-35.31	5945.9
-30Pa	False	9476	9503	28	-29.9	5341.5

Copy Data Table to Clipboard

Reporting Pressure (Pa) 75

Test to View test 1

Test 1: Depressurization

Airflow at 75 Pascals
9150 cfm +/- 1.0 %
Range: 9057 to 9243
0.160 CFM @75/sq ft (0.159 to 0.162)

Leakage Areas
EqLA (10 Pa) = 776.6 in2 +/- 2.6 %
ELA (4 Pa) = 426.5 in2 +/- 4.1 %

Building Leakage Curve
Coef. (C) = 639.5 cfm/Pa^n +/- 6.3 %
Exponent (n) = .616 +/- 0.016
Correlation Coef. (r) = .99929
Corr Coef Squared (r^2) = .99857

View / Edit Test Details

Export to Tectite Express...

USACE Report

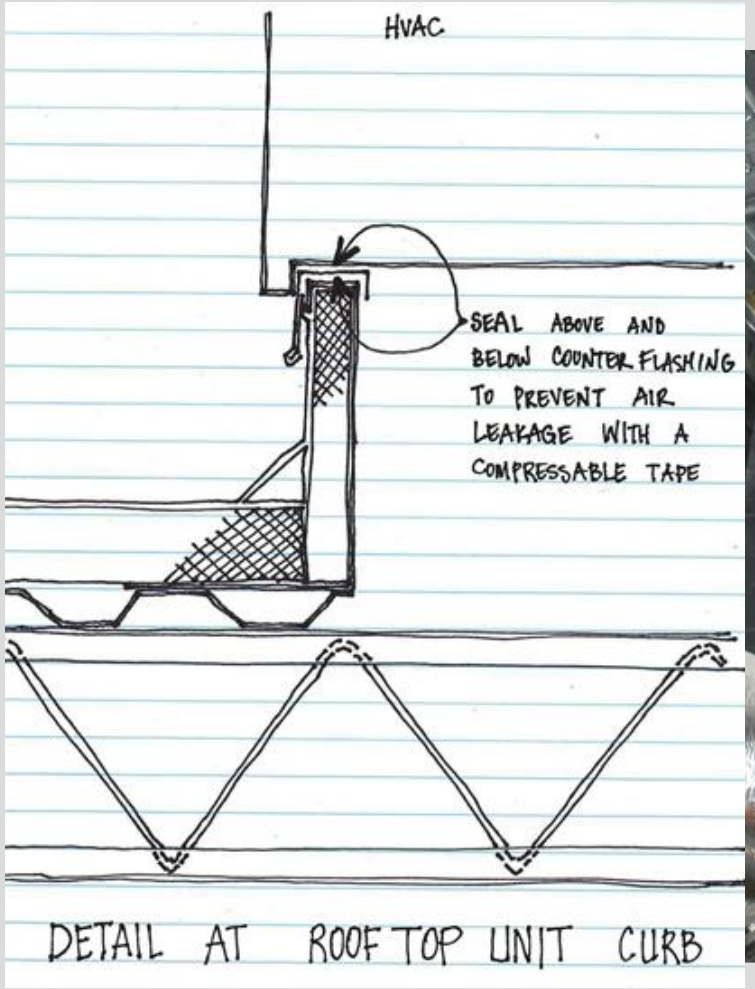
OK

Bonus - Reduced Air Infiltration

- Air infiltration verified by whole-building pressurization test
  - Per ASTM E779 or ASTM E1827
  - 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 and tested per C406.9

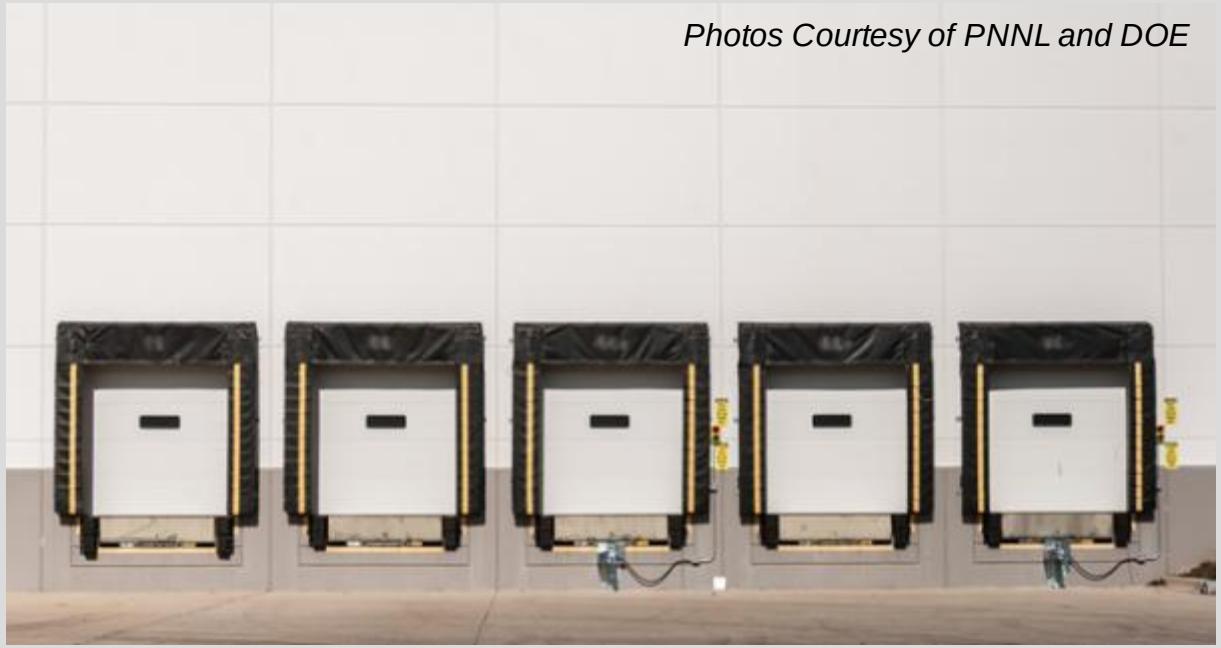
RTU Envelope Penetrations



Wall and roof penetration require sealing at curb and equipment

Loading Dock Weatherseals

- Cargo and loading door openings must be equipped with weatherseals to restrict infiltration and provide direct contact with vehicles along top and sides



Photos Courtesy of PNNL and DOE

Loading Dock Weatherseals

- **ASHRAE 90.1 2019**

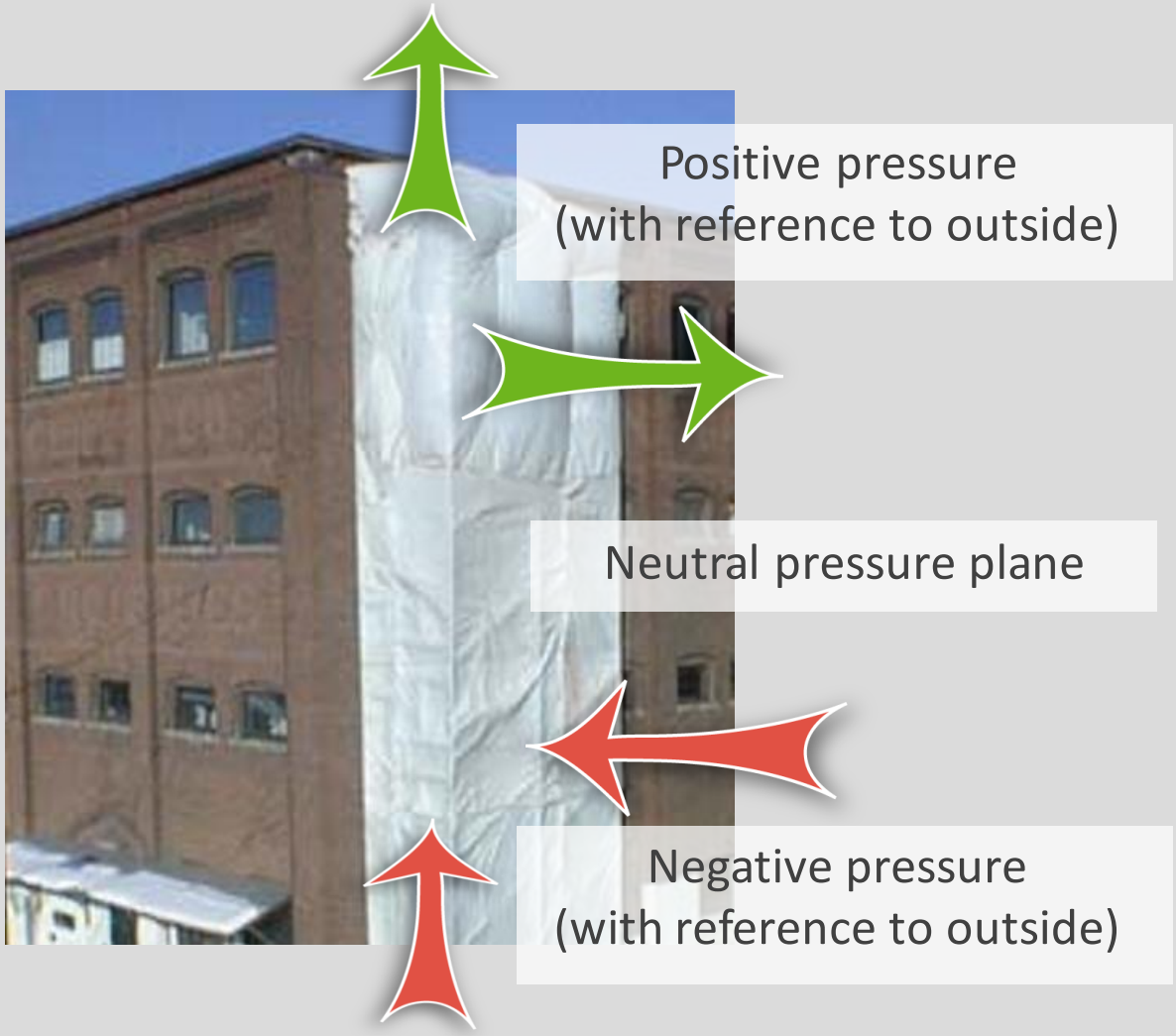
  Exception – Climate zones 1-3

- **IECC 2021**

  No exceptions for warmer climate zones.

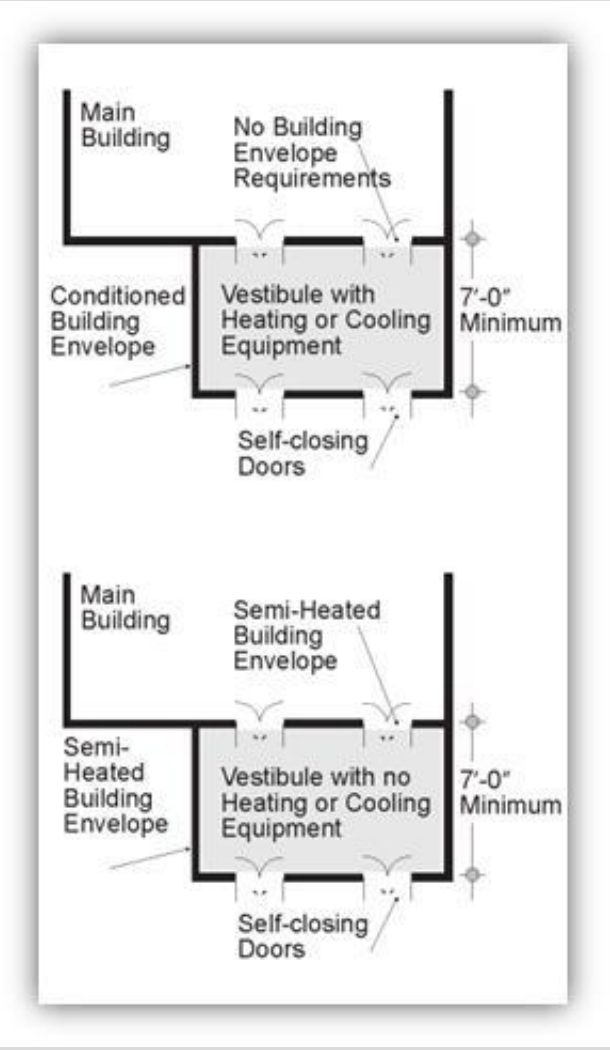
Vestibules

- Required for both codes with many exceptions
- The taller the building, the greater the need for vestibules
- Both codes vary greatly on requirements based on zones and other inputs



Vestibules

- **Vestibules must have**
- Self-closing doors
- Interior and exterior doors not open at the same time
- Distance between interior and exterior doors not < 7 ft when in closed position
- *Floor* area of each vestibule to not exceed the greater of 50 ft^2 or 2% of the gross *conditioned floor area* for that level of the *building*
- Exterior envelope of conditioned vestibule comply with *conditioned space* requirements
- Interior/exterior envelope of unconditioned vestibule comply with *semiheated space* requirements



Vestibules details

- Building entrances shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time. The installation of one or more revolving doors in the building entrance shall not eliminate the requirement that a vestibule be provided on any doors adjacent to revolving doors.

Vestibules exceptions

1. Buildings in Climate Zones 1 and 2.
2. Doors not intended to be used by the public, such as doors to mechanical or electrical equipment rooms, or intended solely for employee use.
3. Doors opening directly from a sleeping unit or dwelling unit.
4. Doors that open directly from a space less than 3,000 square feet (298 m^2) in area.
5. Revolving doors.
6. Doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.
7. Doors that have an air curtain with a velocity of not less than 6.56 feet per second (2 m/s) at the floor that have been tested in accordance with ANSI/AMCA 220 and installed in accordance with the manufacturer's instructions. Manual or automatic controls shall be provided that will operate the air curtain with the opening and closing of the door. Air curtains and their controls shall comply with Section C408.2.3.

90.1 - Vestibules exceptions

- Non-entrance *doors* or *doors* opening from *dwelling unit*
- *Building entrances* with revolving *doors*
- All *building entrances* in climate zones 1 and 2 **OR**
  in *buildings* in climate zone 3 < 4 stories and < 10,000 ft^2 in gross conditioned floor area **OR**
  in buildings < 1000 ft^2 in *gross conditioned floor area* in climate zones 0 and 4-8
- All *doors* that open from *spaces* < 3000 ft^2 and separate from *building entrance*
- *Semiheated spaces*
- Enclosed elevator lobbies for *building entrances* directly from parking garages

90.1 Vestibules for large spaces

- Vestibules opening into large *conditioned spaces* (large retail)
- *spaces* having a *gross conditioned floor area* for that level of the *building* of 40,000 ft^2 and greater,
- and when the *doors* opening into and out of the vestibule are equipped with automatic, electrically driven, self-closing devices, the interior and exterior *doors* shall have a minimum distance between them of not less than 16 ft.

Section 6 – 6.4.3.9
Heating and Cooling in Vestibules

- Include automatic controls to
- shut off heating system when
  - OA temps are > 45°F
  - Also controlled by a thermostat in the vestibule with setpoint limited to maximum of 60°F

  Note: a single heating thermostat in the vestibule limited to 45°F would meet the requirements
- Shut off vestibule cooling system when
  - Controlled by a thermostat in the vestibule with setpoint limited to minimum of 85°F

- **Exceptions**, vestibules:
  - heated or cooled by site-recovered energy
  - tempered with transfer air that would otherwise be exhausted

fenestration

Fenestration Product rating

- How Do You Meet the Requirement?
- Fenestration product rating in accordance to NFRC 100 (Windows, Doors, Skylights)
- Labeled and certified by the manufacturer
- Non-NFRC 100 rated fenestration
  - Default Glazed Fenestration U-factor Table C303.1.3(1)

NATIONAL FENESTRATION RATING COUNCIL
LABEL CERTIFICATE

PRODUCT LISTING

FOR CODE COMPLIANCE

LABEL CERTIFICATE ID: ***XYZ-001*** Issuance Date: mm/dd/yyyy

NFRC CERTIFIED PRODUCT RATING INFORMATION:*

The NFRC Certified Product Rating Information listed here is to be used to verify that the ratings meet applicable energy code requirements.

PRODUCT LISTING:

						CERTIFIED Performance Rating at NFRC Model Size		
CPD ID	Total Area	Name	Framing Ref	Glazing Ref	Spacer Ref	U**	SHGC**	VT**
	ft^2					Btu/ hr·ft^2·°F	-	-
P-PL-010	88.89	PL-2200 / PL-2210	FA-PL2210	GA-TT-001	SA-AM-001	0.53	0.58	0.66
P-PL-005	192.67	PL-3400 / PL-3401	FA-PL3401	GA-TT-001	SA-AM-002	0.56	0.57	0.65
P-PL-012	382.22	PL-5700 / PL-5720	FA-PL5720	GA-TO-002	SA-AM-001	0.52	0.21	0.30
P-PL-002	60.00	PL-1100 / PL-1152	FA-PL1152	GA-TT-001	SA-AM-001	0.42	0.51	0.62
P-PL-022	525.00	PL-9900 / PL-9915	FA-PL9915	GA-TO-003	SA-AM-002	0.45	0.15	0.19

FRAME, GLAZING and SPACER ASSEMBLIES:

FRAMING LISTING:

FRAMING REF	SUPPLIER ID	DESCRIPTION
FA-PL2210		Single Casement Thermally Broken Aluminum
FA-PL3401		Projecting (Awning) Thermally Broken Aluminum
FA-PL5720		Vertical Slider PVC reinforced with Steel
FA-PL1152		Vertical Slider Thermally Broken Aluminum
FA-PL9915		Fixed Thermally Broken Aluminum

GLAZING LISTING:

GLAZING REF	SUPPLIER ID	DESCRIPTION
GA-TT-001		1" Double Glazed, 1/4" HC Low-e, 1/4" Clear, Argon (90%), 1/2" gap
GA-TT-002		1" Triple Glazed, 1/8"Clear, Coated film, 1/8"SC, Argon (90%), 3/8" gap
GA-TT-003		1" Double Glazed, 1/4" Bronze, 1/4" SC Low-e, Argon (90%), 1/2" gap

SPACER LISTING:

SPACER REF	SUPPLIER ID	DESCRIPTION
SA-AM-001		250P Mill Finish Aluminum Low profile (1/2")
SA-AM-002		15A Polymer Spacer (3/8")

ASHRAE fenestration requirements for CZ4

	Nonresidential			*Residential*			Semiheated		
Fenestration	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. *VT/SHGC***	**Assembly Max. U**	**Assembly Max. SHGC**	**Assembly Min. *VT/SHGC***	**Assembly Max. U**	**Assembly Max. *SHGC***	**Assembly Min. *VT/SHGC***
Vertical Fenestration, 0% to 40% of *Wall*									
Fixed	0.36	0.36	1.10 (for all types)	0.36	0.36	1.10 (for all types)	0.50	NR (for all types)	NR (for all types)
Operable	0.45	0.33		0.45	0.33		0.65		
Entrance door	0.63	0.33		0.63	0.33		0.77		
Skylight, 0% to 3% of *Roof*									
All types	0.50	0.40	NR	0.50	0.40	NR	0.75	NR	NR

IECC fenestration requirements

TABLE C402.4 BUILDING ENVELOPE FENESTRATION MAXIMUM *U*-FACTOR AND SHGC REQUIREMENTS

CLIMATE ZONE	0 AND 1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Vertical fenestration																
***U*-factor**																
Fixed fenestration	0.50		0.45		0.42		0.36		0.36		0.34		0.29		0.26	
Operable fenestration	0.62		0.60		0.54		0.45		0.45		0.42		0.36		0.32	
Entrance doors	0.83		0.77		0.68		0.63		0.63		0.63		0.63		0.63	
SHGC																
	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable	Fixed	Operable
PF < 0.2	0.23	0.21	0.25	0.23	0.25	0.23	0.36	0.33	0.38	0.33	0.38	0.34	0.40	0.36	0.40	0.36
0.2 ≤ PF < 0.5	0.28	0.25	0.30	0.28	0.30	0.28	0.43	0.40	0.46	0.40	0.46	0.41	0.48	0.43	0.48	0.43
PF ≥ 0.5	0.37	0.34	0.40	0.37	0.40	0.37	0.58	0.53	0.61	0.53	0.61	0.54	0.64	0.58	0.64	0.58
Skylights																
U-factor	0.70		0.65		0.55		0.50		0.50		0.50		0.44		0.41	
SHGC	0.30		0.30		0.30		0.40		0.40		0.40		NR		NR	

NR = No Requirement, PF = Projection Factor.

Fenestration Product rating

- Unlabeled fenestration is required to use the default U-factor and SHGC values.

Table A8.2 Assembly *U-Factors*, Assembly *SHGCs*, and Assembly Visible Transmittances (*VTs*) for Unlabeled *Vertical Fenestration*

Frame Type	Glazing Type	Unlabeled *Vertical Fenestration*					
		Clear Glass			*Tinted* Glass		
		U-Factor	*SHGC*	*VT*	*U-Factor*	*SHGC*	*VT*
All frame types	Single glazing	1.25	0.82	0.76	1.25	0.70	0.58
	Glass block	0.60	0.56	0.56	NA	NA	NA
Wood, vinyl, or fiberglass frames	Double glazing	0.60	0.59	0.64	0.60	0.42	0.39
	Triple glazing	0.45	0.52	0.57	0.45	0.34	0.21
Metal and other frame types	Double glazing	0.90	0.68	0.66	0.90	0.50	0.40
	Triple glazing	0.70	0.60	0.59	0.70	0.42	0.22

- Those values are very poor and ***will not comply*** with the prescriptive compliance path.

Maximum Area

- Fenestration: All areas (including frames) that let in light, including windows, plastic panels, clerestories, skylights, glass doors that are more than half glass, and glass block walls
- The vertical fenestration area shall not be greater than **30 percent** of the gross above-grade wall area.
- The skylight area shall not be greater than 3 percent of the gross roof area.
  - Can increase skylight area to **5 percent** with the use of daylight responsive lighting controls

Increased Fenestration Area

- In Climate Zones 1 through 6, not more than **40 percent** of the gross above-grade wall area shall be permitted to be vertical fenestration, provided **all** of the following requirements are met:

1. 1-2 story buildings - At least 50 percent of the net floor area is within a daylight zone.
2. 3 stories or more - At least 25 percent of the net floor area is within a daylight zone.
3. Daylight responsive controls complying with Section C405.2.3.1 are installed in daylight zones.
4. Visible transmittance (VT) of vertical fenestration is not less than 1.1 times solar heat gain coefficient (SHGC).

Maximum Area

- Fenestration: Skylights, roof windows, vertical windows (fixed or moveable), *opaque doors*, glazed doors, glazed block, and combination opaque/glazed doors
- The vertical fenestration area shall not be greater than **40 percent** of the gross above-grade wall area.
- The skylight area shall not be greater than 3 percent of the gross roof area.
  - Can increase skylight area to **6 percent** with the use of daylight responsive lighting controls

Maximum Skylight Area

- **IECC**
- Can increase skylight area from 3 percent to **5 percent** with the use of daylight responsive lighting controls

- **ASHRAE**
- Can increase skylight area from 3 percent to **6 percent** with the use of daylight responsive lighting controls

90.1 Daylighting Details

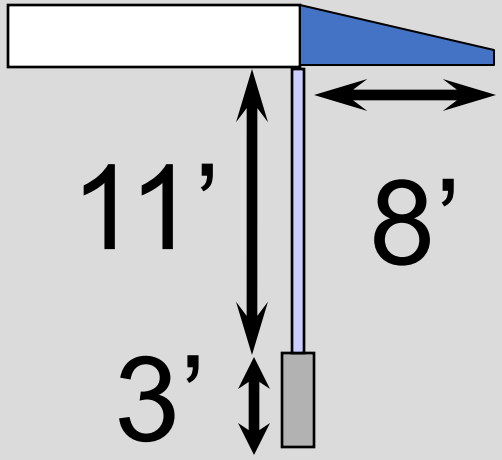
- 5.5.4.2.2 Max. Skylight Fenestration Area
  - Total skylight area shall not exceed 3% of gross roof area
  - May go to 6% of gross roof area provided design meets all criteria
- 5.5.4.2.3 Minimum Skylight Fenestration Area
  - for any enclosed space in a building (all of the following):
    - ≥2,500 sq. ft.
    - Directly under a roof with ceiling heights greater than 15 feet
    - One of the following space types: office, lobby, atrium, concourse, corridor, warehouse, gym, convention center, courtroom automotive service, fire station engine room, manufacturing, retail, library, distribution/sorting, transportation baggage and seating, or workshop
  - Minimum 50% of floor area is daylit area and either:
    - Provide skylight to daylight area of 3% and VT of 0.4
    - Minimum skylight effective aperture of 1%
  - Many exceptions based on LPD, space type, and side daylighting

Exceptions to Section 5.5.4.2.3

1. *Enclosed spaces* in Climate Zones 6 through 8
2. *Enclosed spaces* where it is documented that existing structures or natural objects block direct-beam sunlight on at least half of the *roof* over the *enclosed space* for more than 1500 daytime hours per year between 8 a.m. and 4 p.m.
3. *Enclosed spaces* where the *daylight area under roof monitors* is greater than 50% of the *enclosed space floor* area.
4. *Enclosed spaces* where it is documented that 90% of the *skylight* area is shaded on June 21 in the Northern Hemisphere (December 21 in the Southern Hemisphere) at noon by permanent architectural features of the *building*.
5. *Enclosed spaces* where the total area minus the *primary sidelighted area* and *secondary sidelighted area* is less than 2500 ft^2 and where the lighting is controlled according to sidelighting requirements described in Section 9.4.1.1(e).

Projection Factor (PF)

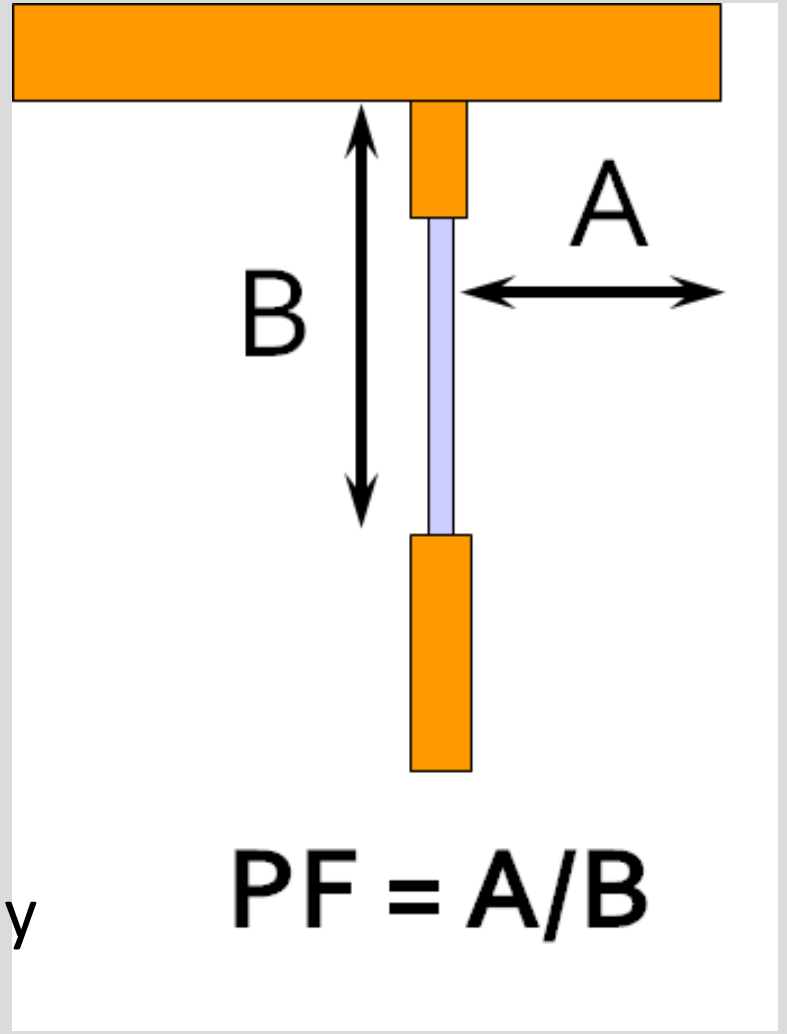
- The ratio of overhang projection divided by height from windowsill to bottom of overhang (must be permanent)



PF = 8/11 = 0.73

For S, E or W glazing SHGC multiplier (from next slide) = **0.51**

If glass SHGC = 0.48, it effectively becomes 0.24 due to overhang



Overhangs

Must be permanent!

Fenestration Orientation

- Area of vertical fenestration on east and west facades may not exceed 25% of total area of vertical glazing with some exceptions for permanent shading

Section 5.5.4.6: VT/SHGC ratio

- Where automatic daylighting controls are required, the Visible Transmittance / SHGC ratio shall be ≥ 1.1

Exceptions to Section 5.5.4.6

1. A *light-to-solar-gain ratio* (*LSG*) of not less than 1.25 is allowed to be used as an alternative to *VT/SHGC*. When using this option, the center-of-glass *VT* and the center-of-glass *SHGC* shall be determined in accordance with NFRC 300 and NFRC 301, determined by an independent laboratory or included in a database published by a government agency, and certified by the *manufacturer*.
2. *Fenestration* not covered in the scope of the NFRC 200.
3. *Enclosed spaces* where the *daylight area under roof monitors* is greater than 50% of the *enclosed space floor* area.
4. *Enclosed spaces* with *skylights* that comply with Section 5.5.4.2.3.
5. *Enclosed spaces* where the *sidelighting effective aperture* is greater than or equal to 0.15.
6. For *dynamic glazing*, the *VT/SHGC* ratio and the *LSG* shall be determined using the maximum *VT* and maximum *SHGC*. *Dynamic glazing* shall be considered separately from other *fenestration*, and area-weighted averaging with other *fenestration* that is not *dynamic glazing* shall not be permitted.

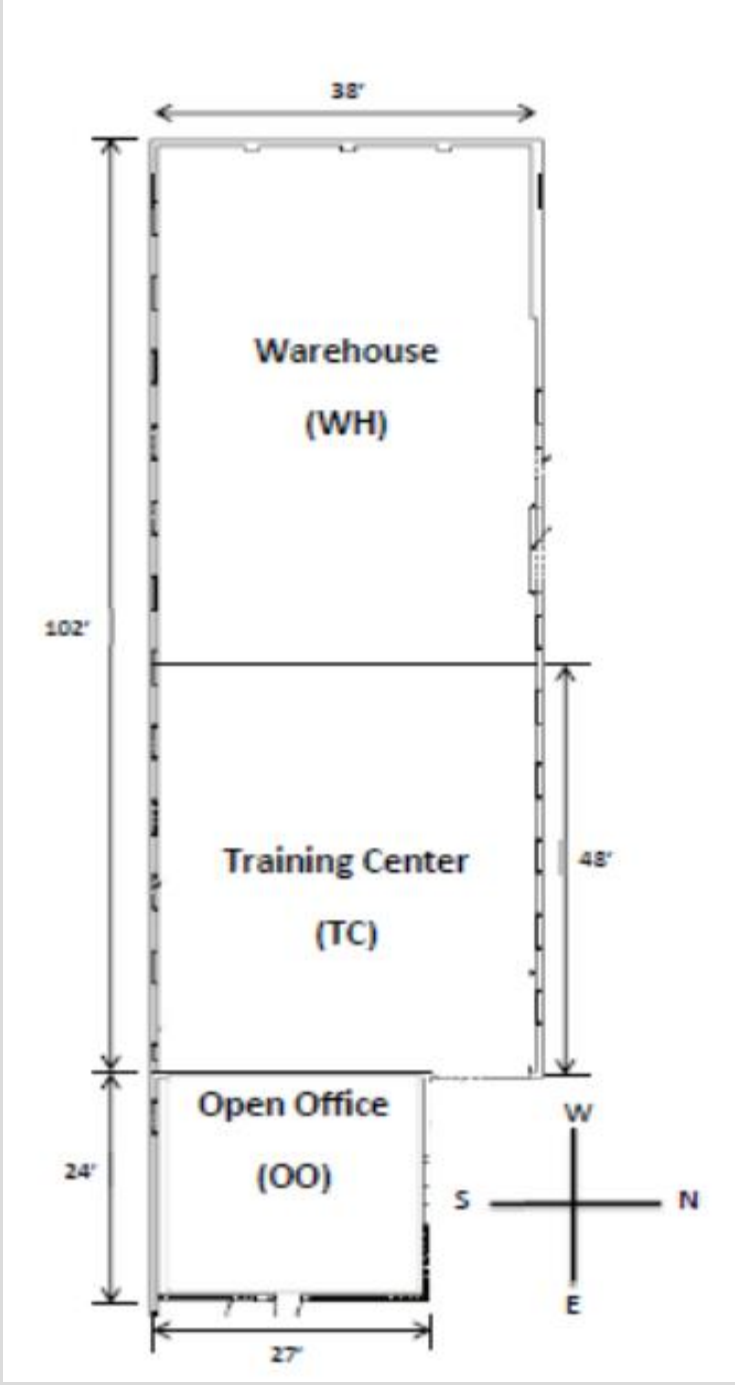
ENERGY CODE TRAINING

Building Envelope Trade offs

Commercial Envelope Part 2

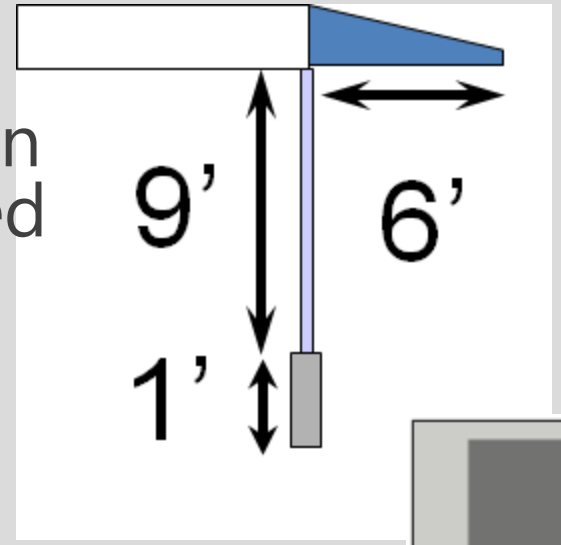
https://vimeo.com/169382048/c973625071

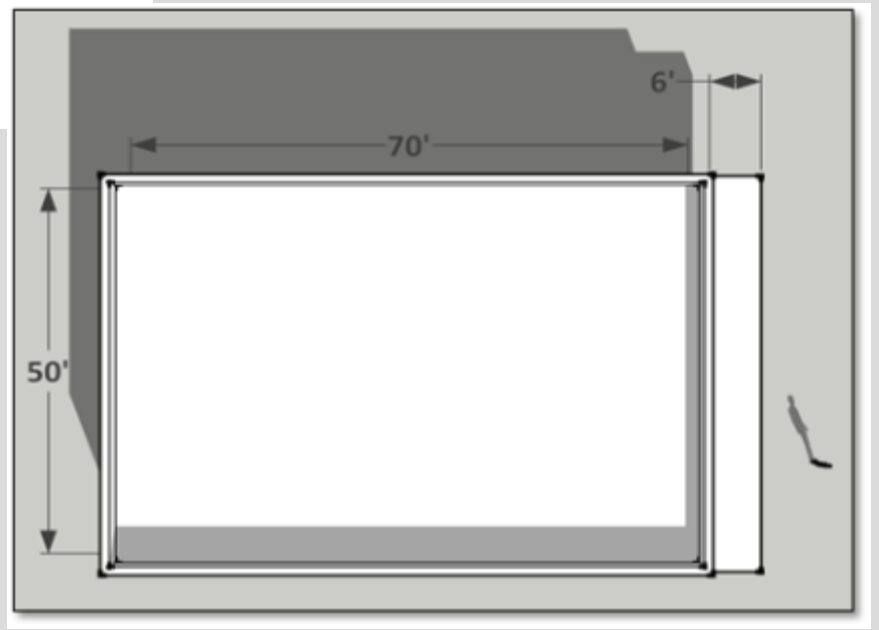
Sweet NEW – using Comcheck



Prescriptive Glazing Example

- **Small Retail Building**
- All metal curtain-wall glazing is on the Front (East) façade and shaded by a 6’ overhang
- <u>Option 1:</u>
- Glazing U = 0.50, SHGC = 0.52
- <u>Option 2:</u>
  Glazing U = 0.36, SHGC = 0.44
- *Does either option comply with the CZ5 prescriptive glazing requirements of 90.1-2016?*





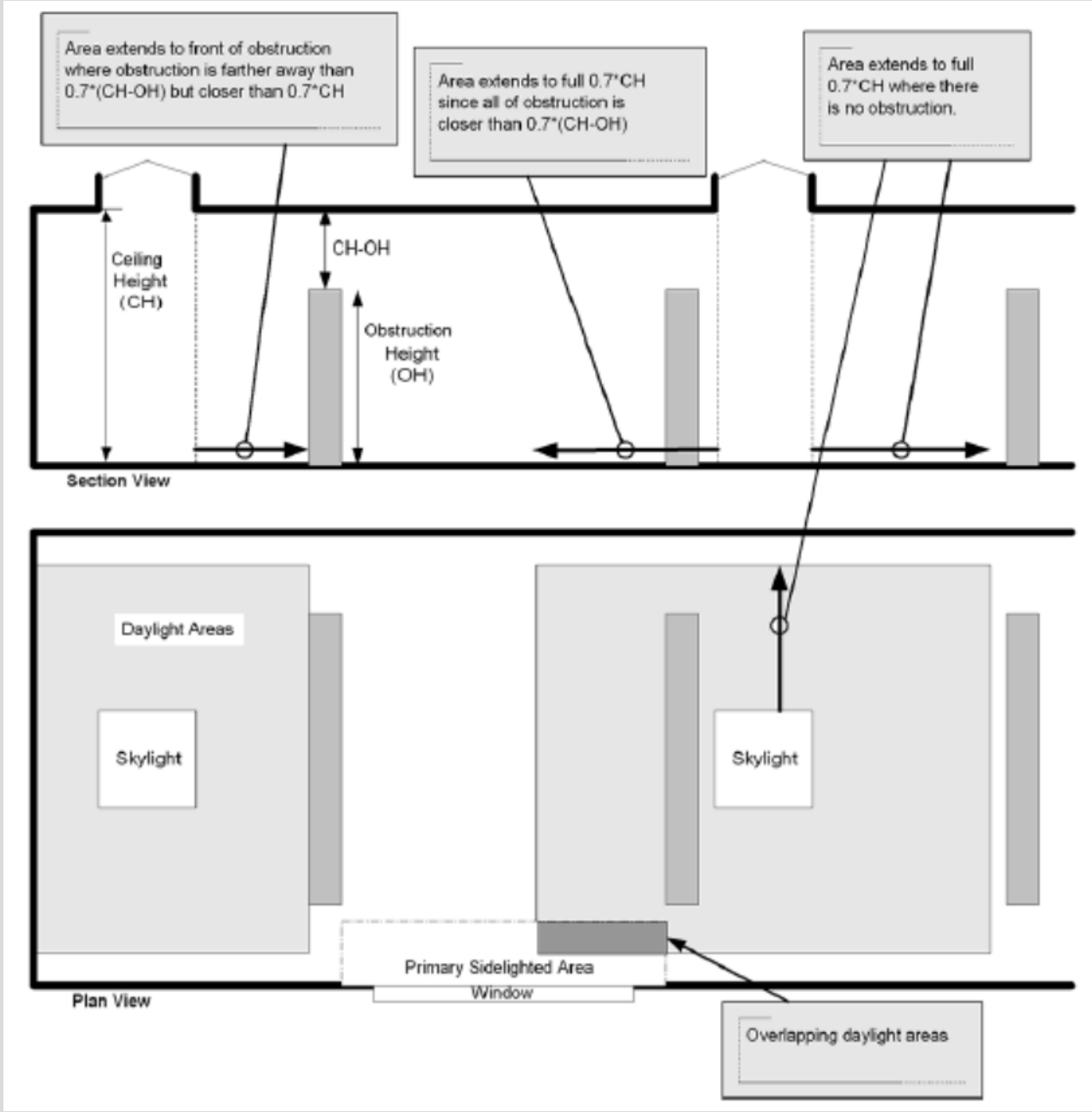
Daylighted Area - skylights

- Daylight area: the floor area substantially illuminated by natural daylight

daylight area under skylights: the *daylight area under skylights* is the combined *daylight area* under each *skylight* within a *space*. The *daylight area* under each *skylight* is bounded by the opening beneath the *skylight* and horizontally in each direction (see Figure 3.2-2), the smaller of

a. 70% of the ceiling height (0.7 × CH) or

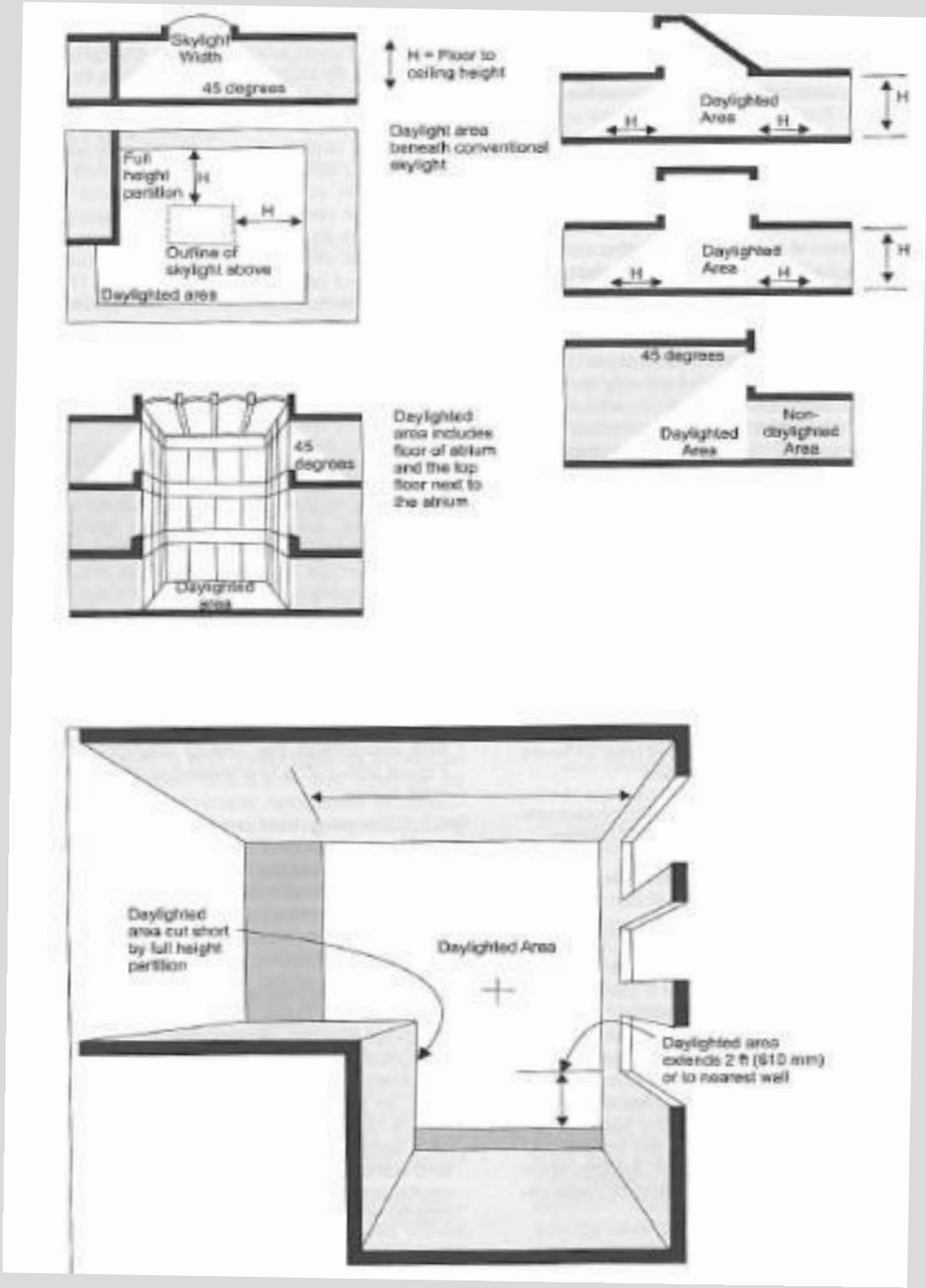
b. the distance to the nearest face of any *opaque* vertical obstruction, where any part of the obstruction is farther away than 70% of the distance between the top of the obstruction and the ceiling (0.7 × [CH – OH], where CH = the height of the ceiling at the lowest edge of the *skylight* and OH = the height to the top of the obstruction).



Skylight Daylit Area

Daylight Zones

- Skylights: 45° angle from skylight at ceiling height (CH); extend outward from skylight ground projection by 0.7xCH)
- Windows:
  15’ inward from vertical glazing
- Windows: width + 2’



Enhanced Envelope Performance - Optional

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 – Component performance alternative.

Air Sealing Testing Compliance Options

1. Whole-Building Testing
2. Materials Testing
3. Assemblies of Materials Testing

Systems Commissioning and Completion Requirements

Section C408

- Commissioning is critical to ensure that buildings are **working as designed**
- Preliminary and final reports required
- Mechanical and lighting commissioning detailed in section C408

Option 1: Whole-Building Testing: ≤ 0.40 CFM_{75}/ft^2

Buildings > 50,000 sf

Can comply by testing only (and all) the following portions and area-weighting measured air leakage:

a) Floor areas under roof or with building entrances

b) Representative above-grade wall sections totaling at least 25% of wall area, not including floor area above

Buildings < 50,000 sf

Must comply by testing entire building

Option 2: Materials Testing

- Acceptable materials must have an air permeance of <0.004 cfm/ft^2 under pressure differential of 0.3 in. of H^{2}O when tested in accordance with ATM E 2178

Material	Thickness (minimum)
Plywood	3/8 in.
Oriented strand board	3/8 in.
Extruded polystyrene insulation board	½ in.
Foil-faced urethane insulation board	½ in.
Exterior gypsum sheathing or interior gypsum board	½ in.
Cement board	½ in.
Built up roofing membrane	
Modified bituminous roof membrane	
Single-ply roof membrane	
A Portland cement/sand parge, stucco, or gypsum plaster	½ in.
Cast-in-place and precast concrete	
Sheet metal	
Closed cell 2 lb/ft^3 nominal density spray polyurethane foam	1 in.

Option 3: Assemblies Testing

Assemblies of materials and components (sealants, tapes, etc.) that have an average air leakage <0.04 cfm/ft^2 under a pressure differential of 0.3 in. of H_2O when tested in accordance with ASTM E 2357, 1677, 1680, or 283.

The following assemblies meet these requirements:

Concrete masonry walls that are

- Fully grouted, or
- Painted to fill the pores.

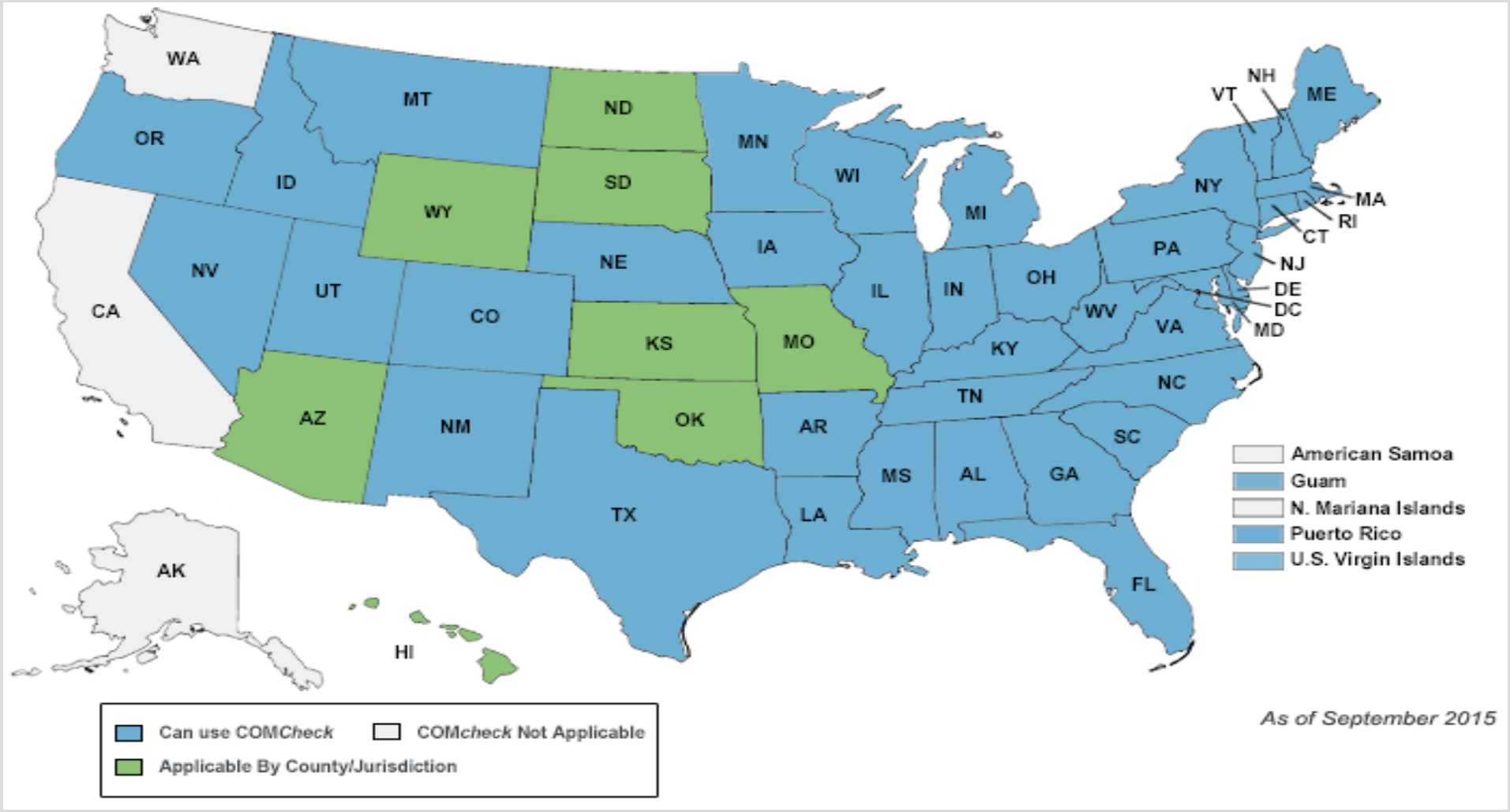
Using COMcheck Learning Objectives:

Basics of using the COMcheck software, reviewing generated compliance reports, and the latest and greatest new features.

1. Obtain an overview of the basic functions and how COMcheck calculates compliance for the building envelope, interior and exterior lighting.
2. Be able to identify the construction specifications needed to complete a compliance calculation in the software.
3. Learn how to enter the building envelope, lighting, and mechanical components into the software.
4. Understand how the compliance reports are created and what they entail.

COMcheck

States that allow COMcheck



Commercial Compliance Tools

Desktop Software Tools

Free

Web-Based Tools

Printed Materials

Compliance Guides

Prescriptive Tables

COMcheck/COMcheck Web

COM*check-Web* simplifies commercial and high-rise residential energy code compliance.

It performs just like COM*check*, the desktop version, but you don't need to download or install any software on your computer.

-Can exchange files between desktop and web

What About Mixed Use? – C101.4.1

- Treat the residential building portion under the applicable residential code
- Treat the commercial building portion under the commercial code
- Code Official has final authority

Image: agarch.com

Project Types:

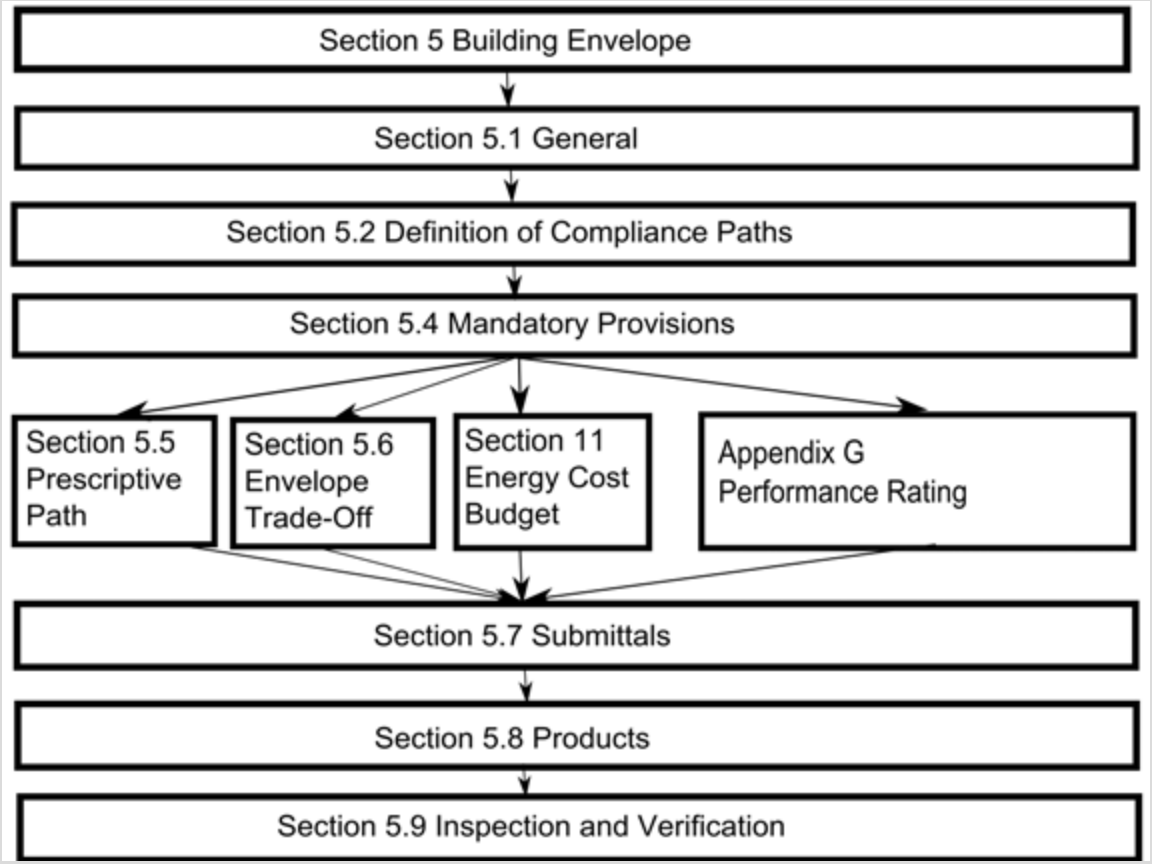
- New Construction: Trade-off compliance method
- Addition Trade-off compliance method
- Alteration Prescriptive compliance

What is COM*check*?

- Envelope
  - trade-off calculations are based on envelope loads only
  - defines a proposed design and a budget design
- Lighting
  - Watts/square foot (LPDs)
- Mechanical
  - short wizard to customize a list of requirements applicable to the system identified

‘21 IECC/ ’19 90.1 Compliance Options –

- Building must comply with
- C402 Envelope
- C403 Mech
- C404 SWH
- C405 Lighting
- Plus pick one additional efficiency package.



U/A Trade off compliance

Compliance: Passes using UA trade-off

Compliance: **12.2% Better Than Code** Maximum UA: **500** Your UA: **439**

The % Better or Worse Than Code Index reflects how close to compliance the house is based on code trade-off rules.
It DOES NOT provide an estimate of energy use or cost relative to a minimum-code home.

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Glazing or Door U-Factor	UA
Exterior Wall Type A: Steel Frame, 16" o.c.	1260	13.0	5.0		88
Window 2: Wood Frame:Double Pane with Low-E	75			0.330	25
Door B: Solid	41			0.420	17
Exterior Wall Type B: Steel Frame, 16" o.c.	2513	13.0	5.0		173
Window 1: Wood Frame:Double Pane with Low-E	210			0.330	69
Window 2: Wood Frame:Double Pane with Low-E	30			0.330	10
Window 3: Wood Frame:Double Pane with Low-E	5			0.330	2
Door A: Glass	24			0.310	7
Roof Type 1: Steel Joist/Rafter, 16" o.c.:2x10	823	0.0	35.0		21
Window 4 - Skylight: Metal Frame with Thermal Break:Triple Pane	32			0.700	22
Window 5 - Skylight: Other	9			0.540	5

Compliance Statement: The proposed building design described here is consistent with the building plans, specifications, and other calculations submitted with the permit application. The proposed building has been designed to meet the 2010 New York Energy Conservati Construction Code requirements in REScheck Version 4.4.1 and to comply with the mandatory requirements listed in the REScheck Inspecti Checklist.

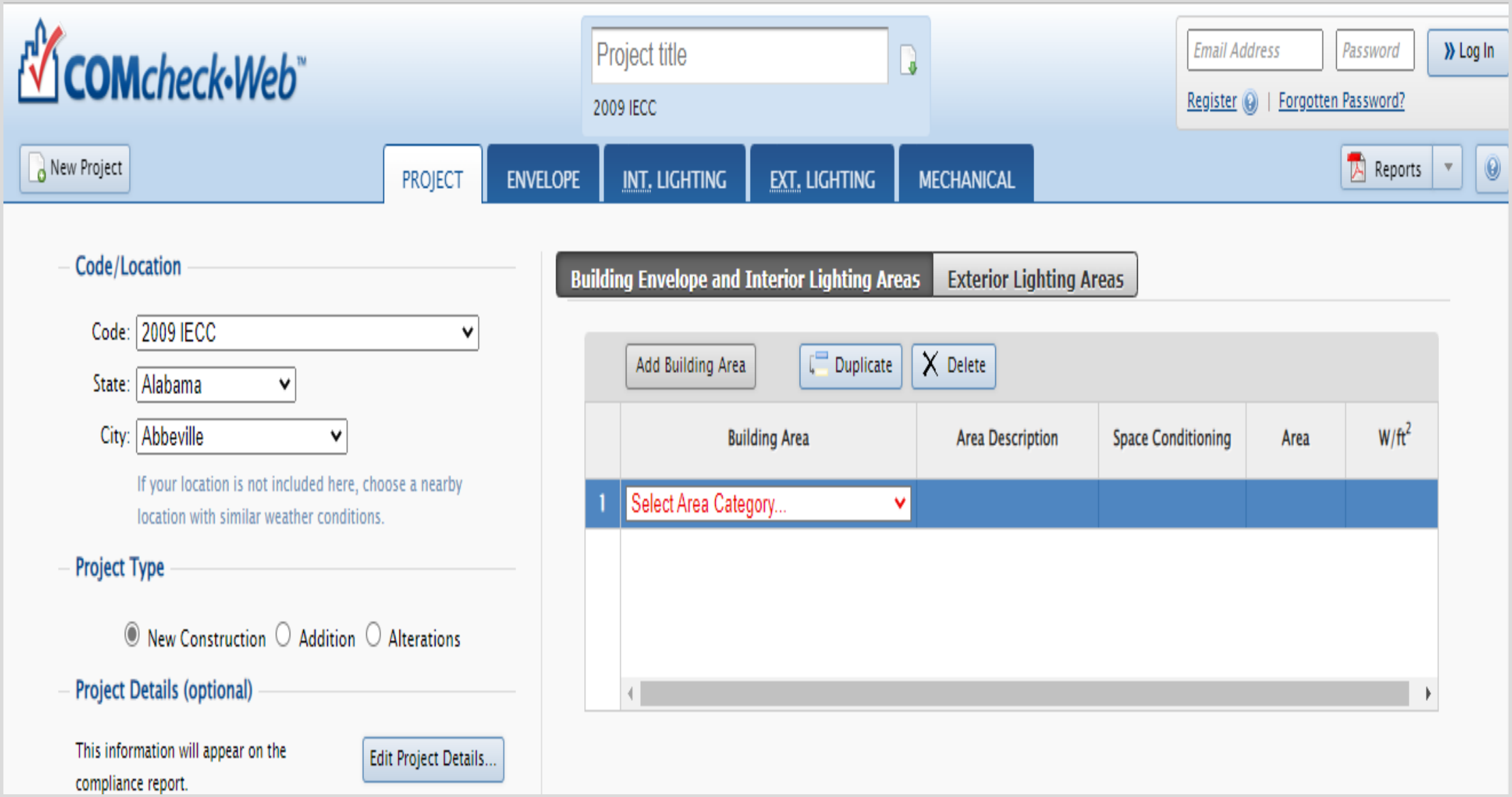
Name - Title _____ Signature _____ Date _____

COMcheck Who may submit:

- The commercial energy code requires that a registered professional submit compliance documentation (construction documents and compliance verification).

- In the IECC, Section C103.1 Construction Documents, General, the wording states that construction documentation *and other supporting data* shall be submitted in one or more sets with each application for a permit. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the code official is authorized to require necessary construction documents to be prepared by a registered design professional.

Landing Page



Information You will need:

- Energy Code Path and Year
- Builder and project location
- Area take-offs for envelope assemblies
- Insulation R-values, fenestration performance data
- Lighting fixture details
- Heating and cooling system details
- Service water heating details

COMcheck

Questions?

Commercial Energy Code

Mechanical Systems
Commercial Lighting and Power Systems

Instructor: Matt Belcher

Friday October 27th 9 AM-4 PM

Commercial Energy & Building Codes Updates and Applications;

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