Ci by Climate Zone in Commercial Energy & Building Codes

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ABTG / ARES Consulting

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Applied Building Technology Group (ABTG) is committed to using sound science and generally accepted engineering practice to develop research supporting the reliable design and installation of foam sheathing. ABTG's educational program work with respect to foam sheathing is supported by the Foam Sheathing Committee (FSC) of the American Chemistry Council.

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Foam sheathing research reports, code compliance documents, educational programs and best practices can be found at www.continuousinsulation.org.

Foam Plastic Applications for Better Building

Outline

- The Building Thermal Envelope & Continuous Insulation (Ci)
- Commercial Energy Code
- Commercial Building Code
- Resources to help put it all together

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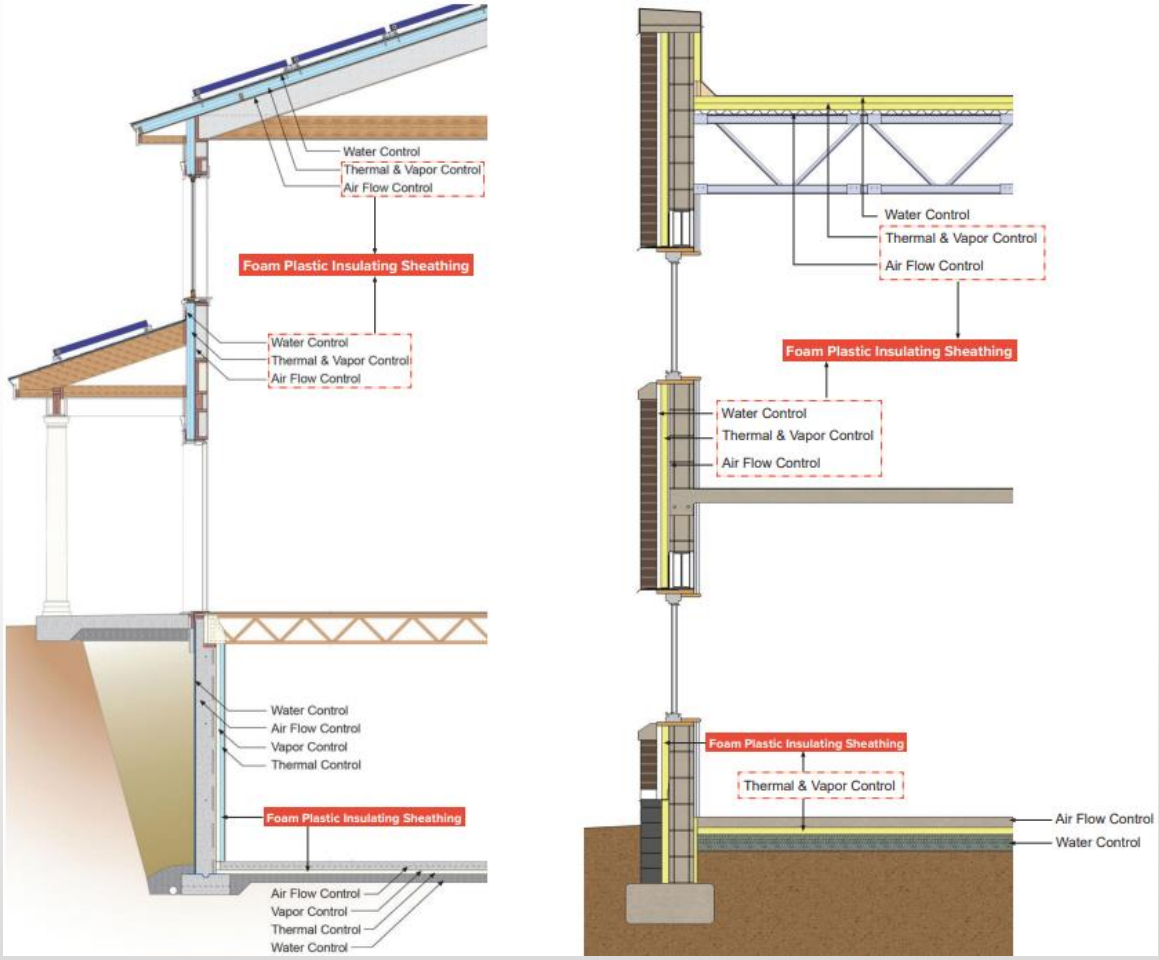
What is the building thermal envelope (BTE)?

- The BTE separates the indoor from the outdoor environment.
- The BTE is an integrated system which also supports the design and function of other building systems.

IECC Definition:

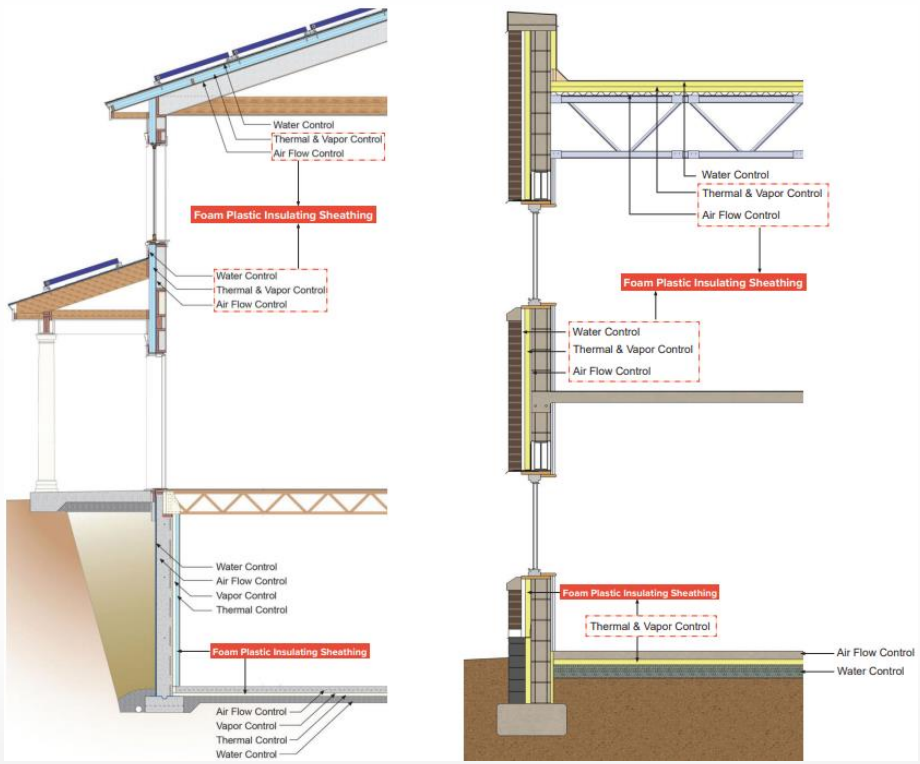
BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floors, ceilings, roofs and any other building element assemblies that enclose *conditioned space* or provide a boundary between *conditioned space* and exempt or unconditioned space.



Why is the BTE important?

- Allows indoor environment (conditioned space) to be controlled for comfort, productivity, and health
- Major factor in sizing HVAC equipment
- Protects the structure and its contents from the outdoor environment (wind, rain, U/V radiation, temperature and humidity cycling, etc.)
- Determines the life-cycle operational cost, energy use (heating/cooling), and carbon footprint/handprint for the building.

RESOURCE: https://www.continuousinsulation.org/sustainability



"Without a good building envelope, …HVAC system and design actions become more difficult and costly, and uncertain in their effectiveness [to control the indoor environment]."

Source: ABTG RR No. 2006-01, p10, https://www.continuousinsulation.org/topical-library/healthy-buildings

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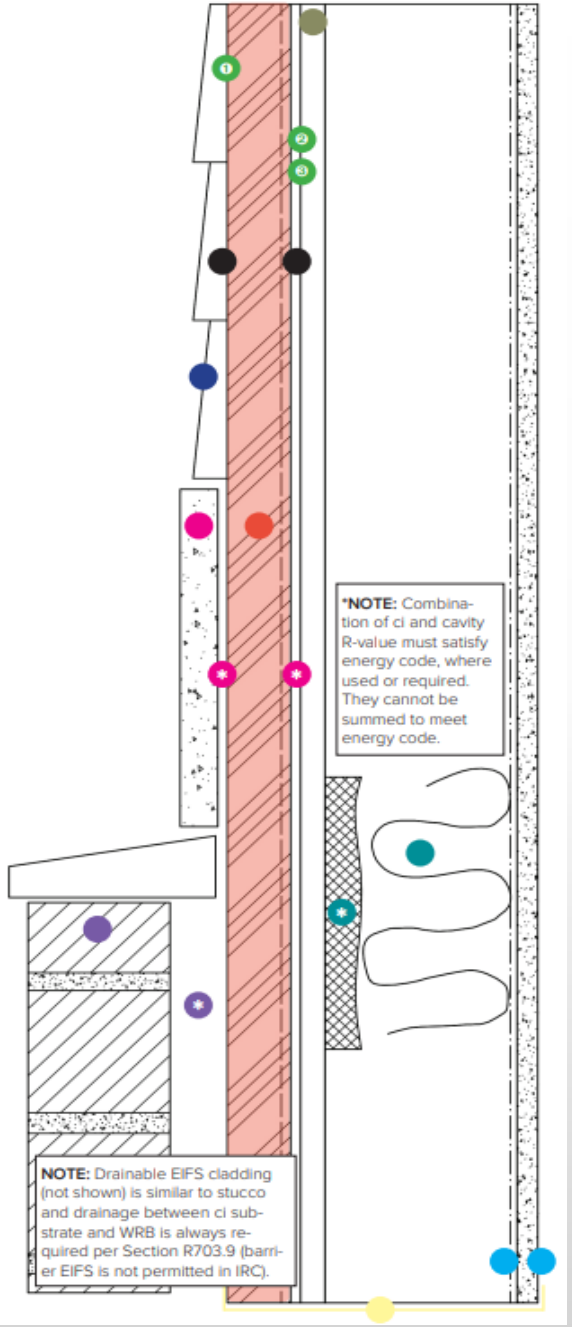
Functions of the BTE

- In addition to fire safety, structural safety, sound control,and durability the BTE must address the following control layers (functions):
  - **Water** control layers [cladding + continuous water-resistive barrier (WRB) + flashing to control water intrusion]
  - **Air** control layer [continuous air barrier (AB) to control air leakage]
  - **Thermal** control layer [continuity of thermal insulation to control heat loss/gain and surface temperatures]
  - **Water vapor** control layer [use of vapor retarders (VR) in coordination with insulation strategy and climate]
- All functions must be satisfied at least to the minimum extent required by the building and energy code.
- Some “layers” or materials can perform multiple functions depending on design approach and material properties



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What is Ci?

- Two building thermal envelope insulation components are defined in the IECC & ASHRAE 90.1{}:
  - **CAVITY INSULATION.** Insulating material located between framing members.
  - **CONTINUOUS INSULATION (ci):** Insulation that is {uncompressed and} continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior or is integral to any opaque surface of the building envelope.
- Various insulation material options for each, but with different performance attributes and functional capabilities for energy code and building code compliance.

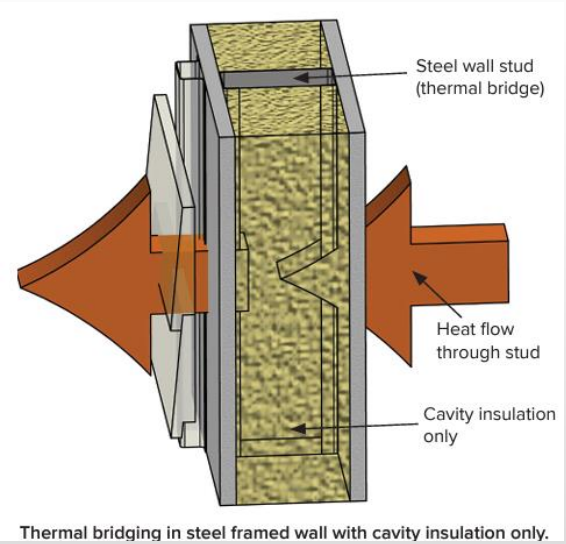
Without Ci

Cavity insulation only

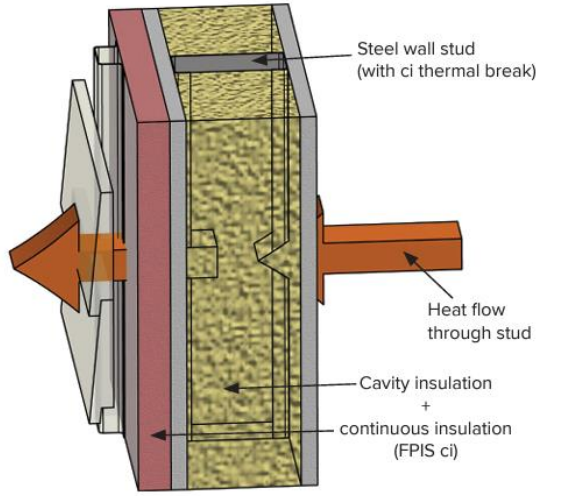
With Ci

Cavity + Ci insulation (or Ci only)

Source: Dryvit/Dow



Thermal bridging in steel framed wall with cavity insulation only.



Thermal bridging in steel framed wall with cavity insulation and foam plastic insulating sheathing (FPIS) continuous insulation (ci).

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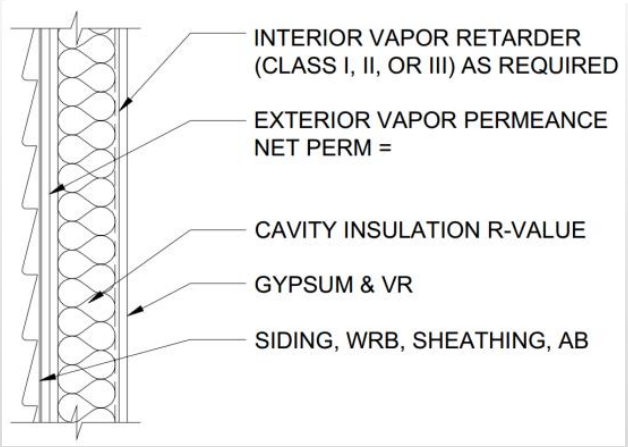
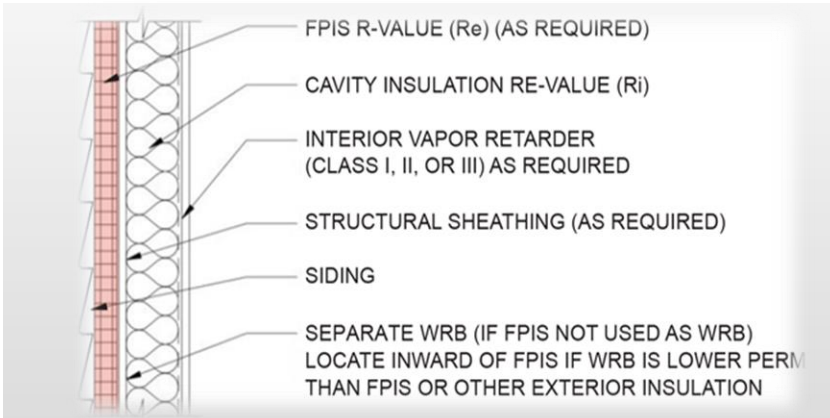
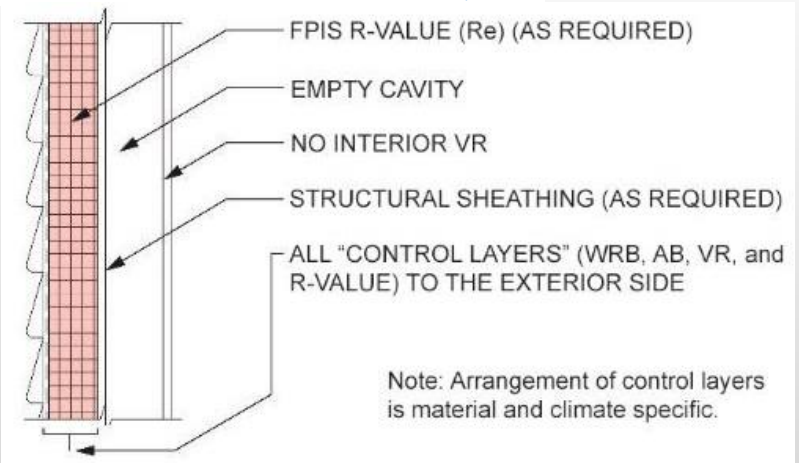
Typical Methods for Insulating *Exterior Walls*

1. ***Cavity insulation only*** (traditional method)
2. ***Cavity insulation + continuous insulation*** (common choice for modern code-compliant or high-performance walls)
3. ***Continuous insulation (ci) only*** (the "perfect wall" with all control layers to the exterior – maximum protection and thermal performance)







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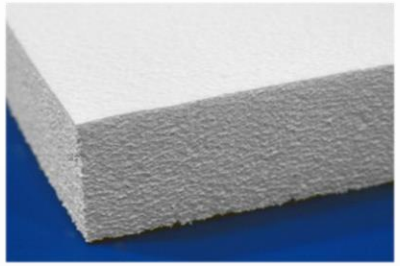
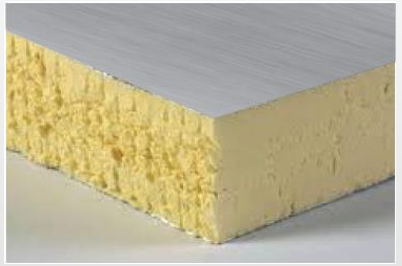
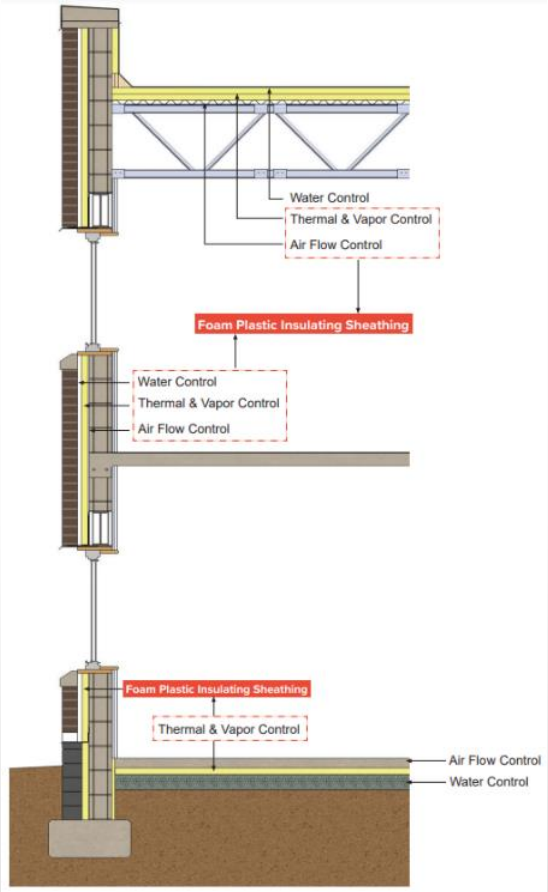
Multi-functional Capabilities of Ci

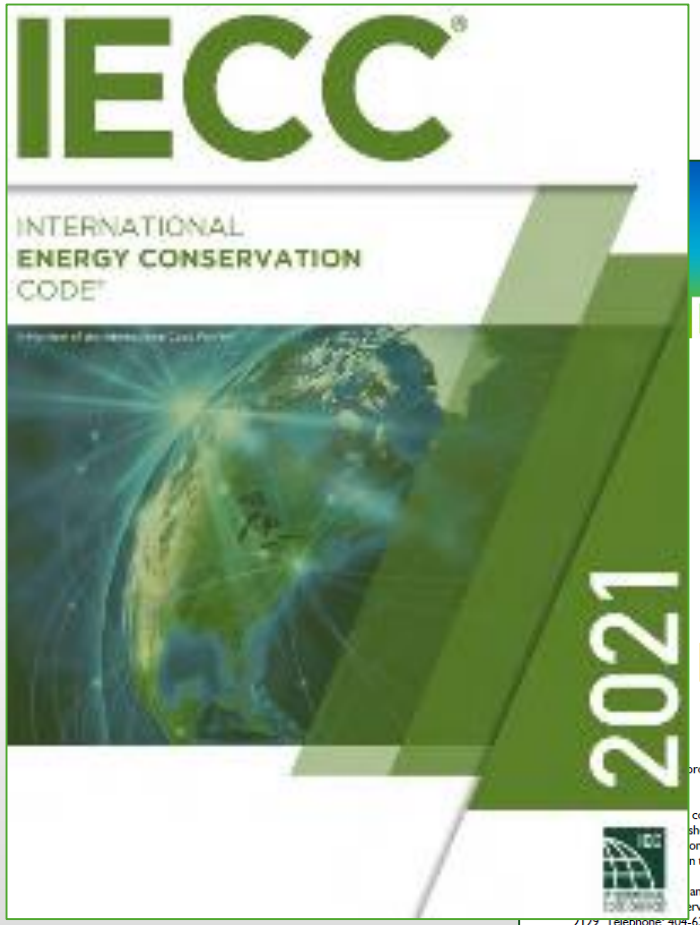
- EXAMPLE: Foam Plastic Insulating Sheathing (FPIS); i.e. “rigid board”
- Applications: walls, roofs, floors, and foundations (residential and commercial)
- BTE Functional Capabilities of FPIS:
  - IECC - Thermal Insulation (Ci)
  - IECC - Air barrier (AB)
  - IBC/IRC – Water vapor control/retarders (VR)
  - IBC/IRC – Water-resistive barrier (WRB) system
  - IBC/IRC – Foundation/footing frost protection
- More multi-functional capabilities =
  ➔ satisfy multiple code requirements
  ➔ simpler assemblies
  ➔ optimized cost vs. performance

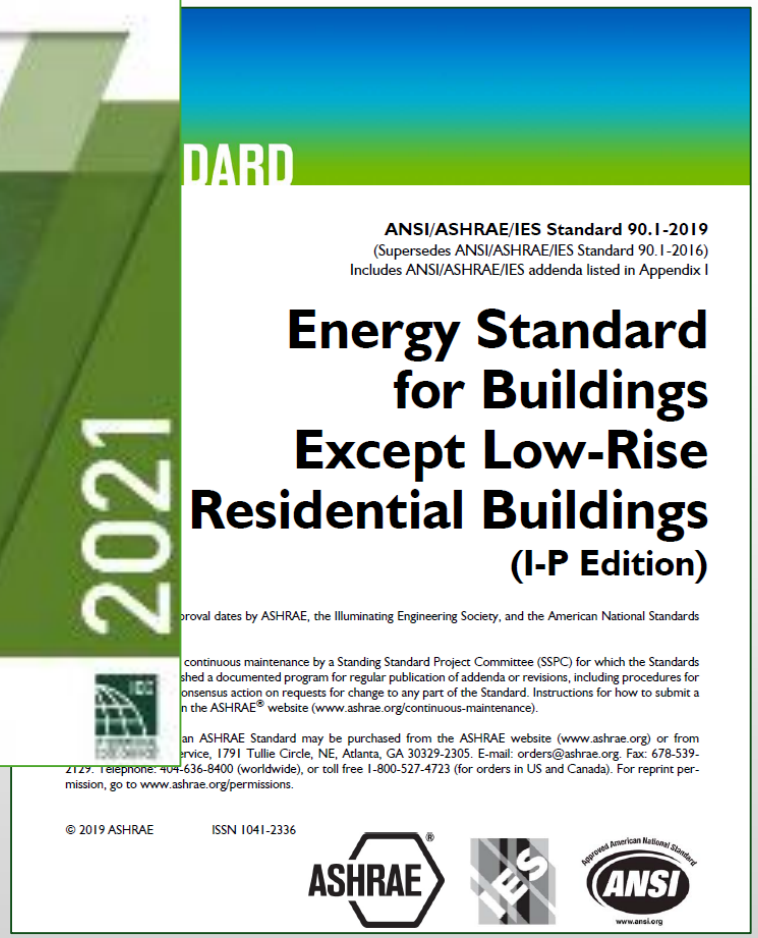


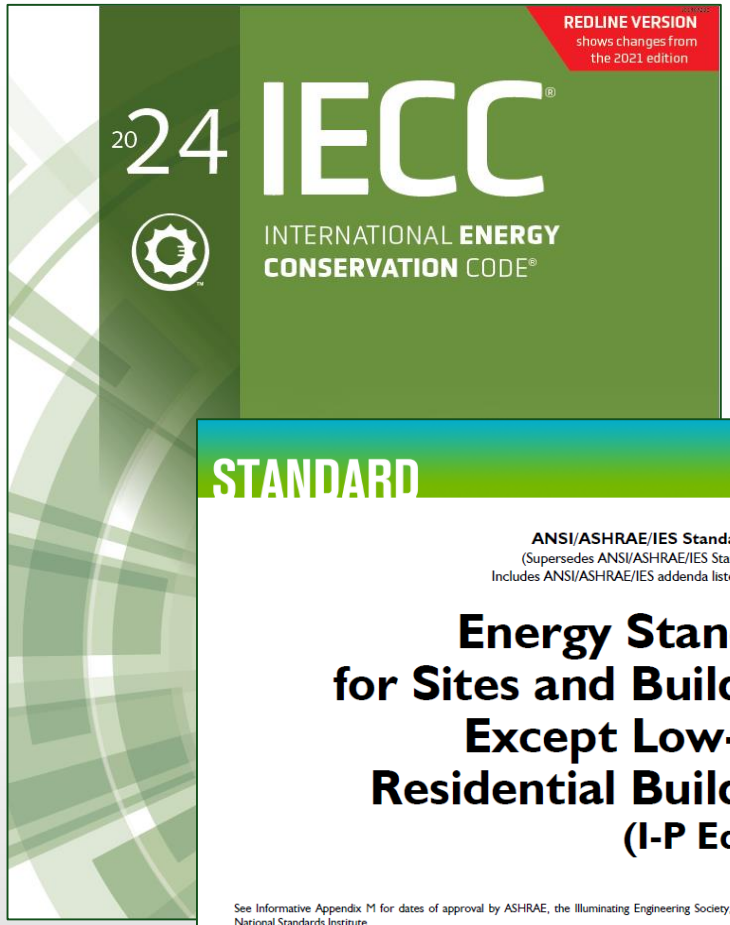




Commercial Energy Codes







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C301 Climate Zone & C302 Design Conditions

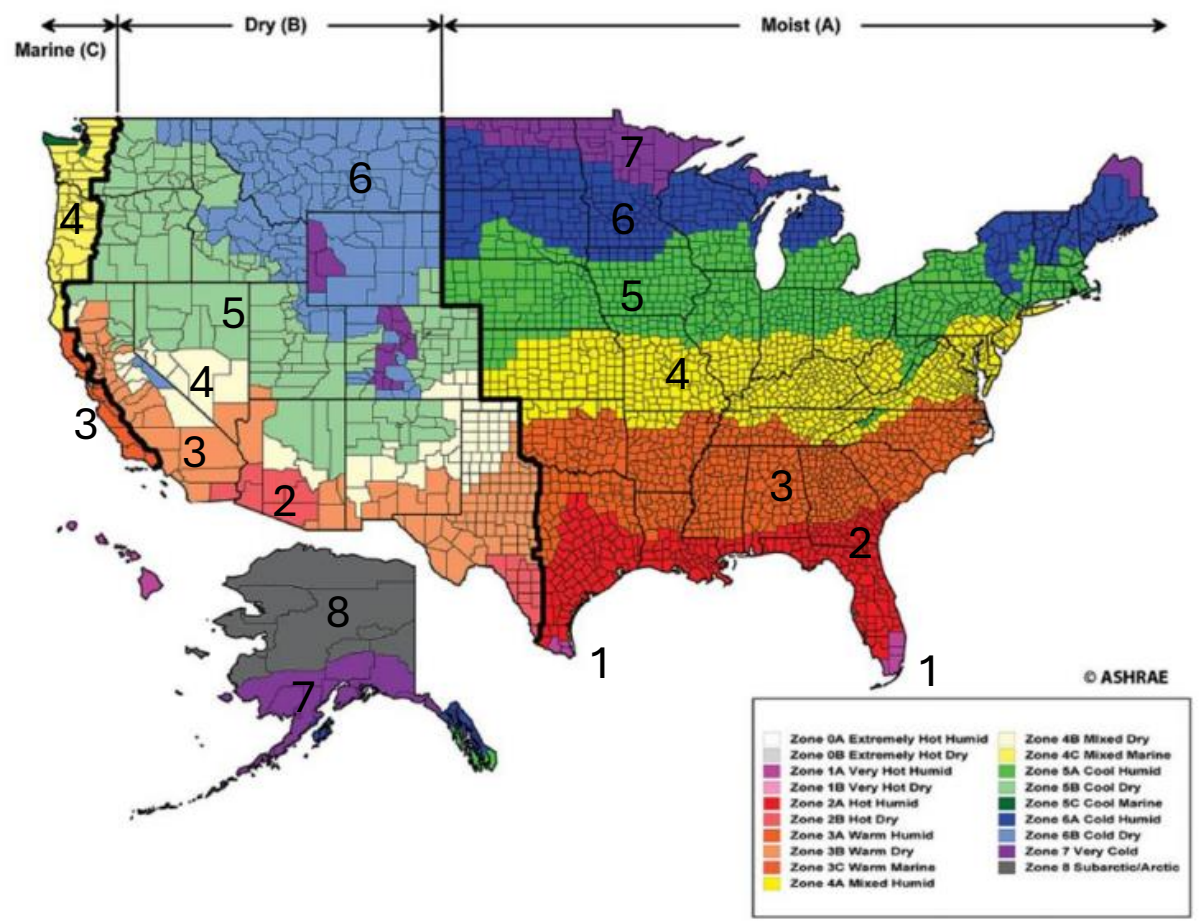


Figure 3.4.2. U.S. Climate Zone Map
(Source: ©ASHRAE www.ashrae.org Standard 169, 2013)

IECC Figure C301.1

SECTION C302
DESIGN CONDITIONS

C302.1 Interior design conditions. The interior design temperatures used for heating and cooling load calculations shall be a maximum of 72°F (22°C) for heating and minimum of 75°F (24°C) for cooling.

Choose your compliance path

- **C401.2.1 International Energy Conservation Code**
  1. Prescriptive Compliance (Sections C402 – C406 and C408)

     For BTE per C402, the following choices:
     - **Prescriptive minimum R-value insulation components**
     - **Prescriptive maximum assembly U-factor**
     - **Prescriptive component performance trade-offs (i.e. COMcheck)**

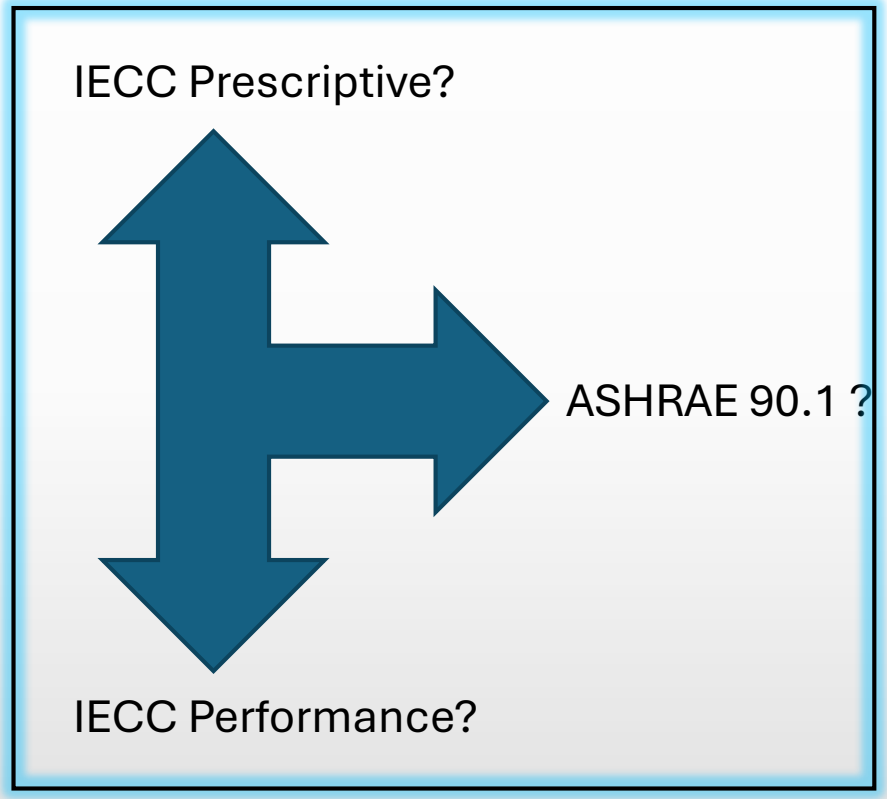
     + Additional Efficiency Credits (C408)

     OR

  2. Total Building Performance (Section C407)

     OR

- **C401.2.2 ASHRAE 90.1**
  - Also has prescriptive and performance paths for compliance



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Opaque Envelope – Minimum R-value Method

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		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-25 + R-11 + R-11 LS	R-25 + R-11 + 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	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-13 + R-5ci	R-13 + R-7.5ci	R-15.2ci	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-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	R-13 + R-19.5ci	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	R-13 + R-18.8ci	R-13 + R-18.8ci
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 ci	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	R-13 + R-18.8ci	R-13 + R-18.8ci
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	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	R-23ci	R-23ci
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	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 24″ below	R-20 for 48″ below	R-20 for 48″ below	R-20 for 48″ below	R-25 for 48″ below
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	R-20 for 48″ below+ R-5 full slab	R-20 for 48″ below+ R-5 full slab

2024 IECC – added equivalent prescriptive R-value options for steel and wood framed walls…

TABLE C402.1.3
OPAQUE BUILDING 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		8	
	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
Walls, above grade																
Metal framed[h, i]	~~R-13 + R-5ci~~ R-0 + R-10ci or R-13 + R-5ci or R-20 + R-3.8ci	~~R-13 + R-5ci~~ R-0 + R-10ci or R-13 + R-5ci or R-20 + R-3.8ci	~~R-13 + R-5ci~~ R-0 + R-10ci or R-13 + R-5ci or R-20 + R-3.8ci	~~R-13 + R-7.5ci~~ R-0 + R-12.6ci or R-13 + R-7.5ci or R-20 + R-6.3ci	~~R-13 + R-7.5ci~~ R-0 + R-12.6ci or R-13 + R-7.5ci or R-20 + R-6.3ci	~~R-13 + R-7.5ci~~ R-0 + R-12.6ci or R-13 + R-7.5ci or R-20 + R-6.3ci	~~R-13 + R-7.5ci~~ R-0 + R-12.6ci or R-13 + R-7.5ci or R-20 + R-6.3ci	~~R-13 + R-7.5ci~~ R-0 + R-12.6ci or R-13 + R-7.5ci or R-20 + R-6.3ci	~~R-13 + R-10ci~~ R-0 + R-15.2ci or R-13 + R-10ci or R-20 + R-9ci	~~R-13 + R-10ci~~ R-0 + R-15.2ci or R-13 + R-10ci or R-20 + R-9ci	~~R-13 + R-12.5ci~~ R-0 + R-17.3ci or R-13 + R-12.5ci or R-20 + R-11ci	~~R-13 + R-12.5ci~~ R-0 + R-17.3ci or R-13 + R-12.5ci or R-20 + R-11ci	~~R-13 + R-12.5ci~~ R-0 + R-17.3ci or R-13 + R-12.5ci or R-20 + R-11ci	~~R-13 + R-15.6ci~~ R-0 + R-21ci or R-13 + R-15.6ci or R-20 + R-14.3ci	~~R-13 + R-18.8ci~~ R-0 + R-24ci or R-13 + R-18.8ci or R-20 + R-17.5ci	~~R-13 + R-18.8ci~~ R-0 + R-24ci or R-13 + R-18.8ci or R-20 + R-17.5ci
Wood framed and other[h, i]	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 + R-12ci or R-13 + R-3.8ci or R-20	R-0 +R-16ci or R-13 + R-7.5ci or R20 + R3.8ci or R-27	R-0 +R-16ci or R-13 + R-7.5ci or R-20 + R-3.8ci or R-27	R-0 +R-16ci or R-13 + R-7.5ci or R-20 + R-3.8ci or R-27	R-0 +R-16ci or R-13 + R-7.5ci or R-20 + R-3.8ci or R-27	R-0 +R-16ci or R-13 + R-7.5ci or R-20 + R-3.8ci or R-27	R-0 +R-16ci or R-13 + R-7.5ci or R-20 + R-3.8ci or R-27	R-0 + R-27.5ci or R-13 + R-18.8ci or R-20 + R-14ci	R-0 + R-27.5ci or R-13 + R-18.8ci or R-20 + R-14ci

h. The first value is cavity insulation; the second value is continuous insulation. Therefore, “R-0 + R-12ci” means R-12 continuous insulation and no cavity insulation; “R-13 + R-3.8ci” means R-13 cavity insulation and R-3.8 continuous insulation; “R-20” means R-20 cavity insulation and no continuous insulation. R-13, R-20 and R-27 cavity insulation, as used in this table, apply to a nominal 4-inch, 6-inch and 8-inch-deep wood or cold-formed steel stud cavities, respectively.
i. Where the required *R*-value in **Table C402.1.3** is met by using continuous insulation such that cavity insulation is not required, the *R*-value is applicable to any wall framing spacing.

Also added new Table C402.1.2.1.7 – effective U-factors / R-values for spandrel panels (opaque wall)

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Summary of IECC Prescriptive R-value & U-factor Requirements for Walls

2021 IECC - Tables C402.1.3 & C402.1.4; 2024 IECC - Tables C402.1.2 & C402.1.3

<table>
<tr><th rowspan="2">Climate Zone</th><th rowspan="2">Building Use</th><th>Mass</th><th colspan="3">Metal Framed</th><th colspan="3">Wood Framed</th></tr>
<tr><th>2018/2021/2024 IECC</th><th>2018 IECC</th><th>2021 IECC</th><th>2024 IECC</th><th>2018 IECC</th><th>2021 IECC</th><th>2024 IECC</th></tr>
<tr><td rowspan="2">0 and 1</td><td>All other</td><td rowspan="3">R-5.7ci
(U-0.151)</td><td rowspan="3">R13+5ci
(U-0.077)</td><td rowspan="3">R13+5ci
(U-0.077)</td><td rowspan="3">R0+10ci or
R13+5ci or
R20+3.8ci
(U-0.077)</td><td rowspan="5">R13+3.8ci or
R20
(U-0.064)</td><td rowspan="4">R13+3.8ci or
R20
(U-0.064)</td><td rowspan="4">R0+12ci or
R13+3.8ci or
R20
(U-0.064)</td></tr>
<tr><td>Group R</td></tr>
<tr><td rowspan="2">2</td><td rowspan="2">All other</td></tr>
<tr><td>Group R</td><td>R-7.6ci
(U-0.123)</td><td rowspan="6">R13+7.5ci
(U-0.064)</td><td rowspan="4">R13+7.5ci
(U-0.064)</td><td rowspan="4">R0+12.6ci or
R13+7.5ci or
R20+6.3ci
(U-0.064)</td></tr>
<tr><td>3</td><td>All other</td><td rowspan="2">R-9.5ci
(U-0.104)</td></tr>
<tr><td>Group R</td></tr>
<tr><td rowspan="2">4 Except Marine</td><td>All other</td></tr>
<tr><td>Group R</td><td rowspan="2">R-11.4ci
(U-0.090)</td><td rowspan="3">R13+10ci
(U-0.055)</td><td rowspan="3">R0+15.2ci or
R13+10ci or
R20+9ci
(U-0.055)</td><td rowspan="5">R13+7.5ci or
R20+3.8ci
(U-0.051)</td><td rowspan="5">R0+16ci or
R13+7.5ci or
R20+3.8ci or
R27
(U-0.051)</td></tr>
<tr><td>5 and Marine 4</td><td>All other</td></tr>
<tr><td rowspan="2">Group R</td><td rowspan="2">R-13.3ci
(U-0.080)</td></tr>
<tr><td rowspan="2">6</td><td>All other</td><td rowspan="4">R13+7.5ci or
R20+3.8ci
(U-0.051)</td></tr>
<tr><td>Group R</td><td rowspan="4">R-15.2ci
(U-0.071)</td><td rowspan="3">R13+12.5ci
(U-0.049)</td><td rowspan="3">R0+17.3ci or
R13+12.5ci or
R20+11ci
(U-0.049)</td></tr>
<tr><td rowspan="2">7</td><td>All other</td></tr>
<tr><td>Group R</td><td>R13+15.6ci
(U-0.052)</td><td>R13+15.6ci
(U-0.042)</td><td>R0+21ci or
R13+15.6ci or
R20+14.3ci
(U-0.042)</td></tr>
<tr><td rowspan="2">8</td><td>All other</td><td rowspan="2">R-25ci
(U-0.037)</td><td>R13+7.5ci
(U-0.064)</td><td rowspan="2">R13+18.8ci
(U-0.037)</td><td rowspan="2">R0+24ci or
R13+18.8ci or
R20+17.5ci
(U-0.037)</td><td rowspan="2">R13+15.6ci or
R20+10ci
(U-0.036)</td><td rowspan="2">R13+18.8ci
(U-0.032)</td><td rowspan="2">R0+27.5ci or
R13+18.8ci or
R20+14ci
(U-0.032)</td></tr>
<tr><td>Group R</td><td>R13+17.5ci
(U-0.045)</td></tr>
</table>

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Opaque Envelope – R-value Method

- Example application of Table C402.1.3 for Climate Zone 5
  - Assume: Office building (use "all other" category, not Group R)
    - Roof ("insulation entirely above deck"): R-30
    - Above-grade walls: R-13+10ci
      ("metal framed" = cold-formed steel)
    - Foundation (below grade walls): R-7.5ci
    - Floors (over unconditioned space): R-30 (steel frame)
      R-14.6ci (mass floor)
    - Floor (slab on grade): R-15 for 24" below

2024 IECC:
R-0 + 15.2ci
R-13 + 10ci
R-20 + 9ci

F-factor equivalent = R-10 for 36" below

CLIMATE ZONE	5 AND MARINE 4	
	All other	Group R
Insulation entirely above roof deck	R-30ci	R-30ci
Metal buildings[b]	R-19 + R-11 LS	R-19 + R-11 LS
Attic and other	R-49	R-49
Mass[f]	R-11.4ci	R-13.3ci
Metal building	R-13 + R-14ci	R-13 + R-14ci
Metal framed	R-13 + R-10ci	R-13 + R-10ci
Wood framed and other	R-13 + R-7.5ci or R20 + R3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci
Below-grade wall[d]	R-7.5ci	R-10ci
Mass[a]	R-14.6ci	R-16.7ci
Joist/framing	R-30	R-30
Unheated slabs	R-15 for 24" below	R-20 for 24" below
Heated slabs[g]	R-15 for 36" below+ R-5 full slab	R-15 for 36" below+ R-5 full slab

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Opaque Envelope – Maximum U-, C-, F-Factor Method

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[g]	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]	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[h]	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[i]	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

Example use of U-factor next slide

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Opaque Envelope – U-, C-, F-Factor Method

- Example cold-formed steel frame wall U-factor calculation (C402.1.4.2, Eq 4-1):

C402.1.4.2 Thermal resistance of cold-formed steel walls. *U*-factors of walls with cold-formed steel studs shall be permitted to be determined in accordance with Equation 4-1.

$U = 1/[R_s + (ER)]$ **(Equation 4-1)**

where:

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

ER = The effective *R*-value of the *cavity insulation* with steel studs as specified in Table C402.1.4.2.

TABLE C402.1.4.2
EFFECTIVE *R*-VALUES FOR STEEL STUD WALL ASSEMBLIES

NOMINAL STUD DEPTH (inches)	SPACING OF FRAMING (inches)	CAVITY *R*-VALUE (insulation)	CORRECTION FACTOR (F_c)	EFFECTIVE *R*-VALUE (ER) (Cavity *R*-Value × F_c)
3 1/2	16	13	0.46	5.98
		15	0.43	6.45
3 1/2	24	13	0.55	7.15
		15	0.52	7.80
6	16	19	0.37	7.03
		21	0.35	7.35
6	24	19	0.45	8.55
		21	0.43	9.03
8	16	25	0.31	7.75
	24	25	0.38	9.50

	3-1/2" Stud 16"oc 13+10ci	6" Stud 16"oc 20+9ci	Any stud size Any spacing 0+15.2ci
Cavity Rated R-value	13	20	0.9
Correction Factor (Fc)	0.46	0.36	1
Core Wall Eff. R-value (ER)	5.98	7.2	0.9
Ci R-value	10	9	15.2
5/8" Gyp (interior)	0.56	0.56	0.56
5/8" Gyp (exerior)	0.56	0.56	0.56
Stucco	0.08	0.08	0.08
Interior air film	0.68	0.68	0.68
Exterior air film	0.17	0.17	0.17
Rs	12.05	11.05	17.25
U-Factor	**0.055**	**0.055**	**0.055**
Effective R-value	**18.0**	**18.3**	**18.2**

NEW 2024: Deletes Eq 4-1 and references AISI S250 standard. But, standard only addresses studs at layout spacing (omits tracks and headers and built-up studs). Significantly underestimates actual wall U-factor. Suggest retaining Eq 4-1 and limit AISI S250 for use on tall curtain walls without framing other than layout studs.

U-factor per Eq 4-1 ≤ U-factor 0.055 required by Table C402.1.4 (OK)

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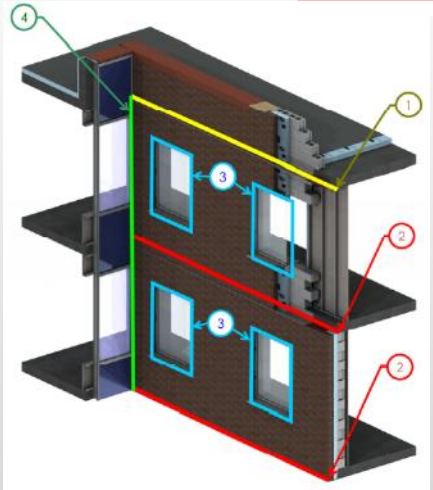
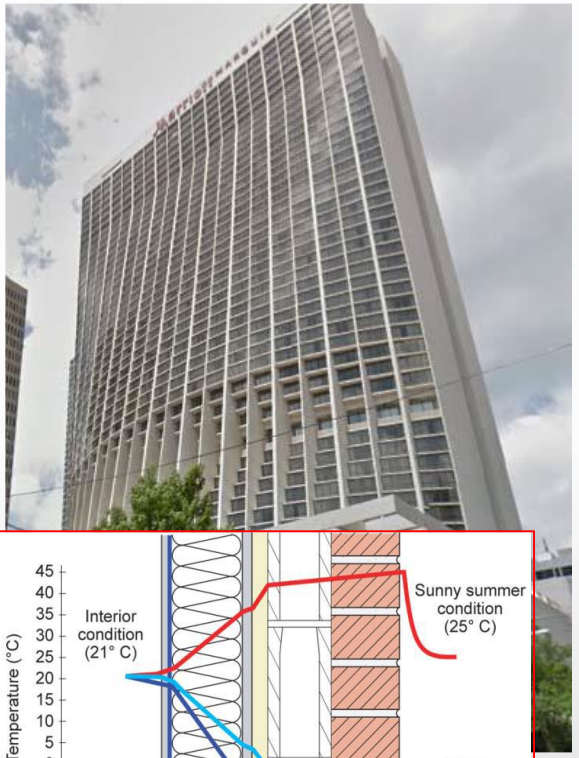
Opaque Envelope – R-value Method

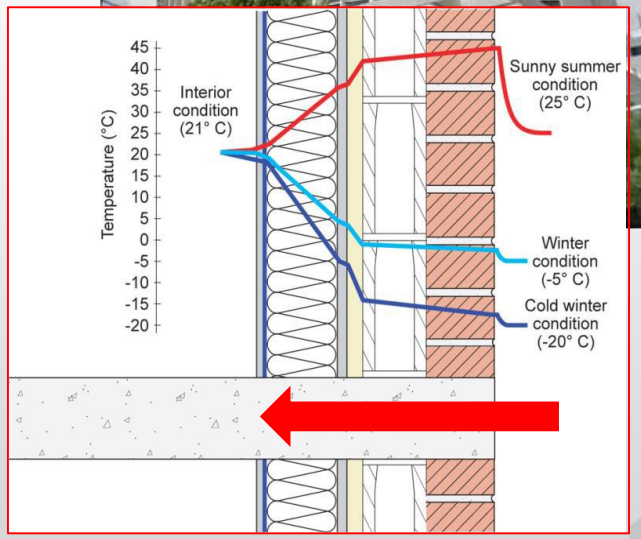
- Again, definitions matter…

WALL, ABOVE-GRADE. A wall associated with the *building thermal envelope* that is more than 15 percent above grade and is on the exterior of the building or any wall that is associated with the *building thermal envelope* that is not on the exterior of the building. This includes, but is not limited to, between-floor spandrels, peripheral edges of floors, roof knee walls, dormer walls, gable end walls, walls enclosing a mansard roof and skylight shafts.



Source: BC Hydro BETB Guide, Morrison Hershfield LTD





NOTE: Thermal bridging at assembly intersections (e.g., wall-floor, wall-roof, window-wall, etc.) must be addressed to avoid unaccounted heat flows that can significantly impact performance of the building thermal envelope.

NEW 2024 IECC: Prescriptive and performance-based thermal bridging provisions in C402.7 & C407 enable compliance with this definition; similar requirements in ASHRAE 90.1-2022 Section 5.5.5, Chapter 12 & Appendix G (modeling), and Appendix A.10. [CZ 0-3 exempted]

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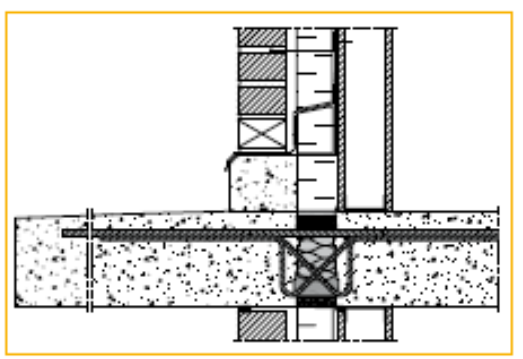
Examples of Mitigated Linear Thermal Bridges (Balconies)

Suspended and separately supported balconies with shear tab or offset shelf-angle point connection to building

OR…



Cantilevered Balcony Structural Thermal Break

Source: Google search

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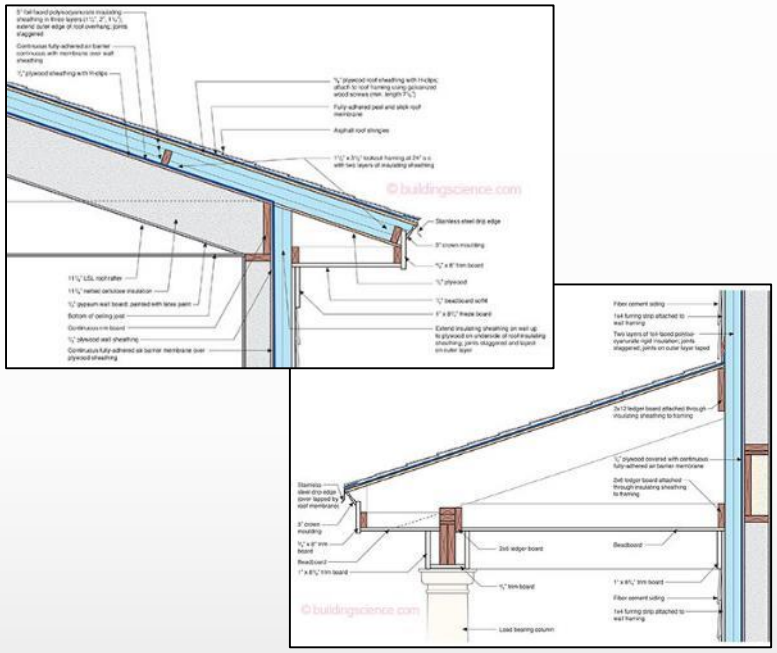
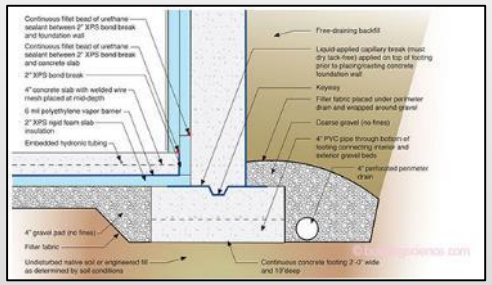
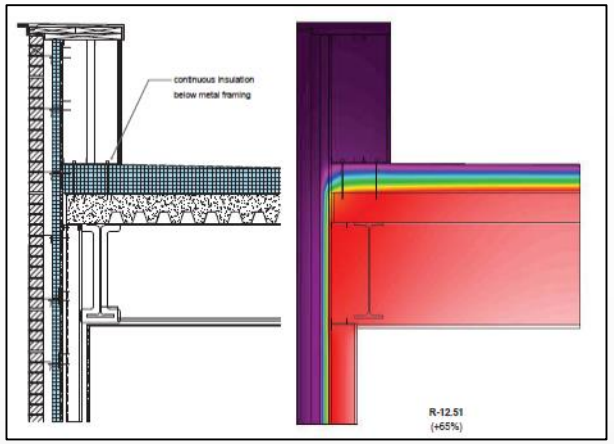
More Examples of Mitigated Linear Thermal Bridges

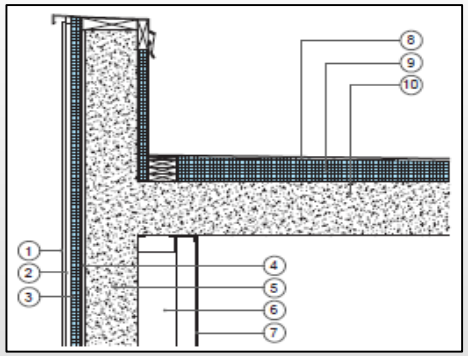
(non-exhaustive “commodity” details)



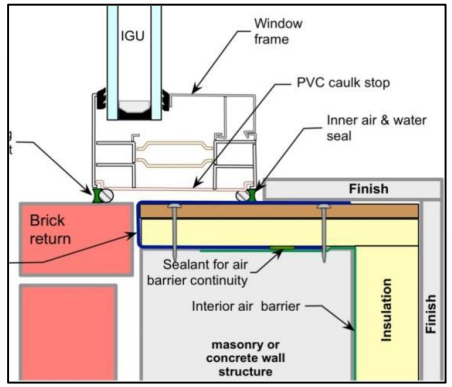


Example Details from BSI-081: Zeroing In (J. Lstiburek, Building Science Corp) as used on NIST NZERTF Project

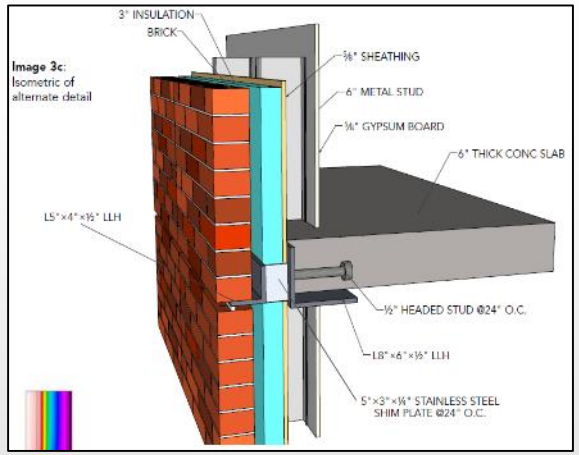




INSULATED PARAPET DETAILS (Payette/AIA report)



INSULATED WINDOW ROUGH OPENING DETAIL (USACE report)



OFFSET SHELF ANGLE (AISC/SEI article)

NOTE: Coordinate detailing at floor-wall and fenestration with NFPA 285 tested assemblies and approved engineering analysis details (applies to Type I-IV buildings, not Type V wood frame).

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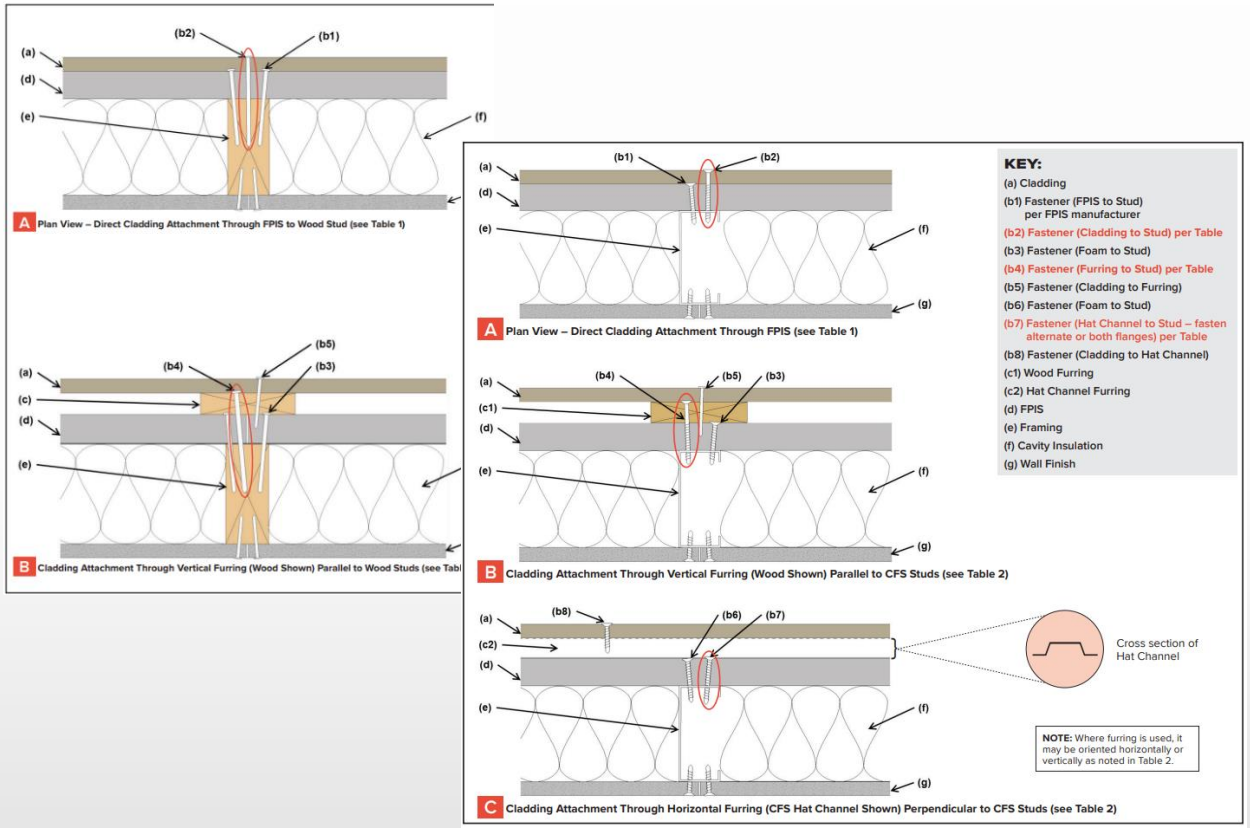
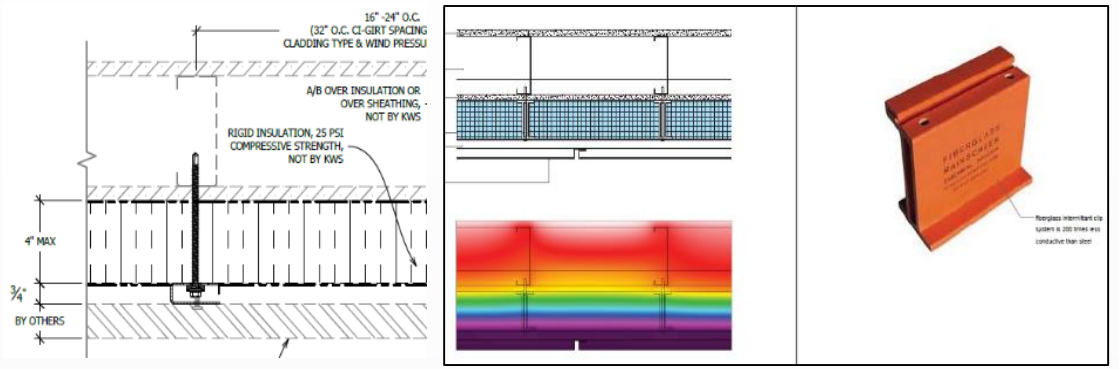
Cladding Connections and Supports





Low thermal conductivity furring/cladding/ledger supports

Sources: Payette/AIA report and product info from Google search

See 2021 IBC Section 2603.12 and .13 (2024 IBC Section 1404.5) for fastening cladding or furring through FPIS ci. Z-furring penetrating through exterior insulation is cavity insulation – doesn't meet continuous insulation definition. See also: https://www.continuousinsulation.org/cladding-connections

GOAL: Avoid continuous linear cladding supports like metal Z-furring penetrating *continuous insulation* which would not meet building and energy code definition for ci; instead, use "point" connections through continuous insulation to offset furring (or fasten cladding directly through FPIS ci to framing).

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2021 IECC C402.5 Air Leakage

- C402.5.1 Air barriers
  - C402.5.1.1 Air barrier construction
  - C402.5.1.2 Air barrier compliance
  - C402.5.1.3 Materials
  - C402.5.1.4 Assemblies
  - C402.5.1.5 Verification
- C402.5.2 Dwelling and sleeping unit enclosure testing
- C402.5.3 Building thermal envelope testing
- C402.5.4 Air leakage of fenestration
- Other related requirements (Section C402.5.5 – C402.5.11)

NEW for 2024 IECC:

- Re-organization of requirements
- Testing expanded to cover more buildings
- Air leakage rate decreased from 0.40 cfm/ft^2 to 0.35 cfm/ft^2 @ 75Pa
- Exception for failed test allowing up to 0.60 cfm/ft^2 is reduced to 0.45 cfm/ft^2
- For Group R-2 and I-1 buildings, it changed from 0.30 cfm/ft^2 to 0.27 cfm/ft^2 @ 50 Pa

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2021 IECC - C402.5 Air Leakage Compliance

- PRESCRIPTIVE: Comply with Sections C402.5.1 through C402.5.11.1 (basically the entirety of C402.5)

  OR

- PERFORMANCE: Tested in accordance with Section C402.5.2 or C402.5.3
  - Including requirements of C402.5.7, C402.5.8, and C402.5.9
- Testing can always be done, if specified, but it is now required in certain conditions for 2021* and 2024 IECC.
  (subject to interpretation)*

C402.5 Air leakage—thermal envelope. The *building thermal envelope* shall comply with Sections C402.5.1 through Section C402.5.11.1, or the building *thermal envelope* shall be tested in accordance with Section C402.5.2 or C402.5.3. Where compliance is based on such testing, the building shall also comply with Sections C402.5.7, C402.5.8 and C402.5.9.

Source: https://www.swinter.com/

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When is air leakage testing required? (2021 IECC)

- **Section C402.5.1.2** - Compliance (testing vs. air barrier install/inspection) varies by building occupancy group with exceptions based on climate zone and building size (FYI - ASHRAE 90.1-2019 has same maximum leakage rate of 0.40 cfm/ft^2, but requires testing in nearly all cases)
- Table below based on interpretation of C402.5 that testing was not intended to be optional and is required in many cases per specific requirements in C402.5.1.2 with exceptions:

Building Occupancy	Testing Requirements	Exceptions by Building Size and Climate Zone	Climate Zones where testing required
Group R & I	Section C402.5.2 (max ALR=0.30 cfm/ft^2 @ 50Pa)	Any Size: 2B, 3C, and 5C	0, 1, 2A, 3A/B, 4, 5A/B, 6, 7, 8
All Other Groups	Section C402.5.3 (max ALR = 0.40 cfm/ft^2 @ 75 Pa)	SF ≤ 5,000: 2B, 3B, 3C and 5C	0, 1, 2A, 3A, 4, 5A/B, 6, 7, 8
		5,000 < SF < 50,000: 0, 1, 2, 3, 4B/C and 5B/C	4A, 5A, 6, 7, 8
		SF ≥ 50,000: 0B, 1, 2, 3B/C, 4B/C, and 5C	0A, 3A, 4A, 5A/B, 6, 7, 8
Any building where testing is excepted above and not otherwise specified	Comply with Sections C402.5.1.3, C402.5.1.4, and C402.5.1.5 (materials, assemblies, and inspection/verification) – These are not required when testing, but often done to ensure achieving test requirement.		

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When is air leakage testing required? (2024 IECC)

- **Section C402.6.2 –** Max air leakage rate reduced to 0.35 cfm/ft^2 @ 75 Pa with fewer exceptions to compliance by whole building testing:
  - Climate Zone 2B exempted from testing or any air barrier installation/inspection requirement for all buildings.
  - Buildings (other than Group I and R) > 25,000 sf in CZ 0-4 that comply with periodic field inspection/verification of C402.6.2.3 are exempted from testing
  - Group I-1 and R-2 buildings are permitted to do dwelling/sleeping unit testing method (C402.6.2.2) at ALR = 0.27 cfm/ft^2 @ 50 Pa in lieu of whole building testing (C402.6.2.1)
- ASHRAE 90.1-2022, Section 5.4.3.1:
  - Only single wythe CMU buildings exempt in CZ 2B
  - Buildings < 10,000 sf ➔ whole building test (to same leakage rate as IECC)
  - Buildings ≥ 10,000 sf ➔ either test or do periodic field inspection/verification

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Air Barrier Tips

- Key to good air barrier system is sealing of joints, gaps, penetrations, and transitions.
- Best practice is dual air barrier to encapsulate air-permeable insulation (if used) – not required by code.
- Multi-functional Ci considerations
  - Most foam sheathing products meet air barrier material requirements (air permeability test)
    - Check manufacturer data/label
    - Some are “deemed-to-comply” (e.g., XPS and Polyiso min. ½” thick) per IECC, but not in ASHRAE 90.1
  - Tape foam sheathing joints per manufacturer instructions (also required if the FPIS ci is used as the WRB system)
  - Integrate with air/water control at fenestration and roof/foundation.

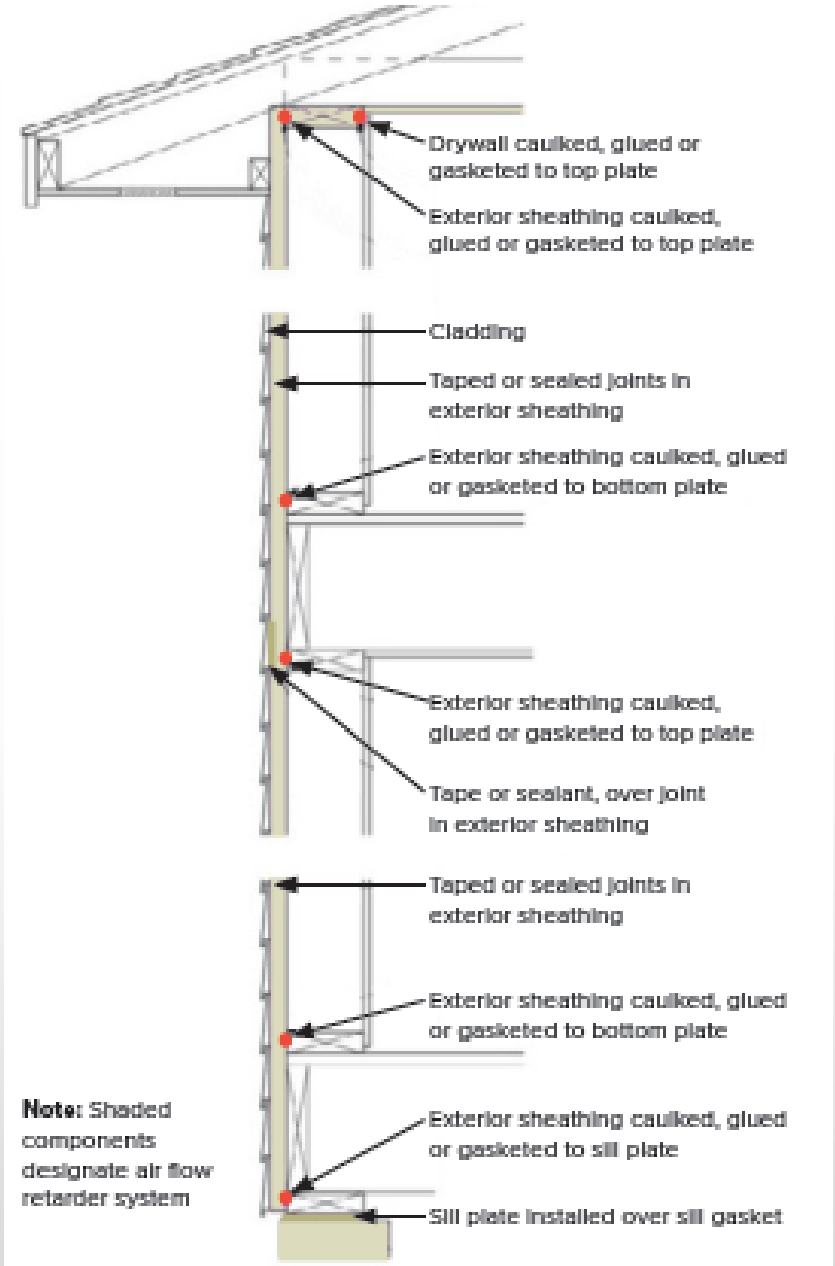

Figure 3. FPIS ci installed as an air barrier exterior sheathing.

Commercial Building Code

- Requirements that vary by energy code climate zones include:
  - **IBC Section 1404.3** - Vapor control (vapor retarders coupled with insulation strategy)
  - **IBC Section 1202.3 –** Unvented roofs for vapor control
  - **IBC Section 2510.6** - Drainage of conventional stucco cladding for Moist(A) and Marine(C) climate regimes
    - Foam sheathing also helps mitigate severe inward vapor drives that can occur with “reservoir” claddings like stucco.
- Other Requirements (fire, WRB, flashing, cladding attachment, wind resistance, etc.) don’t vary by energy code climate zones
  - See additional resources at end of presentation for code compliance and design guidance on these topics

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Rule #1 of 3

Moisture Control for Wall Assemblies:
Building Robust Walls with Foam Plastic Insulating Sheathing (FPIS) Continuous Insulation (ci)

07.27.21

RULE #1: Keep Water Vapor (Humid Air) Away from Cool Surfaces!

When installed in accordance with modern building code and energy code requirements for continuous insulation and water vapor control (see CI's Quick Guide: Water Vapor Control and wall calculators), FPIS ci keeps water-sensitive materials inside the wall dry by maintaining a temperature above the dew point. Simply use the right R-value of FPIS ci for the wall assembly based on the climate zone and an appropriately specified interior vapor retarder (or no interior vapor retarder) to control outward vapor diffusion in the winter and maintain inward vapor diffusion (drying) in the warmer seasons. This approach results in much dryer walls with a more stable moisture content throughout all seasons of the year in comparison to walls that rely exclusively on the traditional use of interior vapor retarders without any temperature control provided by FPIS ci, as shown in Figures 1 and 2. Learn more about the use of FPIS for water vapor control here.

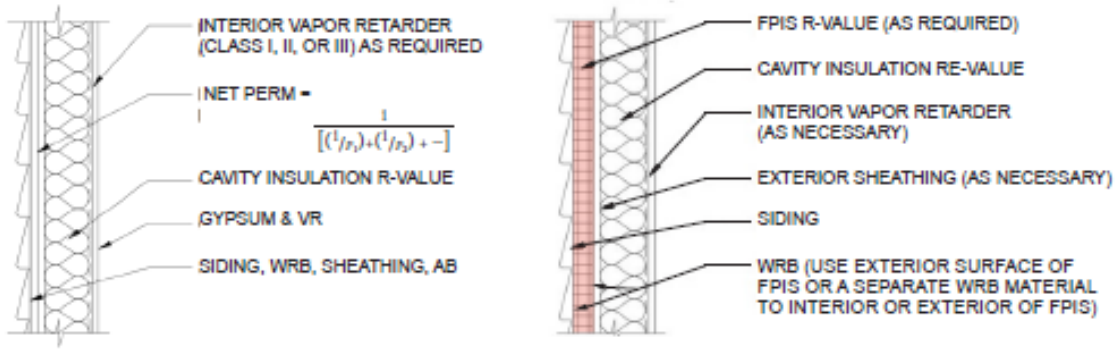
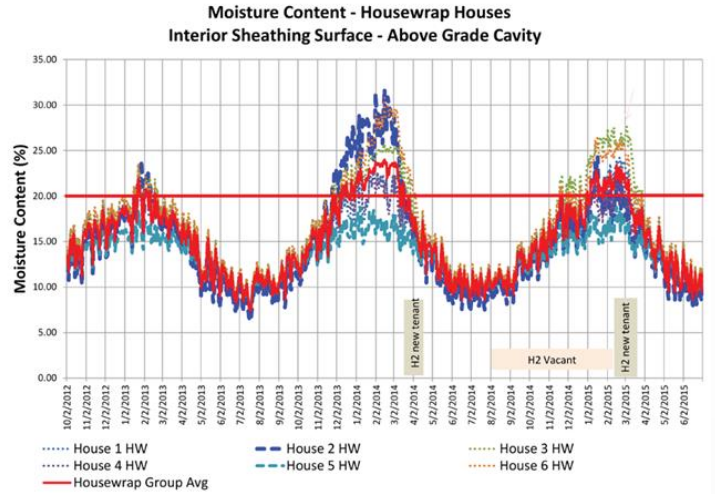
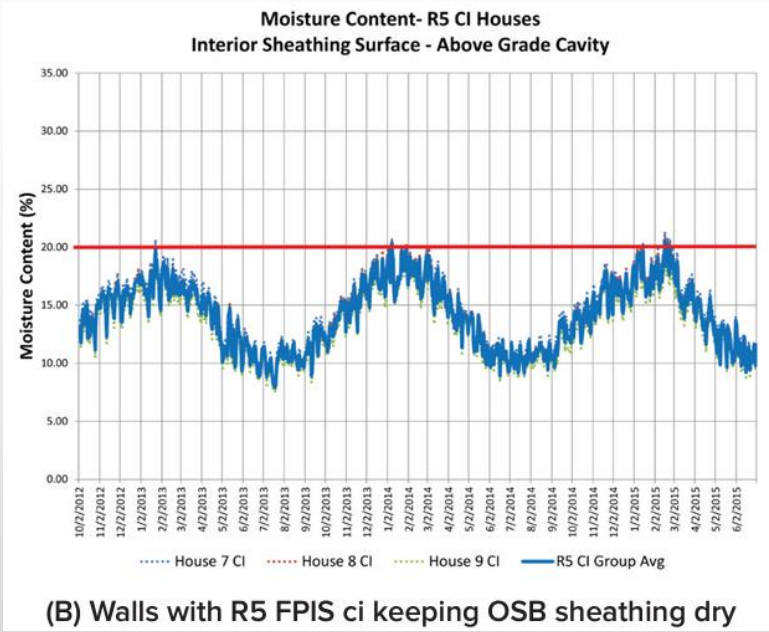


Figure 1. Cavity Insulation only vs. wall with FPIS ci Insulation (see Figure 2 for performance comparison)

https://www.continuousinsulation.org/resources/facts-ci



(A) Walls with R20 cavity insulation only consistently experiencing wet OSB.



(B) Walls with R5 FPIS ci keeping OSB sheathing dry

Figure 2. Comparison of 12 actual walls with and without R5 FPIS ci

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Rule #2 of 3

RULE #2: Minimize Air Leakage!

Leakage of moist air from the indoors or outdoors into or through a building assembly can easily override the function of vapor retarders. Minimize air leakage by following energy code requirements for use of continuous air barriers and sealing of joints and gaps. It's not just an energy code concern (although it does save a lot of energy).

When RULE #1 is followed and the FPIS ci is installed per Figure 3 as a code compliant air barrier, walls are less vulnerable to the consequence of air leakage for two reasons: (1) the FPIS ci will help limit air infiltration from the exterior (especially if it is also used as the WRB system, see RULE #3), and (2) it will also reduce the potential for moist air to condensate on or be adsorbed by moisture-sensitive materials inside the wall because it controls the temperature of those materials. Find more information on use of FPIS as an air barrier here.

https://www.continuousinsulation.org/resources/facts-ci

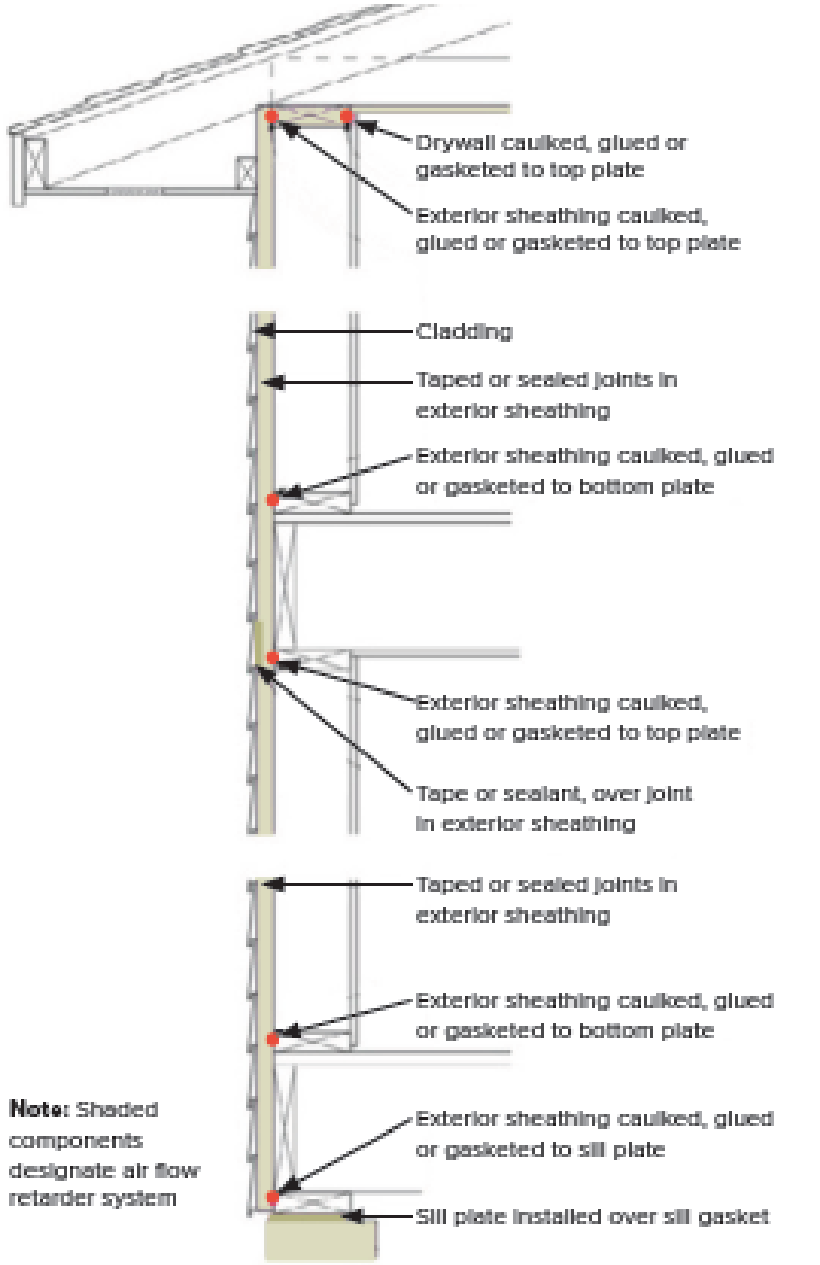

Figure 3. FPIS ci installed as an air barrier exterior sheathing.

Rule #3 of 3

RULE #3: Avoid Rain Water Intrusion!

Most importantly, keep rain water out of walls by proper use of cladding, drainage, water-resistive barrier (WRB), and flashing as required by the building code and good practice. Many FPIS ci products can be used as a code-approved WRB system when installed in accordance with the manufacturer's installation instructions. Approved FPIS WRB systems use durable joint treatments (e.g., joint tapes) and flashing materials (e.g., adhered or fluid-applied flexible flashings) as shown in Figure 4. FPIS WRB systems are subject to some of the most stringent wall assembly water-resistance test requirements. Find more information on FPIS WRB systems here.

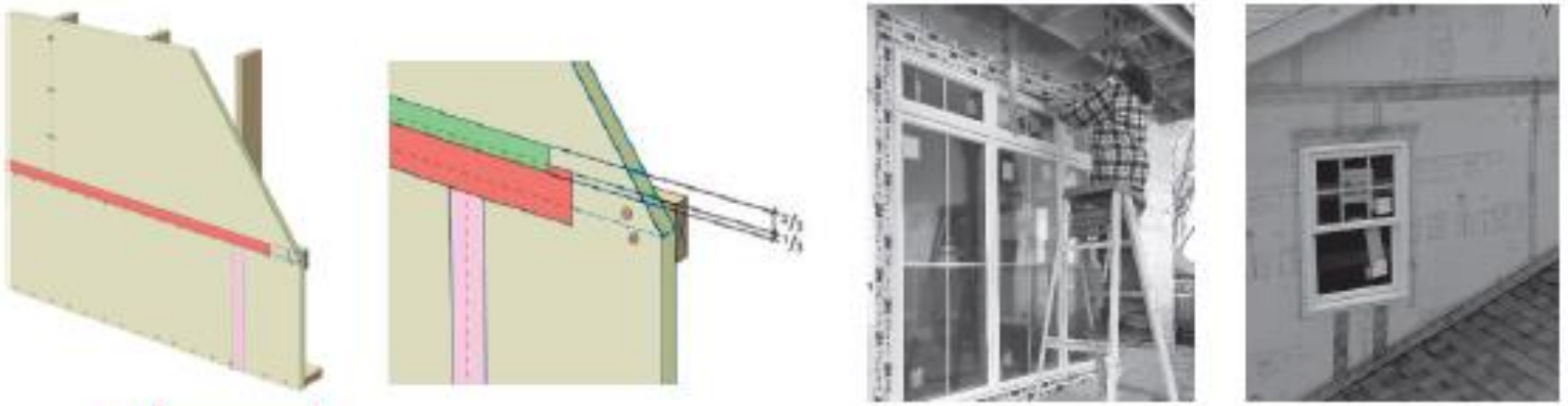

Figure 4. FPIS WRB System installation using joint tapes and adhered flashings; refer to manufacturer installation instructions for specific details.

https://www.continuousinsulation.org/resources/facts-ci

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IBC Section 1404.3 Vapor Retarders

- 2021 IBC includes major improvements for water vapor control with Ci
- 2024 IBC adds some incremental enhancements/options
  - Class I and II “responsive vapor retarders” are defined for Ci applications
  - Added provisions for the “perfect wall” (all control layers on exterior)
- Water vapor control per building code must be coordinated with energy code insulation requirements

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3-Step Guide for Water Vapor Control Code Compliance

(based on 2024 IBC/IRC)

Satisfies Rule #1 of 3 – Keep Water Vapor Away from Cool Surfaces

QUICK GUIDE
Foam Plastic Applications for Better Building

3 STEPS FOR CODE-COMPLIANT USE OF WATER VAPOR RETARDERS and Foam Plastic Insulating Sheathing (FPIS) Continuous Insulation (ci)

07.27.21

This reference guide summarizes key requirements and options in the 2024 International Residential Code (IRC) and 2024 International Building Code (IBC) for design and construction of code-compliant and moisture-resistant frame walls using foam plastic insulating sheathing (FPIS) as continuous insulation (ci). When used in a code-compliant manner, FPIS ci protects walls against the effects of moisture by keeping walls warm to prevent condensation while maximizing drying to the interior with proper vapor retarder specification.

Follow the three steps below for code-compliant water vapor control. The wall assembly design must also be coordinated with minimum energy code insulation requirements. For greater flexibility and to automate the application of this reference guide and energy code compliance, refer to these wall calculators. Various moisture control research reports and other practical guides are also available here.

For a summary of key concepts and principles for moisture control, refer to FACTS: Moisture Control for Wall Assemblies.

STEP 1: KNOW INTERIOR VAPOR RETARDER CLASSES

Use the following definitions for water vapor retarder classes when specifying interior vapor retarders in accordance with Steps 2 and 3:

TABLE R702.7(1) VAPOR RETARDER MATERIALS AND CLASSES

CLASS	ACCEPTABLE MATERIALS
I	Sheet polyethylene, nonperforated aluminum foil, or other approved materials with a perm rating of less than or equal to 0.1.
II	Kraft-faced fiberglass batts, vapor retarder paint, or other approved materials applied in accordance with the manufacturer's installation instructions for a perm rating greater than 0.1 and less than or equal to 1.0.
III	Latex paint, enamel paint, or other approved materials applied in accordance with the manufacturer's installation instructions for a perm rating of grater than 1.0 and less than or equal to 10.0.

https://www.continuousinsulation.org/resources/quick-guides

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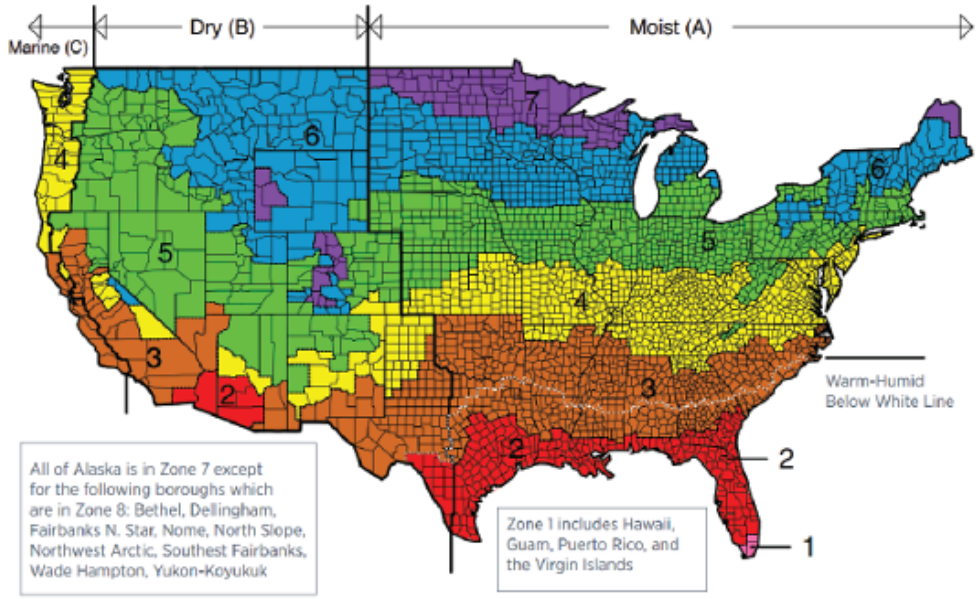
3-Step Guide (cont'd)

STEP 2: CONSIDER PERMITTED INTERIOR VAPOR RETARDERS

Select a "permitted" vapor retarder for the interior side of frame walls based on the Climate Zones as outlined in IRC Table R702.7(2), paying attention to footnotes and other table references. In Climate Zones 4-8, no interior vapor retarder is required where complying with Table R702.7(5).



U.S. Climate Zones

RESPONSIVE VAPOR RETARDER is defined as a "material complying with a *vapor retarder class* of Class I or Class II but which also has a vapor permeance of 1 perm or greater in accordance with ASTM E96, water method (Procedure B)."

TABLE R702.7(2) VAPOR RETARDER OPTIONS

CLIMATE ZONE	VAPOR RETARDER CLASS		
	CLASS I[a]	CLASS II[a]	CLASS III
1, 2	Not Permitted	Not Permitted	Permitted
3, 4 (except Marine 4)	Not Permitted	Permitted[c]	Permitted
Marine 4, 5, 6, 7, 8	Permitted[b]	Permitted[c]	See Table R702.7(3)

a. A responsive vapor retarder shall be allowed on the interior side of any frame wall in all climate zones.

b. In frame walls, use of a Class I interior vapor retarder that is not a responsive vapor retarder on the interior side with a Class I vapor retarder on the exterior side shall require an approved design.

c. Where a Class I or II vapor retarder is used in combination with foam plastic insulating sheathing or insulated siding installed as continuous insulation on the exterior side of frame walls, the continuous insulation shall comply with Table R702.7(4) and the Class I or II vapor retarder shall be a responsive vapor retarder.

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3-Step Guide (cont'd)

STEP 3: DETERMINE MINIMUM R-VALUE REQUIREMENTS FOR CI

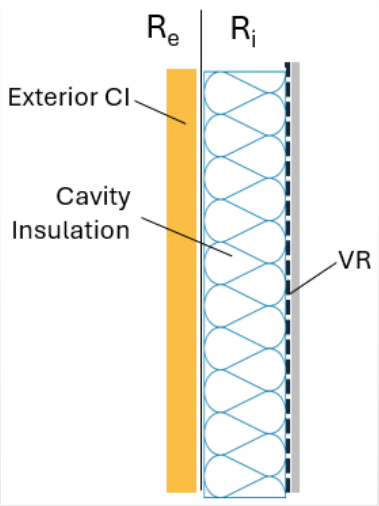
- **Example 1:** CZ 5 with Class III VR
  - IRC Table R702.7(3) or IBC 1404.3(3):
  - Use min. R-5ci on a R13 2x4 wood frame wall (e.g., R13+5ci)
    - Energy code requires R13+7.5ci (OK, exceeds minimum Ci R-value for vapor control)
  - Use min. R-7.5ci on a R20 2x6 wood frame wall
    - Exceeds energy code R20+3.8ci which doesn't work for vapor control (unless flash & batt in cavity, e.g., R13 batt + R7 ccSPF in cavity with R3.8ci on exterior)
    - Alternatively consider using Class I or II RVR (Example 2)
- **Example 2:** CZ 5, Class I or II Responsive Vapor Retarder
  - IRC Table R702.7(4) or IBC Table 1404.3(4):
  - Use min. R-5ci on 2x6 wall with R20 cavity (e.g., R20+5ci wall)
  - Exceeds minimum energy code for 2x6 WFW (i.e., R20+3.8ci) and could use R19+5ci to get closer to minimum energy code (by equivalent U-factor compliance)
  - Class I or II VR must be "responsive vapor retarders" (RVR) to minimize outward diffusion wetting while promoting inward diffusion drying
    - Class II RVR = kraft paper facer
    - Class I RVR = proprietary membranes
- Generally, steel frame walls require more Ci R-value in energy code and thus usually satisfy these vapor control requirements.

TABLE R702.7(3) CLASS III VAPOR RETARDERS
(only requirements for ci are shown)

CLIMATE ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:
4 Marine	ci with R-value ≥ 2.5 over 2 x 4 wall
	ci with R-value ≥ 3.75 over 2 x 6 wall
5	ci with R-value ≥ 5 over 2 x 4 wall
	ci with R-value ≥ 7.5 over 2 x 6 wall
6	ci with R-value ≥ 7.5 over 2 x 4 wall
	ci with R-value ≥ 11.25 over 2 x 6 wall
7	ci with R-value ≥ 10 over 2 x 4 wall
	ci with R-value ≥ 15 over 2 x 6 wall
8	ci with R-value ≥ 12.5 over 2 x 4 wall
	ci with R-value ≥ 20 over 2 x 6 wall

TABLE R702.7(4) CONTINUOUS INSULATION (ci) WITH CLASS I or II RESPONSIVE VAPOR RETARDER

CLIMATE ZONE	PERMITTED CONDITIONS
3	ci with R-value ≥ 2
4, 5, 6	ci with R-value ≥ 3 over 2 x 4 wall
	ci with R-value ≥ 5 over 2 x 6 wall
7	ci with R-value ≥ 5 over 2 x 4 wall
	ci with R-value ≥ 7.5 over 2 x 6 wall
8	ci with R-value ≥ 7.5 over 2 x 4 wall
	ci with R-value ≥ 10 over 2 x 6 wall



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3-Step Guide (cont'd)

- **Example 3:** CZ 5, No interior vapor retarder, exterior Ci only
  - Table R702.7(5) or IBC 1404.3(5)
  - Generally, the minimum ci R-values for moisture control are less than the energy code requires for exterior Ci-only walls.
  - Therefore, if complying with energy code minimums these vapor control requirements are met.
- Footnotes are important!
  - There still must be a max 1 perm vapor retarder but on the exterior side of the wall and to the interior side of the Ci insulation, unless the Ci insulation or its interior facer is a vapor retarder.

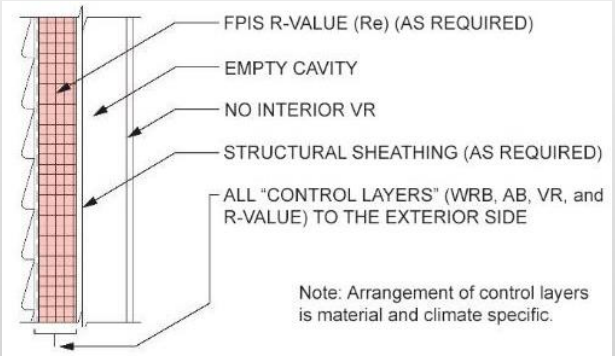
STEP 3: DETERMINE MINIMUM R-VALUE REQUIREMENTS FOR CI

TABLE R702.7(5) CONTINUOUS INSULATION (ci) ON WALLS WITHOUT A CLASS I, II OR III INTERIOR VAPOR RETARDER[a]

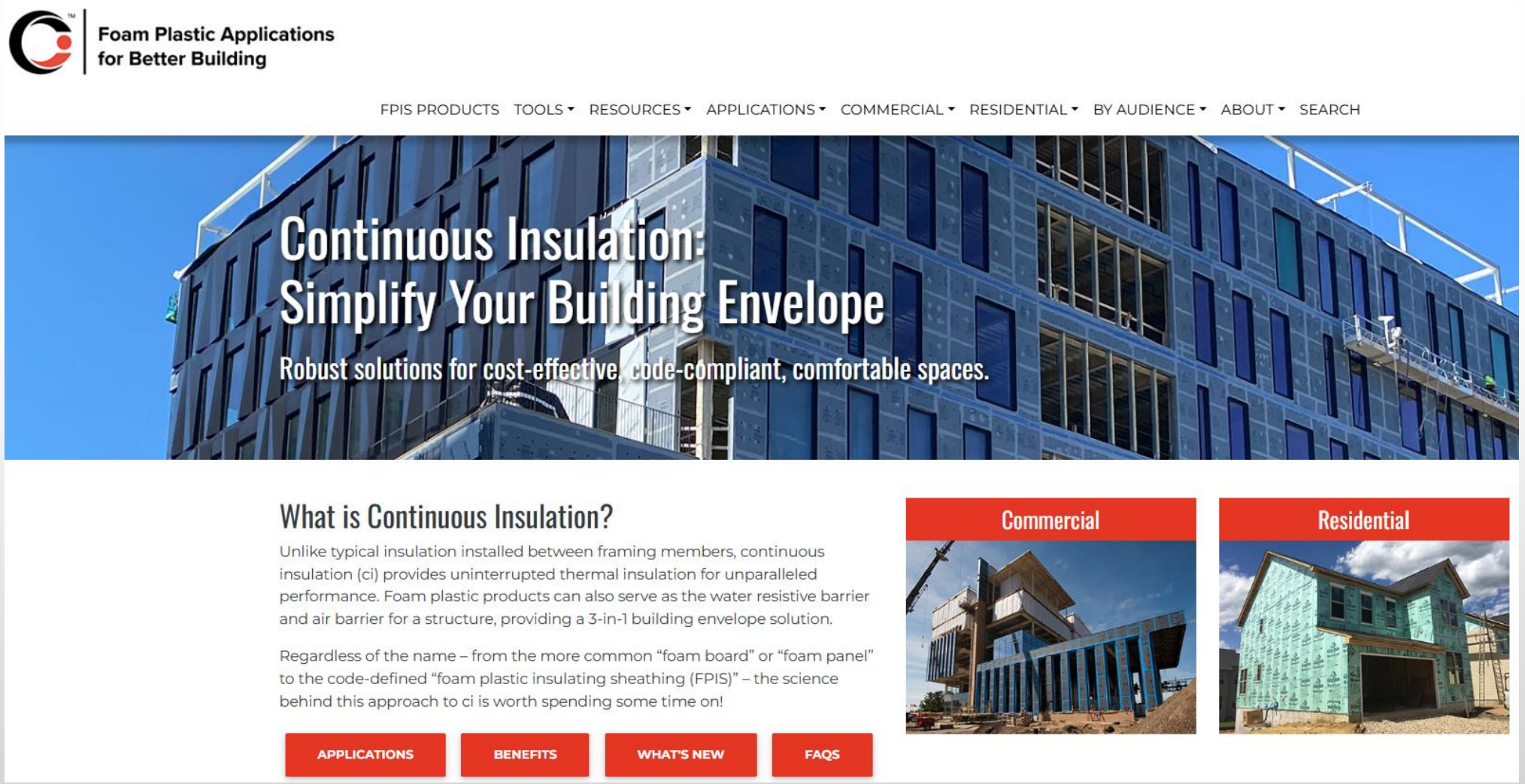
CLIMATE ZONE	PERMITTED CONDITIONS[b,c]
4	ci with R-value ≥ 4.5
5	ci with R-value ≥ 6.5
6	ci with R-value ≥ 8.5
7	ci with R-value ≥ 11.5
8	ci with R-value ≥ 14

a. The total insulating value of materials to the interior side of the exterior continuous insulation, including any cavity insulation, shall not exceed R-5. Where the R-value of materials to the interior side of the exterior continuous insulation exceeds R-5, an approved design shall be required.

b. A water vapor control material layer having a permeance not greater than 1 perm in accordance with ASTM E96 Procedure A (dry cup) shall be placed on the exterior side of the wall and to the interior side of the exterior continuous insulation. The exterior continuous insulation shall be permitted to serve as the vapor control layer where, as its installed thickness or with a facer on its interior face, the exterior continuous insulation is a Class I or II vapor retarder.

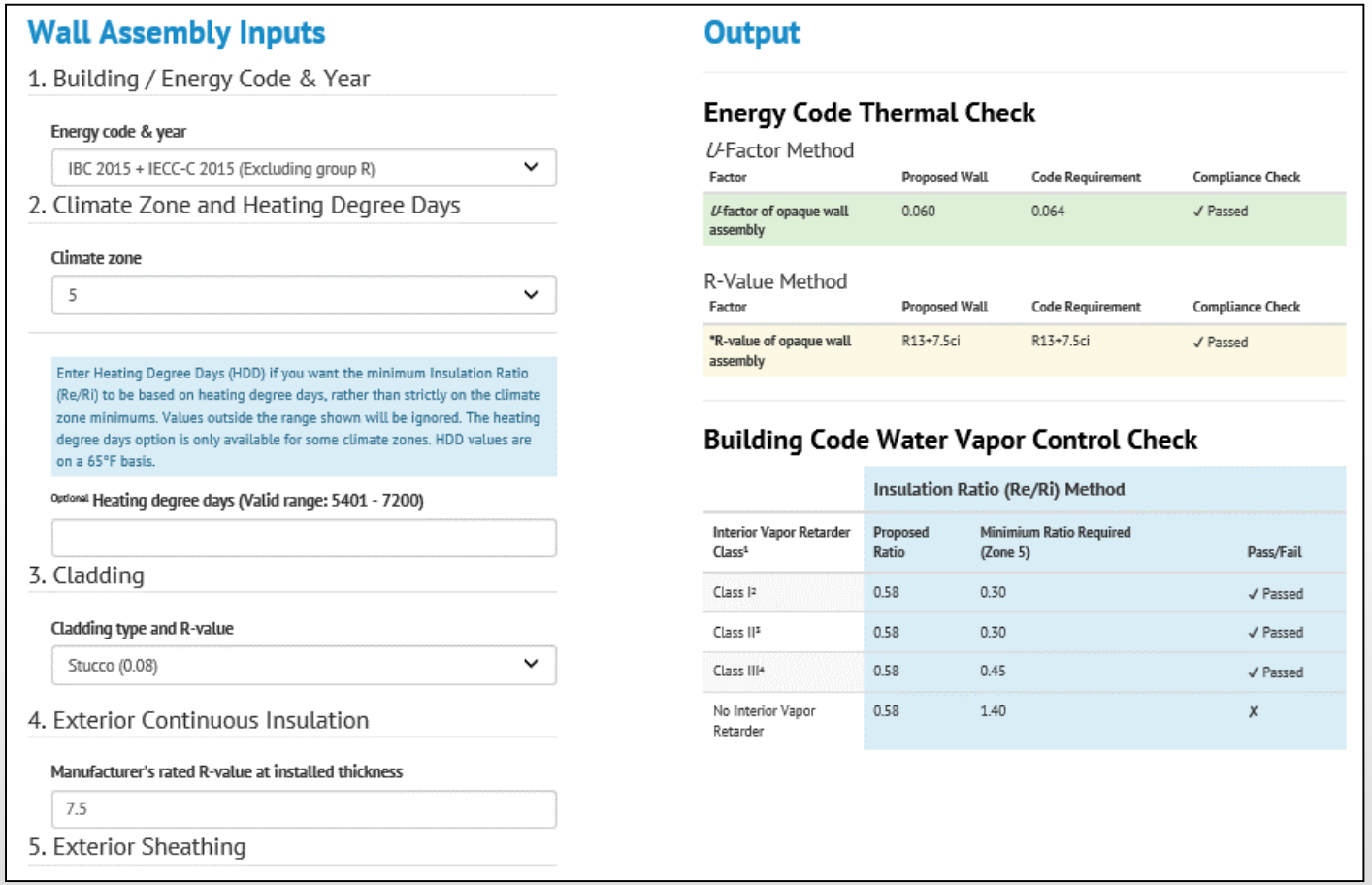


Resources to help put it all together



Simplified Energy & Water Vapor Code Compliance

- Implements R-value and U-factor checks per IECC & ASHRAE 90.1
- Automates vapor control check per IBC/IRC (including insulation ratio and permeance ratio checks)
- Flexible, More Solutions than Code, More Precise
- Wood and Steel framing
- 2-minute wall design and optimization (or compliance check)



https://www.continuousinsulation.org/calculators

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Ci Resource Guide

Scan QR code for PDF download of full document.

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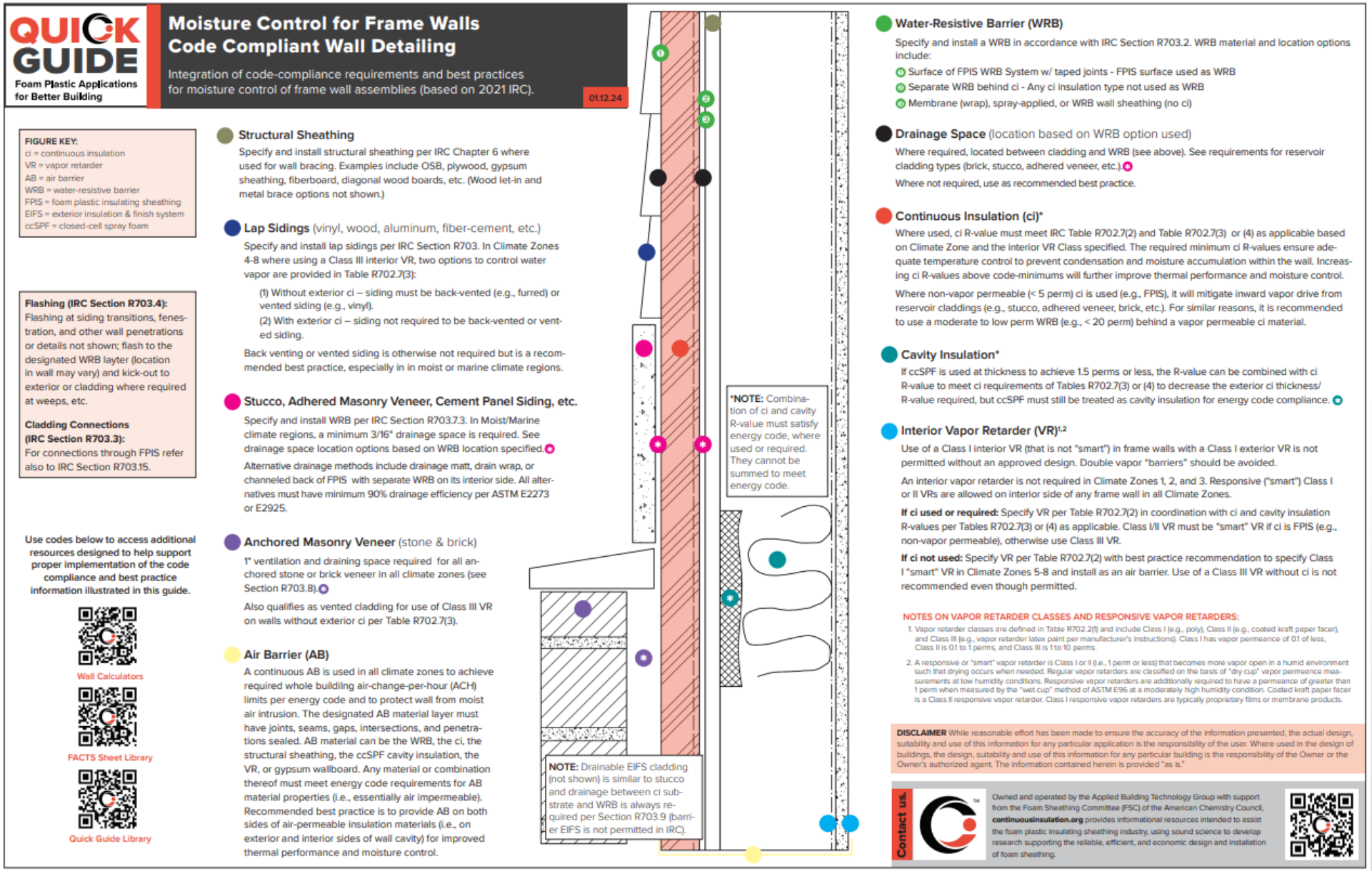

https://www.continuousinsulation.org/resources/quick-guides

"Cheat Sheet"

Integrated, Code-Compliant Moisture Control

(center-fold of the Ci Resource Guide)

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ANSI FS200.1 Standard for FPIS Applications

- Scope
  - Above-grade frame walls
  - Labeling & Quality Assurance
  - Wind resistance
  - WRB (water resistance)
  - Vapor Control
  - Window installation
  - Cladding installation
- Addresses
  - Performance criteria (design)
  - Evaluation/testing criteria by application
  - Prescriptive criteria (“cook-book” design and installation)
- Exclusions
  - Refer to locally applicable code for fire safety requirements (e.g., IBC Chapter 14 and 26; IRC Section R316)
  - Refer to FPIS manufacturer data to demonstrate compliance (ASTM E84, ASTM E119, NFPA 285, etc. – as applicable)

https://www.appliedbuildingtech.com/standards

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THANK YOU!

Questions?

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