Continuous Insulation for Code-Compliant, High-Performance Walls in Types I-IV Construction

Module 4: Building Code Compliance

Revised 10/31/2016

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Building Code Compliance – Fire

- Fire safety requirements for foam sheathing
  - IBC Chapter 26
    - 2603.5.1 – Fire resistance rated walls (e.g. hourly rated walls)
      - ASTM E119 or UL 263 - Standard Test Methods for Fire Tests of Building Construction and Materials
    - 2603.5.2 – Thermal barrier (e.g. 15 minute barrier)
      - Foam needs to be covered by a thermal barrier unless tested in accordance with NFPA 286 (Exception: one story buildings)
    - 2603.5.3 – Potential heat
      - NFPA 259 - Standard Test Method for Potential Heat of Building Materials.

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Building Code Compliance – Fire

- Fire safety requirements for foam sheathing
  - IBC Chapter 26
    - 2603.5.4 - Flame spread index, smoke developed index
      - ASTM E84 or UL 723 - Standard Test Method for Surface Burning Characteristics of Building Materials
    - 2603.5.5 – Vertical and lateral fire propagation
      - NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components

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Building Code Compliance – Fire

- Fire safety requirements for foam sheathing
  - IBC Chapter 26
    - 2603.5.6 – Label required
      - Must be labeled by an approved agency
    - 2603.5.7 – Ignition
      - NFPA 268 - Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source

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Fire Performance Advantages of Polyiso Sheathing

- Thermoset material (polyiso)
- Stays intact during fire exposure
- Remains in place during ASTM E84 tunnel testing
  - Meets or exceeds flame spread ratings
- Not all foam sheathing materials are equal
  - Thermoplastic materials (e.g., polystyrene)
    - Soften at 165°F
    - Melt at approximately 200°F
    - Drip and can continue to burn

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Exterior Flame Spread

- NFPA 285 assembly testing
  - Required for Type I, II, III and IV buildings greater than one story that contain foam plastic insulation
  - Many assemblies are approved
  - Contact PIMA members

Jesse Beitel, Hughes Associates, Inc.

Exterior Flame Spread

- NFPA 285 assembly testing
  - Polyiso passes NFPA 285 with many different types of cladding
  - Polystyrenes can typically only pass with brick or stone, may need special detailing at windows

Jesse Beitel, Hughes Associates, Inc.

Topic #4 – Building Code Compliance – Wind Pressure Resistance

- Wind pressure resistance of exterior wall covering assemblies (IBC 1403.3)
  - *"Exterior walls, and the associated openings, shall be designed and constructed to resist safely the superimposed loads required in Chapter 16"*
  - This includes wind loads

Source: hammerandhand.com

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Wind Pressure Resistance

- 2009/2012 IBC code provision
- Ensures all sheathing materials and claddings meet the code

1609.6.3 Design equations. When using the alternative all-heights method, the MWFRS, and components and cladding of every structure shall be designed to resist the effects of wind pressures on the building envelope in accordance with Equation 16-35.

$$P_{net} = 0.00256 V^2 K_z C_{net} K_{zt} \qquad \textbf{(Equation 16-35)}$$

Design wind forces for the MWFRS shall not be less than 16 psf (0.77 kN/m^2) multiplied by the area of the structure projected on a plane normal to the assumed wind direction (see ASCE 7 Section 27.4.7 for criteria). Design net wind pressure for components and cladding shall not be less than 16 psf (0.77 kN/m^2) acting in either direction normal to the surface.

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Code Compliance Resources (wind pressure)

- ANSI/SBCA/FS 100–2012
  - sbcindustry.com/fs100.php
  - Provides path for code compliance and building official approval

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Building Code Compliance - Building Science

- Building Science
  - Water-Resistive Barriers (WRB)
  - Air Barriers (AB)
  - Vapor Retarders (VR)
  - Moisture Control

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Water-Resistive Barrier

- Rain water is main concern
- WRB equivalence
  - Confirmed by code compliance research report as defined by the IBC Sections 104.11.1 Research reports and 1703.4.2 Research reports.
- Foam sheathing products + flashing tapes = WRB
- Meets energy code and WRB requirements
  - Designer/Builder must consider cost of WRB and insulation strategy

1404.2 Water-resistive barrier. A minimum of one layer of No.15 asphalt felt, complying with ASTM D 226 for Type 1 felt or other *approved* materials, shall be attached to the studs or sheathing, with flashing as described in Section 1405.4, in such a manner as to provide a continuous *water-resistive barrier* behind the *exterior wall* veneer.

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WRB Addresses the "H_2O Fear"

- WRBs
  - Required for nearly all sidings and wall assemblies
  - Must be applied in addition to foam sheathing when not used as the approved WRB layer
- Use WRB and flashing to prevent water intrusion and drain water as required by code and good practice
- Follow current code requirements and research reports

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Proper Use of VR with Foam

- Suppresses Condensation and Promotes Drying
- IBC has vapor retarder options for CI
  - Zones 1 and 2: Low perm on exterior side of wall
- Class III vapor retarder
    - Greater than 1.0 perm but less than or equal to 10 perm (e.g. latex or enamel paint)

1405.3.1 Class III vapor retarders. Class III vapor retarders shall be permitted where any one of the conditions in Table 1405.3.1 is met.

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“Warm Wall” VR Requirements

TABLE 1405.3.1
CLASS III VAPOR RETARDERS

ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:[a]
Marine 4	Vented cladding over wood structural panels Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with *R*-value ≥ R2.5 over 2 × 4 wall Insulated sheathing with *R*-value ≥ R3.75 over 2 × 6 wall
5	Vented cladding over wood structural panels Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with *R*-value ≥ R5 over 2 × 4 wall Insulated sheathing with *R*-value ≥ R7.5 over 2 × 6 wall
6	Vented cladding over fiberboard Vented cladding over gypsum Insulated sheathing with *R*-value ≥ R7.5 over 2 × 4 wall Insulated sheathing with *R*-value ≥ R11.25 over 2 × 6 wall
7 and 8	Insulated sheathing with *R*-value ≥ R10 over 2 × 4 wall Insulated sheathing with *R*-value ≥ R15 over 2 × 6 wall

For SI: 1 pound per cubic foot = 16 kg/m^3.

a. Spray foam with a minimum density of 2 lbs/ft^3 applied to the interior cavity side of wood structural panels, fiberboard, insulating sheathing or gypsum is deemed to meet the insulating sheathing requirement where the spray foam *R*-value meets or exceeds the specified insulating sheathing *R*-value.

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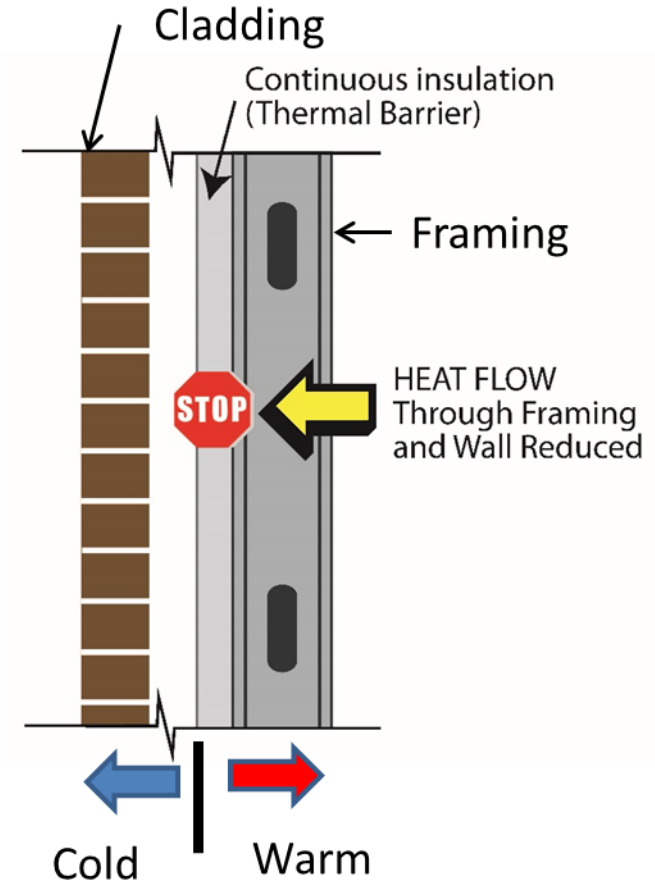
Foam Sheathing Creates Warm, Breathable Wall

- Continuous insulation
  - Reduces condensation
- Non-insulated sheathings
  - Greater condensation potential



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Foam Sheathing has Flexible Vapor Resistance Properties

- Foam sheathing has a successful track record:
  - WRB moisture performance
  - VR properties:
    - Full vapor barrier to
    - Semi-permeable to
    - Permeable
- Meets any climate/application requirement

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Air Barrier Requirements

- Air permeability ≤ 0.004 cfm/ft^2
- These materials comply with ASHRAE 90.1:
  - Portland cement stucco ½" or greater
  - XPS and foil-faced Polyiso ½" or greater
  - Gypsum board ½" or greater
  - Closed cell spray foam 1" or greater

AIR BARRIER. Material(s) assembled and joined together to provide a barrier to air leakage through the building envelope. An air barrier may be a single material or a combination of materials.

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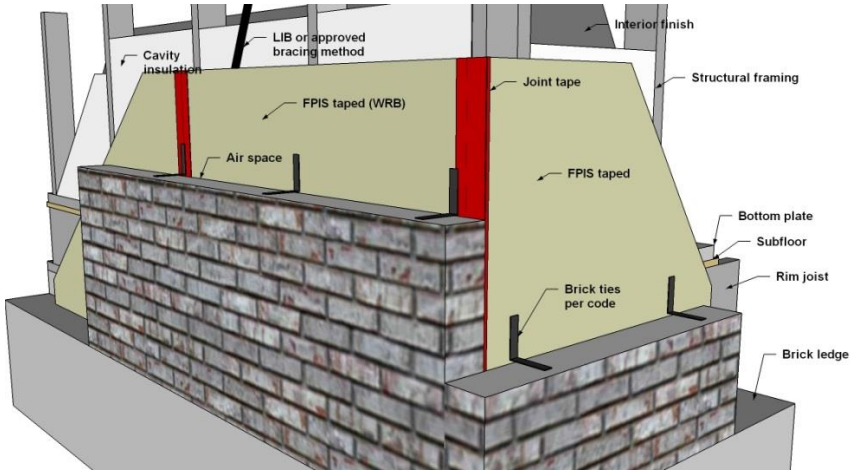
Installation Details

- Must be installed per manufacturer's instructions
- Architects can provide construction details for plan approval
  - DRR No. 1404-04 at http://drjengineering.org/products/polyisocyanurate
  - Provides path for code compliance and approval
  - DXF files also available



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Building Code Compliance and Installation Best Practices Support

- Code compliance resources:
  - drjengineering.org/products/polyisocyanurate
- Best practices for installing Polyiso:
  - drjbestpractices.org/installation
- Building Science technical resources:
  - www.appliedbuildingtech.com