

## Construction Details for the Use of Foam Plastic Insulating Sheathing (FPIS) in Light-Frame Construction

TER No. 1205-05

## Foam Sheathing Committee (FSC) Members

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Atlas Roofing Corporation – <u>www.atlasroofing.com</u> Dow Chemical Company – <u>www.dow.com</u> GAF – <u>www.gaf.com</u> Hunter Panels – <u>www.hpanels.com</u> Johns Manville – <u>www.jm.com</u> Owens Corning – <u>www.owenscorning.com</u> Rmax Operating, LLC – <u>www.rmax.com</u>

### **DIVISION: 07 00 00 – THERMAL AND MOISTURE PROTECTION**

Section: 07 21 00 – Thermal Insulation Section: 07 24 00 – Exterior Insulation and Finish Systems Section: 07 25 00 – Water-Resistive Barriers/Weather Barriers

#### 1. Products Evaluated:

- **1.1.** Foam plastic insulating sheathing (FPIS) from the following manufacturers, up to and including 4" thickness when used as insulating material in exterior wall assemblies
  - **1.1.1.** Atlas Roofing Corporation "Energy Shield<sup>®</sup>, "Energy Shield<sup>®</sup> Plus", "RBoard<sup>®</sup>, "Stucco Shield<sup>®</sup>, "Falcon Foam<sup>®</sup>, "ThermalStar<sup>®</sup>, Elevation<sup>TM</sup> and Stacatto<sup>TM</sup> T&G
  - **1.1.2.** Dow Chemical Company "TUFF-R<sup>™</sup>," Super TUFF-R<sup>™</sup>, "THERMAX<sup>™</sup>, "Isocast<sup>™</sup> R Thermal", "STYROFOAM<sup>™</sup> and "STYROFOAM<sup>™</sup> SIS
  - 1.1.3. Johns Manville "AP Foil Faced Foam Sheathing"
  - **1.1.4.** Owens Corning "FOAMULAR<sup>®</sup>"
  - **1.1.5.** Rmax Operating, LLC "R-Matte<sup>®</sup> Plus-3", DuraSheath<sup>®-</sup>3", "TSA-FA-3", "Thermasheath<sup>®</sup>-3", "TSX 8500", "TSX-8510", "TSP-3" and "Eco-Max<sup>®</sup>"

#### 2. Applicable Codes:<sup>1</sup>

- 2.1. 2006, 2009 and 2012 International Building Code (IBC)<sup>2</sup>
- 2.2. 2006, 2009 and 2012 International Residential Code (IRC)
- 2.3. 2006, 2009 and 2012 International Energy Conservation Code (IECC)

#### TER NOTE

Details in this Technical Evaluation Report (TER) only illustrate solid wood structural framing members. However, the same principles apply for typical shapes used for cold-formed steel light-frame construction.

<sup>1</sup> All references are to the 2012 version of the codes, unless otherwise noted. <sup>2</sup> International Code Council, Inc.

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The IBC defines:		

- APPROVED AGENCY "An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved."
- APPROVED SOURCE "An independent person, firm or corporation, approved by the building official, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses."

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#### 3. Evaluation Scope:

- **3.1.** This Technical Evaluation Report (TER) addresses general construction details to facilitate codecompliant use of FPIS. The details provided in this report shall be reviewed and modified (as needed) by the user of this TER for the specific field application.
- **3.2.** It is the users' responsibility to ensure that use of these details is compliant with the applicable local code jurisdiction's requirements and manufacturers' installation instructions for the specific wall assembly components. These details are intended to assist the user in complying with relevant building code requirements, including the following code sections listed here from the 2012 editions:
  - 3.2.1. IRC Sections R318, R507, R602, R603, R702, R703, R903, R905 and N1100
  - **3.2.2.** *IBC* Sections 720, 1300, 1400, 1500, 1604.8.3, 2211, 2300, 2500 and 2600
- **3.3.** This TER addresses the general construction framing details for applying FPIS over wood or steel light-frame construction, including cladding, water-resistive barrier (WRB) installation and location, vapor permeable membranes and air barriers. Note: Details only illustrate solid wood structural framing members. However, the same principles apply for typical shapes used for cold-formed steel light-frame construction.
- **3.4.** Specific code compliance issues including but not limited to wind pressure resistance, WRB, air barriers, thermal resistance or fire endurance, and flame spread characteristics are outside the scope of this TER.

#### 4. Product Description and Materials:

- **4.1.** FPIS products listed in <u>Section 1</u> and used in accordance with this TER shall comply with the following material standards:
  - 4.1.1. Expanded polystyrene (EPS) manufactured in compliance with ASTM C578
  - **4.1.2.** Extruded polystyrene (XPS) manufactured in compliance with ASTM C578
  - 4.1.3. Polyisocyanurate (Polyiso) manufactured in compliance with ASTM C1289
- **4.2.** FPIS products are produced under proprietary manufacturing processes and are formed into rigid insulation panels.
- **4.3.** EPS and XPS foam plastic sheathing complying with ASTM C578 are used with:
  - 4.3.1. No facings
  - **4.3.2.** Facings on one side
  - **4.3.3.** Facings on both sides
- 4.4. Polyiso foam plastic sheathing complying with ASTM C1289 must have facings on both sides.
- **4.5.** FPIS products are typically available in the following sizes:
  - **4.5.1.** Thicknesses range from  $\frac{1}{2}$ " to 6".<sup>3</sup>
  - 4.5.2. The standard product width is 48".
  - 4.5.3. Standard lengths include 96", 108" and 120".
- **4.6.** Consult manufacturer for availability of product in non-standard widths or lengths.
- **4.7.** Consult FPIS manufacturer and manufacturers of other wall components for material property data regarding vapor permeability, WRB qualification, air barrier qualification, fire performance properties, and other matters required to ensure an overall code-compliant wall assembly. See the <u>References</u> <u>Section</u> of this document for additional information.

<sup>&</sup>lt;sup>3</sup> For FPIS thicknesses over 2" or 3", it is preferable to layer FPIS and off-set the joints. If FPIS is specified as the WRB in a layered application, only the outer layer of FPIS functions as the WRB.



Photo 1: Examples of Polyiso, XPS & EPS Foam Plastic Insulating Sheathings

### 5. Applications:

#### 5.1. General Requirements:

- **5.1.1.** Minimum installation requirements for foam plastic sheathing products listed in <u>Section 1</u> when applied to light-frame wall framing members<sup>4</sup>
  - **5.1.1.1.** Light-frame wood framing members supporting FPIS products shall have a nominal thickness of not less than 2" (1.5" actual). Light-frame cold-formed steel (CFS) members supporting FPIS products shall have a flange width of not less than 1.5".
  - **5.1.1.2.** Framing members shall be spaced a maximum of 24" o.c. Check specific manufacturer's installation instructions for product thicknesses required to resist the required wind pressures.
    - **5.1.1.2.1.** FPIS products shall be attached to the wall framing in accordance with the manufacturer's installation instructions
    - **5.1.1.2.2.** Cladding materials and accessories, such as furring, shall be attached through foam plastic sheathing by design capable of supporting the cladding dead load and transverse loads caused by wind or seismic forces. Refer to the cladding manufacturer's installation instructions and design data as applicable.
    - **5.1.1.2.3.** All sheathing edges shall be supported by wall framing or blocking. Blocking at horizontal sheathing joints located between the top and bottom plates of a wall shall not be required where allowed by the manufacturer's installation instructions. Where the foam sheathing panel is rated for wind pressure resistance without horizontal edges supported on blocking, this installation practice shall be permitted. Refer to the manufacturer installation instructions and wind pressure resistance data.

#### 5.2. Terminology:

- **5.2.1.** Back dam Blocking or beveled wood siding installed at window sill to provide positive drainage to exterior. Pan flashing is typically installed over.
- **5.2.2.** Sealant High-quality caulking or spray foam product used to seal gaps between components in wall assemblies. Sealant selection depends on gap size and other factors.
- **5.2.3.** Continuous Insulation (CI) FPIS products as applied to the exterior side of exterior walls to comply with or exceed energy code requirements.
- **5.2.4.** Drip cap Flashing product used to assist in diverting water away from window/door at head. Requirement for use is dependent upon siding type and location of window in wall system.
- **5.2.5.** Flange flashing Formable self-adhesive membrane installed over nailing flange (when used) at head and jamb.
- **5.2.6.** Furring Typically minimum 1x3 wood furring or suitable steel shape (e.g., tube or hat channel) installed over the WRB layer to provide a means of attaching cladding and to provide ventilation and drainage behind cladding.
- **5.2.7. Head flashing** Formable self-adhesive membrane installed over WRB layer and framing after window/door is installed.

<sup>&</sup>lt;sup>4</sup> Different foam sheathing materials may have different properties affecting appropriate use with this document and compliance with the applicable building code. Refer to the manufacturer's specific data in all cases.

- **5.2.8.** Jamb flashing Formable self-adhesive membrane installed over WRB and framing after window/door is installed.
- **5.2.9.** Let-in-Bracing (LIB) Code prescribed wall bracing method using let-in bracing such as a 1x4 wood member cut into wood studs or approved alternative metal T-braces or flat strap braces. For steel framing, flat steel strap X-braces are similar in function.
- **5.2.10.** Nailing flange Window/door component used to attach unit to the structure from the exterior, Refer to window/door manufacturer's installation instructions.
- **5.2.11. Pan flashing** Either pre-formed or formable self-adhesive membrane or metal at sill installed before window or door.
- **5.2.12. Strap anchor** Window/door attachment component used to attach unit to the structure typically from the inside. Typically required to secure mulled units to framing; refer to window/door manufacturer installation instructions.
- **5.2.13. Panel-type Bracing** All code prescribed wall bracing methods using structural panels or boards approved for use as shear walls or braced wall panels.
- **5.2.14.** Water-Resistive Barrier (WRB) A material behind an exterior wall covering assembly or cladding that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the *exterior wall* assembly. Function may be provided by taped joints and penetrations of FPIS if tested by the manufacturer and installed per the manufacturer's installation instructions. A separate WRB membrane may also be placed to the inside or outside of the FPIS.
- **5.2.15.** Vapor Permeable Membrane A material or covering having a permeance rating of 5 perms (2.9 \_ 10-10 kg/Pa \_ s \_m2) or greater, when tested in accordance with the desiccant method using Procedure A of ASTME 96. A vapor permeable material permits the passage of moisture vapor. For additional information, see *IBC* Section 1405.3 and *IRC* Section R702.7.

#### 5.3. General Conditions:

- **5.3.1.** Details illustrate generic lapsiding materials with solid dimensional (rectangular) trim elements. See individual siding manufacturer's installation instructions for cladding-specific details. The user of this TER shall be responsible to adapt cladding installation details appropriately.
- **5.3.2.** A means of drainage as required by *IRC* Section R703.1.1 may be created by placing the WRB inbound or out-bound of the FPIS layer. Regardless of location of the WRB, materials outbound of the WRB should be moisture-resistive or have sufficient ventilation provided to promote drying of exterior wall covering elements after wetting (rainfall) episodes (see Figure 1d). Regardless of location of the WRB layer in the exterior wall covering, penetrations must be flashed to the WRB layer such that water drains around penetrations and out of the exterior wall covering assembly.
- **5.3.3.** Unless cladding weight is separately supported (e.g., anchored masonry veneer), attachment of cladding and other components through FPIS to framing must take into account weight of the product and the thickness of the FPIS or other materials between the cladding and the framing. Fasteners shall be selected to penetrate framing by the required amount (see <u>FSC Tech Matters</u>: *Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing* for guidance on selection of fasteners for a given cladding type and thickness of foam sheathing. These charts are based on foam sheathing materials with a minimum 15 psi compressive strength per ASTM C578 or ASTM C1289.

## 6. Installation:

- 6.1 Basic Wall Assembly Variations
  - **6.1.1** Generic wall assembly showing: structural component, interior sheathing, cavity insulation, exterior sheathing (structural and/or insulating), WRB, and exterior finish (siding and trim).
    - 6.1.1.1 Light-Frame Wall with LIB Bracing, FPIS, WRB (no furring), lap siding



Figure 1a: Generic Wood Frame Wall (LIB) with Exterior Finish of FPIS, WRB & Lap Siding



6.1.2 Light-Frame Wall with LIB Bracing, FPIS (joints taped) as WRB, furring

Figure 1b: Generic Wood Frame Wall (LIB), FPIS as WRB, Furring & Lap Siding



Figure 1c: Generic Wood Frame Wall (LIB) with Exterior Finish of FPIS, WRB, & Lap Siding



# 6.1.4 Light-Frame Wall with LIB Bracing, WRB, FPIS, furring, lap siding

Figure 1d: Generic Wood Frame Wall (LIB) with Exterior Finish of WRB, FPIS<sup>5</sup>, Furring & Lap Siding

<sup>&</sup>lt;sup>5</sup> When FPIS is out-bound of the WRB, special consideration must be given regarding how penetrations will be dealt with after installation.



6.1.5 Light-Frame Wall with LIB Bracing, FPIS, brick veneer (anchored, separately supported)

Figure 1e: Generic Wood Frame Wall (LIB), FPIS Taped (WRB), Air Space, Brick Veneer





Figure 1f: Generic Wood Frame Wall (LIB), FPIS, 2 Layers WRB<sup>6</sup>, Stucco

<sup>&</sup>lt;sup>6</sup> See the stucco provisions in IBC Section 2510.6 regarding WRB application. The WRB layer would not be required if the FPIS were specified as a WRB and joints taped.



6.1.7 Light-Frame Wall with LIB Bracing, FPIS as WRB, furring, lath, stucco veneer

Figure 1g: Generic Wood Frame Wall (LIB), FPIS, Drainage Mat, Stucco

## 6.2. Inside corner – Light-Frame Wall, FPIS, WRB, No Furring



Figure 2a: ISC Generic Wood Frame Wall with Continuous Insulation, FPIS, WRB, & Lap Siding Provide sufficient framing to attach siding trim & siding as well as interior finish.

**6.3.** Inside corner – Light-Frame Wall, FPIS taped for WRB, furring



Figure 3: ISC Generic Wood Frame Wall with Continuous Insulation, FPIS Taped as WRB, Furring, Lap Siding Provide sufficient framing to attach siding trim & siding as well as interior finish.

6.4. Outside corner – Light-Frame Wall, FPIS, WRB, Siding







6.5. FPIS at bottom of wall (not code required and typically recommended with FPIS thickness over 1"

Figure 5a: Bottom of FPIS Covered with Flashing & Extending Down Foundation



Figure 5b: FPIS Extending over Foundation with Protection Board where Exposed above Grade



Figure 5c: FPIS Extending over Foundation with Termite Shield & Approved Termite Barrier

6.6. Top of wall – Gable (unconditioned attic space illustrating non-FPIS sheathing at gable)



Figure 6a: Top of Wall at Gable End with Gable End Frame Sheathed with WSP & Supported over FPIS with 2x, Which Also Extends to Inside of Wall to Supply Attachment for Ceiling Finish Note: Bracing is not shown.



Figure 6b: Top of Wall at Gable End with Gable End Frame Sheathed with WSP & Cantilevered over Wall Note: Gable bracing is not shown. Contact component manufacturer for load specific details.

6.7. Top of wall – Gable (conditioned attic space illustrating FPIS sheathing at gable)



Figure 7: Top of Wall at Gable End with Gable End Frame Sheathed with FPIS Continuous from Wall Below Note: Bracing is not shown.

6.8. Top of wall – Eave – rafter, standard truss heel, high truss heel, & cantilevered truss



Figure 8a: Top of Wall at Eave with Rafter Construction



Figure 8b: Top of Wall at Eave with Standard Heel Truss



Figure 8c: Top of Wall at Eave with Energy Heel Truss



Figure 8d: Top of Wall at Cantilever Truss



Figure 8e: Top of Wall Standard Truss Eave Detail with Eave Ledger Attached to Structural Framing through FPIS

6.9. Roof intersecting with wall (two views of same application)



Figure 9a: Roof Intersecting with Wall



Figure 9b: Roof Intersecting with Wall (from inside) - Blocking

**6.10.** Deck Ledger – 2" FPIS CI at patio door opening (two views of same application) with 1" FPIS behind ledger<sup>7</sup>



Figure 10a: Deck ledger – 2" FPIS Wall Sheathing, 1" FPIS behind Ledger at Patio Door Opening



Figure 10b: Deck Ledger – 2" FPIS Wall Sheathing, 1" FPIS behind Ledger at Rim

<sup>&</sup>lt;sup>7</sup> An alternative is to specify a separately supported deck. For additional information, see *IBC* Section 1604.8.3, *IRC* Section R507 and AWC TR12.

### 6.11. Penetration Details

6.11.1. Window/door penetrations (flush behind siding layer) - 2" or less CI



Figure 11c: Head detail – Window over CI – 2" or Less CI

**6.11.2.** Window/door penetrations (flush behind siding layer) – 2" or more CI (maximum 4") using wood buck



Figure 11d: Sill Detail - Window over CI - 2" or More CI



Figure 11e: Jamb Detail - Window over CI - 2" or More CI



Figure 11f: Head Detail - Window over CI - 2" or More CI

**6.11.3.** Window/door penetrations (flush to interior finish layer – "Innie") – 2" or more CI (maximum 4") using wood buck



Figure 11i: Head Detail – "Innie" Window over CI – 2" or More CI

#### 6.12. Other penetrations



Figure 12: Penetration – 2" FPIS Taped Joints, Furring, Lap Siding

#### 7. Conditions of Use:

- **7.2.** The insulated sheathing products listed in <u>Section 1</u> of this report comply with, or are suitable alternatives to, the applicable sections of the *2006*, *2009* and *2012 IBC* and the *2006*, *2009* and the *2012 IRC* and are subject to the following conditions.
  - **7.2.1.** These products shall be installed in compliance with:
    - **7.2.1.1.** The manufacturer's installation instructions
    - 7.2.1.2. The applicable building code sections
      - 7.2.1.2.1. Structural requirements
      - 7.2.1.2.2. Fire requirements
      - 7.2.1.2.3. Wind pressure requirements
      - 7.2.1.2.4. Exterior wall covering requirements
      - 7.2.1.2.5. Flashing requirements
      - 7.2.1.2.6. Moisture barrier requirements
    - 7.2.1.3. This TER

#### 8. Identification:

- **8.2.** All FPIS products shall be marked in accordance the ASTM C578 or ASTM C1289 as applicable to the type of material and bear the label of an approved agency on the packaging or individual FPIS panels.
- **8.3.** Additional technical information and related TERs can be found from the SBC Research Institute (<u>www.sbcri.info</u>).

#### 9. References:

- **9.2.** TER 1006-01: Prescriptive Wind Pressure Performance of Foam Plastic Insulation Used as Insulating Sheathing in Exterior Wall Covering Assemblies (available at <u>www.foamsheathing.org</u>)
- **9.3.** Guide to Attaching Exterior Wall Coverings through Foam Sheathing to Wood or Steel Wall Framing, FSC *Tech Matters*, (available at <u>www.foamsheathing.org</u>)
- **9.4.** Additional technical information and related manufacturer's instructions can be found at each of the manufacturer's websites:
  - 9.4.1. Atlas Roofing Corporation www.atlasroofing.com
  - 9.4.2. Dow Chemical Company <u>www.building.dow.com</u>
  - 9.4.3. Johns Manville www.jm.com
  - 9.4.4. Owens Corning www.owenscorning.com
  - 9.4.5. Rmax Operating, LLC <u>www.rmax.com</u>

#### 10. Review Schedule:

- 10.2. This TER is subject to periodic review and revision.
- 10.3. For information on the current status of this report, contact SBCRI.





#### **Responsibility Statement**

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