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ICC-ES Evaluation Report

ESR-3398

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DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION

SECTION: 07 21 00—THERMAL INSULATION

SECTION: 07 25 00—WATER-RESISTIVE BARRIERS/WEATHER BARRIERS

SECTION: 07 27 00—AIR BARRIERS

REPORT HOLDER:

JOHNS MANVILLE

EVALUATION SUBJECT:

JOHNS MANVILLE AP™ FOIL-FACED SHEATHING AND CI MAX® FOAM SHEATHING



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DIVISION: 07 00 00—THERMAL AND MOISTURE PROTECTION

Section: 07 21 00—Thermal Insulation

Section: 07 25 00—Water-Resistive Barriers/Weather Barriers

Section: 07 27 00—Air Barriers

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1.0 EVALUATION SCOPE

1.1 Compliance with the following codes:

- 2012 and 2009 *International Building Code*® (IBC)
- 2012 and 2009 *International Residential Code*® (IRC)
- 2012 and 2009 *International Energy Conservation Code*® (IECC)
- 2013 *Abu Dhabi International Building Code* (ADIBC)†

†The ADIBC is based on the 2009 IBC. 2009 IBC code sections referenced in this report are the same sections in the ADIBC.

Properties evaluated:

- Surface-burning characteristics
- Thermal resistance
- Water vapor transmission
- Attic and crawl space installation
- Exterior walls in Types I through IV construction
- Water-resistive barrier
- Air barrier
- Air permeability

1.2 Evaluation to the following green code(s) and/or standards:

- 2016 California Green Building Standards Code (CALGreen), Title 24, Part 11
- 2015, 2012 and 2008 ICC 700 *National Green Building Standard*™ (ICC 700-2015, ICC 700-2012 and ICC 700-2008)

Attribute verified:

See Section 3.1

2.0 USES

2.1 AP™ Foil-Faced Sheathing:

AP™ Foil-Faced Sheathing is used as nonstructural, thermal insulating material in Types I, II, III, IV and V construction (IBC) and dwellings under the IRC. The insulation boards may be used with a thermal barrier within or on interior or exterior walls and ceiling assemblies, and also in attics and crawl spaces with a thermal or ignition barrier. Additionally, the boards may be used at the perimeter of concrete slab on-grade and on the interior side of basement foundation walls.

The AP™ Foil-Faced Sheathing may be used on the exterior face of exterior walls of any type of construction. When used in exterior walls in Types I, II, III, and IV construction, construction must be in accordance with Section 4.2.2 of this report.

The AP™ Foil-Faced Sheathing insulation boards may be used as an alternative to the water-resistive barrier specified in IBC Section 1404.2 and R703.2 when installed on exterior walls in accordance with Section 4.2.2.3.

2.2 CI Max® Foam Sheathing:

CI Max® Foam Sheathing is used as nonstructural, thermal insulating material for use in interior applications in Type I, II, III, IV and V construction (IBC) and dwellings construction under the IRC. The insulation boards may be left exposed to the interior of the building without a thermal barrier when installed on either walls only or ceilings only. The insulation boards may be left exposed without an ignition barrier in attics and crawl spaces when installed on walls only or ceilings only. See Section 4.3 for additional information.

3.0 DESCRIPTION

3.1 AP™ Foil-Faced Sheathing:

AP™ Foil-Faced Sheathing has a closed-cell, rigid polyisocyanurate foam plastic core, bonded on both sides with an aluminum foil and kraft paper laminate. The foam plastic core has a nominal density of 1.7 pcf (28.8 kg/m³). The boards have square edges and are available in various lengths and widths and in thicknesses between 1/2 inch and 4 1/2 inches (12.7 and 114 mm). The insulation boards are classified as Type I, Class 1 material in accordance with ASTM C1289.

The attributes of the AP™ Foil-Faced Sheathing as an alternative water-resistive barrier have been verified as conforming to the provisions of (i) CALGreen Section 5.407.1 and (ii) ICC 700-2015 Section 602.1.8, 11.602.1.8 and 12.6.602.1.8; (iii) ICC 700-2012 Section 602.1.8, 11.602.1.8 and 12.5.602.1.8; and (iv) ICC 700-2008 Section 602.9 for water-resistive barriers.

The attributes of the AP™ Foil-Faced Sheathing have been verified as conforming to the provisions of ICC 700-2008 Section 703.2.1.1.1(c) as an air impermeable insulation.

Note that decisions on compliance for those areas rest with the user of this report. The user is advised of the project-specific provisions that may be contingent upon meeting specific conditions, and the verification of those conditions is outside the scope of this report. These codes or standards often provide supplemental information as guidance.

3.2 CI Max™ Foam Sheathing:

CI Max® Foam Sheathing has the same closed-cell, rigid polyisocyanurate foam plastic core as the AP™ Foil-Faced Sheathing boards and is bonded on both sides with a glass mat laminated with aluminum foil. The boards have square edges and are available in various lengths and widths and in thicknesses between 1/2 inch and 4 inches (12.7 and 102 mm). The insulation boards are classified as Type I, Class 1 material in accordance with ASTM C1289.

3.3 Joint-sealing:

3.3.1 Johns Manville UltraFast® (3M All Weather) Flashing Tape: Johns Manville UltraFast® (3M All Weather) Flashing Tape (ESR-2797) is nominally 4 inches wide and is used in conjunction with AP™ Foil-Faced Sheathing to seal joints between two or more edges of the boards, when the insulation boards are installed as an alternative water-resistive barrier or an air barrier. The installation must be as described in Sections 4.2.2.3 and 4.2.2.4, respectively.

3.3.2 Sealant: A sealant complying with ASTM C920 Type S, Grade NS, Class 100/50, Use NT, M, G, A and O must be used with AP™ Foil-Faced Sheathing to seal exterior penetrations and panel defects, when the insulation boards are installed as an alternative water-resistive barrier or an air barrier. The installation must be as described in Sections 4.2.2.3 and 4.2.2.4, respectively.

3.4 Surface-burning Characteristics:

The foam core of AP™ Foil-Faced Sheathing has a flame-spread index of 25 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 at a maximum thickness of 4 1/2 inches (114 mm). The faced CI Max® Foam Sheathing has a flame-spread index of 25 or less and a smoke-developed index of 450 or less at a maximum thickness of 4 inches (102 mm).

3.5 Thermal Resistance, R-values:

AP™ Foil-Faced Sheathing and CI Max® Foam Sheathing has the thermal resistances (R-value) at a mean temperature of 75°F (24°C) as shown in Table 1.

3.6 Vapor Retarder:

At a minimum thickness of 1 inch (25.4 mm), the AP™ Foil-Faced Sheathing insulation board has a vapor permeance of less than 0.1 perm [5.7×10^{-12} kg/ (Pa·s·m²)] when tested in accordance with ASTM E96 (desiccant method) (Procedure A), and qualify as a Class I vapor retarder.

3.7 Air Permeability:

At a minimum thickness of 1 inch (25.4 mm), the AP™ Foil-Faced Sheathing insulation board is considered air-impermeable based on testing in accordance with ASTM E2178.

4.0 INSTALLATION

4.1 General:

AP™ Foil-Faced Sheathing and CI Max® Foam Sheathing must be installed in accordance with the Johns Manville published installation instructions, the applicable code and this report. The manufacturer's published installation instructions must be available on the jobsite at all times during installation.

4.2 AP™ Foil-Faced Sheathing:

At a maximum thickness of 4 1/2 inches (114 mm), AP™ Foil-Faced Sheathing may be used as nonstructural insulating material with a thermal barrier on any or all surfaces (wall or ceiling assembly) in any type of structure. For exterior wall applications, the insulation boards must be attached with fasteners spaced a maximum of 24 inches (610 mm) on center in the field and 16 inches (406 mm) on center on the perimeter. For interior applications, the insulation boards must be attached with fasteners spaced a maximum of 24 inches (610 mm) on center along the width of the board and a maximum of 48 inches (1219 mm) on center along the length of the board.

The wall covering must be structurally adequate to resist transverse loads. For exterior wall covering applications, fasteners for insulation board thicker than 1 1/2 inches (38 mm) must be considered for lateral resistance to ensure support for the exterior wall coverings. All walls must be braced in accordance with IBC Sections 2308.9.3 and 2308.12.4 or IRC Section R602.10, as applicable.

4.2.1 Attics and Crawl Spaces: When AP™ Foil-Faced Sheathing is installed within attics and crawl spaces, where entry is made only for service of utilities, an ignition barrier must be installed in accordance with IBC Section 2603.4.1.6 or IRC Section R316.5.3 or R316.5.4, as applicable. The ignition barrier must be consistent with the requirements for the type of construction required by the applicable code, and must be installed in such a manner that the foam plastic insulation is not exposed.

4.2.2 Exterior Walls of Types I, II, III and IV Construction:

4.2.2.1 General: When used on exterior walls of Type I, II, III and IV construction, the assembly must comply with Section 2603.5 of the IBC and this section (Section 4.3), and the insulation boards must be installed at a maximum thickness of 4 1/2 inches (114 mm). The potential heat of the AP™ Foil-Faced Sheathing insulation boards is 1677 Btu/ft² (19.0 MJ/m²) per inch of thickness when tested in accordance with NFPA 259.

4.2.2.2 Specific Wall Assemblies: Wall assemblies complying with Section 4.3 must be as described in Table 2.

4.2.2.3 Water-resistive Barrier:

The AP™ Foil-Faced Sheathing insulation boards may be used as an alternative to the water-resistive barrier prescribed in IBC 1404.2 and IRC R703.2 when installed on exterior walls in accordance with this section.

The boards can be installed in Type I, II, III or IV construction greater than 40 feet (12 192 mm) in height under the 2012 IBC when the wall assemblies comply with Section 4.3 and are as described in Table 2.

The boards can be installed either horizontally or vertically directly to framing spaced a maximum of 24 inches (610 mm) on center or over exterior sheathing. The reflective side of the boards must be oriented to the

exterior. The edges of the boards must be placed tightly together and carefully fitted around openings and penetrations.

When applied directly to framing or over exterior sheathing, the boards must be secured with 2-inch (51 mm) capped fasteners with No. 10 self-tapping screws long enough to penetrate framing a minimum of three threads. Fasteners must be spaced a maximum of 16 inches (406 mm) on center around the board perimeter and in the field.

Seams and joints between the boards must be completely covered with Johns Manville UltraFast® Flashing Tape applied so that it is centered over the joint or seam. Exterior penetrations must be sealed with either Johns Manville UltraFast® Flashing Tape or a sealant complying with ASTM C920 Type S, Grade NS, Class 100/50, Use NT, M, G, A and O, in accordance with the Johns Manville installation instructions. See Figures 1 and 2.

For window installation, refer to Figure 3. Sill flashing is installed prior to window installation. After window installation, jam flashing is installed, and then head flashing. Window installation must be in accordance with the window manufacturer's instructions.

When installed in accordance with this section, the boards must be covered with an approved exterior wall covering within the time set forth in the report holder's published instructions. The wall covering must be installed in accordance with the wall covering manufacturer's instructions.

4.2.2.4 Air Barrier:

4.2.2.4.1 Air Barrier Material: When used as an air barrier material, the AP™ Foil-Faced Sheathing insulation boards must be installed in accordance with the Johns Manville installation instructions and this report.

4.2.2.4.2 Air Barrier Assembly: When installed on exterior walls as a water-resistive barrier as described in Section 4.4, the AP™ Foil-Faced Sheathing insulation boards comply with the requirements for an air barrier assembly in accordance with Section C402.4.1.2.2 of the 2012 IECC, based on testing in accordance with ASTM E2357. The assembly qualifies as a continuous air barrier as prescribed in Section C402.4.1 of the 2012 IECC.

Penetrations in the air barrier assembly must be sealed as described in Section 4.2.2.3 and in accordance with 2012 IECC Section C402.4.2.

Wall coverings must be mechanically attached through the insulation to wall framing or sheathing.

4.3 CI Max® Foam Sheathing:

4.3.1 General:

4.3.1.1 Application with a Prescriptive Thermal Barrier: At a maximum thickness of 4 inches (102 mm), CI Max® Foam Sheathing may be used as nonstructural insulation material with a thermal barrier on any or all surfaces (wall or ceiling assembly) in any type of structure. For interior applications, the CI Max® boards must be attached with fasteners spaced a maximum of 24 inches (610 mm) on center along the width of the board and a maximum of 48 inches (1219 mm) on center along the length of the board.

4.3.1.2 Application without a Prescriptive Thermal Barrier: At a maximum thickness of 4 inches (102 mm), the CI Max insulation may be installed exposed to the interior of the building without installation of the prescriptive

15-minute thermal barrier when installed in accordance with this section. The CI Max must be applied to either the walls only or ceilings only. The CI Max® boards must be attached with either masonry nails, or No. 6 screws or nails, and 1¹/₂-inch metal washers or caps spaced 24 inches (610 mm) on center along the width of the board and a maximum of 48 inches (1219 mm) on center along the length of the board.

4.3.2 Attics and Crawl Spaces:

4.3.2.1 Application with a Prescriptive Ignition Barrier: When CI Max® Foam Insulation is installed within attics and crawl spaces, where entry is made only for service of utilities, an ignition barrier must be installed in accordance with IBC Section 2603.4.1.6 or IRC R316.5.3 and R316.5.4 as applicable. The ignition barrier must be consistent with the requirements for the type of construction required by the applicable code, and must be installed in such a manner that the foam plastic insulation is not exposed.

4.3.2.2 Application without a Prescriptive Ignition Barrier: CI Max® Foam Sheathing may be installed at a maximum thickness of 4 inches (102 mm) to either the walls or the ceilings of attics and crawl spaces without a prescriptive ignition barrier when all of the following conditions apply, as applicable:

1. Attic ventilation is provided when required by IBC Section 1203.2 or IRC Section R806, except air-impermeable insulation is permitted in unvented attics in accordance with IRC Section R806.5 (2009 IRC Section R806.4).
2. Under-floor (crawl space) ventilation is provided when required by IBC Section 1203.3 or IRC Section R408.1, as applicable.
3. Combustion air is provided in accordance with IMC (*International Mechanical Code*) Section 701.

5.0 CONDITIONS OF USE

The Johns Manville AP™ Foil-Faced Sheathing and CI Max™ Foam Sheathing described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 1.0 of this report, subject to the following conditions:

- 5.1 Installation must comply with this report, the manufacturer's published installation instructions and the applicable code. In the event of a conflict between the manufacturer's published installation instructions and this report, this report governs.
- 5.2 Use of the insulation boards to resist structural loads is outside the scope of this report. The walls must be braced in accordance with the requirements of the applicable code.
- 5.3 The insulation boards must not be used as a nailing base for exterior siding materials. All nailing must be into the wall framing as required by the siding manufacturer's instructions or the applicable code.
- 5.4 Jobsite certification and labeling of the insulation must comply with 2012 IRC Section N1101.12 or 2009 IRC Section N1101.4; and 2012 IECC Section C303.1 or R303.3 or 2009 IECC Section 303.1, as applicable.
- 5.5 Use of insulation in areas where the probability of termite infestation is "very heavy" must be in accordance with 2012 IBC Section 2603.9, 2009 IBC Section 2603.8 or IRC Section R318.4, as applicable. In these areas, the insulation must not be installed on the exterior of foundation walls or below floor slabs on grade or in contact with soil. Also, in these areas,

there must be a clearance of at least 6 inches (152 mm) between the foam plastic insulation and exposed earth.

- 5.6 When the AP™ Foil-Faced Sheathing boards are used on exterior walls of buildings of Type I, II, III or IV construction, installation must be as described in Section 4.2.2 and Table 2.
- 5.7 When the AP™ Foil-Faced Sheathing insulation boards are used in interior assemblies, the interior of the building must be separated from the insulation boards with an approved thermal barrier as required in IBC Section 2603.4 or IRC Section R316.4.
- 5.8 When the CI Max Foam Sheathing insulation boards are used in interior assemblies, the interior of the building must be separated from the insulation boards with an approved thermal barrier or ignition barrier, as required in IBC Section 2603.4 or IRC Section R316.4 and IBC Section 2604.3.4.1.6 and IRC Sections R316.5.3 and R316.5.4, respectively, except when the installation is in accordance with Section 4.3.1.2 or Section 4.3.2.2, respectively.
- 5.9 When the CI Max Foam Sheathing is on used on exterior walls in buildings of Type I through IV construction, the insulation boards are limited to use on the interior surface of the exterior wall.
- 5.10 A water-resistive barrier complying with the requirements of the applicable code must be provided except when installation is as described in Section 4.2.2.3 for the AP™ Foil-Faced Sheathing.
- 5.11 AP™ Foil-Faced Sheathing insulation boards must not be used as a water-resistive barrier with Portland cement plaster where two layers of Grade D paper are required in accordance with IBC Section 2510.6 or IRC Section R703.6.3.
- 5.12 The AP™ Foil-Faced Sheathing insulation is a Class I vapor retarder as described in Section 3.5 and its use is subject to the requirements of 2012 IBC Section 1405.3 and IRC Section R702.7 and R806.5 (2009 IRC Section R601.3 and R806.4).
- 5.13 AP™ Foil-Faced Sheathing and CI Max® Foam insulation boards are manufactured by Johns Manville in Bremen, Indiana; Cornwall, Ontario, Canada; Fernley, Nevada; Hazle Township, Pennsylvania, and Jacksonville, Florida, under a quality control program with inspections by ICC-ES.

6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12), dated June 2012 (editorially revised August 2012).
- 6.2 Data in accordance with the ICC-ES Acceptance Criteria for Foam Plastic Sheathing Panels Used as Weather-resistive Barriers (AC71), dated February 2003 (editorially revised November 2013) (AP™ Foil-Faced Sheathing only).
- 6.3 Reports of potential heat tests in accordance with NFPA 259 (AP™ Foil-Faced Sheathing only).
- 6.4 Reports of fire propagation characteristics testing in accordance with NFPA 285 (AP™ Foil-Faced Sheathing only).
- 6.5 Engineering analysis addressing use of alternate exterior wall constructions in Types I, II, III, and IV construction based on NFPA 285 testing (AP™ Foil-Faced Sheathing only).
- 6.6 Reports of air leakage tests in accordance with ASTM E2178 and ASTM E2357 (AP™ Foil-Faced Sheathing only).
- 6.7 Reports of fire test for evaluating contribution of wall and ceiling interior finish to room fire growth in accordance with NFPA 286 (CI Max® Foam Sheathing only).

7.0 IDENTIFICATION

- 7.1 The AP™ Foil-Faced Sheathing and CI Max® Foam Sheathing insulation boards described in this report are identified by a label on the boards or on the packaging material bearing the manufacturer's name (Johns Manville), the plant code or address, the product name, the flame spread and smoke developed indices, and the evaluation report number (ESR-3398); except for the AP™ Foil-Faced Sheathing that is used in Type I, II, III and IV construction, which must always have the above-noted information printed on the boards themselves.
- 7.2 The report holder's contact information is the following:

JOHNS MANVILLE
717 17TH STREET
DENVER, COLORADO 80202
(303) 978-2000
www.jm.com

**TABLE 1—THERMAL RESISTANCE (R-VALUES)
AP™ FOIL FACED SHEATHING and CI MAX POLYISOCYANURATE FOAM SHEATHING**

THICKNESS (INCHES)	R-VALUE [(°F-ft ² -hr)/BTU] at 75°F MEAN TEMPERATURE
1	6.0
2	13
4	26
4.5 ¹	28

For **SI**: 1 inch = 25.4 mm; 1° F-ft²-hr/BTU = 0.176 K-m²/W.

¹Thermal Resistance (R-Value) at 4.5 inches applies to the AP™ Foil Faced Sheathing Boards only.

TABLE 2—NFPA 285 COMPLYING EXTERIOR WALL ASSEMBLIES IN TYPES I, II, III AND IV CONSTRUCTION FOR MAXIMUM 4.5-INCH-THICK JOHNS MANVILLE AP™ FOIL-FACED SHEATHING INSULATION BOARDS ONLY

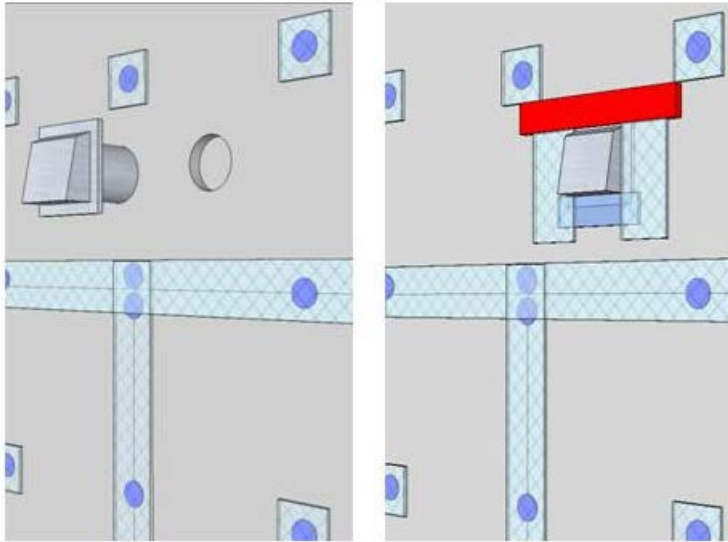
Base wall system – Use either 1, 2 or 3	<ol style="list-style-type: none"> Concrete wall Concrete Masonry wall Steel Studs (Minimum 3⁵/₈-inch-deep, minimum 25-gauge steel studs at a maximum of 24-inch on center) with 1 layer of 5/₈-inch-thick Type X gypsum wallboard (interior face).
Floorline Firestopping	4 lb/ft ³ mineral wool (e.g. Thermafiber) friction fit in each stud cavity and at each floorline.
Cavity Insulation – Use 1, 2, 3, 4, 5 or, 6 when exterior sheathing is used.	<ol style="list-style-type: none"> None Fiberglass batt insulation (faced or unfaced) complying with the applicable code. Fiberglass spray-in insulation. Mineral wool insulation (faced or unfaced). Sprayed cellulosic insulation complying with Section 720 of IBC and ASTM C739. Hybrid systems: spray foam and/or fiberglass insulation or mineral wool insulation (flash and bat insulation systems).
Exterior sheathing – Use either 1, 2 or 3	<ol style="list-style-type: none"> None Minimum 1/2-inch-thick, exterior type gypsum sheathing complying with the applicable code. Minimum 5/₈-inch-thick, Type X exterior type gypsum sheathing complying with the applicable code.
Water-resistive Barrier Applied to Exterior Sheathing – Use 1, 2, 3, 4, 5, 6 or 7.	<ol style="list-style-type: none"> Perm-A-Barrier® VPS – W.R. Grace Tyvek® CommercialWrap® - DuPont (ESR-2375) Green Guard® Max Building Wrap – Pactive Weathermate™ – Dow Chemical (ESR-2862) Weathermate™ Plus – Dow Chemical (ESR-3401) Any water-resistive barrier that meets the applicable codes and has a current ICC-ES evaluation report for the intended use. None [When the exterior insulation is installed in accordance with Section 4.4 with Tape (Section 3.3.1) and Sealant (Section 3.3.2)]. <p>*Note: All barriers to be installed in accordance with manufacturer's installation instructions, the applicable ICC-ES evaluation report and the applicable codes.</p>
Exterior Insulation	Johns Manville AP™ Foil-Faced Sheathing board. Maximum thickness to be 4 1/2 inches. Install AP™ Foil-Faced Sheathing board with offsetting joints or nonstaggered. Insulation board joints may be covered with 6 inch (maximum) wide acrylic, asphalt or butyl-based flashing tape.
Exterior Wall Covering – Use either 1, 2, 3, 4, or 5	<ol style="list-style-type: none"> Brick. Use standard nominal 4-inch-thick, clay brick. Use standard brick veneer anchors installed vertically on each stud at a maximum of 24 inches o.c. creating a 1-inch maximum air gap between the exterior insulation and brick. Stucco¹. Minimum 3/4-inch-thick, exterior cement plaster and lath. A secondary water-resistive barrier can be installed between the exterior insulation and the lath. The secondary water-resistive barrier shall not be full-coverage asphalt or butyl-based self-adhered membranes. Natural Stone Veneer. Minimum 2-inch-thick (granite, limestone, marble, sandstone) installed using any standard non-open joint installation technique, such as shiplap. Cast Artificial Stone complying with ICC-ES AC51, pre-cast concrete or concrete masonry unit (CMU) -- Minimum 1 1/2-inch-thick installed using any standard nonopen joint installation technique such as shiplap. Terracotta² Cladding -- Minimum 1 1/4-inch-thick installed using any standard non-open joint installation technique such as shiplap.

For **SI**: 1 inch = 25.4 mm.

¹Cladding fasteners must penetrate through the foam plastic into wood or steel framing and the system must be designed to handle cladding load and wind load, per applicable code.

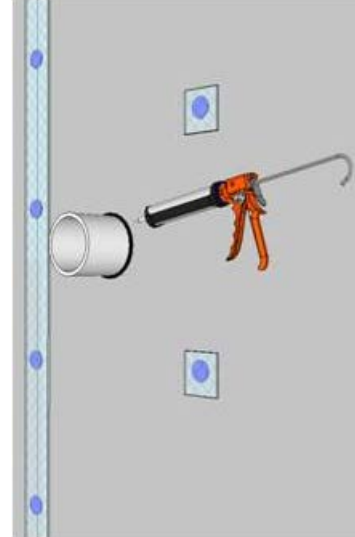
²Fasteners used for securing the terracotta cladding must penetrate through the foam plastic into wood or steel framing and the system must be designed to handle cladding load and wind load, per applicable code.

FIGURE 1. TYPICAL PENETRATION FLASHING DETAIL - FLANGED



1. Install flanged penetration cover.
2. Apply tape in shingle fashion order; lower edge, then sides, then top.

FIGURE 2. TYPICAL PENETRATION FLASHING DETAIL - UNFLANGED

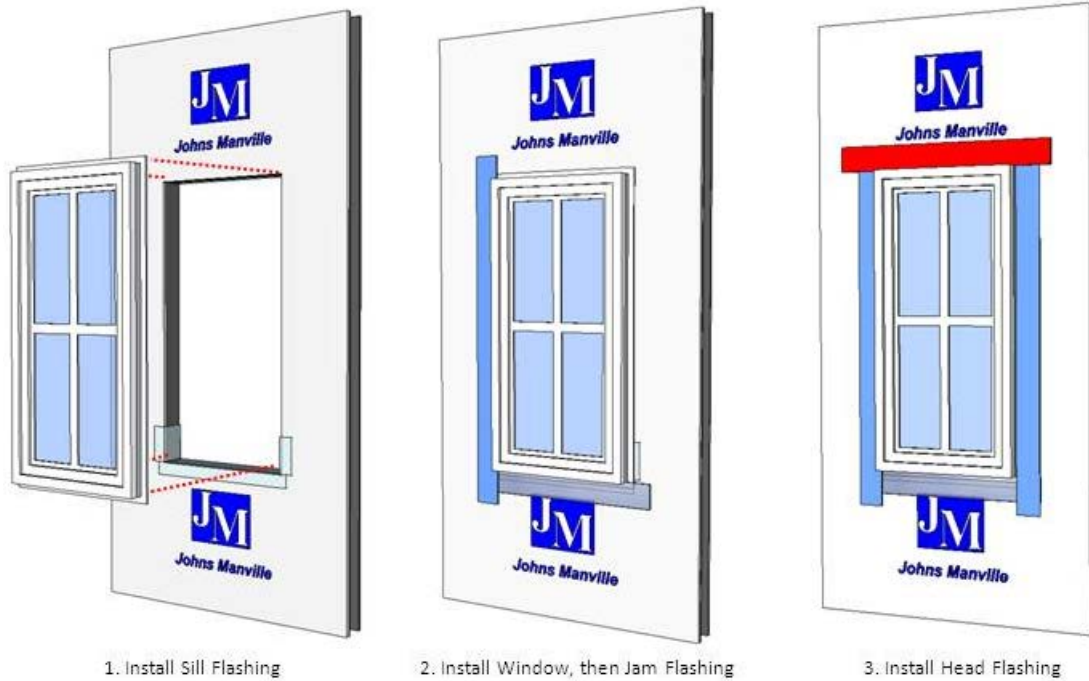


1. Install unflanged item. Apply caulk to seal penetration.

FIGURE 1
(AP™ FOIL-FACED SHEATHING ONLY)

FIGURE 2
(AP™ FOIL-FACED SHEATHING ONLY)

FIGURE 3. TYPICAL WINDOW FLASHING DETAIL



1. Install Sill Flashing
2. Install Window, then Jam Flashing
3. Install Head Flashing

FIGURE 3
(AP™ FOIL-FACED SHEATHING ONLY)

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ESR-3398 Seal & Insulate with ENERGY STAR[®] Supplement

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REPORT HOLDER:

JOHNS MANVILLE

EVALUATION SUBJECT:

JOHNS MANVILLE AP[™] FOIL-FACED SHEATHING

1.0 EVALUATION SCOPE

Conformance to the following requirements:

Seal and Insulate with ENERGY STAR Program, *Definitions and Testing Requirements for Residential Insulation, Version 1.0*

Properties evaluated:

- Thermal resistance
- Surface-burning characteristics

2.0 PURPOSE OF THIS SUPPLEMENT

This supplement is issued to certify that the insulation product described in Sections 2.0 through 7.0 of the master report (ESR-3398) has been reviewed for compliance with the applicable codes noted in Section 1.0 of the master report and with the requirements set forth in the Seal and Insulate with ENERGY STAR Program, *Definitions and Testing Requirements for Residential Insulation, Version 1.0*. The insulation products covered by this supplement are classified as “Board Insulation.”

The requirements for testing laboratory qualifications and product sampling, as well as the specific material and test standards and editions used in this evaluation, are as set forth in the applicable documentation noted in Section 6.0 of the master evaluation report.

3.0 DEFINITIONS

The following definitions are from *Definitions and Testing Requirements for Residential Insulation, Version 1.0*, and are applicable to the subject of this report.

3.1 General Definitions

Insulation: Any material mainly used to slow down heat flow. It may be mineral or organic, fibrous, cellular, or reflective (aluminum foil). It may be in rigid, semi-rigid, flexible, or loose-fill form.

3.2 Insulation Product Definitions

Board Insulation: Semi-rigid insulation preformed into rectangular units having a degree of suppleness particularly related to their geometrical dimensions. Typical materials include, but are not limited to fiberglass, expanded polystyrene (EPS), extruded polystyrene (XPS), polyisocyanurate, or polyurethane. The product may or may not be faced.

3.3 Insulation Performance Definitions

R-value: The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area. For the purposes of the Seal and Insulate with ENERGY STAR program, Imperial units will only be accepted [(h·ft²·°F)/Btu].

Smoke-Development Index: The characteristic of a material to emit smoke when exposed to flame or fire compared to red oak and inorganic cement.

Flame-Spread Index: The characteristic of a material to resist the spreading of flames when exposed to flame or fire compared to red oak and inorganic cement.

3.4 Thermal Resistance:

The AP™ Foil-Faced Sheathing® insulation has thermal resistance *R*-values as noted in Table 1 of ESR-3398.

3.5 Installation

3.5.1 General: The installation of the insulation must be in accordance with the requirements set forth in the manufacturer's published installation instructions (a copy is reprinted at the end of this supplement). The personal protective equipment (PPE) is described in the manufacturer's published installation instructions, which are reprinted at the end of this supplement. The manufacturer's PPE information is reprinted in this report for informational purposes.

3.5.2 Occupancy Time after Application: There are no specific requirements related to time before re-entry or re-occupancy after installation of the insulation.

3.5.3 Figures: The figures shown represent general installations of the insulation in the following applications: below-grade interior walls; above-grade exterior walls; crawl spaces (vented and unvented); and attics and cathedral/vaulted ceilings (vented, unvented and knee walls). These figures are for illustration purposes and are not to be construed or used as construction documents.

This supplement expires concurrently with the master report, reissued November 2018.



Residential Installation Instructions Below-Grade Interior Walls

AP™ Foil-Faced Polyisocyanurate Foam Sheathing

INTERIOR BASEMENT WALL

Johns Manville AP™ Foil-Faced insulation sheathing board is an excellent choice for insulating interior below grade walls. Polyiso provides one of the highest R-values per inch of any rigid insulation (R-6.5 at 1 inch). AP Foil-Faced insulation is lightweight and easy to install. It can be installed on the interior of a basement wall by either direct attachment or using wood furring strips. AP Foil-Faced insulation must be covered with an approved thermal barrier and cannot be left exposed.

BEFORE YOU BEGIN:

Always follow local building codes. AP Foil-Faced sheathing must be separated from the interior of a building by a minimum of ½-inch gypsum board or equivalent 15-minute thermal barrier as required by code. Repair any water leaks or structural cracks in the wall. Gather all materials.

Materials Checklist

- Safety glasses and gloves
- Measuring tape and pencil
- Utility knife or handsaw
- Straight edge
- Construction-grade polyurethane adhesive such as Liquid Nails® or Loctite®
- Flashing tape such as 3M 8067, Grace Vycor Pro, or Lamatek
- Mechanical fasteners such as masonry nails with 1-inch metal washers
- Sealant such as Tremco Spectrem® 1

Measuring and Cutting

1. Measure the board by dragging a measuring tape hook across the surface of the board; create a crease while holding the tape at the desired length.
2. Using a straight edge as a guide, deeply score the crease. There is no need to cut through.
3. Snap the board along the score line over the edge of a table or workbench.

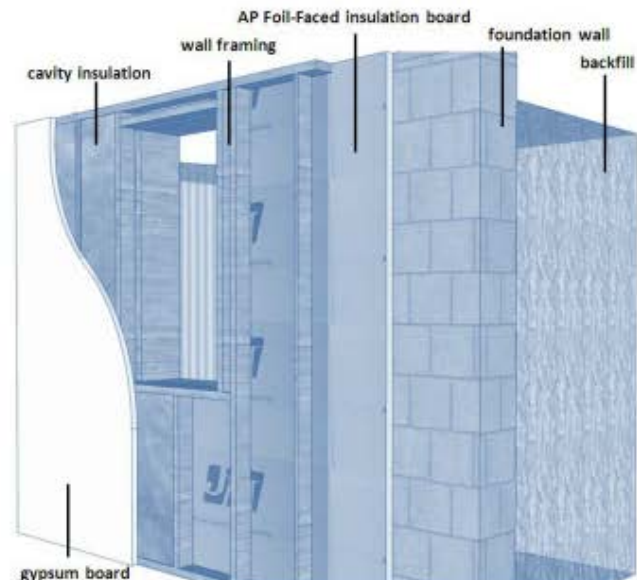


INSTALLATION

OPTION 1: Direct Attachment

1. Use maximum boards lengths to minimize the number of joints.
2. Install AP Foil-Faced insulation over the interior side of foundation walls using construction-grade adhesive or masonry nails or screws with 1-inch washers or caps. Place the reflective side facing the interior, and the nonreflective side facing the foundation wall.
3. Fasteners should penetrate 1 inch minimum into the concrete. Space fasteners approximately 24 inches on center around the perimeter and in the field of each board. Drive fasteners so that the washer is flush with the board surface, but do not countersink.
4. Butt board edges together tightly and carefully fit around penetrations. Patch holes less than 1 inch across with flashing tape or sealant. Patch holes greater than 1 inch across with matching board material and then seal with flashing tape.
5. Cover AP Foil-Faced insulation with a minimum ½-inch gypsum board or equivalent 15-minute thermal barrier as required by local building code.

Figure 1. Below-Grade Interior Direct Attachment



Residential Installation Instructions Below-Grade Interior Walls

INSTALLATION CONTINUED

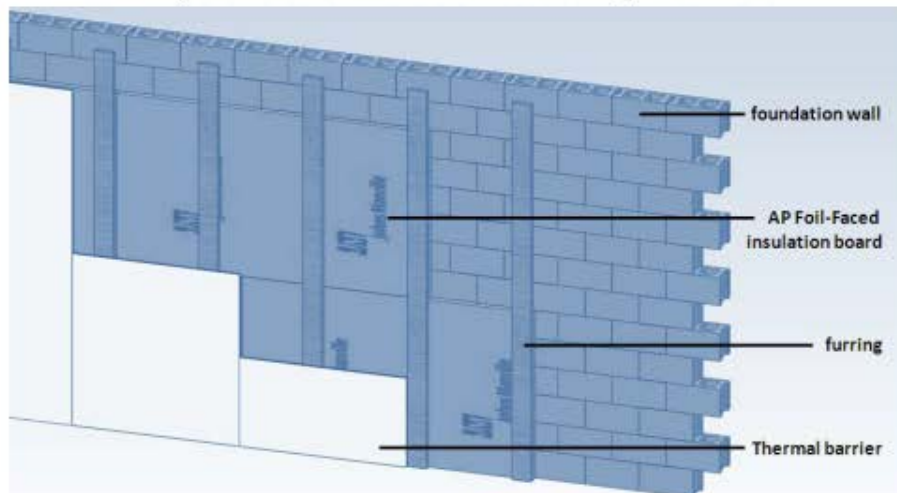
OPTION 1: Direct Attachment - Continued

6. Build a conventional stud wall that firmly presses foam insulation against basement wall.
7. For additional R-value, install insulation between the wall studs. Options for insulating between studs include Johns Manville Formaldehyde-free™ Unfaced fiber glass batts, JM Climate Pro® blown-in fiber glass in the Blow-In-Blanket® system, JM Spider® Custom Insulation System or other approved cavity insulation product.
8. Install ½-inch gypsum board or equivalent 15-minute thermal barrier over wall framing as required by local building code. Tape and finish according to manufacturer's instructions.

OPTION 2: Wood Furring

1. Install AP Foil-Faced insulation over the interior side of foundation walls, butting board edges together tightly. Insulation boards can be held in place with 1- to 2-inch spots of construction-grade adhesive, spaced 16–24 inches in each direction. Place the reflective side facing the interior, and the nonreflective side facing the foundation wall.
2. Apply suitable wood furring strips a maximum of 24 inches on center vertically over the insulation. Use appropriate mechanical fasteners, such as masonry nails or screws, spaced 12 inches on center. Fasteners should be long enough to penetrate masonry approximately one inch, and furring strips should cover vertical seams between insulation boards.
3. Install ½-inch gypsum board or equivalent 15-minute thermal barrier over furring strips. Tape and finish according to manufacturer's instructions. AP Foil-Faced insulation must be covered with an approved thermal barrier and cannot be left exposed.

Figure 2. Below Grade Interior Wood Furring Attachment



PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Safety glasses with side shields are recommended to keep dust out of the eyes.

Personal Protective Equipment: Skin

Leather or cotton gloves should be worn to prevent skin contact and irritation.

Personal Protective Equipment: Respiratory

A NIOSH-certified respirator should be used if ventilation is unavailable, or is inadequate for keeping dust levels below the applicable exposure limits.

Ventilation

In fixed manufacturing settings, local exhaust ventilation should be provided at areas of cutting to remove airborne dust. General dilution ventilation should be provided as necessary to keep airborne dust below the applicable exposure limits and guidelines. The need for ventilation systems should be evaluated by a professional industrial hygienist, while the design of specific ventilation systems should be conducted by a professional engineer.

Personal Protective Equipment: General

Loose-fitting, long-sleeved clothing should be worn to protect skin from irritation. Work clothing should be washed separately from other clothes, and the washer should be rinsed thoroughly (run empty for a complete wash cycle). This will reduce the chances of dust being transferred to other clothing.



Residential Installation Instructions Below-Grade Exterior Walls

AP™ Foil-Faced Polyisocyanurate Foam Sheathing

EXTERIOR BASEMENT WALL

Johns Manville AP™ Foil-Faced insulation sheathing board is an excellent choice for insulating exterior below-grade walls. Polyiso provides one of the highest R-values per inch of any rigid insulation (R-6.5 at 1 inch). AP Foil-Faced insulation is lightweight and easy to install. The best time to insulate the exterior of basement walls is before backfilling. If the backfill is already in place, the above-grade portion of the basement wall may be insulated; however, interior insulation may be a better option.

BEFORE YOU BEGIN:

Always follow local building codes. Some codes may not allow foam insulation on the exterior of foundations due to termites. Repair any water leaks or structural cracks in the wall. Gather all materials.

Materials Checklist

- Safety glasses and gloves
- Measuring tape and pencil
- Utility knife or handsaw
- Straight edge
- Construction-grade polyurethane adhesive such as Liquid Nails® or Loctite®
- Flashing tape such as 3M 8067, Grace Vycor Pro, or Lamatek
- Mechanical fasteners such as masonry nails with 1-inch metal washers
- Sealant such as Tremco Spectrem® 1

Measuring and Cutting

1. Measure the board by dragging a measuring tape hook across the surface of the board; create a crease while holding the tape at the desired length.
2. Using a straight edge as a guide, deeply score the crease. There is no need to cut through.
3. Snap the board along the score line over the edge of a table or workbench.



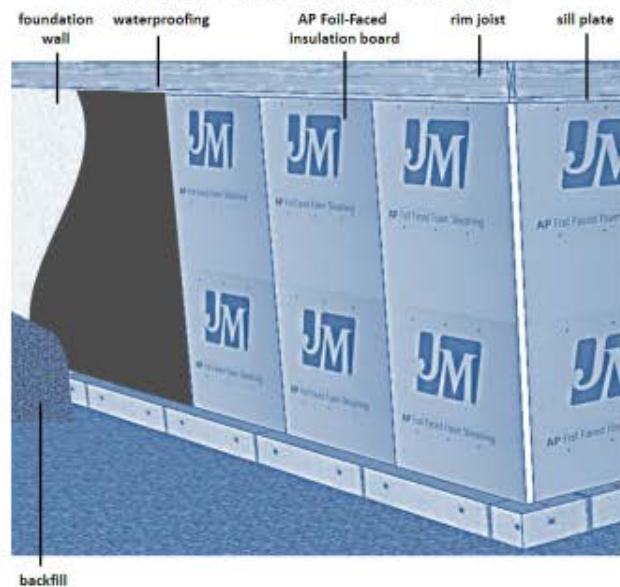
INSTALLATION

1. Install AP Foil-Faced insulation boards over dampproofing or waterproofing.
2. Use maximum board lengths to minimize number of joints. Rest the bottom edge of foam insulation on top of footer and extend up to the sill plate.

Insulation may be held in place temporarily with 1- to 2-inch size spots of high-quality construction adhesive, spaced approximately 16 inches each direction.
3. Fasten foam insulation boards to the foundation wall using power-driven masonry nails with 1-inch minimum metal washers or caps, or other suitable masonry fastener. Fasteners should penetrate 1-inch minimum into the concrete. Space fasteners approximately 24 inches on center.
4. Butt board edges together tightly and carefully fit around penetrations.
5. To enhance water drainage and air sealing performance, seal all board seams with approved flashing tape such as 3M 8067, Grace Vycor Pro, Lamatek, or equivalent.
6. Protect foam insulation that is exposed above grade and 6 inches below grade. Options include fiber cement board, pressure-treated wood, or stucco parging.

IMPORTANT NOTE: Some applications may require a 2- to 3-inch inspection strip along the top of the foundation wall for termite mitigation. Always adhere to local building codes or pest control requirements.

Figure 1. Below-Grade Exterior Wall



Residential Installation Instructions Below-Grade Exterior Walls

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Safety glasses with side shields are recommended to keep dust out of the eyes.

Personal Protective Equipment: Skin

Leather or cotton gloves should be worn to prevent skin contact and irritation.

Personal Protective Equipment: Respiratory

A NIOSH-certified respirator should be used if ventilation is unavailable, or is inadequate for keeping dust levels below the applicable exposure limits.

Ventilation

In fixed manufacturing settings, local exhaust ventilation should be provided at areas of cutting to remove airborne dust. General dilution ventilation should be provided as necessary to keep airborne dust below the applicable exposure limits and guidelines. The need for ventilation systems should be evaluated by a professional industrial hygienist, while the design of specific ventilation systems should be conducted by a professional engineer.

Personal Protective Equipment: General

Loose-fitting, long-sleeved clothing should be worn to protect skin from irritation. Work clothing should be washed separately from other clothes, and the washer should be rinsed thoroughly (run empty for a complete wash cycle). This will reduce the chances of dust being transferred to other clothing.



Residential Installation Instructions Above-Grade Exterior Walls

AP™ Foil-Faced Polyisocyanurate Foam Sheathing

EXTERIOR WALLS

Johns Manville AP™ Foil-Faced insulation sheathing board is an excellent choice for insulating exterior walls. Polyiso provides one of the highest R-values per inch of any rigid insulation (R-6.5 at 1 inch). When applied to the exterior face of wood or steel studs to cover all framing, sills and headers, Johns Manville AP Foil-Faced insulation provides a layer of continuous insulation to prevent heat flow through details not normally covered by insulation products. AP Foil-Faced insulation is lightweight and easy to install. It may be installed with seams taped and penetrations sealed to function as an air barrier and water-resistive barrier (WRB), or it may be installed in conjunction with a separate WRB system.

BEFORE YOU BEGIN:

Always follow local building codes. Some codes may not allow foam insulation on the exterior of foundations due to termites. Repair any water leaks or structural cracks in the wall. Gather all materials.

Materials Checklist

- Safety glasses and gloves
- Measuring tape and pencil
- Utility knife or handsaw
- Straight edge
- Construction-grade polyurethane adhesive such as Liquid Nails® or Loctite®
- Flashing tape such as 3M 8067, Grace Vycor Pro, or Lamatek
- Mechanical fasteners such as masonry nails with 1-inch metal washers, or JM Ultrafast CI Plates and JM Ultrafast CI Phillips screws
- Sealant such as Tremco Spectrem® 1

Measuring and Cutting

1. Measure the board by dragging a measuring tape hook across the surface of the board; create a crease while holding the tape at the desired length.
2. Using a straight edge as a guide, deeply score the crease. There is no need to cut through.
3. Snap the board along the score line over the edge of a table or workbench.



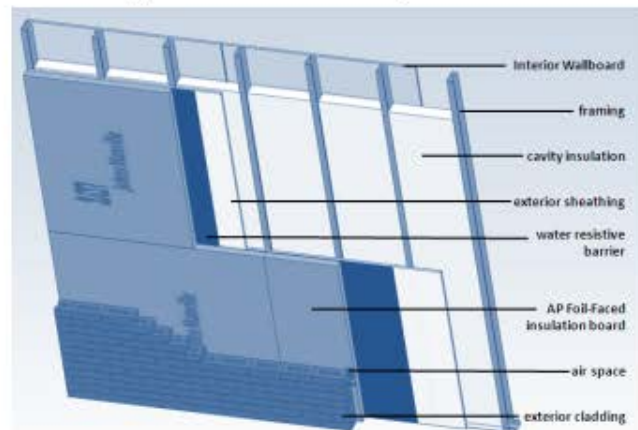
INSTALLATION

OPTION 1: Framed Wall – Separate WRB

1. If a WRB is already installed over the exterior sheathing, care should be taken to maintain its integrity while installing AP Foil-Faced boards. Self-sealing flashing tape should be applied to the WRB where fasteners are expected for insulation or cladding attachment, to prevent fasteners from creating air or water leaks. For liquid/spray/trowel-applied WRB materials, verify manufacturer's recommended cure time before installing foam boards.
2. Install AP Foil-Faced boards horizontally or vertically over exterior sheathing. Use maximum board lengths to minimize the number of joints. The insulation board joints should be staggered relative to structural sheathing (OSB or non-insulated sheathing) joints. Butt board edges together tightly, and carefully fit around openings and penetrations. The reflective side of the board should be oriented to the exterior and the nonreflective white side should be oriented to the interior.

EXCEPTION: If vinyl siding is to be installed over AP Foil-Faced sheathing, install foam boards with the white nonreflective side toward the vinyl siding.

Figure 1. Framed Wall – Separate WRB



3. Fasten insulation using 1-inch head plastic cap nails long enough to penetrate framing at least $\frac{3}{4}$ inch, or $\frac{3}{8}$ -inch head galvanized roofing nails long enough to penetrate at least $\frac{3}{4}$ inch, or 1-inch crown 16-gauge wire staples long enough to penetrate at least $\frac{1}{2}$ inch. Drive fasteners flush with board, but do not countersink. Suggested fastener spacing is 16 inches on center or less along each stud.

Residential Installation Instructions Above-Grade Exterior Walls

INSTALLATION CONTINUED

OPTION 1: Framed Wall – Separate WRB Continued

- Use a utility knife and straight edge to trim the insulation board to conform to irregular wall angles, projections or wall surfaces. Repair any boards damaged during installation. Patch holes less than 1 inch across with flashing tape. Patch holes greater than 1 inch across with matching board material and then seal with flashing tape.
- If a WRB was not installed under the AP Foil-Faced sheathing, install WRB over insulation per WRB manufacturer's instructions. Adjust fastener lengths to account for the thickness of the foam sheathing.
- Brick, wood, hardboard, aluminum or vinyl sidings may be fastened to the wood frame construction through the insulation in accordance with the siding manufacturer's instructions.
- Cement board, shakes or shingles may also be applied by installing furring strips or a plywood nailer base over the insulation and attaching the siding in accordance with the manufacturer's instructions.
- Install cladding systems as soon as possible, preferably within 60 days.

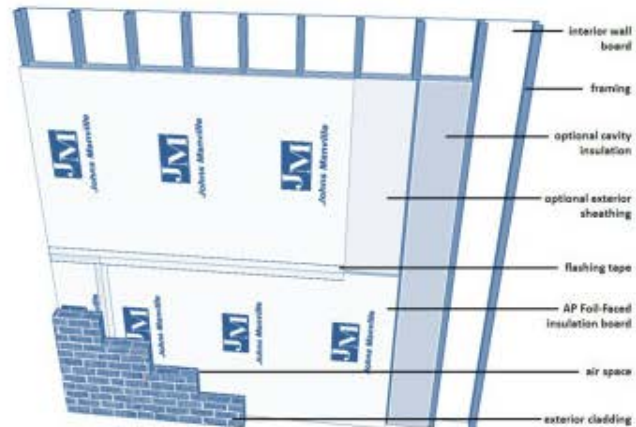
OPTION 2: Framed Wall – AP Foil-Faced as WRB

- Install AP Foil-Faced boards either directly to framing or over exterior sheathing. If over exterior sheathing, insulation board joints should be staggered relative to exterior sheathing. Install boards horizontally or vertically using maximum board lengths to minimize the number of joints. Butt board edges together tightly, and carefully fit around openings and penetrations. The reflective side of the board should be oriented to the exterior and the nonreflective white side should be oriented to the interior.

EXCEPTION: If vinyl siding is to be installed over AP Foil-Faced sheathing, install foam boards with the white nonreflective side toward the vinyl siding.

- Secure AP Foil-Faced boards using recommended 2-inch capped fasteners with no. 10 self tapping screws long enough to penetrate framing a minimum of three threads. Drive fasteners flush with board, but do not countersink. Suggested fastener spacing is 16 inches on center or less around the board perimeter and in the field.
- To create an air/water-resistive barrier, tape all seams, edge and end joints, and thru-wall penetrations with recommended flashing tape as shown in Figures 3 - 5. Install flashing shingle-style with a minimum 4 inch overlap, and follow the tape manufacturer's application instructions. Seal fastener penetrations by applying a minimum 4-inch by 4-inch piece of tape over each plate, smoothing tape edges to create an air-tight seal between the tape and the insulation board. Create continuous air/water barrier at roof and foundation wall interface using peel-and-stick membrane, or other approved barrier, following manufacturer's application instructions.
- Seal penetrations and panel defects with recommended sealant.
- Use a utility knife and straight edge to trim the insulation board to conform to irregular angles, projections or wall surfaces. Repair boards damaged during installation. Patch holes less than 1 inch across with flashing tape and/or sealant. Patch holes greater than 1 inch across with matching board material and seal with flashing tape.

Figure 2. Framed Wall – AP Foil-Faced as WRB



- Brick, wood, hardboard, aluminum, or vinyl sidings may be fastened to the wood frame construction through the insulation in accordance with the siding manufacturer's instructions. Seal penetrations with recommended sealant. This step will help reduce air or water leaks around cladding attachments.
- Cement board, shakes or shingles may also be applied by installing furring strips or a plywood nailer base over the insulation and attaching the siding in accordance with the manufacturer's instructions. Self-sealing flashing tape should be applied to the AP Foil-Faced board under where nailers or furring strips will be installed. This step will help reduce air or water leaks around fasteners used to secure these elements.
- Install cladding systems as soon as possible, preferably within 60 days.

Residential Installation Instructions Above-Grade Exterior Walls

FIGURE 3. TYPICAL WINDOW FLASHING DETAIL

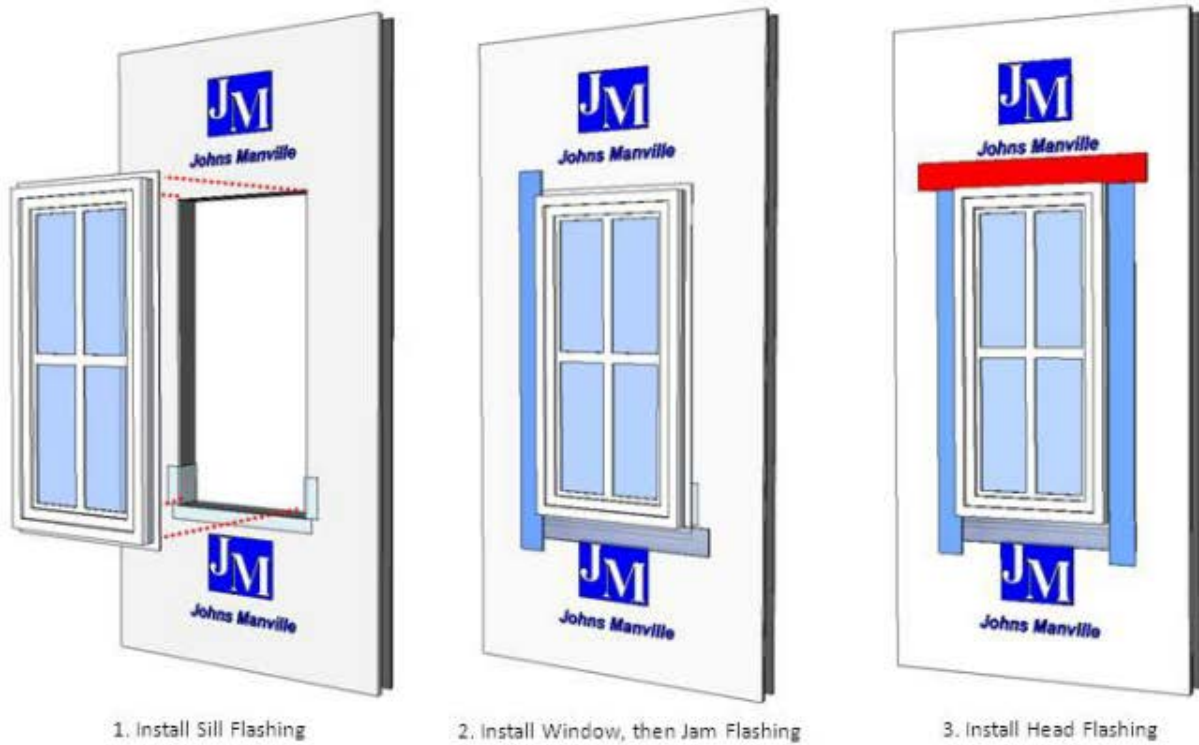


FIGURE 4. TYPICAL PENETRATION FLASHING DETAIL - FLANGED

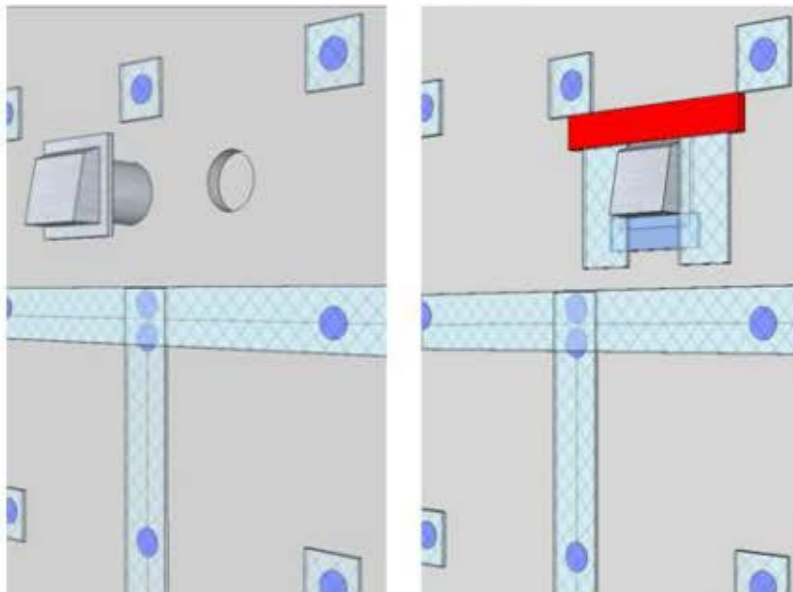
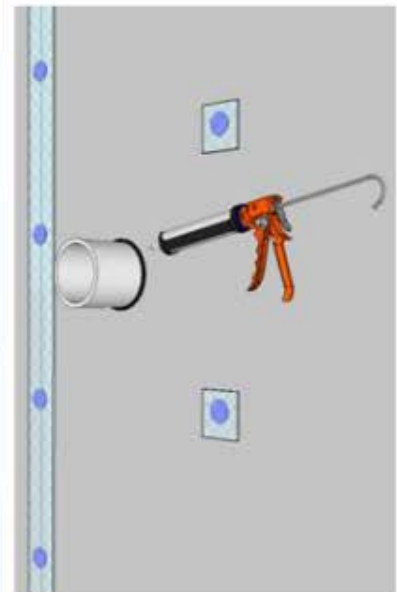


FIGURE 5. TYPICAL PENETRATION FLASHING DETAIL - UNFLANGED



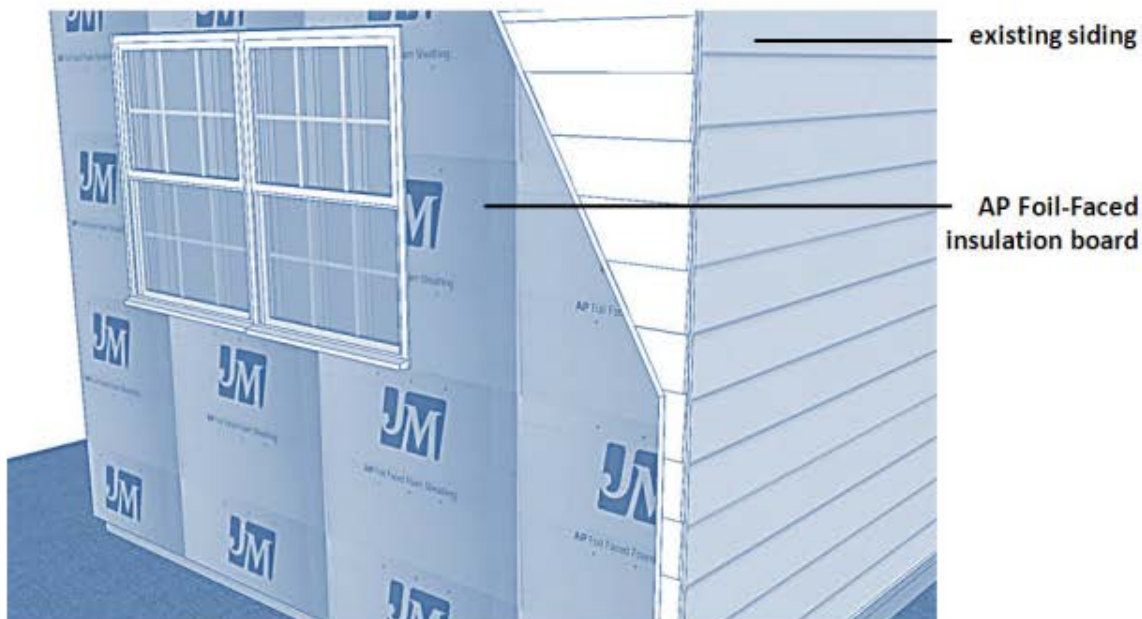
Residential Installation Instructions Above-Grade Exterior Walls

INSTALLATION CONTINUED

OPTION 3: Existing Wall – AP Foil-Faced Insulation Over Siding

1. Correct all moisture-related wall problems before proceeding with new siding application. Because each type of siding may require specific application details, consult siding manufacturer's instructions before beginning. Existing siding should be structurally sound; secure loose siding and repair or replace rotted siding, trim, sills and corner posts, etc. before residing. Remove all gutters, downspouts, shutters, molding and old caulking around windows and doors.
2. Fasten AP Foil-Faced insulation over existing siding. Secure AP Foil-Faced boards using recommended 2-inch capped fasteners with no. 10 self tapping screws long enough to penetrate framing a minimum of three threads. Drive fasteners flush with board, but do not countersink. Suggested fastener spacing is 16 inches on center or less around the board perimeter and in the field. Jamb, frame or sill extenders may be required depending on thickness of insulated sheathing used as well as siding manufacturer's application instructions. It is recommended that AP Foil-Faced insulation boards be installed vertically.
3. If the AP Foil-Faced insulation will also be used as a WRB, tape all seams, edge and end joints, and thru-wall penetrations with recommended flashing tape as shown in Figures 3 - 5. Install flashing shingle-style with a minimum 4 inch overlap, and follow the tape manufacturer's application instructions. Seal fastener penetrations by applying a minimum 4-inch by 4-inch piece of tape over each plate, smoothing tape edges to create an air-tight seal between the tape and the insulation board. Create continuous air/water barrier at roof and foundation wall interface using peel-and-stick membrane, or other approved barrier, following manufacturer's application instructions.
4. Seal penetrations and panel defects with recommended sealant.
5. Use a utility knife and straight edge to trim the insulation board to conform to irregular wall angles, projections or wall surfaces. Repair any boards damaged during installation. Patch holes less than 1 inch across with flashing tape and/or sealant. Patch holes greater than 1 inch across with matching board material and then seal with flashing tape.
6. New siding is applied in accordance with the manufacturer's instructions. Ensure that fasteners are long enough to penetrate both the AP Foil-Faced insulating sheathing and the normal securing substrate to a depth recommended by the siding manufacturer.

Figure 6. Existing Wall – AP™ Foil-Faced Insulation Over Siding



Residential Installation Instructions Above-Grade Exterior Walls

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Safety glasses with side shields are recommended to keep dust out of the eyes.

Personal Protective Equipment: Skin

Leather or cotton gloves should be worn to prevent skin contact and irritation.

Personal Protective Equipment: Respiratory

A NIOSH-certified respirator should be used if ventilation is unavailable, or is inadequate for keeping dust levels below the applicable exposure limits.

Ventilation

In fixed manufacturing settings, local exhaust ventilation should be provided at areas of cutting to remove airborne dust. General dilution ventilation should be provided as necessary to keep airborne dust below the applicable exposure limits and guidelines. The need for ventilation systems should be evaluated by a professional industrial hygienist, while the design of specific ventilation systems should be conducted by a professional engineer.

Personal Protective Equipment: General

Loose-fitting, long-sleeved clothing should be worn to protect skin from irritation. Work clothing should be washed separately from other clothes, and the washer should be rinsed thoroughly (run empty for a complete wash cycle). This will reduce the chances of dust being transferred to other clothing.



Residential Installation Instructions Crawl Spaces

AP™ Foil-Faced Polyisocyanurate Foam Sheathing

Crawl Spaces

Johns Manville AP™ Foil-Faced insulation sheathing board is an excellent choice for insulating crawl spaces. Polyiso provides one of the highest R-values per inch of any rigid insulation (R-6.5 at 1 inch). AP Foil-Faced insulation is lightweight and easy to install. It can be installed in both vented and unvented crawl spaces. AP™ Foil-Faced insulation must be covered with an approved thermal barrier and cannot be left exposed. In crawl spaces where entry is made only for service of utilities, AP Foil-Faced insulation must be covered with an approved ignition barrier and cannot be left exposed.

BEFORE YOU BEGIN:

Always follow local building codes. AP Foil-Faced sheathing must be separated from the interior of a building by either a thermal barrier or ignition barrier as required by code. Repair any water leaks or structural cracks in the wall, and address any pest problems. Gather all materials and clear work area.

Materials Checklist

- Safety glasses and gloves
- Measuring tape and pencil
- Utility knife or handsaw
- Straight edge
- Construction-grade polyurethane adhesive such as Liquid Nails
- Mechanical fasteners such as masonry nails with 1-inch metal washers or caps
- Flashing tape such as 3M 8067, Grace Vycor Pro, or Lamatek
- Sealant such as Tremco Spectrem® 1
- Canned foam such as Touch'nSeal All Season, Hilti CF 810 or CF-F, Dow Great Stuff or Great Stuff Pro

Measuring and Cutting

1. Measure the board by dragging a measuring tape hook across the surface of the board; create a crease while holding the tape at the desired length.
2. Using a straight edge as a guide, deeply score the crease. There is no need to cut through.
3. Snap the board along the score line over the edge of a table or workbench.

1.



2.



3.



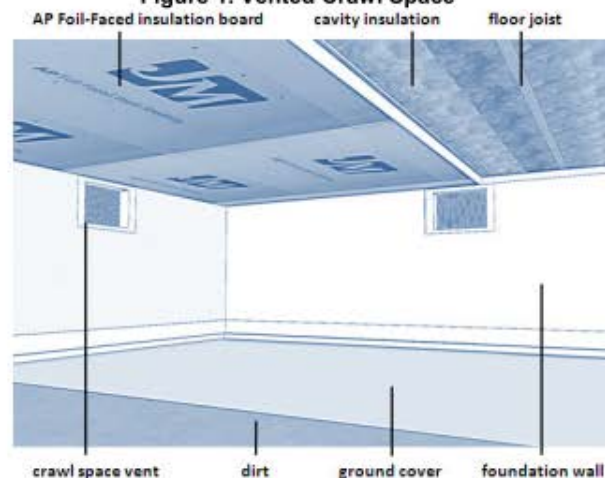
INSTALLATION

OPTION 1: Vented Crawl Space

1. The crawl space should be vented in accordance with local building code requirements.
2. If desired, install cavity insulation between the floor joists. Options for insulating between joists include JM Formaldehyde-free™ fiber glass batts (Unfaced, Faced, or ComfortTherm®), JM Climate Pro® blown-in fiber glass in the Blow-In-Blanket® system, JM Spider® Custom Insulation System, JM spray polyurethane foams (Corbond III®, Corbond MCS™, or Open-cell), or other approved cavity insulation. Fiber glass batts should be installed without compression. The amount of insulation will depend on the product chosen and the depth of the joists.
3. Fiber glass batts must be secured with wire staves or netting to prevent the insulation from falling out of the joist cavity before foam board insulation is installed.
4. Install AP Foil-Faced insulation boards across the bottom of the floor joists. This will prevent future condensation and increase the floor's overall insulation value.

5. Use maximum board lengths to minimize number of joints. Locate joints square to joists and center end joints over joists. Provide additional blocking as necessary. It is not necessary to stagger board joints. Butt board edges together tightly, and carefully fit around openings and penetrations.

Figure 1. Vented Crawl Space



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Residential Installation Instructions Crawl Spaces

INSTALLATION CONTINUED

OPTION 1: Vented Crawl Space – Continued

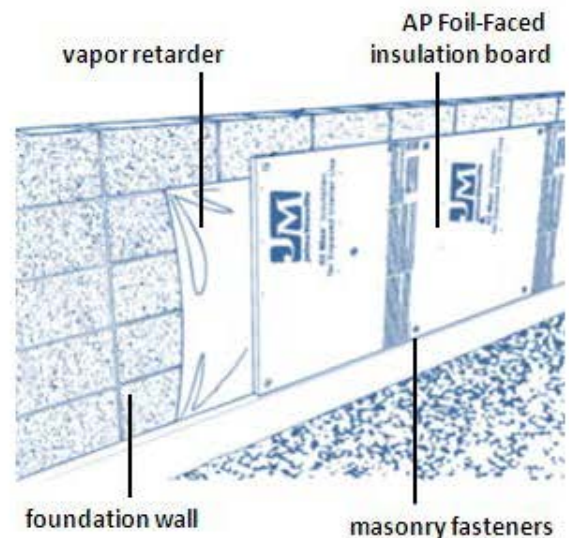
6. Fasten insulation boards to the bottom of the joists using screws or nails with 1-inch minimum washers or caps. Fasteners should be long enough to penetrate in to the joist a minimum of $\frac{3}{4}$ inch. Drive fasteners flush with the board, but do not countersink. Space fasteners approximately 16 inches on center around the perimeter and in the field of each board (16 or 24 inches on center across joists, depending on spacing).
7. To increase air sealing, board edges may be taped and all penetrations sealed with one-part expanding canned foam.
8. Cover exposed foam board insulation with either a thermal barrier or ignition barrier as required by local building code and occupancy of the crawl space.
9. In cold climates, be sure to insulate any plumbing lines that extend below the crawl space insulation.
10. All heating and cooling ducts in the crawl space should be sealed and insulated appropriately.
11. A ground cover must be installed to reduce moisture levels in the crawl space.

OPTION 2: Unvented Crawl Space

IMPORTANT NOTE: Some applications may require a 2- to 3-inch inspection strip along the top of the foundation wall for termite mitigation. Always adhere to local building codes.

1. Install wall section of crawl space moisture barrier. Barrier should consist of 6 mil minimum polyethylene sheeting wide enough to extend from the top of the foundation wall to at least 12 inches onto the ground.
2. Install AP Foil-Faced insulation from the top of the footing to the top of the foundation wall.
3. Fasten AP Foil-Faced boards to the interior of the foundation wall using power-driven masonry nails with $1\frac{1}{2}$ -inch minimum metal washers or caps, or other suitable masonry fastener.
4. Space fasteners approximately 24 inches on center across the short board dimension and 48 inches on center across the long board dimension.
5. Butt board edges together tightly and carefully fit around penetrations.
6. Cover exposed foam board insulation with either a thermal barrier or ignition barrier as required by local building code and occupancy of the crawl space.
7. Air seal the interface between the top of the foundation wall and the mud sill with caulk or expanding foam.
8. Air seal and insulate the inside of the band joist with the following options:
 - a. Seal with expanding canned foam and insulate with JM Formaldehyde-free™ fiber glass batts (Unfaced, Faced or ComfortTherm®).
 - b. Cut pieces of foam board to fit tightly into each band joist space. Install and seal in place with expanding canned foam. Multiple layers of foam board may be used to achieve the desired R-value. Foam boards in band joists are not required to be covered for fire

Figure 2. Unvented Crawl Space



- c. Air seal and insulate the band joist with JM spray polyurethane foam (Corbond III®, Corbond MCS™ or Open-cell). Open cell spray polyurethane foam should not be used to insulate band joists in cold climates.
9. A ground cover must be installed to reduce moisture levels in the crawl space.
10. Unvented crawl spaces must include mechanical ventilation to control humidity.

Residential Installation Instructions Crawl Spaces

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Safety glasses with side shields are recommended to keep dust out of the eyes.

Personal Protective Equipment: Skin

Leather or cotton gloves should be worn to prevent skin contact and irritation.

Personal Protective Equipment: Respiratory

A NIOSH-certified respirator should be used if ventilation is unavailable, or is inadequate for keeping dust levels below the applicable exposure limits.

Ventilation

In fixed manufacturing settings, local exhaust ventilation should be provided at areas of cutting to remove airborne dust. General dilution ventilation should be provided as necessary to keep airborne dust below the applicable exposure limits and guidelines. The need for ventilation systems should be evaluated by a professional industrial hygienist, while the design of specific ventilation systems should be conducted by a professional engineer.

Personal Protective Equipment: General

Loose-fitting, long-sleeved clothing should be worn to protect skin from irritation. Work clothing should be washed separately from other clothes, and the washer should be rinsed thoroughly (run empty for a complete wash cycle). This will reduce the chances of dust being transferred to other clothing.



Residential Installation Instructions Attics and Cathedral/Vaulted Ceilings

ATTICS AND CATHEDRAL/VAULTED CEILINGS

Johns Manville AP™ Foil-Faced insulation sheathing board is an excellent choice for insulating attics and cathedral/vaulted ceilings. Polyiso provides one of the highest R-values per inch of any rigid insulation (R-6.5 at 1 inch). When applied to the interior face of rafters, Johns Manville AP Foil-Faced insulation provides a layer of continuous insulation that eliminates thermal bridging. This prevents heat flow and condensation, thereby increasing the ceiling's overall insulation value. AP Foil-Faced insulation is lightweight and easy to install. AP Foil-Faced insulation must be covered with an approved thermal or ignition barrier, as required by local building code, and cannot be left exposed.

BEFORE YOU BEGIN:

Always follow local building codes. AP Foil-Faced sheathing must be separated from the interior of a building by a minimum of ½-inch gypsum board or equivalent 15-minute thermal barrier as required by code. When AP Foil-Faced insulation sheathing is installed within an attic where entry is made only for service of utilities, an ignition barrier must be installed in accordance with local building codes. Gather all materials.

Materials Checklist

- Safety glasses and gloves
- Measuring tape and pencil
- Utility knife or handsaw
- Straight edge
- Construction-grade polyurethane adhesive, such as Liquid Nails
- Mechanical fasteners such as masonry nails with 1-inch metal washers or caps
- Flashing tape such as 3M 8067, Grace Vycor Pro, or Lamatek
- Sealant such as Tremco Spectrem® 1
- Canned foam such as Touch'nSeal All Season, Hilti CF 810 or CF-F, Dow Great Stuff or Great Stuff Pro

Measuring and Cutting

1. Measure the board by dragging a measuring tape hook across the surface of the board; create a crease while holding the tape at the desired length.
2. Using a straight edge as a guide, deeply score the crease. There is no need to cut through.
3. Snap the board along the score line over the edge of a table or workbench.

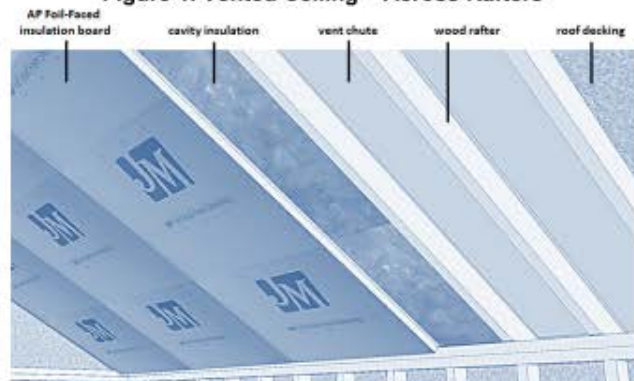


ATTIC INSTALLATION

OPTION 1A: Vented Roof – Foam Board Across Rafters

1. Ensure that proper ventilation is maintained below the roof sheathing, from the soffit vents to the ridge vent at the peak of the roof. This is best accomplished by installing baffles on the underside of the roof sheathing between every rafter prior to installing insulation. Baffles maintain a clear ventilation space and prevent cold air from penetrating into the rafter insulation.
2. If required, install insulation between the rafters. Options for insulating between rafters include Johns Manville Formaldehyde-free™ fiber glass batts (Unfaced, Faced, or ComfortTherm®), JM Climate Pro® blown-in fiber glass in the Blow-In-Blanket® system, JM Spider® Custom Insulation System, JM spray polyurethane foams (Corbond III®, Corbond MCS™ or Open-cell) or other approved insulation product. Fiber glass batts should not be compressed. The level of insulation installed in the rafter cavity will depend on the product chosen and the depth of the rafters.
3. Install AP Foil-Faced foam sheathing across the inside rafter surface. Use maximum board lengths to minimize number of joints. Locate joints square to rafters and center end joints over rafters. Provide additional blocking as necessary. It is not necessary to stagger board joints. Butt board edges together tightly, and carefully fit around openings and penetrations.

Figure 1. Vented Ceiling – Across Rafters



Residential Installation Instructions Attics and Cathedral/Vaulted Ceilings

ATTIC INSTALLATION CONTINUED

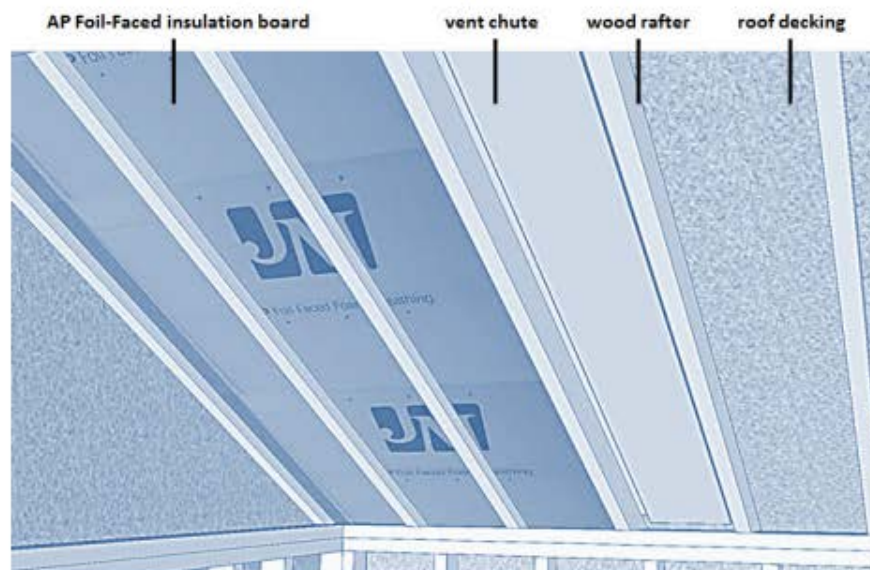
OPTION 1A: Vented Roof – Foam Board Across Rafters - continued

4. Fasten foam insulation boards to the interior of the rafters using screws or nails with 1-inch minimum washers or caps. Alternate fasteners may be used, with the type and length as recommended by their manufacturer for securing foam plastic insulating sheathing. Fasteners should be long enough to penetrate in to the rafter a minimum of $\frac{3}{4}$ inch.
5. Space fasteners approximately 16 inches on center around the perimeter and in the field of each board (16 or 24 inches on center across rafters, depending on spacing). Drive fasteners so the washer or stress plate is tight and flush with the board surface, but do not countersink.
6. When installing boards that butt-up at different angles, such as a wall to a sloped ceiling, or sloped ceiling to flat ceiling junctions, mitre the edge of the foam board. This will provide a better fit as well as cover wall headers and other thermal bridges.
7. Cover AP Foil-Faced insulation with a 15-minute thermal barrier or ignition barrier as required by local building codes.

OPTION 1B: Vented Roof – Foam Board Between Rafters

1. Ensure that proper ventilation is maintained below the roof sheathing, from the soffit vents to the ridge vent at the peak of the roof. This is best accomplishing by installing baffles on the underside of the roof sheathing in between every rafter prior to installing insulation between the rafters. Baffles maintain a clear ventilation space and prevent cold air from penetrating into the rafter insulation.
2. Cut AP Foil-Faced foam sheathing to fit snugly between the rafters, and install against the baffles. Properly cut boards should friction-fit between the rafters without falling out. Secure insulation boards and seal all board edges using one-part canned foam.
3. If additional insulation is required, install in the remaining rafter space. Options for insulating the remaining rafter depth include Johns Manville Formaldehyde-free™ fiber glass batts (Unfaced, Faced, or ComfortTherm), JM Climate Pro blown-in fiber glass in the Blow-In-Blanket system, JM Spider Custom Insulation System or other approved insulation product. Fiber glass batts should not be compressed. The level of additional insulation will depend on the product chosen and the depth of the rafters. All additional insulation must be secured to hold it in place.
4. If additional insulation is not required, the foil facing of AP Foil-Faced foam sheathing can provide additional thermal performance to the attic by functioning as a radiant barrier. The reflective side of the board should be oriented to the interior, and the nonreflective white side should be oriented to the exterior. To gain radiant barrier performance, an air space of at least $\frac{1}{2}$ inch should be left between the foam insulation and the thermal or ignition barrier.
5. Cover AP Foil-Faced insulation with a 15-minute thermal barrier or ignition barrier as required by local building code.

Figure 2. Vented Ceiling – Between Rafters



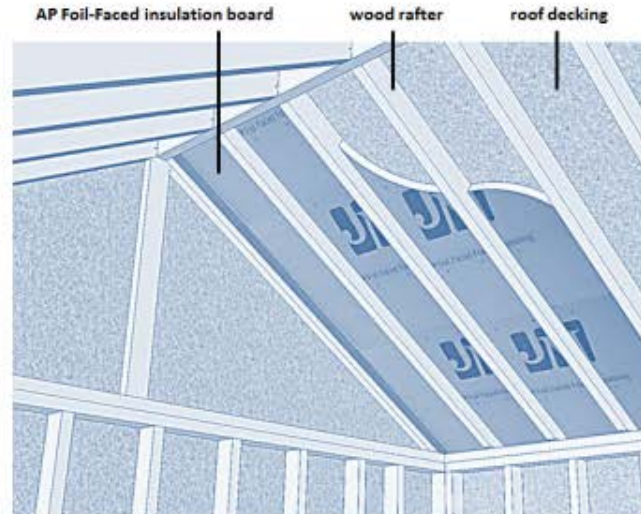
Residential Installation Instructions Attics and Cathedral/Vaulted Ceilings

ATTIC INSTALLATION CONTINUED

OPTION 2: Unvented Roof Sheathing

1. Cut AP Foil-Faced foam sheathing to fit snugly between the rafters.
2. Install AP Foil-Faced foam boards between rafters, directly against the bottom of the roof sheathing. The R-value of the insulation must meet local building code requirements for unvented attics to prevent condensation. Multiple layers of foam board may be required. If multiple layers are installed, stagger board joints.
3. Fasten insulation boards to the roof sheathing per the following options:
 - a. Secure insulation boards between the rafters and seal board edges using one-part canned foam. Properly cut boards should friction-fit between rafters without falling out.
 - b. Use screws or nails with 1-inch minimum washers or caps. Alternate fasteners may be used, with the type and length as recommended by their manufacturer for securing foam plastic insulating sheathing. Fasteners should be long enough to penetrate in to the roof sheathing a minimum of $\frac{1}{2}$ inch, but not too long as to penetrate through the roof waterproofing. Fasteners are not required around the perimeter of the boards. Space fasteners approximately 24 inches on center in the field.
4. Seal all board edges and penetrations with one-part expanding canned foam to prevent air leakage and water vapor diffusion to the roof sheathing.
5. If additional insulation is required, install in the remaining rafter space. Options to insulate the remaining rafter depth include Johns Manville Formaldehyde-free™ fiber glass batts (Unfaced, Faced, or ComfortTherm), JM Climate Pro blown-in fiber glass in the Blow-In-Blanket system, JM Spider Custom Insulation System or other approved insulation product. Fiber glass batts should not be compressed. The level of additional insulation will depend on the product chosen and the depth of the rafters. Additional insulation must be secured.
6. If additional insulation is not required, the foil facing of AP Foil-Faced foam sheathing can provide additional thermal performance to the attic by acting as a radiant barrier. The reflective side of the board should be oriented to the interior, and the nonreflective white side should be oriented to the exterior. To gain radiant barrier performance, an air space of at least $\frac{1}{2}$ inch should be left between the foam insulation and the thermal or ignition barrier.
7. Cover AP Foil-Faced insulation with a 15-minute thermal barrier or ignition barrier as required by local building code.

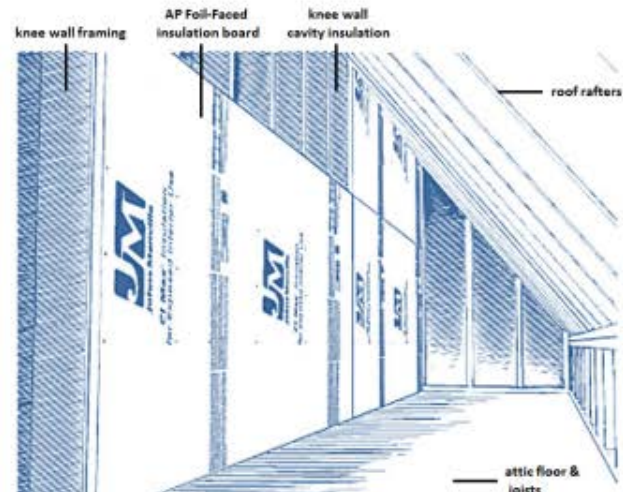
Figure 3. Unvented Ceiling – Between Rafters



OPTION 3: Knee Walls

1. If desired, insulate the knee wall cavity with either Johns Manville Formaldehyde-free™ fiber glass batts (Unfaced, Faced, or ComfortTherm), JM Climate Pro blown-in fiber glass in the Blow-In-Blanket system, JM Spider Custom Insulation System, JM spray polyurethane foam (Corbond III, Corbond MCS or Open-cell) or other approved insulation product. Fiber glass batts should not be compressed. The amount of insulation will depend on the product chosen and the depth of the framing.
2. There are two options for installing continuous foam board insulation over knee wall framing:
 - a. Use wood lath or strapping fastened to the exterior of the knee wall framing to secure cavity insulation. Install AP Foil-Faced insulation as described in section 1A. Ensure that there is a ventilation space below the roof sheathing at the intersection of the knee wall and roof.

Figure 4. Knee Walls



Residential Installation Instructions Attics and Cathedral/Vaulted Ceilings

ATTIC INSTALLATION CONTINUED

- b. Insulate the knee wall framing on the exterior with AP Foil-Faced insulation by screwing or nailing insulation boards to the exterior (attic side) of the framing using screws or nails with 1-inch minimum washers or caps. Alternate fasteners may be used, with the type and length as recommended by their manufacturer for securing foam plastic insulating sheathing. Fasteners should be selected to be long enough to penetrate in to the framing a minimum of ¼ inch. To provide air sealing to the knee wall, foam board seams may be taped. Additional sections of board foam should be cut and fit to block off the space between attic floor joists and sealed in place with one-part expanding foam to provide an air seal below the knee wall.
3. Cover AP Foil-Faced insulation with a 15-minute thermal barrier or ignition barrier as required by local building code.

CATHEDRAL/VAULTED CEILINGS INSTALLATION

OPTION 1: Gypsum Board Finish

1. The roof sheathing may be vented or unvented. The following options may be followed prior to installing foam board sheathing:

Vented Roof Sheathing

- a. Ensure that proper ventilation is maintained below the roof sheathing, from the soffit vents to the ridge vent at the peak of the roof. This is best accomplishing by installing baffles on the underside of the roof sheathing in between every rafter prior to installing insulation between the rafters. Baffles maintain a clear ventilation space and prevent cold air from penetrating into the rafter insulation.
- b. If desired, install insulation between the rafters. Options for insulating between rafters include Johns Manville Formaldehyde-free™ fiber glass batts (Unfaced, Faced, or ComfortTherm), JM Climate Pro blown-in fiber glass in the Blow-In-Blanket system, JM Spider Custom Insulation System, JM spray polyurethane foams (Corbond III, Corbond MCS or Open-cell) or other approved insulation product. Fiber glass batts should not be compressed. The level of insulation installed in the rafter cavity will depend on the product chosen and the depth of the rafters.

OR

Unvented Roof Sheathing

- c. If desired, install JM spray polyurethane foams (Corbond III, Corbond MCS or Open-cell) directly against the bottom of the roof sheathing. The amount of insulation should be sufficient to meet local building code requirements for unvented attic spaces to prevent condensation.
2. Install AP Foil-Faced™ foam sheathing across the inside rafter surface. Use maximum board lengths to minimize number of joints. Locate joints square to rafters and center end joints over rafters. Provide additional blocking as necessary. It is not necessary to stagger board joints. Butt board edges together tightly, and carefully fit around openings and penetrations.
3. Fasten foam insulation boards to the interior of the rafters using screws or nails with 1 inch minimum washers or caps. Alternate fasteners may be used, with the type and length as recommended by their manufacturer for securing foam plastic insulating sheathing. Fasteners should be selected to be long enough to penetrate in to the rafter a minimum of ¾-inch.
4. Space fasteners approximately 16 inches on center around the perimeter and in the field of each board. (16 or 24 inches on center across rafters, depending on spacing). Drive fasteners so the washer or stress plate is tight and flush with the board surface, but do not countersink.
5. AP Foil-Faced foam boards qualify as Class I vapor retarders, so no additional vapor retarder is required.
6. Cover AP Foil-Faced insulation with a minimum ½-inch gypsum board or equivalent 15-minute thermal barrier as required by local building code.

OPTION 2: Exposed Beams Finish

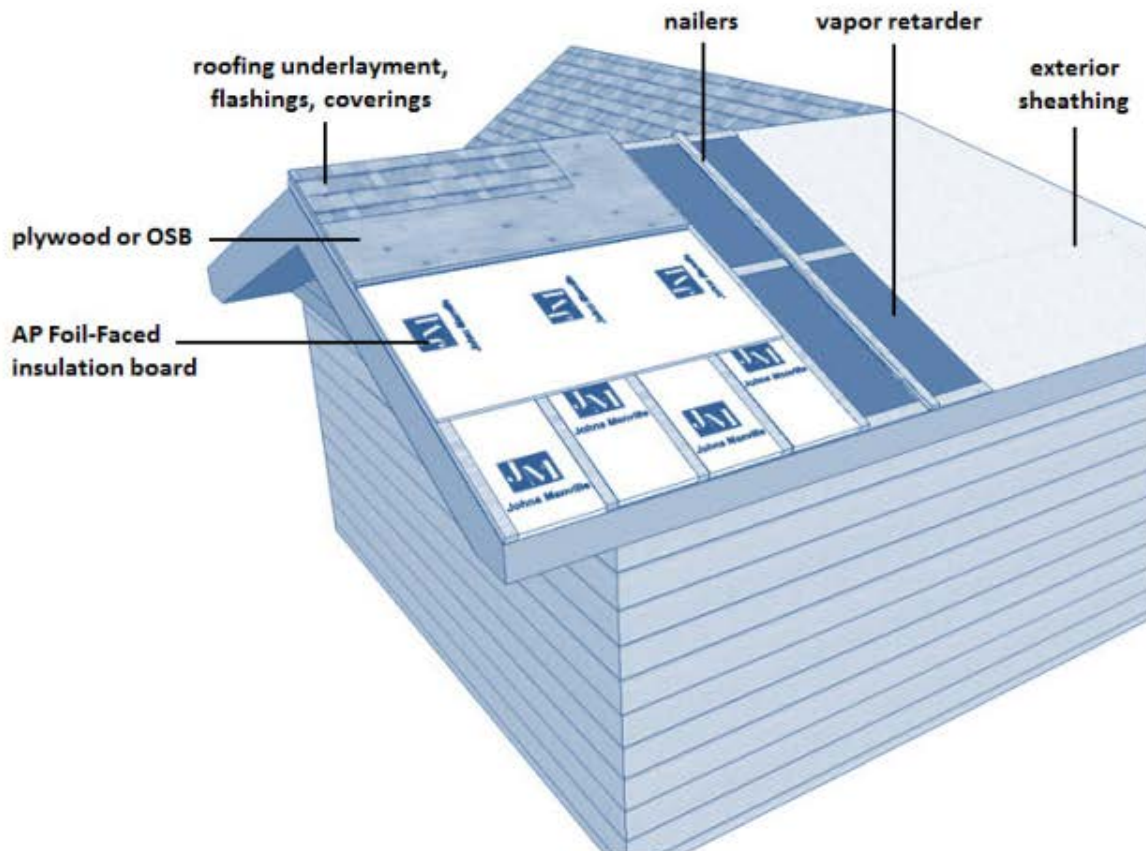
1. From the exterior side of the ceiling, install an appropriate vapor retarder over the wood planks.
2. Over the vapor retarder, install wood nailers 3.5 inches wide by the thickness of the foam insulation. Wood nailers are installed parallel to the roof slope on 16- or 24-inch centers and around the perimeter of the roof deck, at valleys, ridges and anywhere flashings will be attached. 2x4 lumber is approximately 1.5 inches thick, so 2x4 lumber may require a strip of plywood or foam insulation under the wood nailer to match the final foam board thickness. Install nailers with additional strips of foam or plywood against the vapor retarder. Screw or nail wood nailers securely to roof deck.

Residential Installation Instructions Attics and Cathedral/Vaulted Ceilings

CATHEDRAL/VAULTED CEILINGS INSTALLTION - CONTINUED

3. Install AP Foil-Faced insulation tightly between the wood nailers, nailing minimally.
4. Install a second layer of foam insulation perpendicular to the wood nailers keeping all joints tight and nailing minimally into the wood nailers.
5. If an unvented roof is desired, install plywood/OSB shingle base over the foam insulation, staggering all joints versus foam joints. Run plywood/OSB perpendicular to the wood nailers and ensure end joints in plywood/OSB are located over a wood nailer (wood nailers are under top layer of foam insulation). Secure plywood/OSB to the wood nailers.
6. If a vented roof is desired, install a second set of wood nailers or furring strips over the top layer of foam insulation and directly over existing wood nailers which are below top layer of foam insulation. Fasten top wood nailer into existing wood nailer. Install plywood/OSB shingle base perpendicular to the wood nailers and ensure end joints in plywood/OSB are located over a wood nailer. Secure plywood/OSB to the wood nailers. Vented roofs require vents at the eaves and at the ridge that are connected via the air space under the shingle base.
7. Install roofing underlayment, flashings, and roof coverings.

Figure 5. Cathedral/Vaulted Ceiling
Exposed Beams – Unvented



Residential Installation Instructions Attics and Cathedral/Vaulted Ceilings

PERSONAL PROTECTIVE EQUIPMENT

Personal Protective Equipment: Eyes/Face

Safety glasses with side shields are recommended to keep dust out of the eyes.

Personal Protective Equipment: Skin

Leather or cotton gloves should be worn to prevent skin contact and irritation.

Personal Protective Equipment: Respiratory

A NIOSH-certified respirator should be used if ventilation is unavailable, or is inadequate for keeping dust levels below the applicable exposure limits.

Ventilation

In fixed manufacturing settings, local exhaust ventilation should be provided at areas of cutting to remove airborne dust. General dilution ventilation should be provided as necessary to keep airborne dust below the applicable exposure limits and guidelines. The need for ventilation systems should be evaluated by a professional industrial hygienist, while the design of specific ventilation systems should be conducted by a professional engineer.

Personal Protective Equipment: General

Loose-fitting, long-sleeved clothing should be worn to protect skin from irritation. Work clothing should be washed separately from other clothes, and the washer should be rinsed thoroughly (run empty for a complete wash cycle). This will reduce the chances of dust being transferred to other clothing.