

ICC-ES Evaluation Report

ESR-2142***Underwriters Laboratories** ICC-ES/UL
Dual Report

Issued January 1, 2009

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A Subsidiary of the International Code Council®

DIVISION: 07—THERMAL AND MOISTURE PROTECTION
Section: 07210—Building Insulation
Section: 07270—Air Barrier
Section: 07280—Water-Resistive Barrier

REPORT HOLDER:

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EVALUATION SUBJECT:

**STYROFOAM™ BRAND INSULATION BOARDS AND
DOW FAN-FOLD PRODUCTS**

1.0 EVALUATION SCOPE**Compliance with the following codes:**

- 2006 *International Building Code*® (IBC)
- 2006 *International Residential Code*® (IRC)
- 2006 *International Energy Conservation Code*® (IECC)
- 1997 *Uniform Building Code*™

Properties evaluated:

- Surface burning characteristics
- Attic installations
- Crawl space installations
- Air barrier
- Water-resistive barrier
- Thermal resistance

2.0 USES

STYROFOAM brand insulation boards are extruded polystyrene foam plastic boards used as nonstructural thermal insulation in wall assemblies, ceiling/floor assemblies, door cavities, roofs, and foundations. The foam plastic may be used in any type of construction; see Section 4.4 for use on exterior walls of Types I, II, III and IV construction. The insulation boards may be used on wall ceiling and floor surfaces of attics, crawl spaces, detached garages, pole barns, telecommunication shelters, concrete modular buildings, agricultural buildings, buildings regulated under IBC Section 312 (Utility and Miscellaneous, Group U), or structures constructed in accordance with the IBC or IRC, with no coverings applied to the foam plastics when the boards are installed in accordance with Section 4.2.

Dow fan-fold products are extruded polystyrene foam plastic boards used as nonstructural thermal insulation in roofs, on foundations or on walls constructed in accordance with the IBC or IRC.

STYROFOAM DURAMATE™ Plus, STYROFOAM Residential Sheathing, STYROFOAM Residing Board, STYROFOAM Utilityfit, STYROFOAM SCOREBOARD, STYROFOAM Sheathing Material, STYROFOAM Ship Lap, STYROFOAM Square Edge, STYROFOAM Tongue and Groove, STYROFOAM XPS Insulation, Dow High Performance Underlayment, BLUECOR™, and Dow Protection Board III brand insulation boards may be used as alternatives to the water-resistive barriers specified in the IBC, IRC and UBC when installed as set forth in Section 4.3.

3.0 DESCRIPTION**3.1 STYROFOAM Brand Insulation Boards:**

STYROFOAM brand insulation boards are extruded polystyrene foam plastic. The boards are available as various products having the product names and properties detailed in Table 1. The boards are available in various lengths and widths and in thicknesses up to 4 inches. The actual board thickness provided is determined based on the *R*-value stated for the product.

3.2 Dow Fan-fold Products:

Dow fan-fold products are extruded polystyrene foam plastic insulation provided in “fan-folded” bundles. The boards are available in various lengths and widths and in thicknesses up to $\frac{3}{8}$ inch (9.5 mm). Table 2 details the physical properties of the fan-fold products. The actual board thickness provided is determined based on the *R*-value stated for the product.

3.3 Joint-sealing Tape:

WEATHERMATE™ Construction Tape is nominally $2\frac{7}{8}$ inches (73 mm) wide and is used in conjunction with STYROFOAM brand insulation boards and Dow fan-fold products to seal joints between two or more edges of the boards, when the insulation boards are installed as a water-resistive barrier. The installation must be as described in Section 4.3 of this report.

3.4 Surface Burning Characteristics

STYROFOAM brand insulation boards and Dow fan-fold products have a flame-spread index (FSI) of 25 or less and a smoke-developed index (SDI) of 450 or less when tested in accordance with ASTM E 84 at a maximum thickness of 4 inches (102 mm) and a maximum density of 4.0 pcf (64 kg/m³).

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3.5 Thermal Resistance

STYROFOAM brand insulation boards have a thermal resistance (*R*-value) as noted in Table 1. Dow fan-fold products have a thermal resistance (*R*-value) as noted in Table 2.

4.0 INSTALLATION

4.1 General

STYROFOAM brand insulation boards and Dow fan-fold products must be installed in accordance with the manufacturer's published installation instructions and this report. For the purposes of this report, the term "insulation board" is intended to refer to both STYROFOAM brand insulation boards and Dow fan-fold products.

Except as described in Section 4.2, the interior of the building must be separated from the insulation boards by an approved 15-minute thermal barrier as required in IBC Section 2603.4, IRC Section R314.4 or R314.5, or UBC Section 2602.4 or 2602.5.3. The installation of the insulation boards in areas of "very heavy" termite infestation probability must comply with IBC Section 2603.8 or IRC Section R320.5. Under the IBC, protection against condensation must be provided in accordance with IBC Section 1403.2; under the IRC, a vapor retarder must be provided in accordance with IRC Section R318 and N1102.5; under the UBC, a vapor barrier may be required by the code official. Insulation boards must not be used as a nailing base for finish materials or wall covering materials. Fasteners used to attach finish material over insulation boards must comply with a current ICC-ES evaluation report for proprietary wall covering materials, IBC Section 1404 or 1405, IRC Table 703.4, or UBC Sections 1403 and 1404, and the installation instructions from the finish manufacturer. For cementitious exterior wall coating 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 coatings.

Exterior wall assembly, exterior finish or a wall covering in conjunction with insulation boards must be structurally adequate to resist horizontal forces perpendicular to the wall. All walls must be braced in accordance with IBC Sections 2308.9.3 and 2308.12.4, IRC Section R602.10, or UBC Section 2320.11.3 or 2320.11.4, as applicable.

When the insulation boards are applied over open framing, vertical butt joints must be over framing members. Vertical tongue-and-groove or shiplap joints need not be over framing members, provided joints are staggered a minimum of one stud space from adjacent courses. For cementitious exterior wall coating systems, unbacked joints are permitted only when specified in the ICC-ES evaluation report on the cementitious exterior wall coating system.

4.2 Special Uses:

4.2.1 Attics:

4.2.1.1 Assembly 1: ASTM C 578 Type X and ASTM C 578 Type IV STYROFOAM brand insulation boards with a maximum nominal thickness of 2 inches (51 mm) may be installed on surfaces (wall, ceiling, floor) of an attic (the attic may contain utilities, including but not limited to, mechanical equipment; electrical wiring; fans; plumbing; gas or electric hot water heaters; gas or electric furnaces; etc.) with no coverings (no thermal or ignition barrier) applied to the attic space side of the foam plastic insulation, when all the following conditions are met:

1. Attic ventilation is provided when required by IBC Section 1203.2 or IRC Section R806, as applicable; or unvented, conditioned attic assemblies are permitted under the conditions prescribed in IRC Section 806.4.

2. Combustion air is provided in accordance with IMC (*International Mechanical Code*) Sections 701 and 703, or IRC Sections M1701 and M1703.

4.2.1.2 Assembly 2: ASTM C 578 Type X and ASTM C 578 Type IV STYROFOAM brand insulation boards, with a maximum nominal thickness of 1 inch (25.4 mm), covered with a water-resistive barrier (Weathermate (ESR-2862), Weathermate Plus (NER-640) or DuPont Tyvek (ESR-2375) exposed to the interior of attic space, may be installed on the walls of an attic (including gable ends and knee walls) (the attic may contain utilities, including but not limited to, mechanical equipment; electrical wiring; fans; plumbing; gas or electric hot water heaters; gas or electric furnaces; etc.) with no coverings (no thermal or ignition barrier) applied, when all of the following conditions are met:

1. Entry to the attic is only to service utilities and no storage is permitted.
2. There are no interconnected attic areas.
3. Air in the attic is not circulated to other parts of the building.
4. Attic ventilation is provided when required by IBC Section 1203.2 or IRC Section R806, as applicable; or unvented, conditioned attic assemblies are permitted under the conditions prescribed in IRC Section 806.4.
5. Combustion air is provided in accordance with IMC Sections 701 and 703, or IRC Sections M1701 and M1703.

4.2.2 Crawl Spaces:

ASTM C 578 Type X and ASTM C 578 Type IV STYROFOAM brand insulation boards with a maximum nominal thickness of 2 inches (51 mm) may be installed on surfaces (wall, ceiling) of a crawl space (the crawl space may contain utilities, including but not limited to, mechanical equipment; electrical wiring; fans; plumbing; gas or electric hot water heaters; gas or electric furnaces; etc.) with no coverings (no thermal or ignition barrier) applied to the crawl space side of the foam plastic insulation, when all the following conditions are met:

1. Under-floor (crawl space) ventilation is provided when required by IBC Section 1203.3 or IRC Section R 408.1, as applicable; or unvented crawl spaces are permitted under the conditions prescribed in IRC Section R408.3
2. Combustion air is provided in accordance with IMC Sections 701 and 703, or IRC Sections R1701 and R1703.

4.2.3 Other Structures: ASTM C 578 Type X and ASTM C 578 Type IV STYROFOAM brand insulation boards with a maximum nominal thickness of 2 inches (51 mm) may be installed on any or all surfaces (wall, ceiling, floor) of detached garage, pole barn, telecommunication shelter, concrete modular building, agricultural building, buildings under the IBC Utility and Miscellaneous Group U or other structures under the IBC or IRC, with no coverings (no thermal or ignition barrier) applied to the foam plastics, when all other requirements of the building code for that building are met.

4.3 Water-resistive Barrier:

The noted STYROFOAM brand insulation boards (STYROFOAM DURAMATE™ Plus, STYROFOAM Residential Sheathing, STYROFOAM Residing Board, STYROFOAM Utilityfit, STYROFOAM SCOREBOARD, STYROFOAM Sheathing Material, STYROFOAM Ship Lap, STYROFOAM Square Edge, STYROFOAM Tongue

and Groove and STYROFOAM XPS Insulation) and Dow fan-fold products (Dow High Performance Underlayment, BLUECOR™, and Dow Protection Board III) may be used as alternate water-resistive barriers as prescribed in Section 1404.2 of the IBC, Section 703.2 of the IRC, and Section 1402.1 UBC, when installed on exterior walls as described in this section.

STYROFOAM brand insulation boards measuring 4 feet by 8 to 10 feet are installed vertically with long joints in contact with one another. Boards measuring 2 feet by 8 feet are installed horizontally. When installed directly on framing members, framing members are spaced a maximum of 24 inches on center. The insulation boards are attached using $\frac{3}{8}$ -inch-head (9.5 mm) galvanized nails, 1-inch-crown (25.4 mm) galvanized staples or 1-inch-head (25.4 mm) plastic cap nails or equivalent fasteners long enough to penetrate framing a minimum of $\frac{3}{4}$ inch. Nails or staples must not be over-driven. Fastener spacing for boards measuring 4 feet by 8 to 10 feet is a minimum of 12 inches on center around the perimeter and 16 inches on center in the field; for 2-foot-by-8-foot boards, fastener spacing is a minimum of 12 inches on center on each stud (three fasteners per stud). For window installation, the nailing flange is set against sealant bedding and fastened to the framing with galvanized roofing nails 3 inches from each corner and 8 inches on center. Minimum 3-inch-wide flashing is used to seal the sill of windows, and minimum 2-inch-wide flashing is used to seal jambs and heads. Window installation must be in accordance with the window manufacturer's instructions. See also Figure 1.

Dow fan-fold products must be installed over wood structural sheathing with long joints butted tightly together. The insulation foam board joints must be staggered relative to joints in the structural sheathing. The remainder of the installation is as described above for rigid boards.

For the STYROFOAM brand insulation boards and Dow fan-fold products mentioned in this section, seams and joints between boards must be covered by minimum $2\frac{7}{8}$ -inch-wide (73 mm) WEATHERMATE™ Construction Tape or equivalent. Penetrations in exterior walls must be sealed with a sealant complying with ASTM C 920, Type S or M, Grade NS, Class 25, or with Dow GREAT STUFF™ Gaps & Cracks sealant (ESR-1961), or with another expanding spray foam sealant complying with AAMA 812 as part of the penetration flashing procedure illustrated in Figures 2 and 3.

4.4 Use on Exterior Walls in Types I, II, III and IV Construction:

When used on walls of Types I, II, III and IV construction, the assembly in which the ASTM C 578 Type X and ASTM C 578 Type IV STYROFOAM foam plastic insulation is used must comply with IBC Section 2603.5. The potential heat of the foam plastic insulation boards in any portion of the wall or panels must not exceed the potential heat, expressed in Btu/ft² (mJ/m²), of the foam plastic insulation contained in the wall assembly tested in accordance with NFPA 285. The potential heat for the ASTM C 578 Type X and ASTM C 578 Type IV STYROFOAM foam plastic insulation boards is 2802 Btu/ft² per inch of thickness.

5.0 CONDITIONS OF USE

The STYROFOAM brand insulation boards and Dow fan-fold products 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 STYROFOAM brand insulation boards and Dow fan-fold products must be installed in accordance with the

manufacturer's published installation instructions, subject to the conditions of this report and the applicable code. In the event of a conflict, this report governs.

- 5.2 A water-resistive barrier complying with the requirements of the applicable code must be provided except when installation is as described in Section 4.3 of this report.
 - 5.3 Use of the insulation boards to structurally resist transverse, racking-shear or vertical loading is outside the scope of this report. The walls must be braced in accordance with the requirements of the applicable code.
 - 5.4 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.
 - 5.5 The insulation boards must be separated from the interior of the building by an approved 15-minute thermal barrier, except as described in Section 4.2.
 - 5.6 Where required by the applicable code, a vapor retarder system, which may include the foam plastic insulation, must be installed in the exterior wall, floor, and/or roof ceiling assembly.
 - 5.7 Jobsite certification and labeling of the insulation must comply with IRC Section N1101.4 and IECC Section 102.1.1, as applicable.
 - 5.8 Use of insulation in areas where the probability of termite infestation is very heavy must be in accordance with IBC Section 2603.8 or IRC Section R320.5. In these areas, the insulation must not be installed on the exterior of the foundation walls or below floor slabs on grade or in contact with soil. Also, in these areas, the clearance between the foam plastic insulation and exposed earth shall be a minimum of 6 inches (152 mm).
 - 5.9 When use is on Buildings of Type I, II, III, or IV construction, documentation must be submitted to the code official verifying that the insulation has been qualified as a component of an assembly tested in accordance with Sections 2603.5.1, 2603.5.5 and 2603.5.7 of the IBC. The maximum potential heat of the foam plastic used in the assembly must be no greater than that noted in Section 4.4.
 - 5.10 STYROFOAM brand insulation boards and Dow fan-fold products may be manufactured in Dalton, Georgia; Ironton, Ohio; Channahan, Illinois; LaPorte, Texas; Pevely, Missouri; Varennes, Quebec; and Wyoming, Michigan, under a quality control program with inspections by Underwriters Laboratories Inc. (AA-668).
- #### 6.0 EVIDENCE SUBMITTED
- 6.1 Data in accordance with the ICC-ES Acceptance Criteria for Foam Plastic Insulation (AC12), dated June 2009.
 - 6.2 Data in accordance with the ICC-ES Acceptance Criteria for Foam Plastic Sheathing Panels Used as Water-resistive Barriers (AC71), dated February, 2003.
 - 6.3 Reports of room corner fire tests in accordance with NFPA 286 and UBC Standard 26-3, for the special uses in Section 4.2.
 - 6.4 Reports of air leakage tests in accordance with ASTM E 283.

6.5 Reports of potential heat tests in accordance with NFPA 259.

7.0 IDENTIFICATION

The STYROFOAM brand insulation boards and Dow fan-fold products described in this report are identified by a label on the board or packaging material bearing the

manufacturer's name, product name, plant code or manufacturing address, label of the inspection agency (Underwriters Laboratories Inc.), other information to confirm code compliance, and the ICC-ES evaluation report number (ESR-2142); except for those products that are used in Types I, II, III, and IV construction, which must have the above-noted labeling printed on the board.

TABLE 1—STYROFOAM BRAND INSULATION BOARDS

PRODUCT NAME	ASTM C 578 TYPE ¹	R-VALUE, R / INCH (unless otherwise noted) at 75°F (ft ² -hr-°F/Btu)
STYROFOAM Ag Board™	IV	5.0
STYROFOAM CAVITYMATE™	X	5.0
STYROFOAM CAVITYMATE™ Plus	IV	5.0
STYROFOAM CAVITYMATE™ SC	IV	5.0
STYROFOAM DECKMATE™ Plus	IV	5.0
STYROFOAM DECKMATE™ Plus FA	IV	5.0
STYROFOAM DURAMATE™ Plus R2	X	2.0 at nominal 3/8"
STYROFOAM DURAMATE™ Plus	X	3.0 at nominal 1/2"
STYROFOAM DURAMATE™ Perforated	X	3.0 at nominal 1/2"
STYROFOAM FREEZERMATE™	IV	5.0
STYROFOAM Highload	VI, VII	5.0
STYROFOAM Lightguard feedstock	VI	5.0
STYROFOAM Panel Core	X, IV, VI, VII	5.0
STYROFOAM PANELMATE™ Plus	IV	5.0
STYROFOAM PERIMATE™	IV	5.0
STYROFOAM PLAZAMATE™	VII	5.0
STYROFOAM Residential Sheathing R5	X	5.0 at nominal 1"
STYROFOAM Residential Sheathing R4	X	4.0 at nominal 3/4"
STYROFOAM Residential Sheathing R3	X	3.0 at nominal 1/2"
STYROFOAM Residing Board	X	5.0
STYROFOAM Ribbed ROOFMATE™	VI	5.0
STYROFOAM ROOFMATE™	VI	5.0
STYROFOAM SCOREBOARD	IV	5.0
STYROFOAM Sheathing Material	X, IV	5.0
STYROFOAM Ship Lap	X, IV	5.0
STYROFOAM Square Edge	IV	5.0
STYROFOAM Square Edge R3	IV	3.0 at nominal 1/2"
STYROFOAM Square Edge R4	IV	4.0 at nominal 3/4"
STYROFOAM STUCCOMATE™	X	5.0
STYROFOAM Tongue and Groove	IV	5.0
STYROFOAM UTILITYFIT™	X	5.0
STYROFOAM WALLMATE™	X	5.0
STYROFOAM XPS Insulation	X, IV	5.0
STYROFOAM VALUEMATE™	X	1.5 at nominal 3/8"
STYROFOAM Z-MATE	X	5.0

For SI: 1 inch = 25.4 mm, 1 pcf = 16.02 kg/m³, 1°F·ft²-hr/Btu = 0.176 m²·K/W, 1°F = 1.8°C+32.

¹Type IV has a minimum density of 1.55 pcf., Type VI has a minimum density of 1.80 pcf. Type VII has a minimum density of 2.20 pcf., Type X has a minimum density of 1.30 pcf.

TABLE 2—DOW FAN-FOLD PRODUCTS

PRODUCT NAME	NOMINAL THICKNESS (inch)	THERMAL RESISTANCE (R-VALUE) at 75°F (ft ² -hr-°F/Btu)
Dow High Performance Underlayment	1/4	1.0
	3/8	1.5
BLUECOR™	1/4	1.0
Dow Protection Board III	1/4	1.0
STYROFOAM RECOVERMATE™ CR	3/8	1.5

For SI: 1 inch = 25.4 mm, 1 pcf = 16.02 kg/m³, 1°F·ft²-hr/Btu = 0.176 m²·K/W, 1°F = 1.8°C+32.

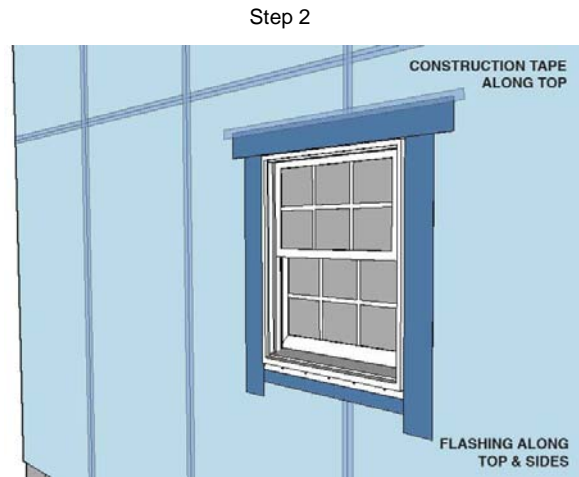
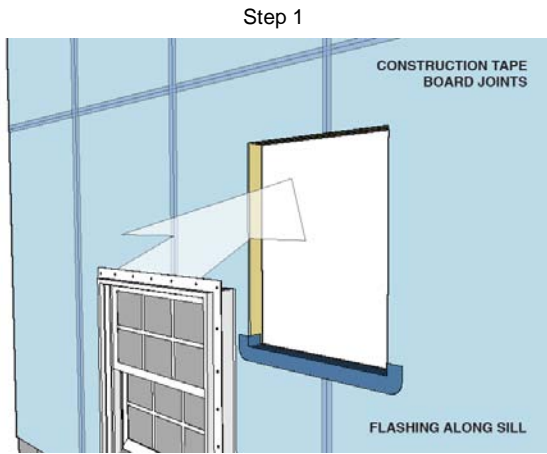


FIGURE 1—TYPICAL WINDOW FLASHING DETAIL

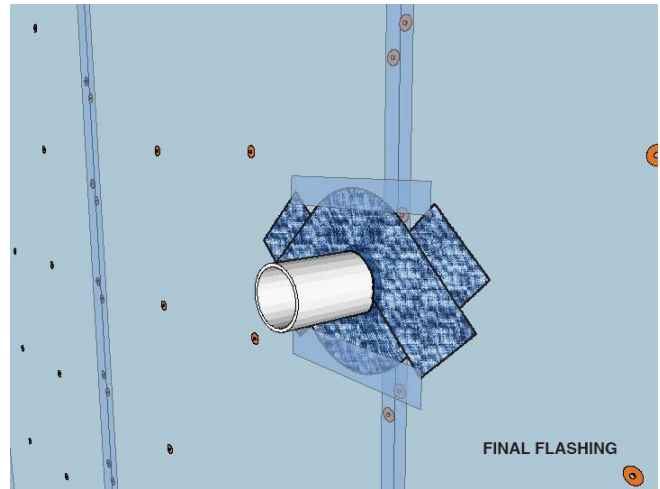
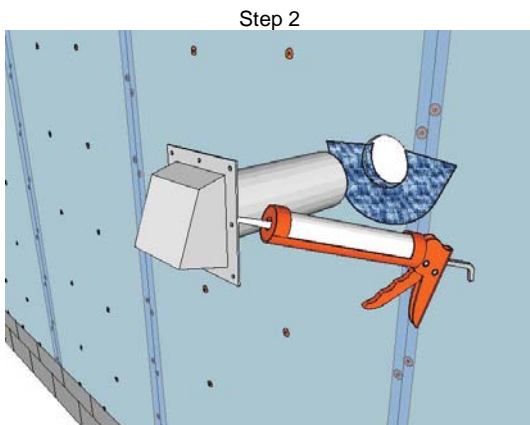
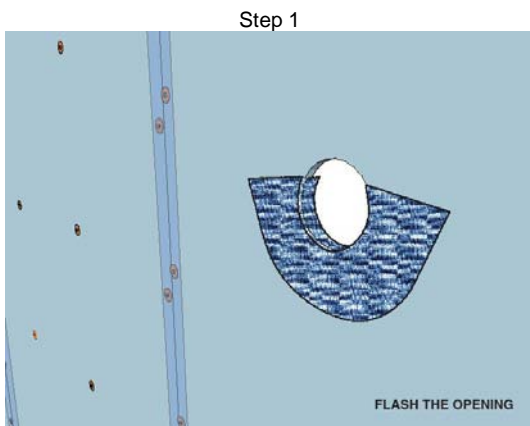


FIGURE 3—TYPICAL FLASHING DETAIL – UNFLANGED

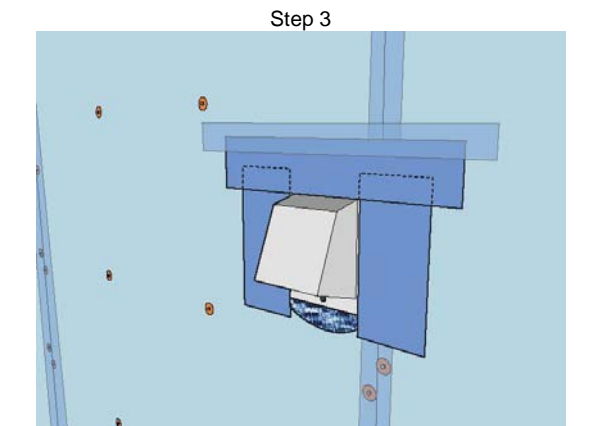


FIGURE 2—TYPICAL PENETRATION FLASHING DETAIL – FLANGED