

# TECH SOLUTIONS 510.0 STYROFOAM™ BRAND CAVITYMATE™ INSULATION PRODUCTS FOR STEEL STUD CAVITY WALLS



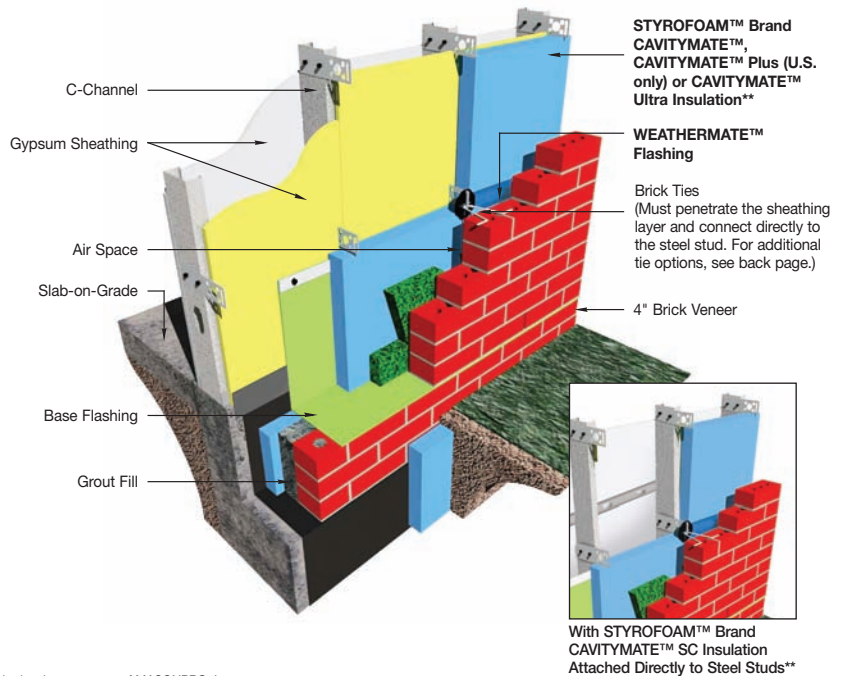
## INTRODUCTION

Steel stud construction contributes to an economical and versatile wall system in commercial and multistory residential construction. However, steel stud construction can also present challenges, including moisture accumulation and high thermal conductivity, reducing the wall system's R-value (RSI).<sup>\*</sup> Insulating with STYROFOAM™ Brand CAVITYMATE™ Extruded Polystyrene (XPS) Foam Insulation products helps address these challenges head-on. These products are specially designed for use in wet cavity wall environments. The distinct closed-cell structure of the extruded polystyrene foam gives it advanced moisture resistance and long-term thermal performance.

## THE ANATOMY OF A STEEL STUD CAVITY WALL

One of the most common commercial steel stud wall assemblies consists of brick veneer with steel stud backup. The National Research Council (NRC) considers this an "open rain screen" design – vented to the outside by openings in the brick veneer to allow rapid equalization of the cavity and external pressures caused by wind loads.

Figure 1: Steel Stud Wall Assemblies  
With STYROFOAM™ Brand CAVITYMATE™ Insulation Products



Isometric drawings courtesy of MASONPRO, Inc.

In this design, some rainwater will pass through the brick veneer and run down the interior of the cavity. Also, moisture can enter the cavity through cracks that form in the brick joint work. Since moisture can cause damage and compromise the thermal performance of the sheathing, the NRC recommends the addition of an air/water-resistive barrier on the outside of the stud wall.

Any of the STYROFOAM™ Brand CAVITYMATE™ products, together with WEATHERMATE™ Flashing to seal the insulation

board seams, serves as an effective drainage plane and eliminates the need for a separate air/water-resistive barrier.

## R-Value and Thermal Efficiency

Steel studs transfer heat approximately 300 times faster than wood studs. This can lead to thermal shorts in the typical steel stud assembly, where heat bypasses the fiberglass cavity insulation and is transferred through the steel studs. Figure 2 illustrates how thermal shorts can reduce the R-value of fiberglass.

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<sup>\*</sup>R means resistance to heat flow. The higher the R-value or RSI, the greater the insulating power. RSI (R-value Système International) is the metric equivalent of R-value.

<sup>\*\*</sup>When using extruded polystyrene foam on exterior studs without the use of gypsum, mineral wool must be used in the header of all openings and in the stud cavity at each floor line when the studs are placed outboard of the floor slab.

# STYROFOAM™ BRAND CAVITYMATE™ INSULATION PRODUCTS FOR STEEL STUD CAVITY WALLS

Good building science supports the removal of fiberglass from the wall cavity. Insulating the exterior of the steel studs with STYROFOAM™ Brand CAVITYMATE™ Insulation products greatly increases the effective R-value of the wall assembly. This also allows the wall assembly design to exceed insulation requirements prescribed by ASHRAE 90.1-2007 (Table 1).

## Moisture Control

Moisture that enters the wall assembly can condense if it reaches a cold spot (below the dew point) (Figure 3). Condensation within walls can lead to corrosion of the steel studs, reduced R-value, moisture accumulation, mold development and indoor air quality problems.

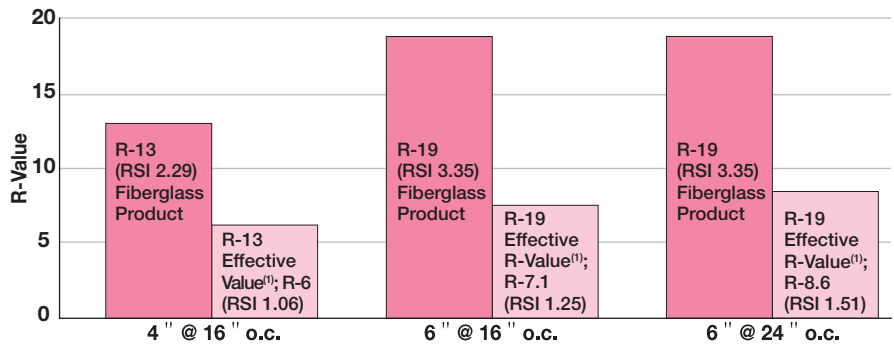
By keeping the cavity temperature above the dew-point temperature, STYROFOAM™ Brand CAVITYMATE™ products significantly reduce the potential for condensation in steel stud cavities (Figure 4).

**TABLE 1: MEETING ASHRAE 90.1-2007 CONTINUOUS INSULATION REQUIREMENTS FOR U.S. CLIMATE ZONES USING STYROFOAM™ BRAND CAVITYMATE™ INSULATION PRODUCTS**

| Climate Zone | ASHRAE Requirements <sup>(1)</sup> for Insulation R-Value and Resulting U-Factor and System R-Value | STYROFOAM™ Brand CAVITYMATE™ Product Thickness Required and Resulting U-Factor and System R-Value <sup>(2)</sup> |
|--------------|---|--|
| 1-2          | R-13, U=0.124, R=8.06   | 1.5", U=0.089, R=11.2  |
| 3            | R-13 + 3.8 ci, U=0.084, R=11.90   | 2", U=0.073, R=13.07   |
| 4-8          | R-13 + 7.5 ci, U=0.064, R=15.63   | 2.5", U=0.062, R=16.2  |

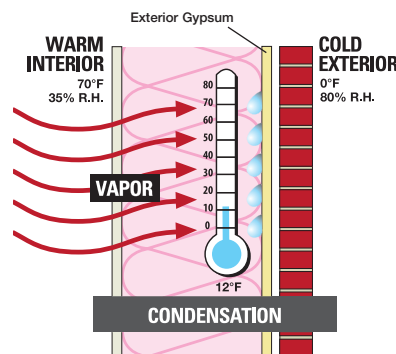
(1) The ASHRAE 90.1-2007 Non-Residential requirements are used as the baseline.  
 (2) The ORNL Modified Zone Calculator was used to calculate the system R-value. Walls are nominal 2x6 steel stud framed, interior and exterior gypsum included, as well as interior and exterior winter air films.

**Figure 2: Thermal Shorts Reduce Fiberglass R-Value More Than 50 Percent**



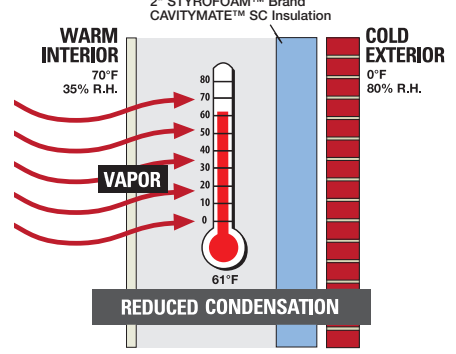
(1) Effective R-value (RSI) calculations based on ASHRAE 90.1-2004 Table A9.2B for effective R-value of batt insulation and cavity. All cases have 1/2" (13 mm) interior gypsum with R-0.45 and no air films or exterior finishes.

**Figure 3: Typical Steel Stud Wall Assembly**



Based on a 2x6 assembly with batt insulation and exterior gypsum at conditions of 70°F (21°C) and 35 percent R.H. on the interior and 0°F (-18°C) and 80 percent R.H. on the exterior. Note that the interior of the surface of the gypsum is 12°F (-11°C) with the potential for condensation very high. The system R-value is R-11.1 (RSI 1.96).

**Figure 4: Assembly With STYROFOAM™ Brand CAVITYMATE™ SC Insulation**



Replacing the batt insulation and exterior gypsum with 2" (50 mm) thick STYROFOAM™ Brand CAVITYMATE™ SC Insulation increases the insulation's interior surface to 61°F (16°C). The cavity is now a conditioned space with the condensation potential near zero. Plus, the system R-value is R-13.1 (RSI 2.31).

## STYROFOAM™ BRAND CAVITYMATE™ INSULATION PRODUCTS FOR STEEL STUD CAVITY WALLS

### DESIGN CONSIDERATIONS

#### Bracing Method

International Building Code (IBC) Chapter 22 requires that steel stud wall construction incorporate the lateral bracing design practice provided by the American Iron and Steel Institute. Each of its bracing methods uses horizontal or diagonal steel members that are attached through the center of a stud space via cutouts or on the face of the stud on the interior and exterior. STYROFOAM™ Brand CAVITYMATE™ Insulation products are not to be included as part of the structural design.

#### Air/Water-Resistive Barrier Methods

Based on NFPA 285 testing, there are three approved<sup>†</sup> air/water-resistive barrier methods in wall assemblies using STYROFOAM™ Brand CAVITYMATE™ Insulation products.

1. Seal the joints of STYROFOAM™ Brand CAVITYMATE™ Insulation boards with WEATHERMATE™ Flashing.
2. Place WEATHERMATE™ or WEATHERMATE™ Plus Wrap over STYROFOAM™ Brand CAVITYMATE™ Insulation products.
3. Apply an approved<sup>†</sup> full-coverage, air/water-resistive barrier to the face of the exterior gypsum.

#### FOAM PLASTIC REQUIREMENTS FOR STEEL STUD WALLS USING STYROFOAM™ BRAND XPS FOAM INSULATION

STYROFOAM™ Brand CAVITYMATE™ Insulation products are listed in the ICC ESR-2142 Code Report.

Section 2603.5 of the IBC states the requirements for foam plastic insulation used in exterior walls of buildings of any height, Types I-IV construction. Steel stud walls must be in compliance with all seven of the following subsections.

#### 2603.5.1

Commercial walls may need to meet fire resistance requirement ASTM E119 (hourly rating) based on construction type, occupancy of the structure, or separation distance from other structures. STYROFOAM™ Brand XPS Foam Insulation has been tested for the following steel stud assemblies: U403, U452, U457, U460, V414, V416 and V454.

For more information, visit the Underwriters Laboratories (UL) directory at <http://database.ul.com>.

#### 2603.5.2

Any foam plastic must be separated from the interior of the building by an approved thermal barrier per Section 2603.4. Wall designs using STYROFOAM™ Brand XPS Foam Insulation incorporate a 5/8" (1.6 cm) thick, Type X gypsum layer on the interior of the steel studs to serve this purpose. Any design without a thermal barrier must meet Section 2603.9 (Special Approval) or other exception provided in 2006 IBC Chapter 26.

#### 2603.5.3

STYROFOAM™ Brand XPS Foam Insulation has been tested according to ASTM D1929 (NFPA 259) "Standard Test Method for Potential Heat of Building Materials." The results: Potential heat of 16,800 Btu/lb, 7,005 Btu/ft<sup>2</sup> at 2.5" thickness (max.) per NFPA 285 approved assembly.

#### 2603.5.4

Foam plastic insulations must have a flame spread index of 25 or less and a smoke developed index of 450

or less as determined in accordance with ASTM E84. STYROFOAM™ Brand XPS Foam Insulation complies at up to 4" (100 mm) thick.

#### 2603.5.5

The wall assembly must be tested in accordance with NFPA 285 "Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Apparatus." Type IV and Type X STYROFOAM™ Brand XPS Foam Insulation (2-1/2" [62 mm] thick max.) passed NFPA 285 for a steel stud or block-backed cavity with 4" (10 cm) nominal exterior brick veneer. Mineral wool fire safing (min. 1" [25 mm] thick) is required in the header of all openings. Attachment may be achieved with impaling pins welded to the underside of the header lintel or similar method. Floor-line firestopping is also required in the stud cavity at each floor line when the studs are placed outboard of the floor slab.

#### 2603.5.6

Proper labeling of the foam plastic by an approved agency is required. The bundle unit label on STYROFOAM™ Brand XPS Foam Insulation has the UL logo as its approved agency.

#### 2603.5.7

Foam plastic insulation in an assembly must not ignite from the exterior side of the wall when tested in accordance with NFPA 268. Five exceptions are noted in Section 2603.5.7 as approved outside protection layers and do not require this testing. Masonry (min. 1" thick) is listed as one of the exceptions; thus this testing is not required when this veneer is used with NFPA 285 approved STYROFOAM™ Brand XPS Foam Insulation.

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<sup>†</sup>For a list of approved full-coverage, air/water-resistive barriers, contact your Dow representative or consult Tech Solutions 514.0: NFPA 285-[06] Approved Wall Assemblies Using Foam Plastic Insulation From Dow (Form No. 179-04502).

## STYROFOAM™ BRAND CAVITYMATE™ INSULATION PRODUCTS FOR STEEL STUD CAVITY WALLS

### Suggested Brick Ties

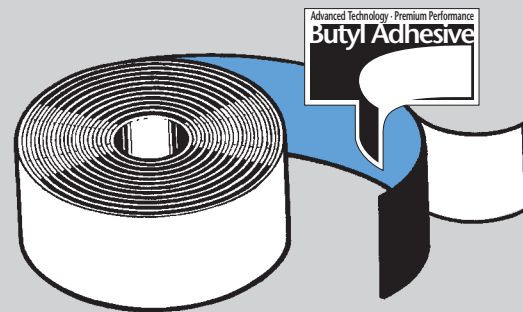
Use brick ties that connect directly to the framing without relying on the compressive resistance of the exterior sheathing material to transfer positive wind loads to the steel studs. Materials and suppliers include:

- **Pos-I-Tie System and Drill Bolt System**  
Heckmann Building Products, Inc.  
www.heckmannbuildingprods.com  
1-800-621-4140
- **X-SEAL Anchor**  
Hohmann & Barnard, Inc.  
www.h-b.com  
1-800-645-0616
- **Slotted Stud Tie (Type II)**  
FERO Corporation  
www.ferocorp.com  
1-780-455-5098
- **Dur-O-Wal Veneer Anchors (DA210X and DA213)**  
Dayton Superior  
www.daytonsuperior.com  
1-888-977-9600

Consult the specific manufacturer for application and installation recommendations.

### A Strong Finish

For a tear-resistant seal that resists water intrusion, Dow recommends sealing STYROFOAM™ Brand CAVITYMATE™ Insulation seams with WEATHERMATE™ Flashing. It combines a high-density polyethylene (HDPE) film facer with a butyl rubber adhesive that forms a strong mechanical and chemical bond to STYROFOAM™ Brand CAVITYMATE™ Insulation products.



#### IN THE U.S. AND CANADA:

For Technical Information: 1-866-583-BLUE (2583) (English) 1-800-363-6210 (French)

For Sales Information: 1-800-232-2436 (English) 1-800-565-1255 (French)

THE DOW CHEMICAL COMPANY . Dow Building Solutions . 200 Larkin . Midland, MI 48674

DOW CHEMICAL CANADA ULC . Dow Building Solutions . 450 – 1st St. SW . Suite 2100 . Calgary, AB T2P 5H1

www.dowbuildingsolutions.com

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#### STYROFOAM™ Brand Extruded Polystyrene Foam Insulation

**CAUTION:** This product is combustible. Protect from high heat sources. A protective barrier or thermal barrier may be required as specified in the appropriate building code. For more information, consult MSDS, call Dow at 1-866-583-BLUE (2583) or contact your local building inspector. In an emergency, call 1-989-636-4400 in the U.S. or 1-519-339-3711 in Canada.

**WARNING:** Rigid foam insulation does not constitute a working walkable surface or qualify as a fall protection product.

Building and/or construction practices unrelated to building materials could greatly affect moisture and the potential for mold formation. No material supplier including Dow can give assurance that mold will not develop in any specific system.

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