**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).* 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.

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.
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).
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, 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/ft² 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.
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

Illustrations are not intended to replace the need for design by appropriate professionals such as architects or engineers.

NOTICE: No freedom from any patent owned by Dow or others is to be inferred. Because use conditions and applicable laws may differ from one location to another and may change with time, Customer is responsible for determining whether products and the information in this document are appropriate for Customer’s use and for ensuring that Customer’s workplace and disposal practices are in compliance with applicable laws and other government enactments. Dow assumes no obligation or liability for the information in this document. NO EXPRESS WARRANTIES ARE GIVEN EXCEPT FOR ANY APPLICABLE WRITTEN WARRANTIES SPECIFICALLY PROVIDED BY DOW. ALL IMPLIED WARRANTIES INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED.

**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.

Published December 2009