



## WHY INSULATE Steel Stud Cavity Walls

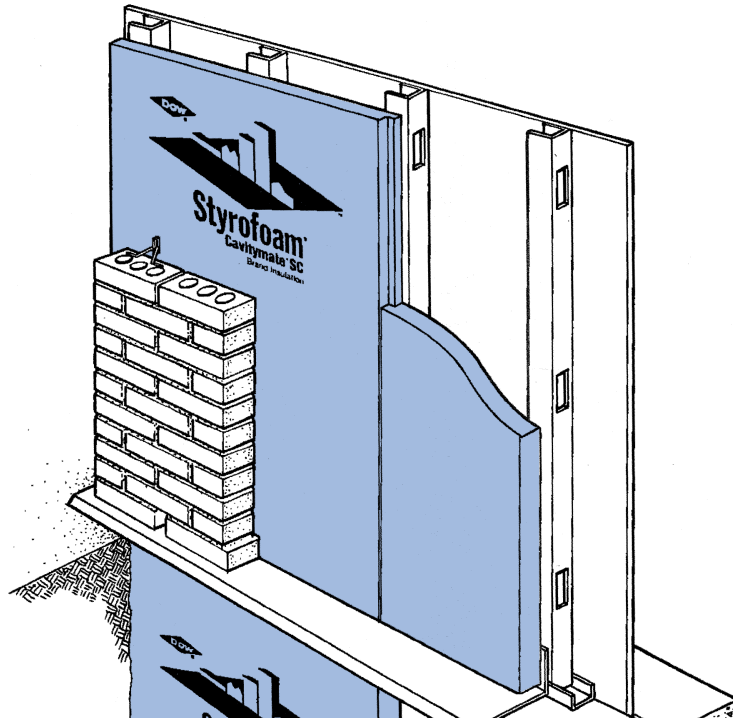
Steel stud construction contributes to an economical and versatile wall system in commercial and multistory residential construction. However, steel stud construction can also present unique challenges, including moisture accumulation and lowered R-value of the wall system. Insulating with STYROFOAM® CAVITYMATE® brand insulation helps you meet these challenges head-on.

### Why STYROFOAM CAVITYMATE?

Extruded polystyrene is specially designed to solve the challenges of steel stud cavity wall construction. The shiplap edge provides one of the most thermally efficient joints available, and its unique closed-cell structure gives it superior moisture resistance and long-term R-value.

### 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. This means the wall cavity is vented to the outside by openings in the outer layer (brick veneer) to allow rapid equalization of the cavity and external pressures caused by wind loads.



In this type of 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. As a result, the exterior surface of the sheathing behind the brick veneer is exposed to a very moist environment. Since moisture can cause damage and compromise the R-value of the sheathing, the NRC recommends the addition of a water-resistant barrier on the outside of the stud wall.

STYROFOAM brand insulation is manufactured from an extruded polymer that is naturally moisture-resistant. In many cases, using STYROFOAM

brand insulation eliminates the need for a protective covering, which saves money in the construction process.

### The Advantage of STYROFOAM Brand Insulation

While steel studs offer superior strength and structural integrity, their thermal conductivity can present some challenges. STYROFOAM helps solve these challenges.

**R-Value and Thermal Efficiency.** Steel studs transfer heat approximately 400 times faster than wood studs. This can lead to thermal bridging,



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TABLE 1

Effective R-Value Comparison: Cavity Insulation Alone vs. Cavity Insulation Plus STYROFOAM Brand Insulation					
Nominal Framing Depth and Spacing	Cavity Insulation R-Value	Effective Framing and Cavity R-Value	Wall Thermal Efficiency <sup>1</sup>	Effective R-Value by Adding 1" of STYROFOAM Brand Insulation <sup>2</sup>	Wall Thermal Efficiency With STYROFOAM Brand Insulation
4" @ 16" on center	R-11	5.5	50%	11.5	72%
	R-13	6.0	46%	12.3	68%
	R-15	6.4	43%	12.7	64%
4" @ 24" on center	R-11	6.6	60%	12.6	79%
	R-13	7.2	55%	13.5	75%
	R-15	7.8	52%	14.1	71%
6" @ 16" on center	R-19	7.6	40%	14.3	60%
	R-21	7.4	35%	14.1	54%
6" @ 24" on center	R-19	8.6	45%	15.3	64%
	R-21	9.0	43%	15.7	60%

<sup>1</sup>Data Source: ASHRAE/EIS Standard 90.11989, User's Manual, November 1992.

<sup>2</sup>Data Source: The Pennsylvania Housing Research Center Report Number 58.

where heat bypasses the cavity insulation and is transferred through the steel studs. Testing has shown that, depending on the specific design, thermal bridging can reduce the effectiveness of cavity insulation by as much as 65 percent. (See Table 1.)

During winter months, steel studs conduct cold (thermal short). This may cause the interior surfaces on gypsum board to be cooler at stud

locations than the rest of the wall. Dust and dirt can deposit at these cold spots, leading to poor aesthetics and increased maintenance costs.

Adding STYROFOAM brand insulation to the exterior wall makes steel stud construction systems more thermally efficient. (See Table 1.)

As shown in Table 1, adding just one inch of STYROFOAM brand insulation increases the effective R-value of the wall

assembly by as much as 90 percent. It will also increase the thermal efficiency of the wall by approximately 20 percent.

**Moisture Control.** Moisture that enters the wall cavity can condense if it reaches a cold spot (dew point). A steel stud may provide that cold spot if the wall is not insulated properly.

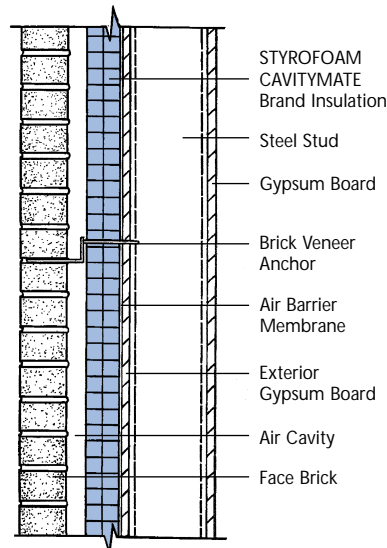
Condensation in walls can lead to corrosion of the steel studs, loss of R-value, mold development and indoor air quality problems.

STYROFOAM CAVITYMATE helps prevent condensation by reducing air infiltration, limiting the amount of moisture penetration and keeping the cavity temperature above the dew-point temperature.

### Design Options

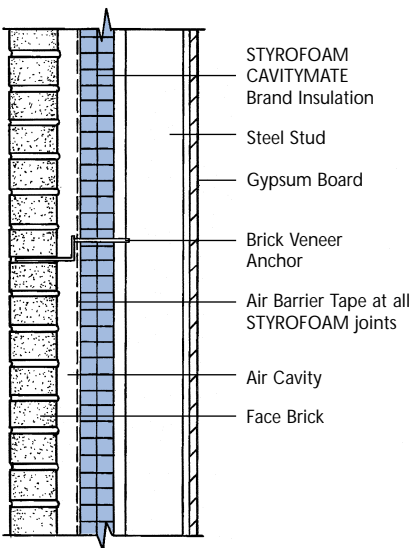
Figures 1, 2 and 3 represent three common designs for steel stud cavity wall construction. When incorporated into these wall systems, STYROFOAM CAVITYMATE brand insulation provides excellent thermal efficiency and superior moisture control.

FIGURE 1



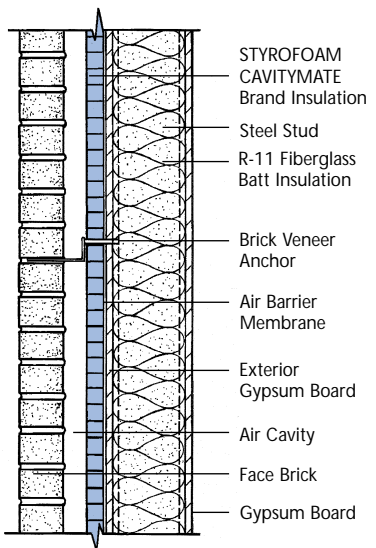
Steel stud cavity wall with interior and exterior gypsum and uninsulated stud cavity.

FIGURE 2



Steel stud cavity wall with interior gypsum (no exterior) and uninsulated stud cavity.

FIGURE 3



Steel stud cavity wall with interior and exterior gypsum and insulated stud cavity.

## Design Considerations

**Bracing and Deflection Criteria.** The Brick Institute Association (BIA) Technical Note 28B states that “steel studs must be designed to provide adequate out-of-plane support for all loads imposed on the wall system. This is done by establishing a maximum deflection limit on the stud while maintaining steel stress values in the stud within permissible limits. The allowable out-of-plane deflection of the studs should be restricted to  $L/600$  using service level loads.” The service level loads are based on a number of building-specific variables such as location, height and surrounding terrain. Technical Note 28B also states that the flanges of the steel studs must be laterally braced to resist compression in bending.

The bracing and deflection design process is complicated and requires the services of a trained professional. The following points should be kept in mind when designing this type of system:

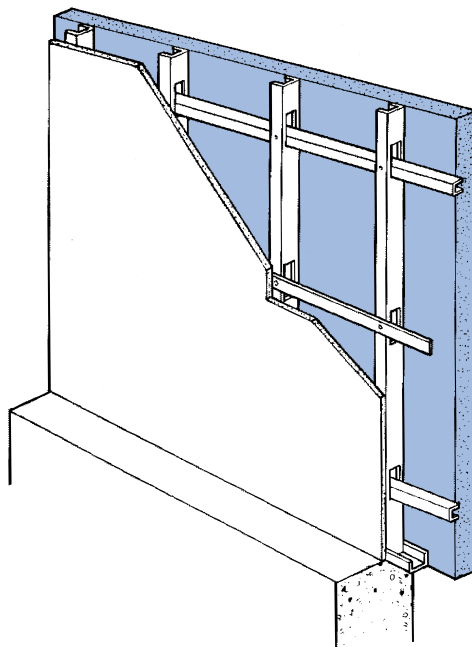
- STYROFOAM brand insulation is not a structural sheathing material and should not be included as part of the structural design.
- Disregard any contribution of the gypsum sheathing in determining the stiffness of the backing.<sup>1</sup>
- Verify that the manufacturer of exterior gypsum sheathing recommends its product as a structural sheathing.
- Many designers recognize that bracing needs to be connected to the studs to be effective and that gypsum interior and exterior cladding is not always reliable for preventing rotation, let alone for composite action.<sup>2</sup>

<sup>1</sup> Brick Institute Recommendations, Progressive Architecture 2.92

<sup>2</sup> CCMC Brick Veneer Steel Stud Best Practice Guide, Canada Mortgage and Housing Corporation

<sup>3</sup> Brick Institute of America, Technical Note 28B – Revised

FIGURE 4



Bracing of a steel stud wall assembly when STYROFOAM brand insulation is used as the sheathing

- Allow use of gypsum sheathing as bracing only in dry conditions. Standard fastening may not be adequate if gypsum sheathing is used as bracing. Ensure that cyclic loading will not render the sheathing ineffective as bracing.<sup>2</sup>
- The CCMC Brick Veneer Steel Stud Best Practice Guide states: “Brace steel studs with horizontal bridging channels through stud cutouts or flat strap bringing at maximum vertical centers of 1500 mm or 1200 mm for brick veneer.”<sup>2</sup>

Figure 4 shows one method of bracing the steel stud wall, with STYROFOAM brand insulation as the sheathing.

**Fire Resistance Ratings.** Building codes may require that exterior walls have a fire resistance rating depending on such factors as building occupancy, size and proximity to other buildings. In brick masonry construction, a 4-inch brick wythe has a fire resistance period of 75 minutes, providing a one-hour fire resistance rating for the exterior surface of the wall.<sup>3</sup>

**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**  
Heckman Building Products Inc.  
800-621-4140
- **DW-10-X**  
Hohmann & Barnard, Inc.  
631-234-0600
- **Slotted Wrap-Tie**  
Fero Corporation  
780-455-5098

**Suggested Tapes.** Tapes should be durable and designed to resist the effects of the moist environment present in the wall cavity.

- **CCW-705**  
Carlisle Coatings and Waterproofing, Inc.  
800-338-8701
- **Polyguard**  
Polyguard Products, Inc.  
972-875-8421
- **Protecto Wrap BT20**  
Protecto-wrap Company  
800-759-9727



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