



Energy efficiency for steel-framed brick veneer buildings.

The Challenges of Construction with Brick Veneer and Steel Framing

Steel-framed/brick veneer walls are widely used as an economical wall system that combines the durability and aesthetics of brick with the structural reliability and construction economies of steel. Until now, this system presented several challenges for the designer and builder:

- Will steel framing become a “thermal bridge” that robs energy?
- Will the steel corrode from exposure to moisture?
- Is the steel sufficiently stiff to prevent flexural cracking of the brick?
- Are commercial brick ties adequate to transfer lateral loads?

A System Solution

FOAMULAR extruded polystyrene insulation, combined with proper construction techniques and materials, is the answer to these questions. FOAMULAR insulation:

- Reduces thermal bridging
- Enhances moisture resistance
- Enables masonry to be effectively tied to the steel framing with commonly available anchoring systems

In other words, the marriage of brick and steel components can be accomplished with a system solution, as demonstrated in the drawing on this page.

The Benefits of FOAMULAR Insulation

Owens Corning FOAMULAR insulation is key to the system solution because it:

- Discourages condensation in the wall cavity, and thereby reduces the potential for corrosion
- Positively impacts life-cycle energy costs and provides high moisture resistance for long-term insulating value
- Decreases HVAC load requirements
- Reduces air infiltration
- Increases sound dampening properties



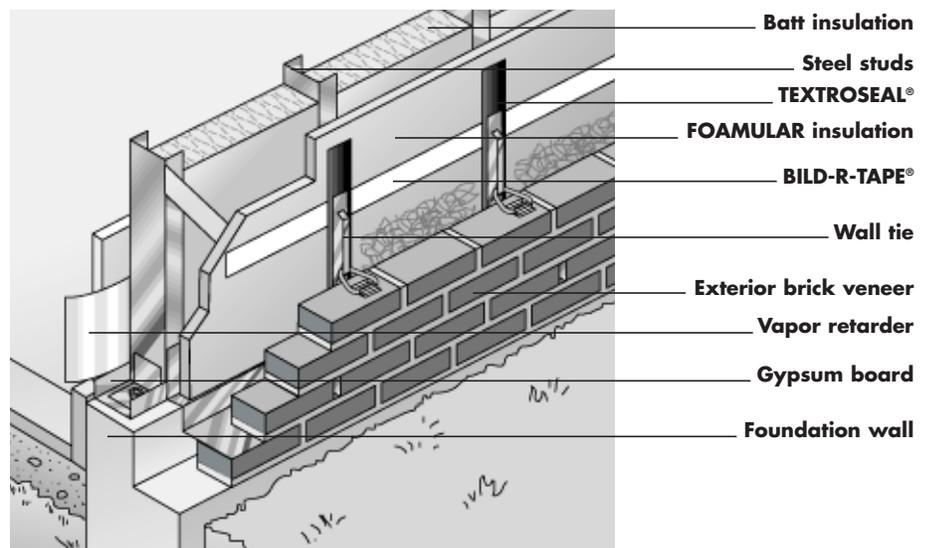
Achieving High Performance

Thermal Bridging Conquered

Thermal bridging, in which the high conductivity of the steel studs can rapidly transfer heat through a wall, can reduce the effectiveness of cavity insulation by as much as 50 percent.

In the system suggested by Owens Corning (and in conformance with the findings of both ASHRAE and the

National Research Council of Canada), FOAMULAR insulation is used to minimize the effect of thermal bridging by providing a continuous insulation layer on the exterior face of the steel studs. At the same time, high performance energy design is achieved by filling the stud cavities with Owens Corning fiber glass batt insulation.





Commercial Steel Stud System with Brick Veneer

FOAMULAR® Extruded Polystyrene Insulation

As the chart below demonstrates, adding FOAMULAR insulation to the wall system not only increases the R-value* of the complete wall, but also reduces the thermal bridging effect of the steel studs. The “correction factor” is an ASHRAE calculation, derived from testing, that is applied to the R-value of the cavity insulation to account for the energy loss caused by thermal bridging. Adding just a 1" thickness of FOAMULAR insulation provides an additional R-5.0 to the wall system.

Managing Air and Water Intrusion

Steel-framed/brick veneer walls are considered an “open rain screen” design, according to the National Research Council of Canada (NRC). This means that the cavity is vented to the outside by openings in the outer layer (brick veneer) to allow rapid equalization of cavity and external pressures due to wind. In this construction, some rainwater will pass through the veneer and run down the inside to drain out at the bottom. However, because of wind-driven rain and flexural cracking as the building ages, this construction does not completely prevent the infiltration of moisture into joints, sealants and insulation.

To prevent damage and loss of R-value, the NRC recommends the addition of a water-resistant barrier on the outside of the stud wall (adjacent to the 1" or 2" air space between the veneer and the stud wall). Hydrophobic, closed cell FOAMULAR insulation, with either tongue-and-groove or taped joints, is the perfect barrier for this application. Not only does it reduce the introduction of moisture, it also helps reduce condensation in the interstitial space and prevent corrosion of the steel studs. As a bonus, FOAMULAR insulation acts as a barrier to air infiltration, thereby further enhancing the thermal performance of the building.

Flexural Cracking

Water will inevitably penetrate brick veneer, no matter the quality of the brick work. As a result, flexural cracking should be anticipated in the design of these wall systems. However, controlled flexural cracking should not be equated with structural failure. Flexural cracks in the veneer, properly controlled through deflection criteria, do not let in excessive amounts of wind-driven rain.

FOAMULAR extruded polystyrene insulation with proper joint treatment is effective at repelling water that does intrude into the system through flexural cracking and other naturally occurring phenomenon. Furthermore, FOAMULAR insulation reduces problems of moisture and condensation and the corrosion that can result, because it helps maintain a relatively higher temperature in the steel frame face flange and in the cavity itself.

Bracing and Deflection Criteria

The width of flexural cracks can be controlled through the selection of appropriate deflection criteria for the steel studs. Deflection of the steel stud backing system at full lateral design load should be less than the stud span length divided by 600 or even 720. According to the Brick Institute of America, designers should disregard any contribution of gypsum sheathing in determining stiffness of the backing. Under the influence of cyclical loading, research has determined that the initial bracing contribution of gypsum sheathing rapidly deteriorates. The Institute recommends following stud design as outlined in the Cold-Form Steel Design Manual published by the American Iron and Steel Institute. It also notes that “...this method allows... materials such as board insulation to be attached to the exterior of the studs without a rigid sheathing.”

Internal bridging attached to the studs by clip angles may be used to brace the studs, at a maximum of 48 inches o.c.

Brick Ties

Use brick ties such as the H&B DW-10-X® (or equal) that connect directly to the framing without relying on the compressive strength of the exterior sheathing to transfer positive wind pressures to the steel studs. Proper brick ties also will allow only minimal thermal bridging. Corrugated metal strips should not be used. Remember that exterior sheathings such as gypsum board and rigid insulation do not have adequate compressive strength to accomplish the transfer of positive structural wind loads.

Effective Steel Frame Wall R-values Using FOAMULAR Extruded Polystyrene Insulation

Size of Members (ft)	Gauge of Stud	Spacing of Framing (in)	Cavity Insulation R-value	Correction Factor	Effective Framing & Cavity R-value	Effective Wall R-value Adding 1" (R-5.0) of FOAMULAR Insulation
2 x 4	18 – 16	16 o.c.	R-11	0.50	R-5.5	R-10.5
			R-13	0.46	R-6.0	R-11.0
			R-15	0.43	R-6.4	R-11.4
2 x 4	18 – 16	24 o.c.	R-11	0.60	R-6.6	R-11.6
			R-13	0.55	R-7.2	R-12.2
			R-15	0.52	R-7.8	R-12.8
2 x 6	18 – 16	16 o.c.	R-19	0.37	R-7.1	R-12.1
			R-21	0.35	R-7.4	R-12.4
2 x 6	18 – 16	24 o.c.	R-19	0.45	R-8.6	R-13.6
			R-21	0.43	R-9.0	R-14.0
2 x 8	18 – 16	16 o.c.	R-25	0.31	R-7.8	R-12.8
2 x 8	18 – 16	24 o.c.	R-25	0.38	R-9.6	R-14.6

Note: Many factors affect the thermal performance of steel frame wall assemblies, including the characteristics of sheathing materials, thickness, R-value, type of facing (foil facers serve as lateral thermal shorts), type and spacing of fasteners used, presence of thermal breaks in the stud, and size of web punch-outs.

*The higher the R-value, the greater the insulating power. Ask your seller for the fact sheet on R-values.

Missing information

Corrosion

Corrosion of the many steel parts in cavity walls can be minimized by specifying proper corrosion-resistant coatings, such as defined by ASTM A153 or CAN3-A370-A84 for brick ties and ASTM A525 for the steel stud framing.

FOAMULAR insulation provides important protection against corrosion. Testing by C_____ M_____ H_____ C_____ has shown in studies simulating winter conditions that rusting of steel components is prevented by insulation such as FOAMULAR insulation, because the material keeps the metal warm relative to the exterior temperature, and therefore decreases condensation.

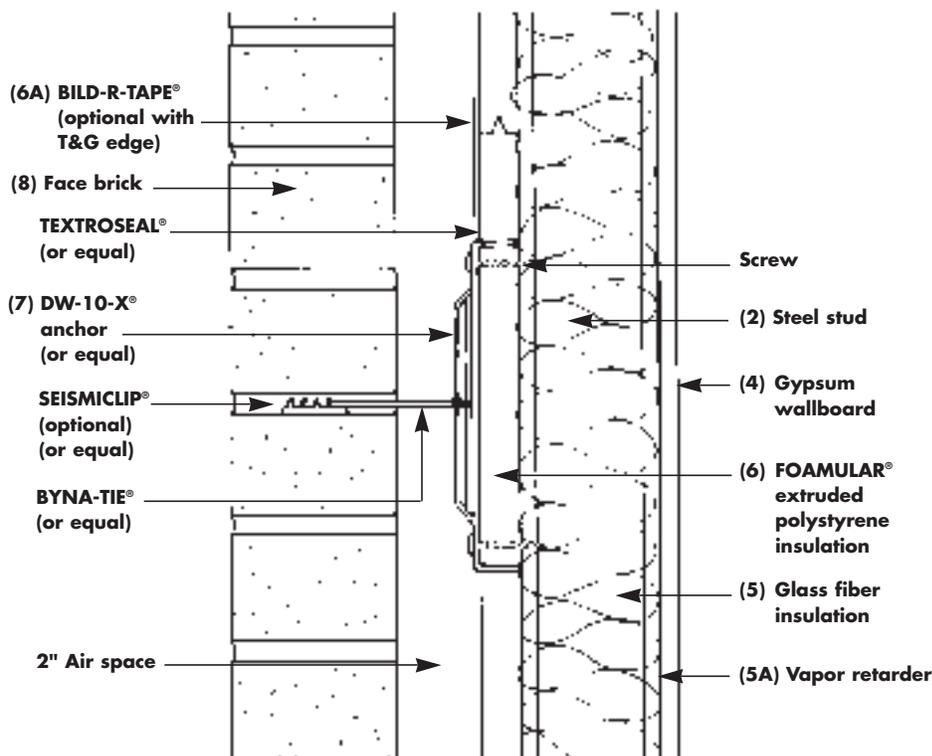
Fire Resistance Ratings

FOAMULAR extruded polystyrene insulation is part of a three-hour fire resistance-rated steel framing/masonry veneer, non-load bearing exterior wall assembly. The wall assembly has been tested in accordance with ASTM E119 (ANSI/UL 263), "Standard for Fire Tests of Building Construction and Materials." See Underwriter's Laboratories Fire Resistance Directory, Volume I, Assembly Design Number V414, at right.

Sample Wall Construction/ Design Notes

- 1. Floor and Ceiling Runners** (not shown) – Channel shaped, min. 3/8" wide with min. 1 1/8" flanges, fabricated from min. No. 20 MSG galv. steel. Attached to floor and ceiling with fasteners spaced max. 24" o.c.
- 2. Steel Studs** – C-shaped, fabricated from min. No. 20 MSG galv. steel, min. 3 5/8" wide with min. 1 5/8" legs and min. 5/16" stiffening flanges, spaced max. 16" o.c. Studs cut 3/4" less than assembly height.
- 3. Cold-rolled Channel** (not shown) – C-shaped channel, used for lateral support, fabricated from min. No. 18 MSG galv. steel, min. 1 1/2" wide with min. 1/2" legs.
- 4. Wallboard, Gypsum** – 5/8" min. wallboard applied vertically with the joints centered over the studs. Type S screws spaced 8" o.c. at the edges and 12" o.c. in the field.

Design No. V414 Nonbearing Wall Rating-3 HR



Notes

- Steel frame back-up for brick masonry veneer should always be designed without relying on sheathing to resist torsion and weak axis buckling. Internal bridging attached to the studs by clip angles may be used to brace the studs, at a maximum of 48" o.c.
- Use brick ties such as H&B DW-10-X® (or equal) that connect directly to the framing without relying on the compressive strength of the exterior sheathing to transfer positive wind pressures to the steel studs. Corrugated metal strips should not be used.
- Additional corrosion protection can be obtained by specifying steel coatings such as defined by ASTM A153 or CAN3-A370-A84 for brick ties and ASTM A525 for the steel stud framing.

5. Batts and Blankets – Kraft paper, foil, or unfaced fiber glass batts, min. 3 1/2" thick, having a min. density of 0.8 pcf, placed to fill the interior of the stud cavities.

5A. Vapor Retarder (optional) – 4 mil polyethylene installed between steel studs and gypsum board.

6. Foamed Plastic – 2" thick max. attached to studs with 2 1/2" long type S-12 screws spaced 12" o.c. FOAMULAR 150 or 250 insulation.

6A. Joint Tape (optional) – BILD-R-TAPE construction tape.

7. Metal Bracket and Ties – Attach to studs 16" o.c. max. Underlay bracket with self-sealing gasket material and secure with 2 1/2" max. type S-12 flange screws. Bracket legs penetrate foam plastic and engage the steel stud flange.

8. Brick Veneer – Any 4" wide brick. Allow a 2" air space between the veneer and the foamed plastic.

9. Joint Tape and Compound (not shown) – Vinyl or casein, dry or premixed joint compound applied in two coats to joints and screw heads. Paper tape, 2" wide, embedded in first layer of compound over all joints.

Specification Guide

Insulated Steel Stud Framing/Masonry Veneer System

This guide is intended to be used by project specification writers as the basis for the development of a system specification that will be integrated into a complete project specification. Brackets [] appear where information must be inserted or edited to accommodate a specific project. Please modify as necessary for your specific project.

PART 1: General

1.01 Products Specified in This Section

- A. Extruded polystyrene rigid foam insulation; sheathing
- B. Masonry ties
- C. Construction tape
- D. Batt insulation
- E. Steel framing, cold-formed
- F. Gypsum board [fire rated]
- G. Face brick

1.02 Related Sections

- A. Steel stud framing, cold-formed, section []
- B. Veneer masonry, section [], [concrete masonry or pre-faced unit masonry or cut stone or facebrick]
- C. Batt insulation, section []
- D. Vapor retarder, section []
- E. Gypsum board, section []
- F. Head and sill flashings, section []

1.03 References

- A. ASTM C 578, Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
- B. ICBO Evaluation Report No. 4882, Masonry Wall Tie System (or equal)
- C. Brick Institute of America, Technical Note on Brick Construction, 28B Revised II
- D. Underwriters Laboratories (UL), Fire Resistance Directory, Vol. 1, Assembly Design No. V414
- E. American Iron and Steel Institute, Design of Cold-Formed Steel Structural Members

1.04 System Description

- A. Cold-formed steel stud framing system for exterior wall, [load bearing, non-load bearing], with [batt insulation and vapor retarder], covered on the interior with gypsum board finish; covered on the exterior with FOAMULAR extruded polystyrene rigid insulation, air space, and masonry veneer, attached through the FOAMULAR insulating sheathing to the steel stud framing with an approved, load-transferring masonry tie system. [3-hour maximum fire resistance rated, non-load bearing cold-formed steel stud framing system. Fire resistance rating shall be determined by testing in accordance with ANSI/UL 263, ASTM E119, see UL Fire Resistance Directory, Volume 1, Assembly Design No. V414 for Construction Specifications. Steel framing members may be nominal [4" or 6"], [18 or 20 gauge].
- B. Cold-formed steel framing shall be designed in accordance with the current edition of the specification for the design of cold-formed steel structural members by the American Iron and Steel Institute (AISI). All design details enhancing the structural integrity of the wall assembly, including the axial design load of the studs, shall be as specified by the steel stud designer and/or producer, and shall meet the requirements of all applicable local code agencies.
- C. Design and size system components to withstand all axial dead and live loads, and all loads imposed by positive and negative wind pressures acting perpendicular to the plane of the wall to a design pressure of [] lb/sf, calculated in accordance with [] code. Sheathing shall not be considered as bracing for the cold-formed steel stud framing system.
- D. Maximum allowable system deflection: [1/360 or 1/600 or 1/720]
- E. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners or ties, or other detrimental effects when subject to cyclic seasonal or diurnal temperature variation.

- F. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
- G. Structural design shall be consistent with the American Iron and Steel Institute, Design of Cold-Formed Steel Structural Members, and all other applicable codes and standards.

1.05 Submittals

- A. Structural verification: provide calculations bearing the seal of a professional structural engineer for loading, deflection and stresses of exterior wall system.
- B. Product data: provide data describing standard framing member materials finish, load charts and structural properties.

1.06 Quality Assurance

1.07 Contractor Qualifications

1.08 System Mock-up

1.09 Coordination

PART 2: Products

2.01 Manufacturers

- A. FOAMULAR 150, 250 extruded polystyrene rigid insulation; Owens Corning.
- B. Masonry tie system; DW-10-X[®] bracket with Textroseal[®] self sealing membrane gasket; BYNA-TIE[®] [and Seismicclip[®] interlock]; Hohmann & Barnard (or equal).
- C. Construction tape; BILD-R-TAPE, Owens Corning.
- D. [Gypsum board, fire rated; Boral Gypsum, Inc., Type BG-C; Canadian Gypsum Co. LTD., Type C; Celotex Corp.; Type FRP; Domtar Gypsum, Type 5; Eagle Gypsum Products, Type EG-C; Georgia-Pacific Corp., Gypsum Div., Type GPFS-C; Pabco Gypsum Co., Type C or PG-C; Republic Gypsum Co., Type RG-C; Standard Gypsum Corp., Type SG-C; Temple-Inland Forest Products Corp., Type TP-5; United States Gypsum Co., Type C.]

Specification Guide

Insulated Steel Stud Framing/Masonry Veneer System

[Gypsum Board, Regular, Generic]

- E. Glass fiber batt insulation; [generic for fire rated or non-fire rated assembly]
- F. Vapor retarder: [generic for fire rated or non-fire rated assembly]
- G. Cold-formed steel framing; [generic for fire rated or non-fire rated assembly]
- H. Masonry veneer, [generic for fire rated or non-fire rated assembly]

2.02 Extruded Polystyrene Rigid Insulation

- A. Extruded polystyrene sheathing; conforming with ASTM C578 Type IV FOAMULAR [150, 250] [2' x 8' or 4' x 8'] insulation; thickness, [1/2" or 3/4" or 1" or ____"] [maximum 2" thickness for fire resistance rated wall assembly]; [straight or T&G] [verify that edge configuration selected is available in the thickness specified] edge; flame spread no greater than 5, smoke developed no greater than 175, measured in accordance with ASTM E 84.

"K-Factor" shall not exceed .20 BTU x in/sf x hr x °F measured by ASTM C518. Compressive strength shall be [15 or 25] PSI, minimum, measured by ASTM D1621. Water absorption shall not exceed .10 by volume measured by ASTM C272.

FOAMULAR insulation shall be delivered in its original, unopened units, stored off the ground, protected from direct sunlight with a light-colored opaque film and ventilated to prevent exposure to excessive temperature. Damaged or deteriorated materials shall be removed from the premises.

[Apply exterior masonry veneer as soon as possible to prevent discoloration from exposure to sunlight].

[FOAMULAR insulation is not recommended for use where sustained temperatures exceed 165°F. Do not use in contact with chimneys, heater vents, steam pipes, or surfaces with temperatures of over 150°F].

[CAUTION: FOAMULAR insulation will ignite if exposed to fire of sufficient heat and intensity, although it does contain a flame-retardant additive to inhibit ignition from small fire sources.

During shipping, storage, installation and use, this product should not be exposed to open flame or other ignition sources. This product should be installed only with a thermal barrier such as 1/2" thick gypsum board on the interior side of the wall. This requirement applies to return air plenums and may apply to interstitial dead air spaces above suspended ceilings. Check local building codes.]

2.03 Masonry Ties (generic equal acceptable)

- A. DW-10-X (or equal) bracket; [No. 14 or No. 12] gauge sheet steel conforming to ASTM A 366 with a hotdipped galvanized finish conforming to ASTM A153 class B2 or type 304 stainless steel conforming to ASTM A240; 6" long x 1 1/4" wide; with a pronged leg [1/2" through 3"] in length at each end.

Textroseal self sealing membrane gasket: .040" thick x 2.5" wide. BYNA-TIE; round looped wire of carbon steel conforming to ASTM A82 with zinc coating conforming to ASTM A153, Class B3; or stainless steel conforming to ASTM A580 [size length to fit cavity width].

[*Seismiclip*; rectangular PVC extrusion with retaining slots to receive BYNA-TIE and continuous joint reinforcement wire.] [Specify where required for earthquake resistant design; not required for fire resistance rated wall assembly, except where earthquake resistant design is also required.]

2.04 Construction Tape

- A. [Optional if specifying FOAMULAR T&G sheathing] Owens Corning BILD-R-TAPE construction tape; .003" thick polypropylene backing, with permanent acrylic weather adhesive. [Optional in fire resistance rated assembly.]

2.05 Gypsum Board

- A. [For up to 3-hour maximum fire resistance rating, 5/8" minimum "third generation," type X gypsum board conforming to ASTM C36, with specially formulated mineral core to provide additional fire resistance. See UL fire Resistance Directory, Vol. 1, Assembly Design No. V414.]

[Gypsum board for non-fire rated assemblies may be regular, non-fire rated variety.]

2.06 Glass Fiber Batt Insulation

- A. Kraft paper, foil, or unfaced glass fiber batts, minimum 3-1/2" thick, minimum density 0.8 PCF.

2.07 Vapor Retarder

- A. [Optional] [Assemblies should be evaluated for effectiveness and location of vapor retarders to avoid condensation and subsequent damage to structures.] 4 or 6 mil polyethylene.

2.08 Cold-Formed Steel Framing

- A. Corrosion-protected cold-formed steel framing, [for fire-resistance rated assemblies minimum 20 gauge, and minimum 3 1/2" wide, minimum 1 5/8" legs and minimum 5/16" stiffened flanges, maximum spacing 16" o.c.], designed in accordance with the current edition of the specification for the design of cold-formed steel structural members by the American Iron and Steel Institute (AISI). All design details enhancing the structural integrity of the wall assembly including the axial design load of the studs, shall be as specified by the steel stud designer and/or producer, and shall meet the requirements of all applicable local code agencies.

2.09 Masonry Veneer

- A. [For non-fire rated assembly any approved unit masonry. For fire rated assembly, any 4" wide face brick.]

PART 3: Execution

3.01 Examination

- A. Verify job site conditions are suitable as planned per contract documents.
- B. Verify that job site progress is ready to receive system installation.

3.02 Erection

- A. Erect metal stud framing system in accordance with section [___]. Install adequate steel stud bracing against lateral and rotational forces.
- B. Install FOAMULAR insulation [150 or 250] [2' x 8' or 4' x 8'] [horizontally or vertically] [install tongue up if using 2' x 8' T&G panels installed horizontally over steel stud framing system], spaced no greater than [16" or 24" o.c.] [16" o.c. maximum for fire resistance rated assembly]. Secure FOAMULAR insulation to steel studs with [1½" or 2" or 2½" or 3"] self drilling, self-tapping steel screws with 1" diameter steel or plastic washers spaced 12" on center.
- C. [Optional construction tape installation over joints if using FOAMULAR T&G]; verify that FOAMULAR insulation surface is clean and dry before installing Owens Corning BILD-R-TAPE construction tape; do not install tape if ambient temperature is below 14°F; center tape on FOAMULAR insulation joints and press firmly into place.
- D. Place DW-10-X (or equal) bracket over a steel stud framing member and impale into FOAMULAR sheathing. Underlay bracket with *Textroseal* (or equal) self-sealing membrane. Bracket legs must firmly engage steel stud flange. Secure bracket to steel stud in accordance with manufacturer's instructions.
- E. Insert BYNA-TIE (or equal) into slotted portion of DW-10-X (or equal) bracket. Adjust vertically to fit masonry coursing.
- F. [Where required for structural or seismic reinforcement] Snap-fit BYNA-TIE (or equal) masonry wire tie and continuous joint reinforcement wire into *Seismicclip* (or equal) and embed in mortar joint of masonry veneer system.
- G. Install head and sill flashings, shingle style under foam sheathing to shed water; sealing foam to flashing is optional in accordance with section [___].
- H. Install masonry veneer in accordance with section [___]. Maintain 2" clear air space between masonry veneer and FOAMULAR sheathing. Minimum of ⅓ of veneer width must be bearing on support.
- I. Install batt insulation in accordance with section [___].
- J. Install vapor retarder in accordance with section [___].
- K. Install interior gypsum board finish in accordance with section [___]. [For fire rated assembly, install gypsum board finish with type S screws spaced 8" o.c. at the edges and 12" o.c. in the field.]



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