ENCLOSURE SOLUTIONS
STRUCTURAL INSULATING BLOCK DESIGN GUIDE

ES-CMU-06

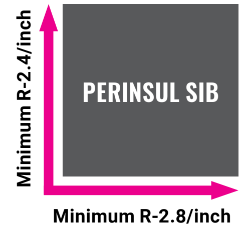
Cellular glass is a high-compressive-strength insulating material composed of foamed glass without the use of fire retardants or blowing agents. Its unique properties make it an ideal product to address thermal bridges and provide continuous insulation in key building areas. FOAMGLAS® Perinsul® SIB Structural Insulating Block is intended for this application. See Figure 1.

This guide is intended to assist the designer and installer in the proper application of this material for thermal bridging applications, such as below low-rise masonry veneer walls. It is recommended that the design team consult a registered design professional and applicable building code to verify this and any other uses of FOAMGLAS® Perinsul® SIB insulation.

Prevent Thermal Bridging

FOAMGLAS® Perinsul® SIB cellular glass is tested to a minimum thermal resistance of R-2.8 per inch thickness in the x direction and R-2.4 per inch thickness in the y direction when measured across a plane in its proper orientation. The slight increase in thermal performance in the x direction (across the width of the wall) is due to a slightly less dense cellular structure in this direction. Along the vertical y axis, the density is increased to increase compressive strength. See Figure 2.

Fig. 2

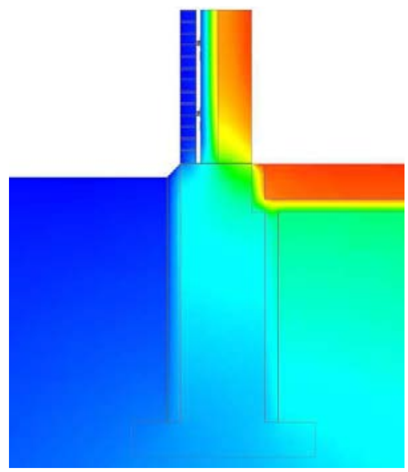


The R-value and product thickness can be used to calculate anticipated thermal resistance across a thermal bridge. In the case of masonry veneer walls at the foundation, this information may be modeled in energy software by a qualified design professional to document the U-value of a wall assembly, considering the addition of FOAMGLAS® Perinsul® SIB, selected masonry anchors and insulation fasteners, selected cavity wall insulation, structure, and specific climatic conditions.

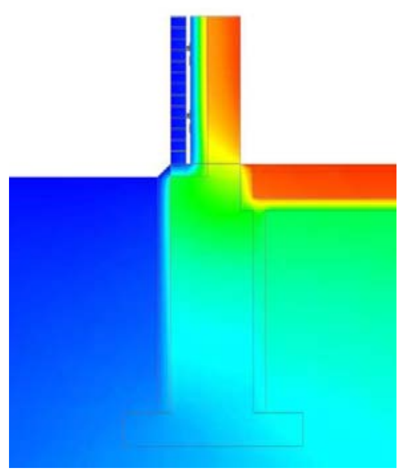
As an example, the below THERM image was modeled for an example project in the Chicago area, demonstrating a masonry veneer wall with no thermal bridge solutions (A), and FOAMGLAS® Perinsul® SIB insulation (B) used to prevent the loss of heat through the thermal bridge (shown by warmer colored foundation wall).

Fig. 1

A. Section View without FOAMGLAS® Perinsul® SIB



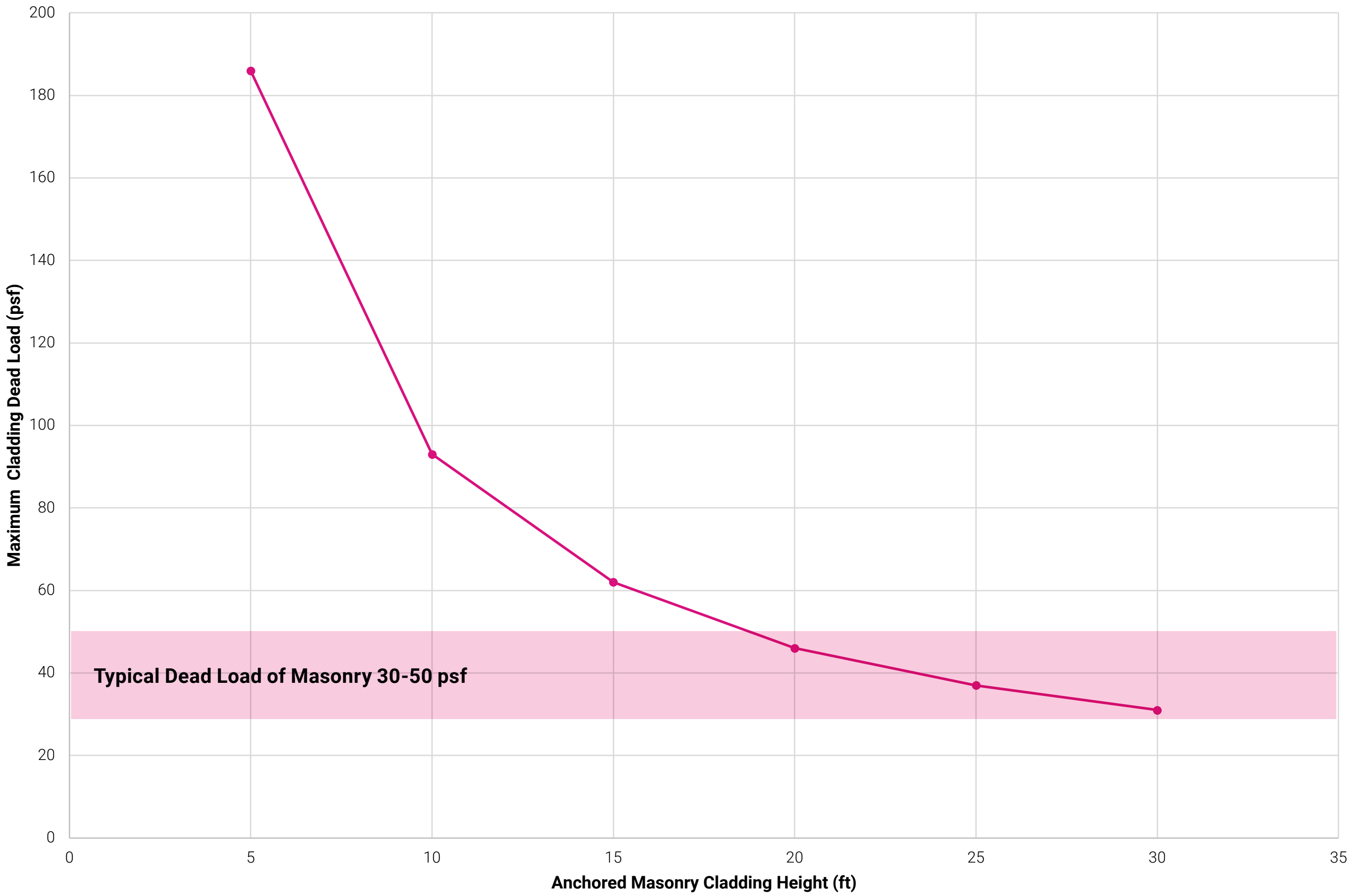
B. Section View with FOAMGLAS® Perinsul® SIB



Loading Information

FOAMGLAS® Perinsul® SIB cellular glass insulation may be used beneath non-load-bearing masonry veneer walls up to 20 feet in height with a recommended dead load of up to 46 psf.

Maximum Anchored Cladding Dead Load



1 Long-term compressive strength of 77 psi based on 83% reduction from ASTM C165 testing results
2 Compressive Strength Safety Factor = 4
3 Width of masonry and Perinsul SIB assumed to be equal
4 Maximum deadload can be factored by actual width, using formula: $\frac{W_{act}}{4" \text{ *Max DL}}$ W_{act}= Actual width of masonry & Perinsul SIB. Max DL= Maximum Dead Load
5 No factors have been applied to the deadload

Eccentric Loading

Cellular glass should be evenly loaded due to the physical properties of the material. It is not recommended to eccentrically load Perinsul SIB and therefore only brick veneer matching the width of the Perinsul SIB should be placed over the Perinsul SIB. The first layer of masonry installed above Perinsul SIB should be solid to ensure centric loading as well however, hollow masonry may be installed in subsequent courses.

Reinforcement

Masonry veneers should be anchored to the structural wall.

Per TMS 402 12.2.2.3.3, horizontally spanning members supporting anchored veneer shall be designed so that the deflection due to allowable stress level (dead plus live load) does not exceed L/600.

Spacing should be per prevailing building code and recommendations of the masonry anchor manufacturer.

Linear Thermal Bridging Performance

A linear thermal bridge is one of three types of thermal bridges where two materials in contact transfer thermal energy across a continuous pathway such as the intersection between floor slab and exterior wall. This demonstrates a consistent thermal conductivity along an expanse as opposed to the other two types of thermal bridges: repeating thermal bridges (such as metal studs) and point thermal bridges (such as conductive fasteners or joints between steel structure). Linear thermal bridging is reported as "Ψ Value" — the lower the Ψ Value, the lower the thermal bridging. This information can be used in calculating CO_2 emissions related to building energy usage as building designers strive to reduce carbon footprint of the built environment.

The Ψ value improvement created by integrating Perinsul SIB below masonry veneer walls varies based on many factors, including wall components, configuration, and climatic conditions. Most notably, when concrete or CMU is used as the structure without additional furring and insulation, the contribution of the Perinsul SIB to overall thermal performance becomes more significant. Due to the intricacies of each project, it is recommended that a qualified professional model specific project applications for predicted performance.

For reference, several Owens Corning Enclosure Solutions Details were modeled for comparison in climate zone 7 where some of the coldest climate would be expected in the United States. It is expected Perinsul SIB would contribute more to the linear thermal resistance in colder climate zones (e.g., zone 8) and would contribute less in warmer climate zones (e.g., zones 0–6). This is illustrated in two of the details also being analyzed in moderate climate zone 4 and cooling zone 1.

A summary of performance results is listed below.

	ORIGINAL EFFECTIVE R-VALUE OF OVERALL DETAIL (H.FT²°F/BTU)	IMPROVED EFFECTIVE R-VALUE OF OVERALL DETAIL WITH PERINSUL SIB (H.FT²°F/BTU)	% IMPROVEMENT	ORIGINAL LINEAR TRANSMITTANCE Ψ VALUE (BTU/H.FT²°F)	IMPROVED LINEAR TRANSMITTANCE WITH PERINSUL SIB Ψ VALUE (BTU/H.FT²°F)	% IMPROVEMENT
CM118a (Zone 1)	2.6	2.7	4%	0.139	0.050	64%
CM118b (Zone 4)	4.5	4.9	9%	0.188	0.096	49%
CM118c (Zone 7)	5.8	6.4	10%	0.195	0.112	43%
CM119a (Zone 4)	4.5	4.9	9%	0.186	0.097	48%
CM119b (Zone 7)	5.7	6.4	12%	0.199	0.111	44%
SS115 (Zone 7)	6.8	6.9	1%	0.087	0.080	8%
SS117 (Zone 7)	6.8	6.9	1%	0.085	0.079	7%
WS115 (Zone 7)	6.8	6.9	1%	0.073	0.066	10%
WS117 (Zone 7)	6.9	7.0	1%	0.072	0.066	8%

Disclaimer: For this report, a steady-state conduction model was created by engineers at Morrison Hershfield. The data presented should not be used as documentation of code compliance documentation, and any analysis for code compliance should be performed by a qualified design professional. The following parameters were assumed:

Material properties were taken from information provided by Owens Corning and ASHRAE Handbook of Fundamentals for common materials.

Large enclosed air spaces greater than 1/2" in depth such as stud cavities were simulated with an equivalent thermal conductivity of the air that includes the impacts of convection and radiation within the enclosure. Calculation for this equivalent conductivity were based on Table 6 of CSA Z5010 and Chapter 26 of 2017 ASHRAE Handbook of Fundamentals.

Small enclosed air spaces less than 1/2" in depth were simulated with an equivalent thermal conductivity of the air that includes the impacts of convection and radiation within the enclosure. Calculations for this equivalent conductivity were based on ISO 10077.

The interior/exterior air films were taken from Table 8 of CSA Z5010:21 which are similar to Table 10 page 26.21 of 2017 ASHRAE Handbook of Fundamentals depending on surface orientation. The exterior air films were based on an exterior wind speed of 15 mph.

Contact resistances between materials were simulated following Table 5 of CSA Z5010 depending on the materials and interfaces.

Insulation and other components were considered tight to adjacent interfaces.

No solar heating impacts were included.

Impacts of air leakage through the system were not directly analyzed.

Moisture Protection

While cellular glass material is waterproof per ASTM D5385/C1306, all materials in a wall assembly should be protected from standing water risking damage of freeze/thaw. Best practices for all wall materials require proper drainage and flashings integrated with positive slope. Figure 1 depicts ventilation and drainage techniques incorporated into the wall assembly. Fig 2 demonstrates the same concepts with different materials.

Fig. 1

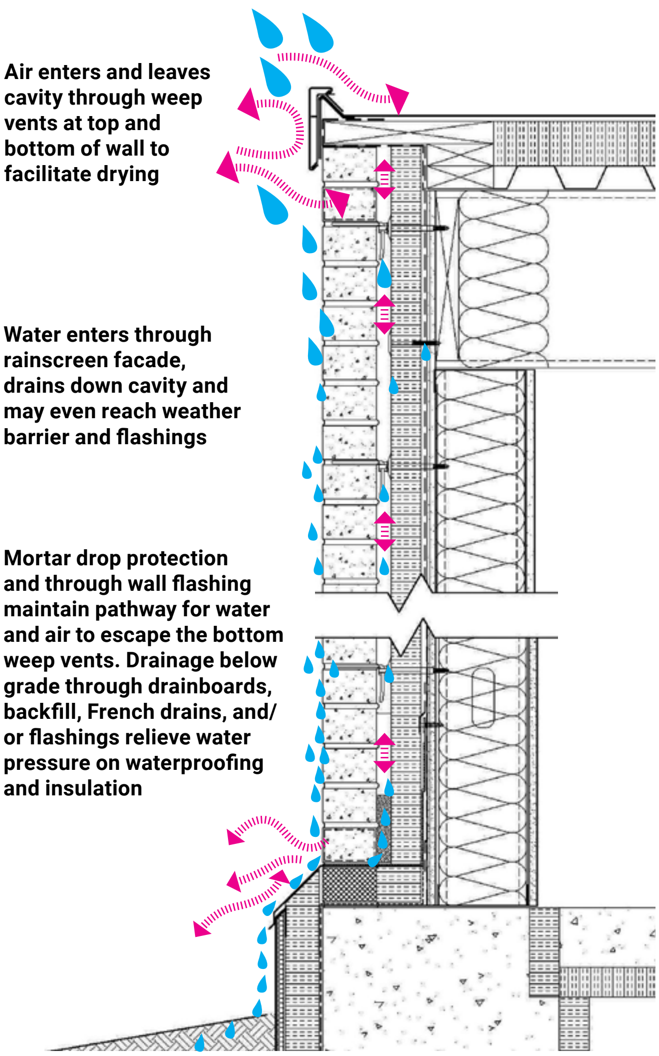
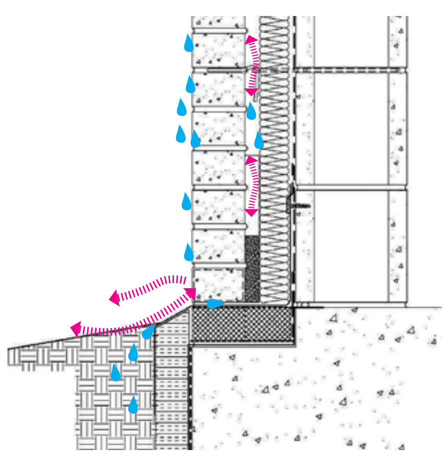


Fig. 2



Availability

FOAMGLAS® Perinsul® SIB cellular glass insulation is designed for use under standard non-load-bearing masonry veneer walls. As the masonry should bear completely and evenly across the upper face without cantilevering or point loading, three common sizes are available. Select the size that corresponds with the masonry units to be installed above:

TYPICAL MASONRY UNIT SIZE	THICKNESS X WIDTH X LENGTH (IN)	PIECES PER BOX	LINEAL FEET PER BOX
Standard/Normal	2.25 x 3.63 x 17.717 to 17.72	24	35.4
Jumbo	2.75 x 3.63 x 17.717 to 17.72	20	29.5
Economy	3.63 x 3.63 x17.717 to 17.72	16	23.6

Installation

For step-by-step instructions, please see the Owens Corning® FOAMGLAS® Perinsul® SIB Installation Instructions.

Cellular glass must be evenly loaded and bear evenly on solid surfaces. It is not intended to span openings or joints and load should not cantilever on the material. The first course of masonry above the Perinsul should be solid brick or block with no holes.

Spacing

FOAMGLAS® Perinsul® SIB blocks should be butted tightly with no mortar joints to ensure continuous thermal resistance.

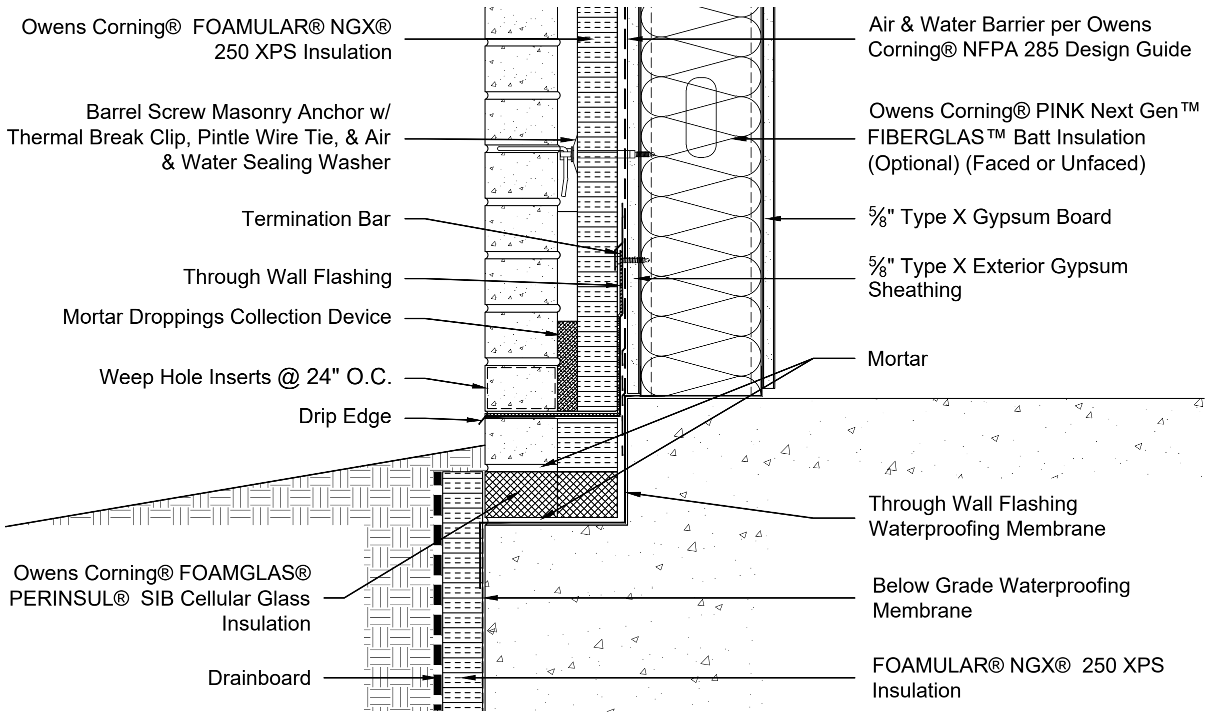
Additional FOAMGLAS material may be inserted in cavity space adjacent to Perinsul® SIB when load-bearing is not required but additional insulation is needed. See installation instructions for more information.

EXAMPLE DETAILS

These details are intended for reference at the convenience of the design team and demonstrate a variety of insulation and structure types. It is critical to evaluate each transition not only for continuity of the insulation resistance layer but for air and moisture management and structural requirements. Corresponding details, such as foundation, floorline, and roof transitions are also available to complete an entire wall assembly. These and other CAD files can be found at www.owenscorning.com/enclosure in both CAD and PDF format, or by contacting gettech@owenscorning.com or calling 1-800-GET-PINK.

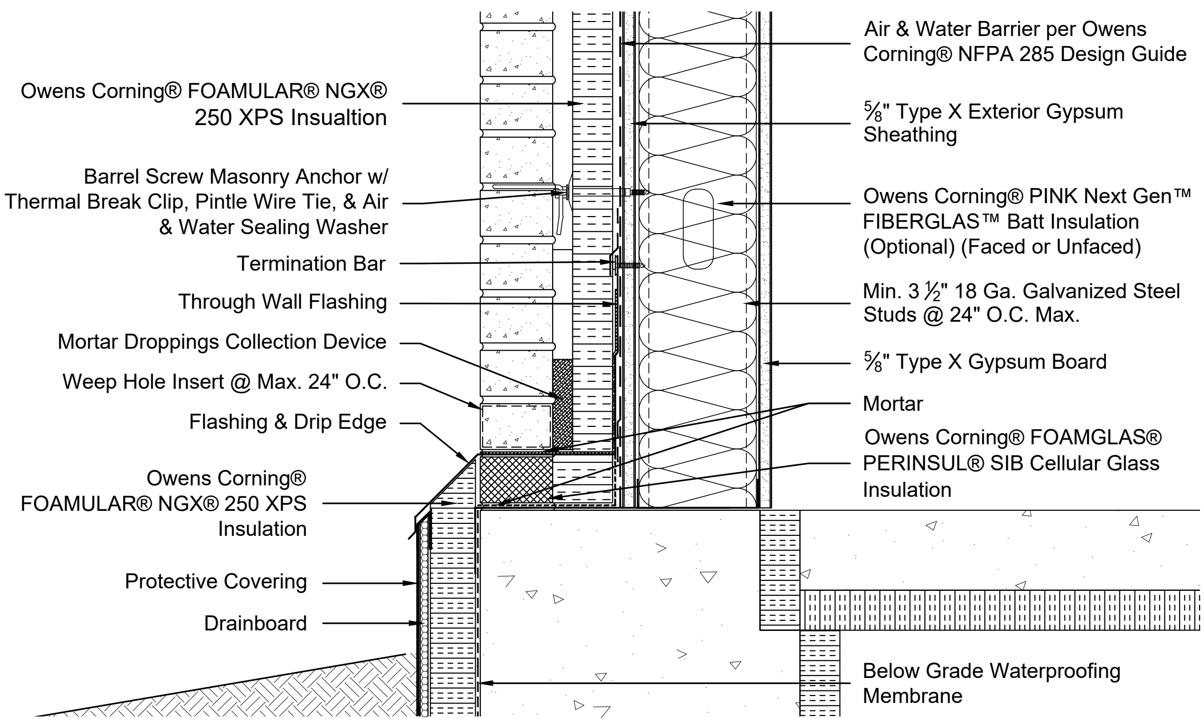
ES-SS-111

Steel Stud Wall with XPS Continuous Insulation



ES-SS-115

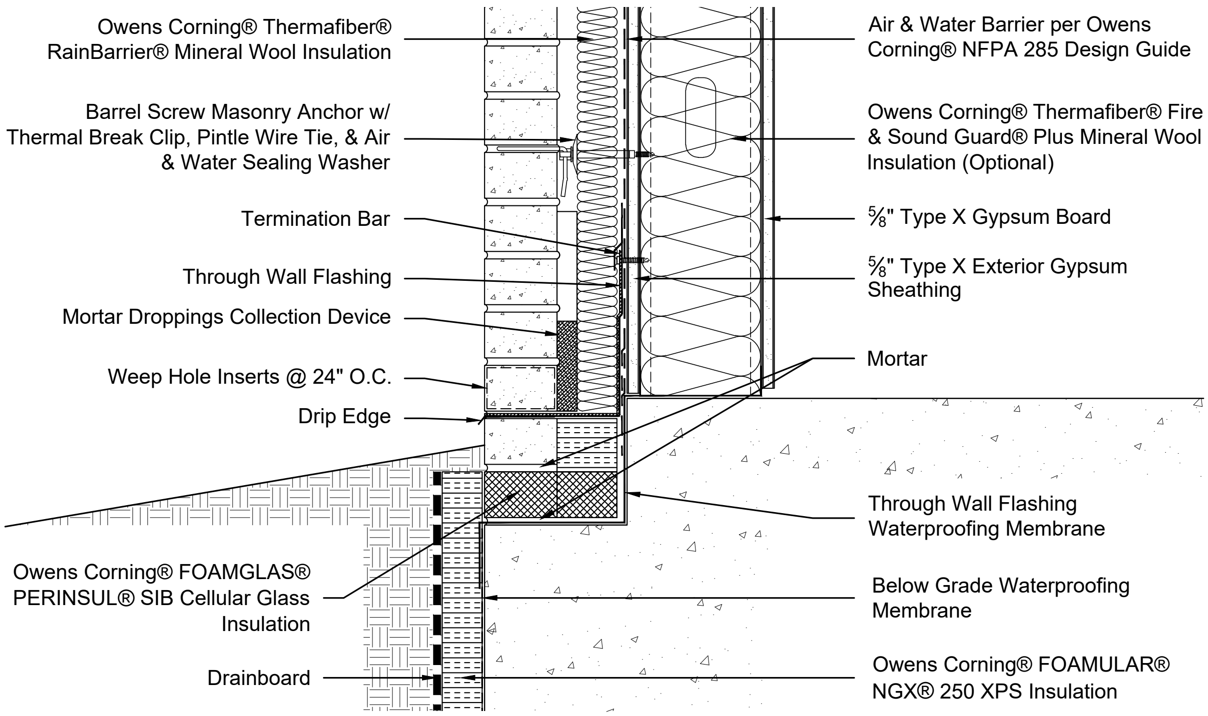
Steel Stud Wall with XPS Continuous Insulation



Please note that not all assemblies may be shown.
Contact GETTECH@OwensCorning.com for more information.

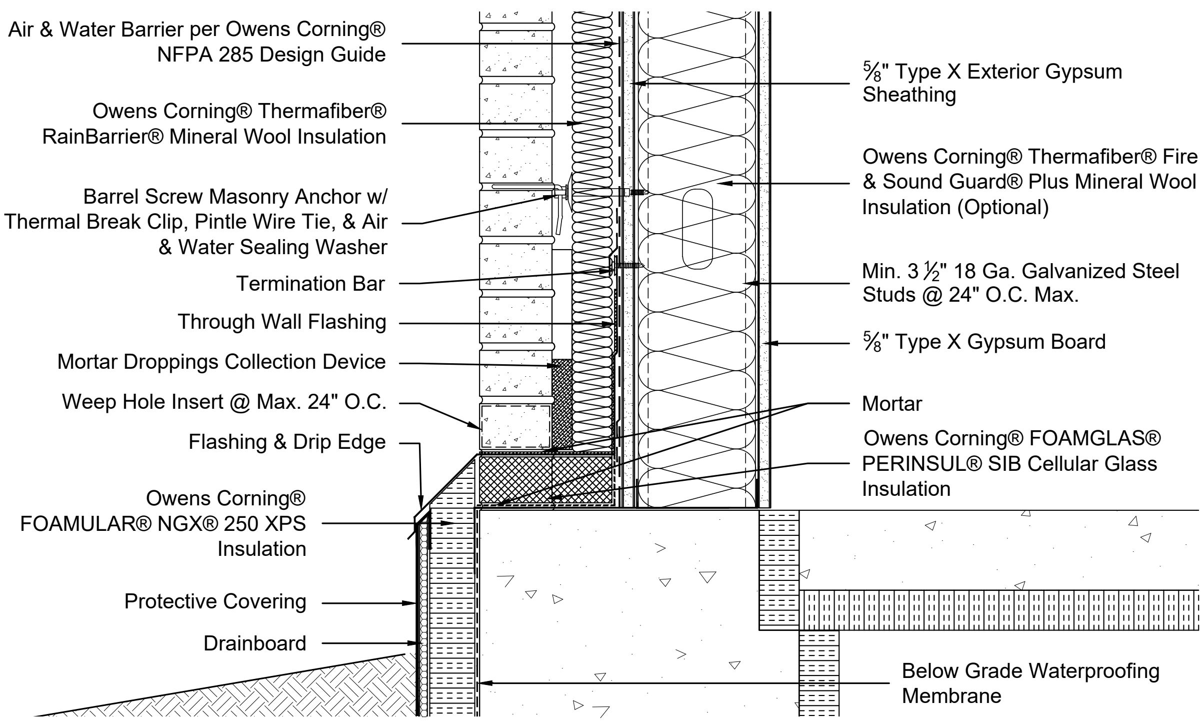
ES-SS-112

Steel Stud Wall with Mineral Wool Continuous Insulation



ES-SS-116

Steel Stud Wall with Mineral Wool Continuous Insulation



Please note that not all assemblies may be shown.
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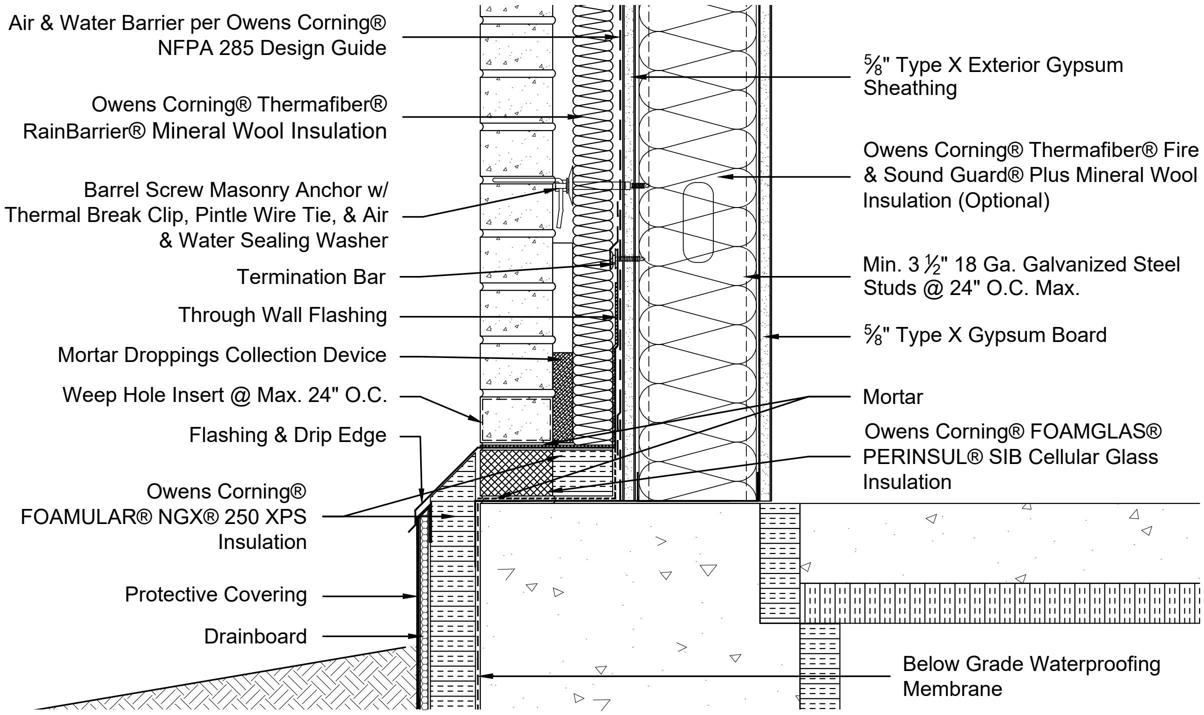
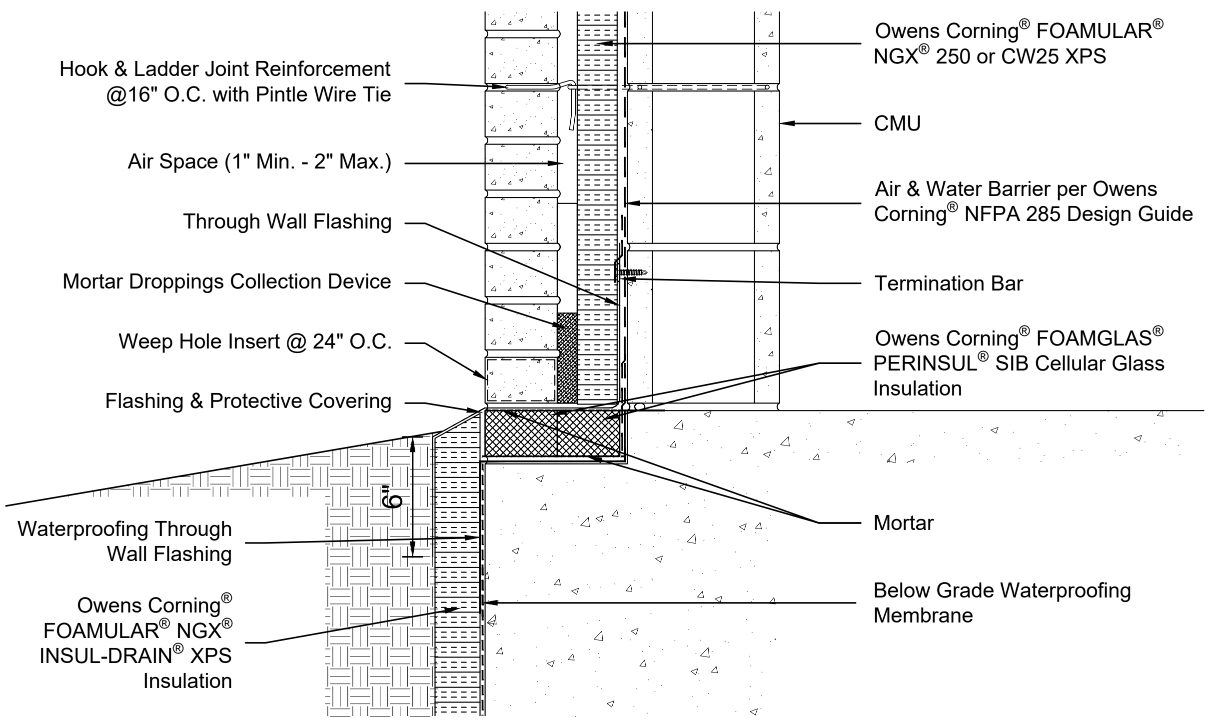
ES-SS-117

Steel Stud Wall with Mineral Wool Continuous Insulation



ES-CM-113

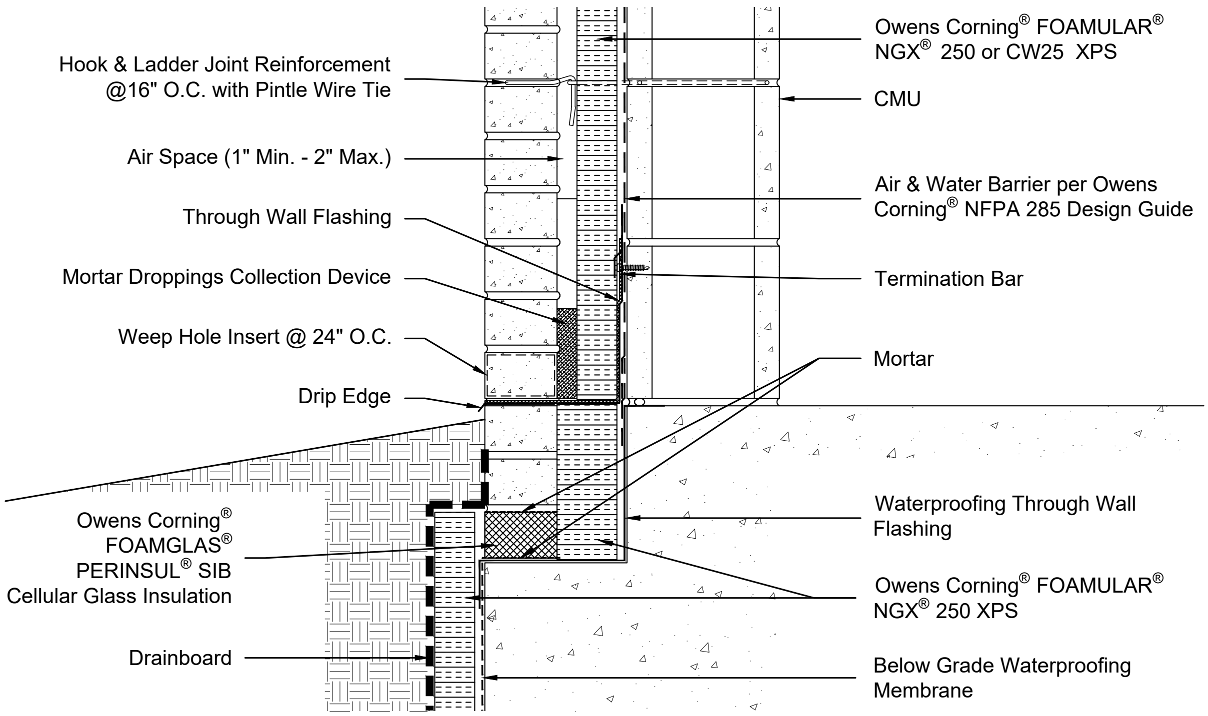
CMU Wall with XPS Continuous Insulation



Please note that not all assemblies may be shown.
Contact GETTECH@OwensCorning.com for more information.

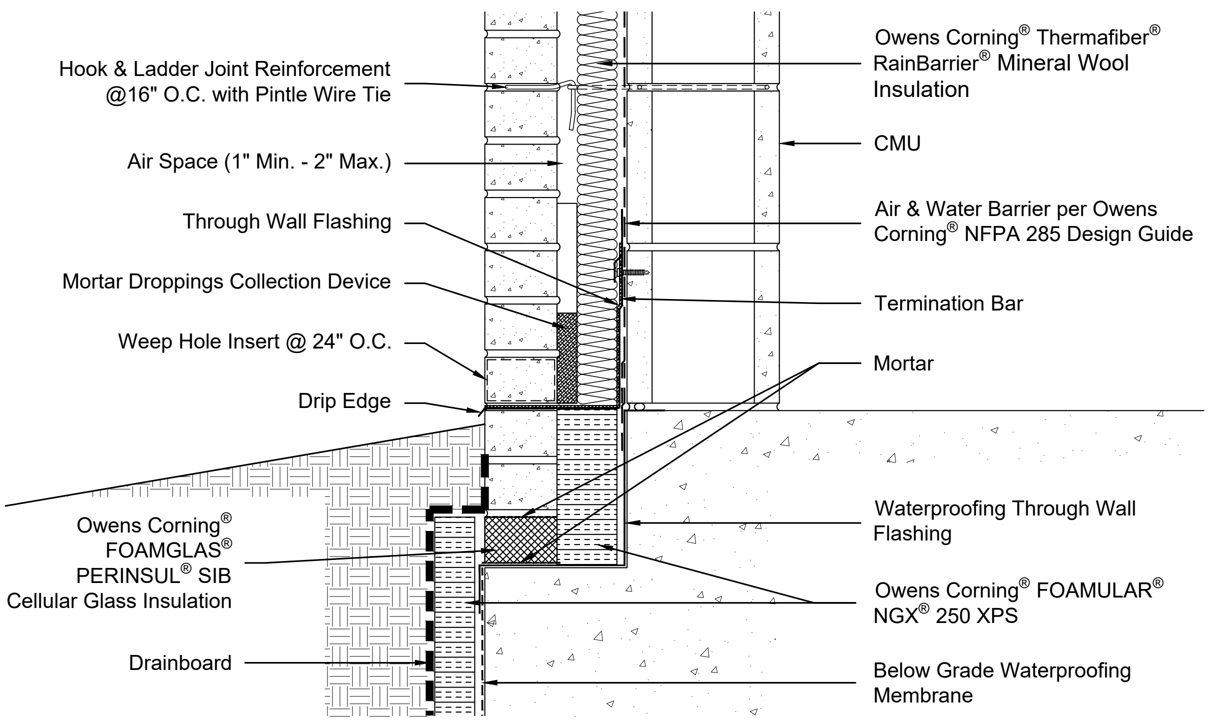
ES-CM-111

CMU Wall with XPS Continuous Insulation



ES-CM-115

CMU Wall with Mineral Wool Continuous Insulation



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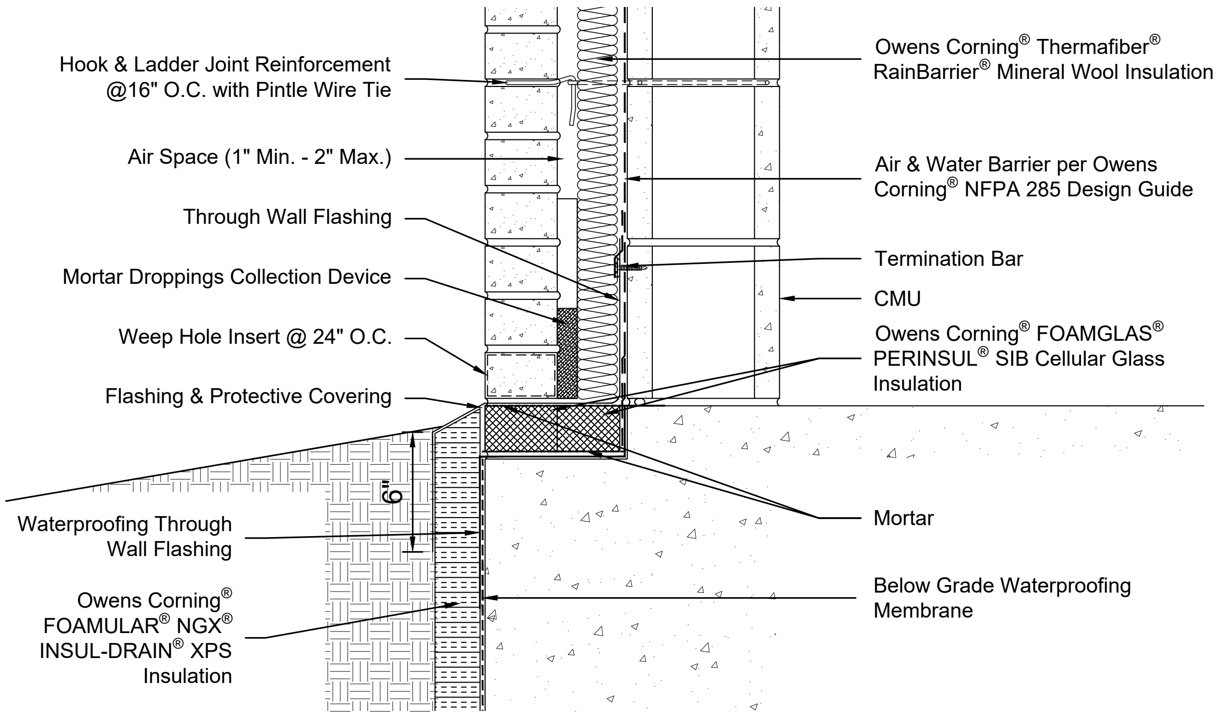
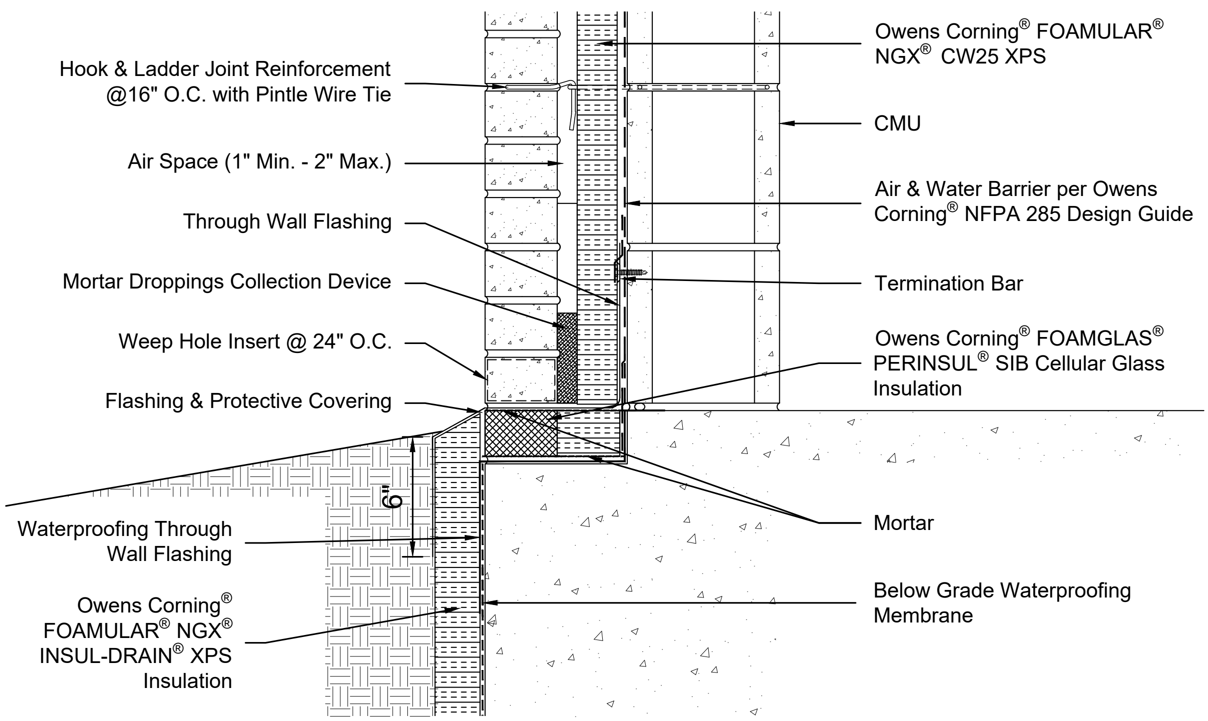
ES-CM-117

CMU Wall with Mineral Wool Continuous Insulation



ES-CM-118

CMU Wall with XPS Continuous Insulation



Please note that not all assemblies may be shown.
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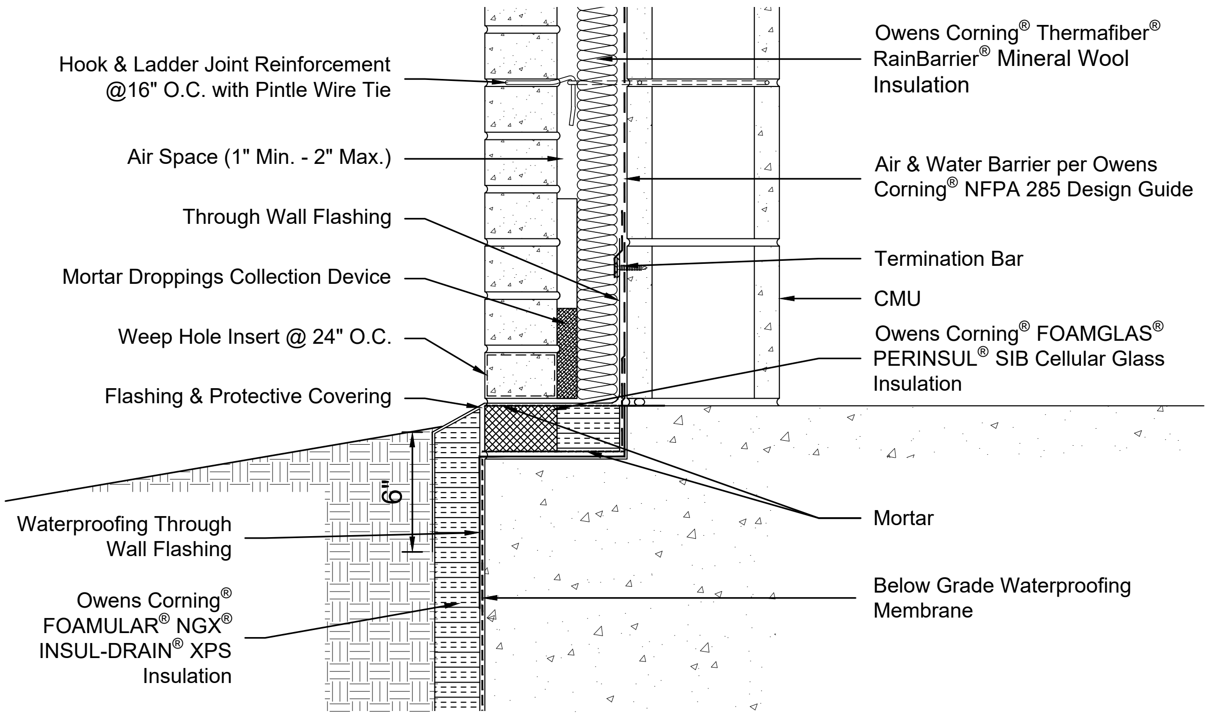
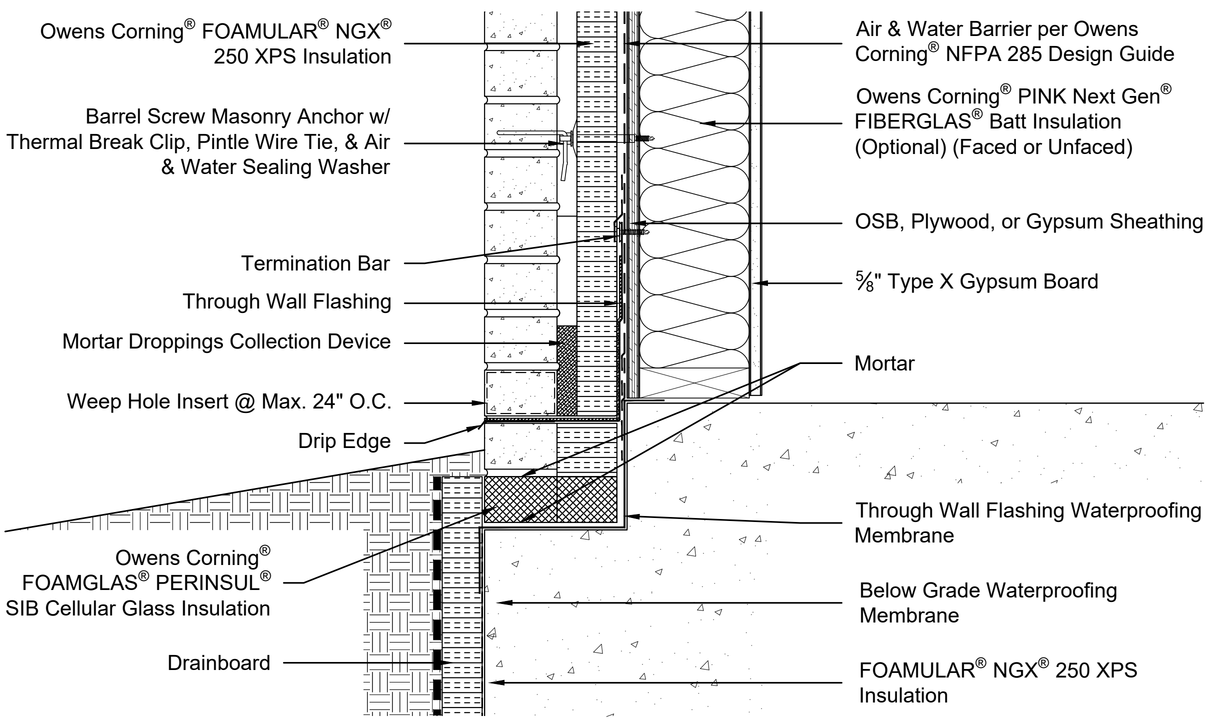
ES-CM-119

CMU Wall with Mineral Wool Continuous Insulation



ES-WS-111

Wood Stud Wall with XPS Continuous Insulation



Please note that not all assemblies may be shown.
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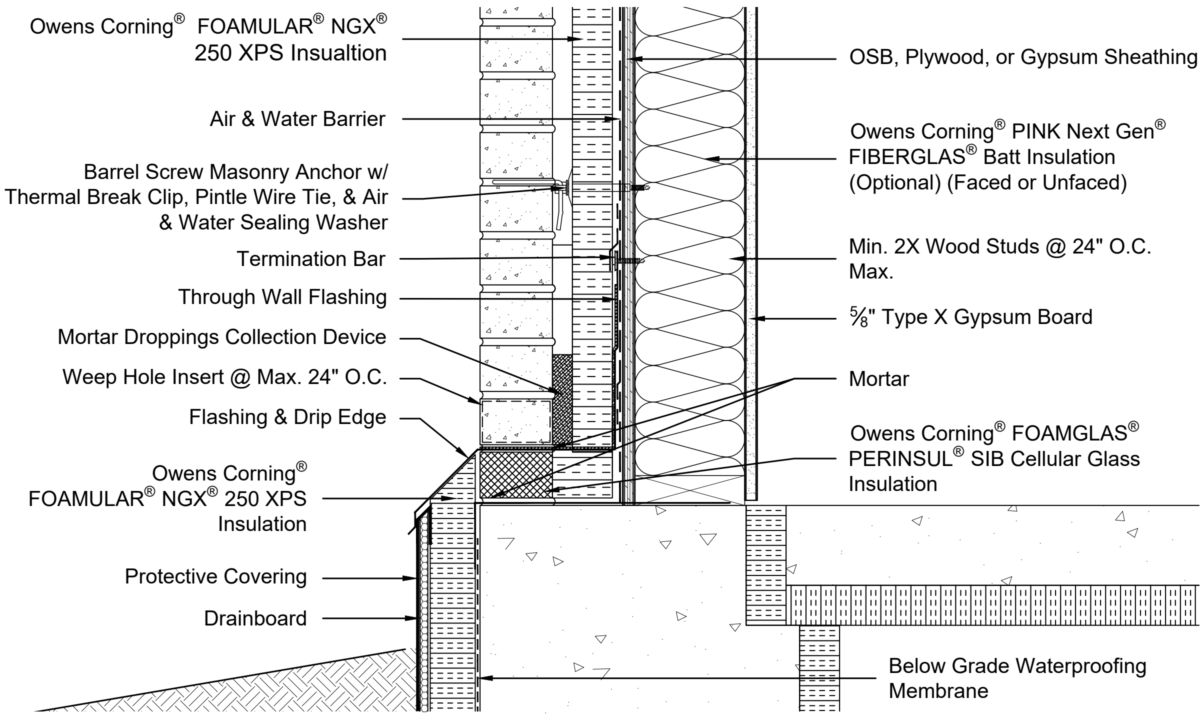
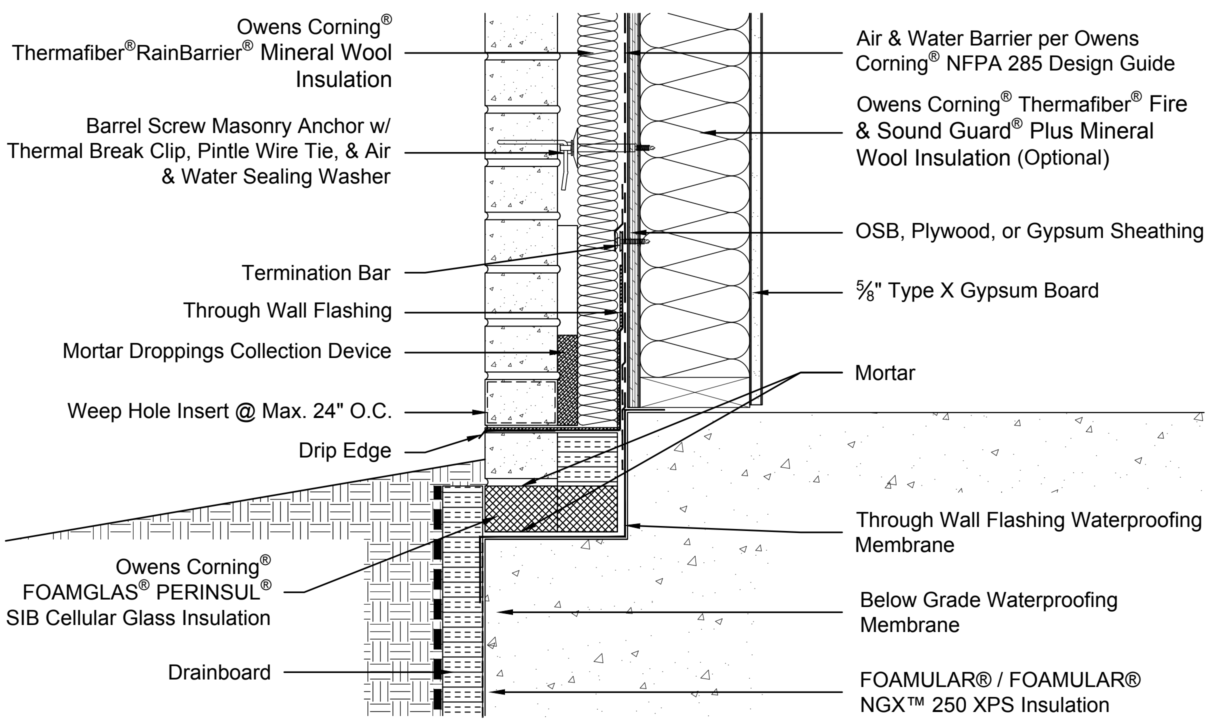
ES-WS-115
Wood Stud Wall with XPS Continuous Insulation



ES-WS-112
Wood Stud Wall with Mineral Wool Continuous Insulation



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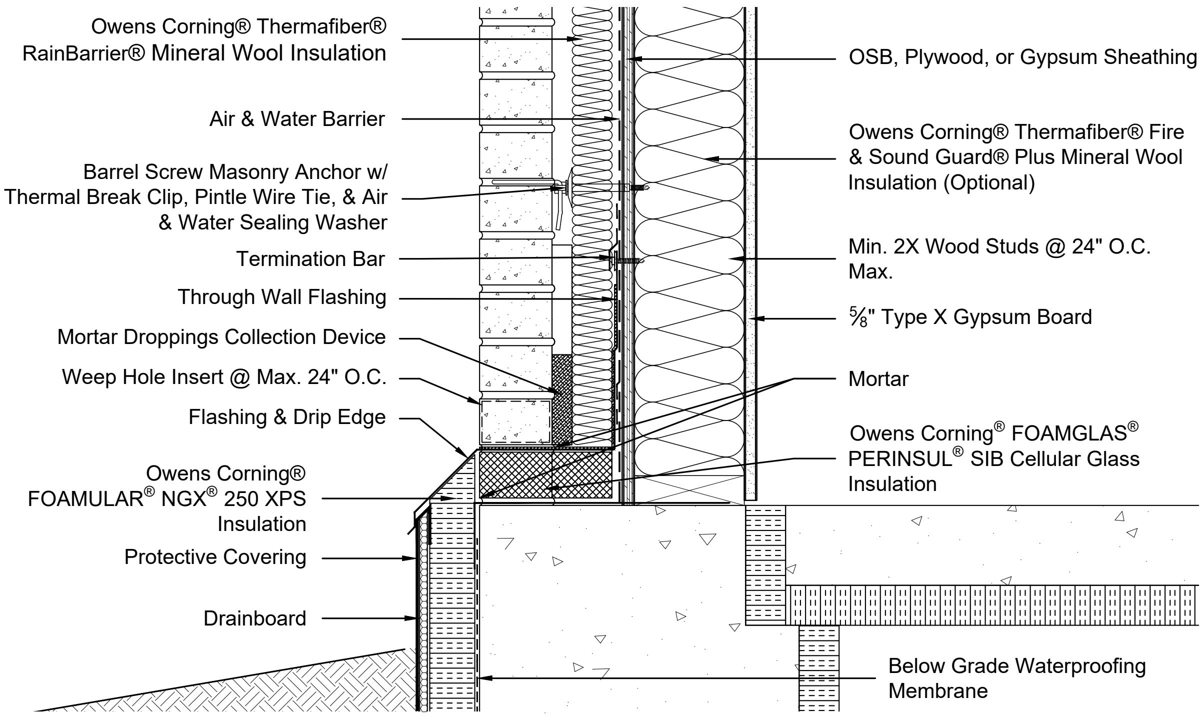
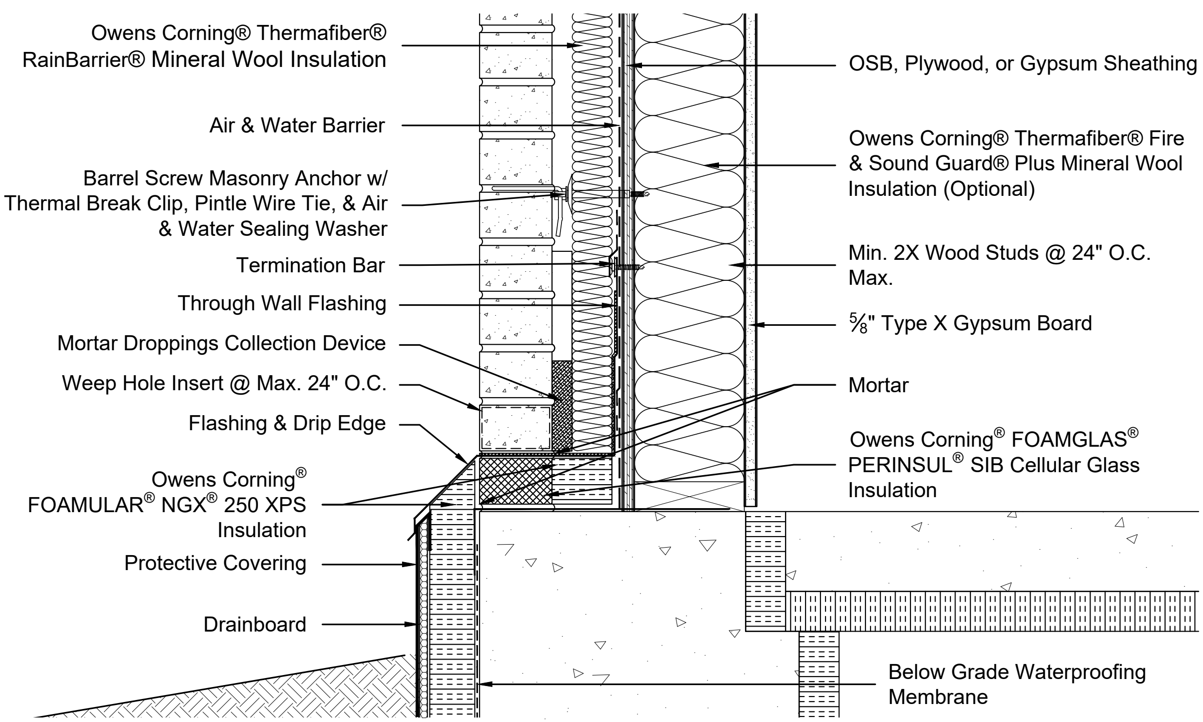
ES-WS-116

Wood Stud Wall with Mineral Wool Continuous Insulation



ES-WS-117

Wood Stud Wall with Mineral Wool Continuous Insulation



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