CHAPTER 6:

CMU WALL WITH ADHERED MASONRY VENEER

Assembly 6 is a **rainscreen design approach** with concrete masonry unit (CMU) structure and thin-set masonry veneer over cement backer board. The components of this assembly, from interior to exterior, are described in Fig. 6-1. This assembly is appropriate for many applications including low- or mid-rise residential or commercial buildings. An example application of this assembly is shown in Fig. 6-2 on page 6-3. Benefits and special considerations for this assembly are discussed in Table 6-1 on page 6-2.

Building Enclosure Control Functions and Critical Barriers

As noted in the Introduction, an above-grade wall assembly should provide control of water, air, heat, vapor, sound, and fire to serve as an effective and durable environmental separator. Control of these elements is provided by critical barriers such as a water-shedding surface (WSS), water-resistive barrier (WRB), air barrier system (AB), thermal envelope, and vapor retarder (VR). Refer to Fig. i-8 on page i-15 of the introductory chapter for a list of primary building enclosure control functions and associated critical barriers.

INTERIOR

- Single-wythe CMU wall
- Air and water-resistive barrier
- Intermittent standoff clip with 1-inch vertical Z-girt
- Exterior insulation
- Cement backer board
- Crack isolation membrane
- Adhesive thinset mortar
- Adhered masonry veneer with grouted joints
- Clear water repellent

EXTERIOR

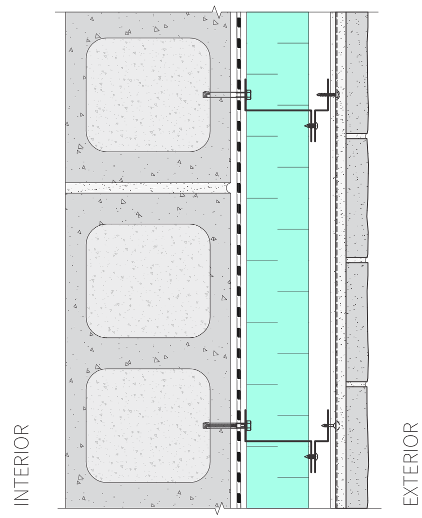


Fig. 6-1 Typical Assembly 6 components from interior to exterior.

Table 6-1 Assembly 6 comparison matrix excerpt from the introductory chapter

Assembly	#6
Assembly Comparison Category	**CMU Wall with Adhered Masonry Veneer**
Recommended Occupancy Type	Residential OR Commercial
Building Enclosure Design Approach and Recommended Exposure	Rainscreen Design Approach, Low- to Mid-Rise Exposure. Consider access for maintenance on high-rise applications.
Long-Term Wall Assembly Durability	Resilient due to exterior insulation and rainscreen drainage cavity
Typical Wall Thickness	CMU structure thicker than wood or steel (Chapters #7 and #8 Assemblies); thinner than anchored wall (Chapter #1 Assembly); continuous insulation increases thickness
Typical Cladding Design Compliance	Cladding system typically engineered. When proprietary cladding attachment systems are used, contact manufacturer.
Typical Thermal Performance	Similar to Chapter #1 Assembly, continuous exterior insulation typically required. Cladding support penetrations through the insulation may need to be considered when determining thermal performance.
Special Construction Considerations	Several cladding components and stages required
Construction Ease with Limited / No Exterior Access (property line applications)	Requires exterior access
Fire Resistivity Considerations	Fire resistivity high. Exterior insulation may affect fire propogation requirements.
Maintenance Considerations	Regular maintenance required. Additional maintenance/review recommended to ensure adhered veneer integrity.
Price Per Square Foot	Low and High Baseline Cost: $49.50 - $60.75

Fig. 6-3 illustrates the critical barrier locations for this assembly. The critical barriers for typical Chapter 6 assembly details are also provided adjacent to each detail at the end of this chapter.

As shown in Fig. 6-3, the WSS critical barrier occurs at the adhered masonry veneer with most watershedding occurring at the wall face, while a minimal amount of water will be stored within the masonry veneer to be released at a later time. The WRB, AB, and VR critical barriers are all depicted at the same location at the exterior face of the CMU wall structure. As a result, a single membrane is used to serve as the WRB and AB (and may serve as the VR); this membrane is commonly referred to in this chapter as the air and water-resistive barrier (AB/WRB). The thermal envelope barrier includes the exterior insulation between the wall structure and masonry veneer.

The following sections provide more information and discuss best practices for the specific critical barriers of this assembly.

Water-Shedding Surface (WSS)

The water-shedding surface is a critical barrier that controls water.

The adhered masonry veneer cladding—including both grouted joints and masonry veneer

Fig. 6-2 Typical Assembly 6 application

units—is the primary WSS of this assembly. Additional components include sheet-metal flashings and drip edges, sealant joints, and fenestration systems as shown on the details included at the end of this assembly chapter.

Critical Barriers

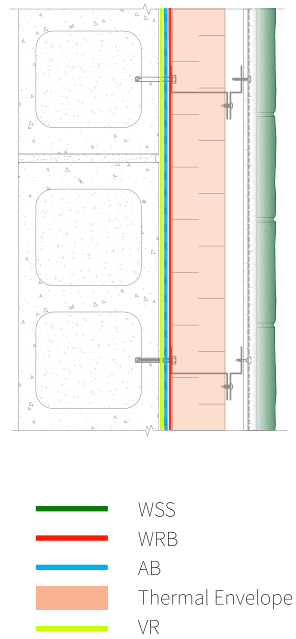


Fig. 6-3 Critical barrier locations for Assembly 6

To promote water shedding at the masonry cladding, grouted joints between veneer units should be appropriately installed with a tooled concave (preferred) or "V" shape.

When finished, the WSS critical barrier should be free of gaps except where providing drainage. Movement joints and joints around fenestrations and penetrations should be continuously sealed with a backer rod and sealant joint or counterflashed with a sheet-metal flashing to deflect wind-driven rain and shed water away from the rainscreen cavity.

Water-Resistive Barrier (WRB)

The water-resistive barrier is a critical barrier that controls water.

In this assembly, the WRB is a sheet-applied or fluid-applied membrane (that also functions as an AB and may function as a VR). Either a fluid-applied or self-adhered sheet-applied membrane is depicted in the details at the end of this chapter. An example of a fluid-applied WRB membrane is shown in Fig. 6-4 on page 6-4. This membrane may be either vapor-permeable or vapor-impermeable product because it is located interior (warm side) of the assembly's thermal envelope. Physical properties such as vapor permeability of WRB products are discussed in

Fig. 6-4 Fluid-applied AB/WRB field membrane installed over CMU wall substrate

detail in the introductory chapter.

The WRB layer must be continuous across the wall face to serve as an effective critical barrier. In addition to the field membrane, the WRB layer of this assembly also includes fluid-applied or flexible flashing membranes, sealants, sheet-metal flashings, and interfaces with fenestration systems (e.g., windows and doors) as shown in the detail drawings that follow this chapter discussion. Where sheet-metal flashing components occur, the back leg of the sheet-metal flashing is lapped into the fluid-applied membrane to encourage water at the WRB layer to drain toward the building exterior.

Cladding support clip fasteners in this assembly will penetrate the AB/WRB critical barrier and should be detailed based on the WRB manufacturer's installation requirements. Typically, fasteners may be required to be set in a compatible sealant or fluid-applied flashing product or be attached through a self-adhered membrane patch.

Air Barrier (AB)

The AB system is a critical barrier that primarily controls air, heat, and vapor. The AB system also controls water, sounds, and fire.

In this assembly, the AB system critical barrier is the same self-adhered sheet or fluid-applied field membrane that also serves as the WRB critical barrier. The components described in the above Water-Resistive Barrier (WRB) section are also part of the AB layer, except sheet-metal flashings.

Thermal Envelope

The thermal envelope is a critical barrier that controls heat and assists with controlling vapor, sound, and fire.

In this wall assembly, the exterior insulation provides the thermal envelope. At transition details, the thermal envelope includes exterior insulation across bond beams, peripheral floor lines, and roof assembly insulation as well as slab and foundation insulation. Windows and doors that penetrate this wall are also part of the thermal envelope.

Exterior insulation provides the following benefits:

1. It allows for exterior insulation across floor lines (which are typically required to meet similar energy code compliance values as this wall assembly).
2. It keeps the structure warm (which reduces the risk that condensation may form interior face of the WRB).
3. It protects the AB/WRB from both extreme temperature fluctuations and damage during veneer installation.

The CMU (or concrete) in this assembly is also a thermal mass; thus, may provide thermal mass benefits as discussed in the introductory chapter.

Additional thermal envelope discussion is provided in the Thermal Performance and Energy Code Compliance section of this chapter and the introductory chapter.

Insulation Selection

Where exterior insulation is provided, semi-rigid mineral fiberboard insulation or moisture-tolerant rigid board insulation products (e.g., polyisocyanurate or XPS) may be used. Refer to the introductory chapter for a

Although masonry is defined as a noncombustible cladding material, a combustible air and water-resistive barrier or foam plastic insulation within a wall cavity can trigger fire propagation considerations and requirements. Depending on the local jurisdiction, IBC Section 1403.5 regarding vertical and lateral flame propagation as it relates to a combustible water-resistive barrier may require acceptance criteria for NFPA 285. The use of foam plastic insulation within a wall cavity should also be addressed for IBC Chapter 26 provisions.

discussion on various insulation types and considerations.

Vapor Retarder (VR)

The VR critical barrier is a layer that retards or greatly reduces (e.g., vapor barrier) the flow of water vapor due to vapor pressure differences across enclosure assemblies. Unlike the other critical barriers presented in this guide, the VR is not always necessary or required to be continuous.

For this assembly, a VR is not necessary. The risk of condensation development or damage to the structure due to outward vapor drive and condensation is unlikely due to all of the assembly's insulation being located exterior of the wall structure and the AB/WRB.

Note that Fig. 6-3 identifies the VR at the exterior face of the CMU. This represents the exterior-most plane of the CMU wall structure, which has some vapor resistance. It would also represent the location of a VR if an impermeable AB/WRB membrane is used.

Thermal Performance and Energy Code Compliance

This chapter assembly is typically classified as a "mass" above-grade wall for energy code compliance purposes. Prescriptive energy code compliance values for this assembly are summarized in Table 6-2 on page 10and describe:

- Minimum insulation R-values for a **prescriptive R-value compliance strategy.**
- Maximum assembly U-factors for a **prescriptive U-factor alternative compliance strategy.** Note, the equivalent assembly effective R-value of this maximum U-factor has been calculated and is denoted in parenthesis ( ) for easy comparison to thermal modeling results included within this chapter.
- Footnote (2) for compliance by **exception**. The ability to use this option depends on the jurisdiction, building's occupancy type, and availability of CMU cores to be filled with insulation. If this exception is to be used, refer to the Chapter 4 Thermal Performance and Energy Code Compliance section.

When a **non-prescriptive compliance option** (e.g., a trade-off strategy or whole-building modeling strategy) is used for energy code compliance, this assembly's effective thermal performance will need to be calculated; however, it may or may not be required to meet the prescriptive values shown in Table 6-2.

Fig. i-17 on page i-29 of the introductory chapter describes the typical process of navigating energy code compliance strategies and options. Thermal modeling results demonstrated within this chapter may be used to assist with estimating insulation thickness and cladding support clip type/material to achieve a target thermal performance value. Options for thermally optimizing this assembly, as determined through the modeling results are also provided.

Project-specific thermal performance values for the opaque above-grade wall assembly of this chapter should be used for energy code compliance and should be determined from a source that is approved by the local governing jurisdiction. Sources may include the Appendices of the WSEC and SEC, ASHRAE 90.1, COMcheck, thermal modeling, or other industry resources.

Assembly Effective Thermal Performance

Claddings support clips, such as intermittent Z-girts or fiberglass clips as shown in Fig. 6-5, penetrate the exterior insulation in this assembly and create areas of thermal bridging (i.e., heat loss). An example of thermal bridging is described by Fig. 6-6 and Fig. 6-7 on page 6-8, which show the relative thermal gradient of this assembly when thermally modeled with an intermittent Z-girt. The lighter blue thermal gradient color at the attachment describes a warmer temperature than the adjacent darker blue insulation face—an indicator of heat loss at the penetration through the insulation. This thermal bridging reduces the assembly's effective thermal performance.

To demonstrate the this assembly's effective thermal performance with various insulation thicknesses, insulation R-values, and cladding support clips/materials, three dimensional thermal modeling was performed. A discussion on the modeling performed for this guide is included in the Introduction Chapter and the Appendix.

Thermal Modeling: Variables

The following are modeling variables specific to this assembly—CMU wall with adhered masonry veneer:

- **Wall Structure:** An 8-inch medium-weight block
- **Cladding Supports Clips and Fasteners:** Two example cladding support systems are

Fig. 6-5 Cladding support clip options modeled include intermittent Z-girt (top) and fiberglass standoff clip (bottom)

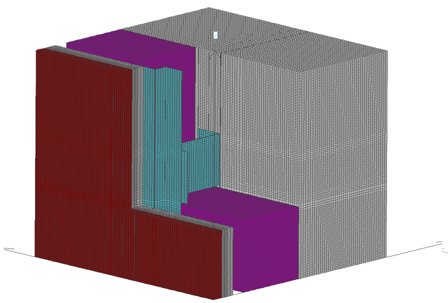


Fig. 6-6 Three-dimensional section of an intermittent Z-girt through exterior insulation

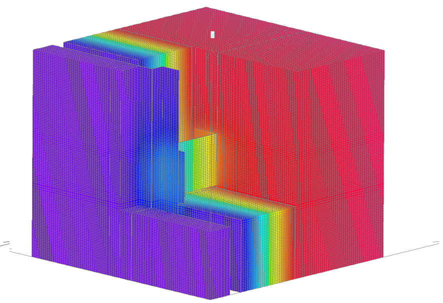


Fig. 6-7 Three-dimensional thermal image of an intermittent Z-girt through exterior insulation

considered and are shown in Fig. 6-5:

- Intermittent Z-girts (16-gauge) made of either stainless steel or galvanized steel. Clips are 6 inches tall and spaced at 24 inches on-center vertically, 16 inches on-center horizontally.
- Fiberglass standoff clips spaced at 24 inches on-center vertically and 16 inches on-center horizontally. Both stainless steel and galvanized steel fasteners are considered for the fiberglass clip option.

- **Exterior Insulation:** R-4.2/inch or R-6/inch insulation product in thicknesses of 3, 4, and 5 inches. The R-values selected demonstrate the lower and upper thermal resistance of typical exterior insulation products.

Thermal Modeling: Results

The results of this modeling are shown in Table 6-3, Fig. 6-8, and Fig. 6-9 (see page 6-10 and page 6-11)and demonstrate the assembly effective R-value under various conditions; Fig. 6-8, and Fig. 6-9 are graphical representations of the results summarized in Table 6-3. Discussion of these results is provided below and key points for thermally optimizing this assembly are ***italicized in boldface.***

- Based on the modeling results shown in Table 6-3 and when compared to the Exterior Insulation (Without Penetrations), fiberglass clips reduce the assembly's effective R-value by 11 to 32%, while intermittent Z-girts provide a 21 to 53% reduction. Table 6-3 also shows that greater effective R-values are provided with fiberglass clips than with intermittent Z-girts in most cases. ***This assembly has a greater effective R-value when fiberglass clips or other low-conductivity clip supports are used in lieu of intermittent Z-girts. A number of systems are commercially available and new products continue to be developed. Most manufacturers of proprietary clip systems will have thermal modeling results available for use in determining the assembly's thermal performance for energy code compliance.***

- Greater assembly effective R-values occur when comparing the same insulation thickness for different fiberglass clip fastener types as shown in Table 6-3, Fig. 6-8, and Fig. 6-9. This guide's modeling exercise demonstrate sthe assembly effective R-value with Exterior Insulation (Without Penetrations) is reduced by 11 to 19% for stainless steel fasteners and by 20 to 32% for galvanized steel fasteners. ***Stainless steel fasteners through fiberglass clips perform better than galvanized steel fasteners.***

- As determined from Table 6-3, intermittent stainless steel Z-girts reduce the assembly's effective R-value for Exterior Insulation (Without Penetrations) by 21 to 32%. Galvanized steel intermittent Z-girts reduce it by 35 to 53%. ***Greater assembly effective R-values are achieved with stainless steel intermittent Z-girts as opposed to galvanized steel Z-girts.***

- Assembly effective R-values are similar for both fiberglass clips with galvanized steel fasteners or stainless steel intermittent Z-girts as shown in Table 6-3, Fig. 6-8, and Fig. 6-9. ***This demonstrates that some performance targets can be met without proprietary cladding attachment systems. This consideration may prove to be a cost-effective solution.***

Drainage, Ventilation, and Water Deflection

The adhered veneer cladding is expected to shed most water it is exposed to; however, some moisture is expected to penetrate the cladding and enter the rainscreen cavity. This moisture is drained through the cavity created by the continuous Z-girts that support the cladding and through the drainable, semi-rigid insulation.

Drainage and Ventilation

The rainscreen cavity is created by 1-inch minimum continuous Z-girts typically spaced at 16 inches on-center. These Z-girts should be broken at horizontal joints where movement joints occur or where cross-cavity sheet-metal flashings occur; typically at every floor line for structures 3 stories or taller.

Table 6-2 Assembly 6 prescriptive energy code compliance values excerpted from Table i-1 of the introductory chapter

OPAQUE ABOVE-GRADE WALL - THERMAL ENVELOPE REQUIREMENTS												
		Energy Code	2012 SEC		2012 WSEC		2014 OEESC		2012 IECC			
		Climate Zone	5 and Marine 4		5, 6 and Marine 4		5 and Marine 4		5 and Marine 4		6	
Guide Assembly #		Classification	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R	All Other	Group R
6	CMU Wall with Adhered Masonry Veneer	Mass	Exterior: R-16ci[1]	Exterior: R-16ci[1]	R-9.5ci[2]	R-13.3ci[2]	R-11.4ci	R-13.3ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci
			U-0.057 (R-17.5)	*U-0.057 (R-17.5)*	*U-0.104 [2] (R-9.6)*	*U-0.078 (R-12.8)*	*U-0.150 [2] (R-6.7)*	*U-0.090 [2] (R-11.1)*	*U-0.078 (R-12.8)*	*U-0.078 (R-12.8)*	*U-0.078 (R-12.8)*	*U-0.071 (R-14.1)*

[1] When using interior insulation: R-13 + R-6 ci for wood studs or R-13 + R-10 ci for metal stud

[2] Provided at least 50% of block cores are filled with vermiculite (or equivalent fill insulation), and enclosing one of the following uses: gymnasium, auditorium, church chapel, arena, kennel manufacturing plant, indoor swimming pool, pump station, water and waste water treatment facility, storage facility, restroom/concessions, mechanical/electric structures, storage area, warehouse (storage and retail), and motor vehicle service facility. In Washington, where additional uses not listed (such as office, retail, etc.) are contained within the building, the exterior walls that enclose these areas may not utilize this exception.

Table 6-3 Assembly 6 thermal modeling results

Exterior Insulation Thickness	CMU Walls with Adhered Masonry over Exterior Insulation, R-4.2/in - R-6/in Exterior Insulation			
		3D Thermal Modeling Effective R-Value (ft²·°F·hr/Btu)		
	Nominal Exterior Insulation R-Value	Exterior Insulation (Without Penetrations)	Fiberglass Clips (0.8% Area)	
			Stainless Fasteners	Galvanized Fasteners
3"	12.6–18	15.8–21.2	14.0–17.9	12.7–15.7
4"	16.8–24	20.1–27.4	17.6–22.6	15.7–19.4
5"	21–30	24.2–33.3	20.9–26.9	18.4–22.8
			Intermittent 6" Z-Girts (0.09% Area)	
			Stainless Girt	Galvanized Girt
3"	12.6–18	15.8–21.2	12.5–15.3	10.2–11.7
4"	16.8–24	20.1–27.4	15.5–19.1	12.0–13.8
5"	21–30	24.2–33.3	18.4–22.7	13.7–15.7

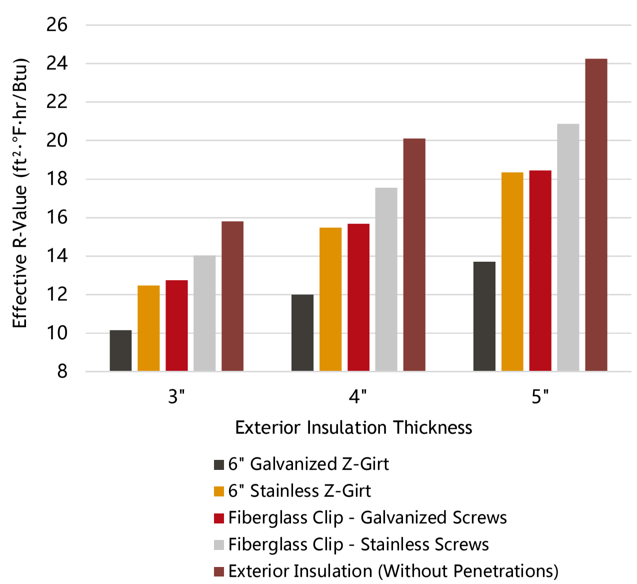


Fig. 6-8 Assembly 6 effective R-value modeling results for R-4.2/inch insulation and various types of cladding support clips

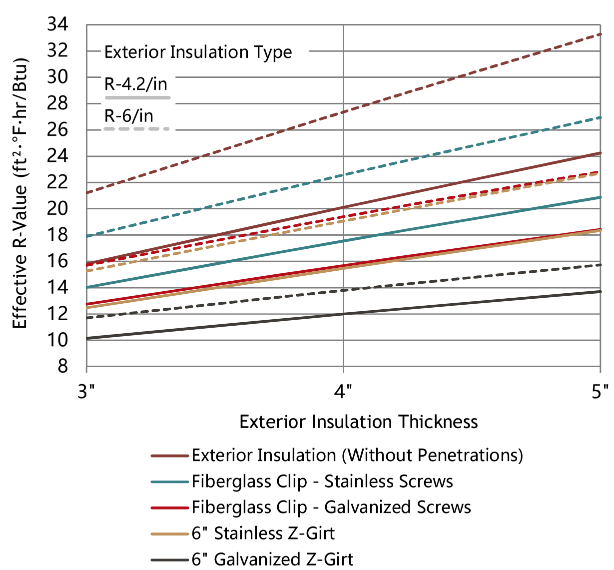


Fig. 6-9 Assembly 6 effective R-value comparison of various cladding support clips and a range of insulation R-values per inch

The rainscreen cavity should be open at the top and bottom to encourage ventilation and should be protected with an insect screen. This can be achieved by wrapping the insulation and base of the Z-girt. Insect screen should be placed at all locations where the rainscreen cavity is open to the exterior (e.g., base of walls, window head flashings, parapets, and cross-cavity flashings at floor lines).

Sheet-Metal Components

Sheet-metal components for this assembly are reflected throughout the details located at the end of this chapter. Cross-cavity sheet-metal components are located at the head of a penetration (e.g., a window head) and at cross-cavity floor line locations similar to that shown in Fig. 6-10. These flashings assist with draining the rainscreen cavity. Counterflashing sheet-metal components assist with watershed and are located at window sill and parapet cap to protect the cavity from water ingress while still allowing for cavity ventilation.

Sheet-metal flashing components that bridge the exterior insulation degrade the thermal performance of the assembly; however, they are a necessary element for the rainscreen design approach.

Refer to the introductory chapter for general recommendations on sheet-metal flashing products, including design considerations and materials.

Movement Joints

In this assembly, the thin masonry units are bonded to a crack isolation membrane over cement backer board. If using clay masonry units, they will expand over time, whereas manufacturer concrete veneer products and grout joints between units will shrink. Movement of the thin masonry veneer is accommodated within the grout, cement backer board, and crack isolation membrane.

Fig. 6-10 Cross-cavity sheet-metal flashing shown below cement backer board

The cement backer board and cladding support intermittent Z-girts and Z-furring will experience some movement along with the CMU backup structure which is expected to shrink over time due to initial drying, temperature fluctuations, and carbonation. As a result, both horizontal and vertical movement joints are needed to accommodate differential movement between the structure, cladding support system, and veneer.

Horizontal gaps within the veneer and cladding support system are recommended at every floor line for buildings taller than three stories. These gaps are typical and provided at cross-cavity sheet-metal flashing locations and should be continuous across all elevations of the building. Gaps above and below penetrations (such as windows) and below structure projections (such as parapet blocking) should also be provided. Locations where this gap should occur are indicated with an asterisk (*****) in the details at the end of this chapter. At each horizontal gap, place either a backer rod and sealant joint or a cross-cavity sheet-metal flashing. The sizing and location of vertical movement joints will vary depending on the expected differential movement between the wall and veneer. It is the Designer of Record's responsibility to appropriately locate and size each joint. In general, a minimum gap dimension of 3/8 inch should be provided.

Vertical joint recommendations vary throughout the industry and should be confirmed with the veneer unit manufacturer for the project-specific application. This guide recommends that vertical movement joints be located throughout the veneer system and that horizontal-to-vertical placement relationships are also considered. Refer to the Joint Location section of the introductory chapter for more information on locating joints. For vertical joints, provide a minimum gap dimension of 3/8 of an inch.

Structural Considerations

Adhered masonry veneers rely on adhesion to secure the masonry units and should be designed to comply with local building codes and ACI 530.

The code requires that adhered veneers be applied over concrete or masonry backings and, traditionally, adhered masonry was applied directly over these wall types. However, recent code cycles requiring exterior insulation have dictated that adhered veneers over a CMU wall include some insulation at the exterior face of the backup wall and WRB plane.

Adhesion between adhered veneer units and the backer board must have a minimum shear strength at of at least 50 psi in accordance with ASTM C482. The units should be adhered in a thin-set mortar adhesive application to form a continuous bed free of voids. It is best practice to adhere veneer units with a modified mortar adhesive over a crack isolation membrane and water-resistive cement backer board.

When exterior insulation is required, the thin masonry assembly is supported by an intermittent cladding support clips and continuous vertical Z-girts such as those shown in Fig. 6-11. The spacing of the supports and the sizing of the girts will need to be designed by the Designer of Record to resist building loads and limit out-of-plane deflection of the wall to less than L/360. Limiting this deflection will reduce the likelihood of flexural cracking. Minimizing the cladding support spacing may be considered to limit out-of-plane deflection but should be considered for impact on the effective thermal performance of the assembly. As shown in Fig. 6-12, smaller cladding support clip spacing is necessary to resist greater wind loads. As clip spacing is reduced, the effective thermal performance of the assembly is also reduced. Using lower conductivity structural supports can reduce the effect that cladding support clips have.

Corrosion Resistance

To avoid premature cladding replacement, the durability and longevity of metal components within this assembly should match that expected of the masonry veneer cladding system. Metal components within this assembly include intermittent Z-girts (when constructed of metal), continuous Z-furring, sheet-metal flashings, and fasteners such as screws and anchors. Where available, metal components should be manufactured of Type 304 or 316 stainless steel, which is nonstaining, resistant to the alkaline content of mortar materials, and tolerant of the high humidity conditions that can exist within a rainscreen cavity. Where stainless steel components may not be available, minimum G185 hot-dipped galvanized steel products should be considered.

Whereas the use of stainless steel sheet-metal flashing components is not always economically feasible or aesthetically desirable, prefinishing sheet metal may be considered. Where used, the base sheet metal should receive a minimum G90 hot- dipped galvanized coating in conformance with ASTM A653 or minimum AZ50 galvalume coating in conformance

Fig. 6-11 Hot-dipped galvanized steel Z-girts attached to fiberglass cladding support clips

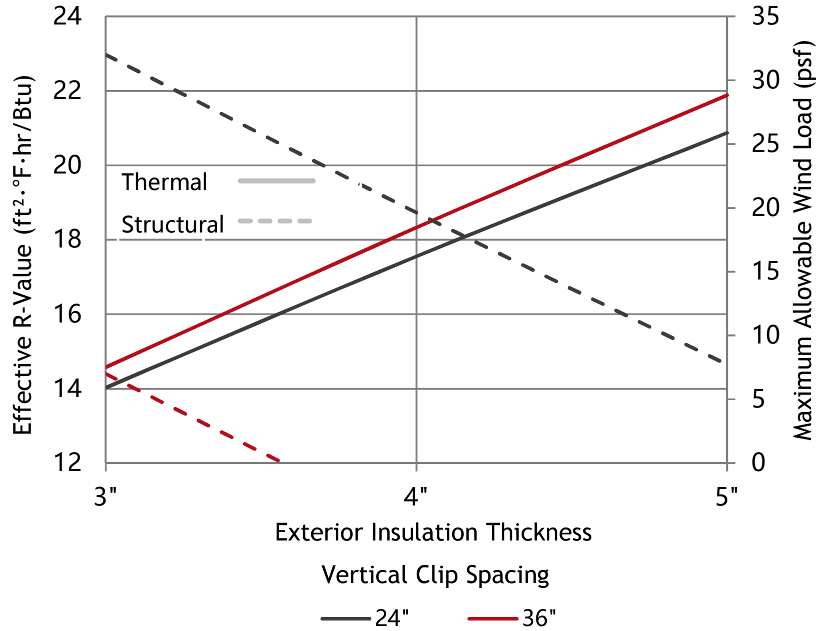


Fig. 6-12 Assembly effective R-value as it compares to maximum-allowable wind loads for various fiberglass cladding support clip spacing. These results assume fiberglass cladding support clips with two stainless steel screws spaced at 3 inches vertically and attached into a CMU substrate. The clips resist vertical gravity loads equally and receive horizontal loads based on their tributary areas. The design is generally limited by the pull-out resistance of the upper screw through the clip, which is under tension from the weight of the cladding and from horizontal wind suction pressures. The allowable screw loads are based on testing data and are specific to the type of screw modeled. The allowable wind pressure should always be compared to the specified wind pressure acting on the cladding, as determined by the local building code in the applicable jurisdiction. These structural values provide a schematic relationship between thermal and structural performance and are not intended to be used as structural design values. In the structural design graphs, the cladding weight was set at 20 psf for all assemblies. The horizontal clip spacing remained at 16 inches on-center. The vertical spacing options are 24 and 36 inches and the exterior insulation thickness ranges from 1 to 5 inches.

with ASTM A792. The exposed top finish of the sheet metal should be coated with an architectural grade coating conforming to AAMA 2605.

Cement Backer Board

Cement backer board used within this assembly should be exterior-grade water-, mold-, and mildew-resistant, which meets ASTM C1325 Type A (exterior applications) or ANSI 118.9. The cement backer board should be attached to the continuous vertical Z-girts as required by the backer board manufacturer and project-specific design loads. The attachment method used should be appropriate for the Z-furring and intermittent cladding support design.

Joints of the cement board should be staggered and treated with a mesh tape bed in the veneer bonding material. Cement backer board product should be installed in conformance with the manufacturer installation instructions and set to provide a maximum 1/4-inch per 10 feet of tolerance. The cement backer board should not span joints within the veneer that are expected to accommodate movement.

Crack Isolation Membrane

A crack isolation membrane, like that shown in Fig. 6-13, is a flexible fluid-applied membrane used in thin masonry veneer applications where the veneer is adhered to a cement backer board. The crack isolation membrane is applied following installation of the cement backer board and treatment of the board joints. This membrane assists with:

- Reducing veneer cracking. The thin veneer adheres to the membrane, which allows the cement backer board to move independently of the veneer.
- Reducing fastener corrosion risk. The membrane protects cement board fasteners from moisture held within the veneer and bond coat.
- Reducing cement board exposure to moisture. The membrane reduces the moisture exchanged between the cement board and veneer bond coat and can increase the longevity of the board.
- Reducing efflorescence. The membrane reduces the moisture exchanged between the cement board and veneer bond coat and may result in reduced efflorescence.

Traditionally, this membrane may have been installed to protect the primary structure from moisture exposure. However, in this rainscreen assembly, the crack isolation membrane is not a replacement for the AB/WRB membrane, which is

Fig. 6-13 Crack isolation membrane application over cement backer board. Cement board corners and fastener locations are treated prior to membrane application. A trowel-applied membrane is shown; membranes may also be fluid-applied.

located on the exterior face of the CMU wall.

It is best practice to use a crack isolation membrane over cement backer board in thin masonry veneer applications. Some manufacturers may require this membrane to achieve a warrantable cladding installation.

Masonry Veneer

There are several types of adhered masonry veneer products that may be used with this assembly. Those most typical within the Northwest include thin veneer brick units made of clay or shale or manufacturer stone masonry veneer units.

Thin veneer brick used for this assembly should comply with ASTM C1088 and should be exterior-grade. Manufacturer stone masonry veneer units should comply with ASTM C1670.

For thin-set applications over cement board, as shown in this assembly, modified mortars at-minimum should conform to ANSI A118.4.

Appropriate product selection of masonry veneer unit and mortar materials is necessary to provide a durable and water-resistive cladding system. The veneer units and mortar bed and joints should also be installed in conformance with industry standard best practices and manufacturer requirements and should comply with ASTM C1780. The specifics of architectural characteristics and structural properties of the veneer system, including mortar and cladding support systems, should be designed and reviewed by a qualified Designer of Record.

Various industry resources are available to assist with veneer design and are listed in the Resources section.

Clear Water Repellents

A clear water repellent should be applied to the adhered masonry veneer of this assembly. Refer to the introductory chapter for more information on selecting an appropriate clear water repellent and best practice installation guidelines.

Pricing Analysis

A pricing analysis for this assembly is provided in Table 6-4 on page 6-19. Pricing demonstrates the relative price per square foot and is based on a 10,000-square-foot wall area with easy drive-up access. Pricing includes all components outboard of the CMU wall structure and provides no evaluation for interior finishes or CMU wall structure.

Pricing is valued for the 2015–2016 calendar year. Current pricing is also available at www.masonrysystemsguide.com.

Online Availability

The content of this guide and additional resources may be accessed online at www.masonrysystemsguide.com. Also available online are downloadable digital versions of two- and three-dimensional assembly details and cutaway sections as well as sample project specifications. Ongoing updates to references and resources included within this guide can also be accessed.

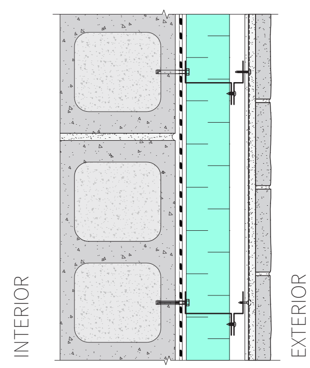
Table 6-4 Assembly 6 CMU wall with adhered masonry veneer pricing analysis

Assembly 6: CMU Wall with Adhered Masonry Veneer					
	Assembly Component	Baseline Product	Alternate (call for estimate)	Baseline Cost/ft^2 (incl. labor) Low	High
INTERIOR					
1	Structural concrete wall	No evaluation of these components provided.			
2*	Air and water-resistant barrier	Fully adhered sheet-applied membrane	Fluid-applied membrane system	$1.50	$2.00
3*	Exterior insulation	Rigid XPS board insulation; 2-inch thickness	No specified alternate	$1.75	$2.25
4*	Intermittent standoff clip with 1-inch Z-girt	6-inch-tall clips at 24" o.c. vertical; clips and girts G185 hot-dipped galvanized; self-tapping fasteners	Stainless clips or thermally improved proprietary cladding support system	$3.00	$9.00
5*	Cement backer board	Moisture-resistant 5/8"-thick, taped & fastened	No specified alternate	$2.50	$4.00
6*	Adhered masonry or stone veneer with grouted joints, includes polymer modified thin-set	Modular (3/4" x 2-1/4" x 7-5/8") extruded TBX; running bond; 3/8-inch mortar joints	Altnerate veneer products	$39.00	$41.00
7*	Clear water repellent	Silane/siloxane blend	Antigraffiti clear water repellent	$1.75	$2.50
EXTERIOR					
Total cost to install 10,000 sq ft wall area w/easy drive-up access -->				$49.50	$60.75

Pricing Analysis Discussion

- Low and high baseline costs are based on baseline products. Call for an estimate for alternate product pricing.
- Baseline costs provided will vary based on product-specific conditions and should be used as an estimate only.
- Veneer unit prices is for typical units as noted. Pricing will vary based on size, color, and finish and should be confirmed with the unit manufacturer.
- *See the Resource section of this guide for product recommendation.

Assembly Plan View

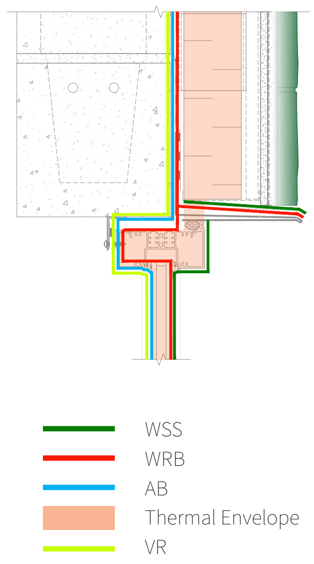


LEGEND

1. Typical Assembly:
   - Single-wythe CMU wall
   - Fluid-applied or self-adhered sheet AB/WRB
   - Exterior insulation
   - Intermittent cladding support clip with 1-inch vertical Z-girt
   - Cement backer board
   - Crack isolation membrane
   - Adhesive thinset mortar
   - Adhered masonry veneer with grouted joints
   - Clear water repellent
2. Fluid-applied or self-adhered sheet AB/WRB head prestrip membrane
3. Sheet-metal head flashing with 1/2-inch hemmed drip edge and end dams beyond
4. Insect screen
5. Sealant over backer rod
6. Continuous back dam angle at rough opening perimeter, minimum 1 inch tall, with window fastened through back dam angle per window manufacturer recommendations
7. Continuous AB sealant, tide to continue seal at window perimeter
8. Storefront window

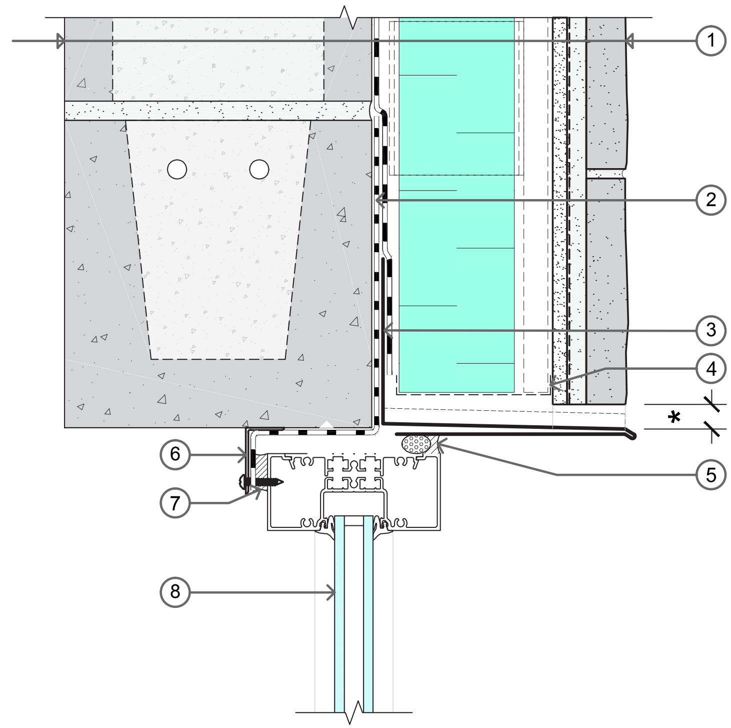
* Size joint for project-specific building movement, minimum 3/8-inch.

Critical Barriers



Detail Discussion

- AB and WRB continuity is provided by the fluid-applied or self-adhered sheet AB/WRB field membrane, AB/WRB head prestrip membrane, and AB sealant transition to the storefront.
- The hemmed drip edge of the sheet-metal head flashing sheds water away from the masonry veneer above before it reaches the window and sill.
- The insect screen extends from the face of the CMU to the face of the vertical Z-girt to protect the cavity from insects while still allowing for ventilation and drainage.



Storefront Window Head

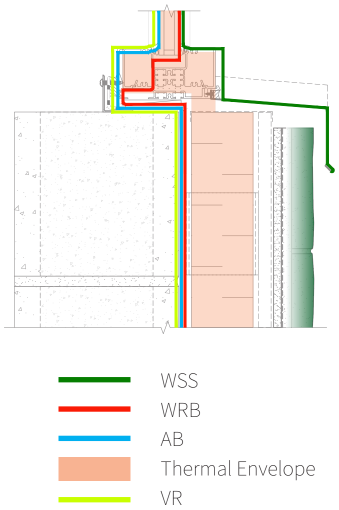
Detail 6-A

LEGEND

1. Typical Assembly:
   - Single-wythe CMU wall
   - Fluid-applied or self-adhered sheet AB/WRB
   - Exterior insulation
   - Intermittent cladding support clip with 1-inch vertical Z-girt
   - Cement backer board
   - Crack isolation membrane
   - Adhesive thinset mortar
   - Adhered masonry veneer with grouted joints
   - Clear water repellent
2. Storefront window on minimum 1/4-inch intermittent shims
3. Sealant over bond breaker
4. Insect screen
5. Sheet-metal sill flashing with 1/2-inch hemmed drip edge and end dams beyond
6. Fluid-applied AB/WRB sill membrane (or flexible self-adhered flashing membrane)
7. Continuous AB sealant, tied to continuous seal at window perimeter
8. Continuous back dam angle, minimum 1 inch tall, with window fastened through back dam angle per window manufacturer recommendations.

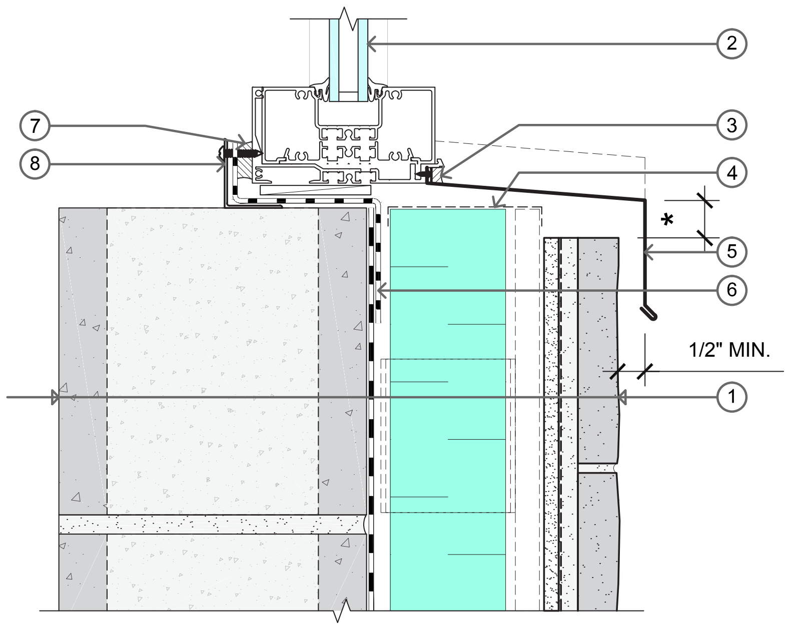
* Size joint for project-specific building movement, minimum 3/8-inch wide.

Critical Barriers



Detail Discussion

- AB and WRB continuity is provided by the fluid-applied or self-adhered sheet AB/WRB field membrane, fluid-applied or flexible self-adhered AB/WRB sill flashing membrane, and AB sealant transition to the storefront.
- The sheet-metal sill flashing conceals the rainscreen cavity and protects the cavity insulation from UV exposure. Terminate the sill flashing with end dams at each jamb; counterflash each end dam with the sheet-metal jamb trim to close off the rainscreen cavity and complete the WSS.
- The sheet-metal sill flashing sheds water from the window above and protects the rainscreen cavity. The hemmed drip of the sheet-metal flashing projects away from the cladding to promote watershed away from the masonry veneer face.



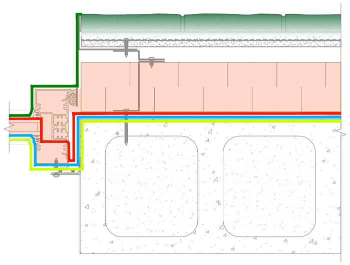
Storefront Window Sill

Detail 6-B

LEGEND

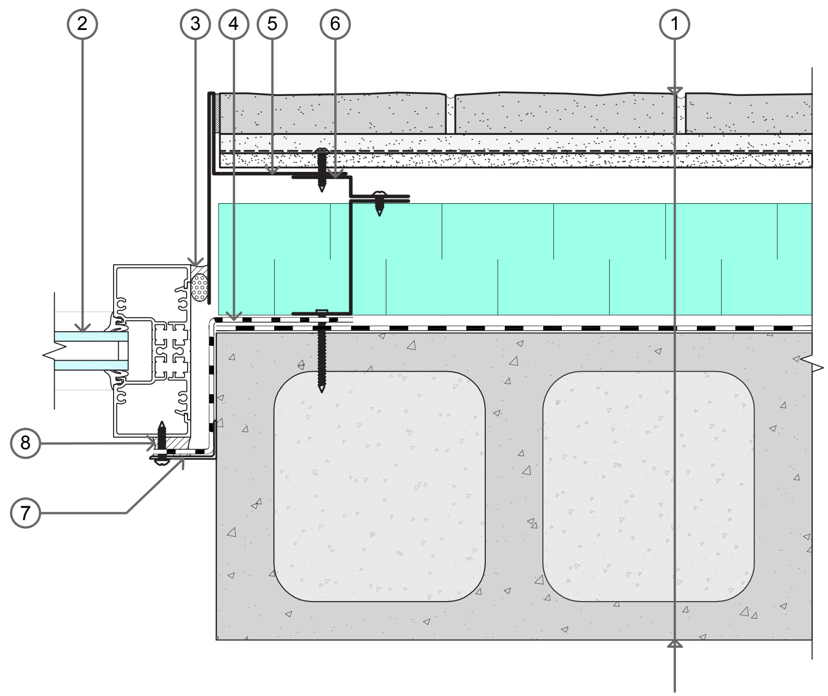
1. Typical Assembly:
   - Single-wythe CMU wall
   - Fluid-applied or self-adhered sheet AB/WRB
   - Exterior insulation
   - Intermittent cladding support clip with 1-inch vertical Z-girt
   - Cement backer board
   - Crack isolation membrane
   - Adhesive thinset mortar
   - Adhered masonry veneer with grouted joints
   - Clear water repellent
2. Storefront window
3. Sealant over backer rod
4. Fluid-applied or self-adhered sheet AB/WRB jamb prestrip membrane
5. Sheet-metal jamb trim bed in sealant at masonry veneer and counterflashed over sill flashing end dams below. Attach trim to nearest vertical Z-girt as shown.
6. Intermittent cladding support clip with 1-inch vertical Z-girt
7. Continuous back dam angle at rough opening perimeter, minimum 1 inch tall, with window fastened through back dam angle per window manufacturer recommendations.
8. Continuous AB sealant, tie to continuous seal at window perimeter

Critical Barriers



Detail Discussion

- AB and WRB continuity is provided by the fluid-applied or self-adhered sheet AB/WRB membrane, AB/WRB jamb prestrip membrane, and AB sealant transition to the storefront.
- Where needed, the exterior insulation should be supported with intermittent fasteners such as mechanically attached impaling pins. Consult with the AB/WRB manufacturer for requirements on detailing these pin attachments through the plane of the AB/WRB field membrane.



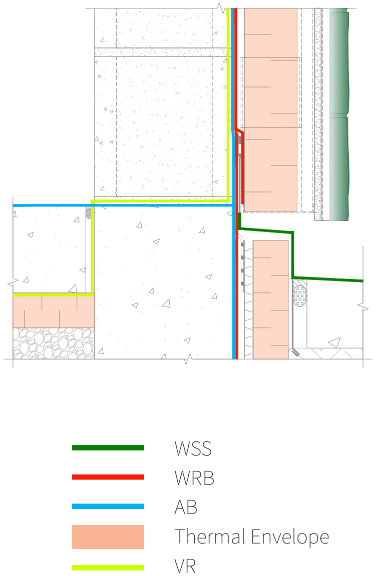
Storefront Window Jamb

Detail 6-C

LEGEND

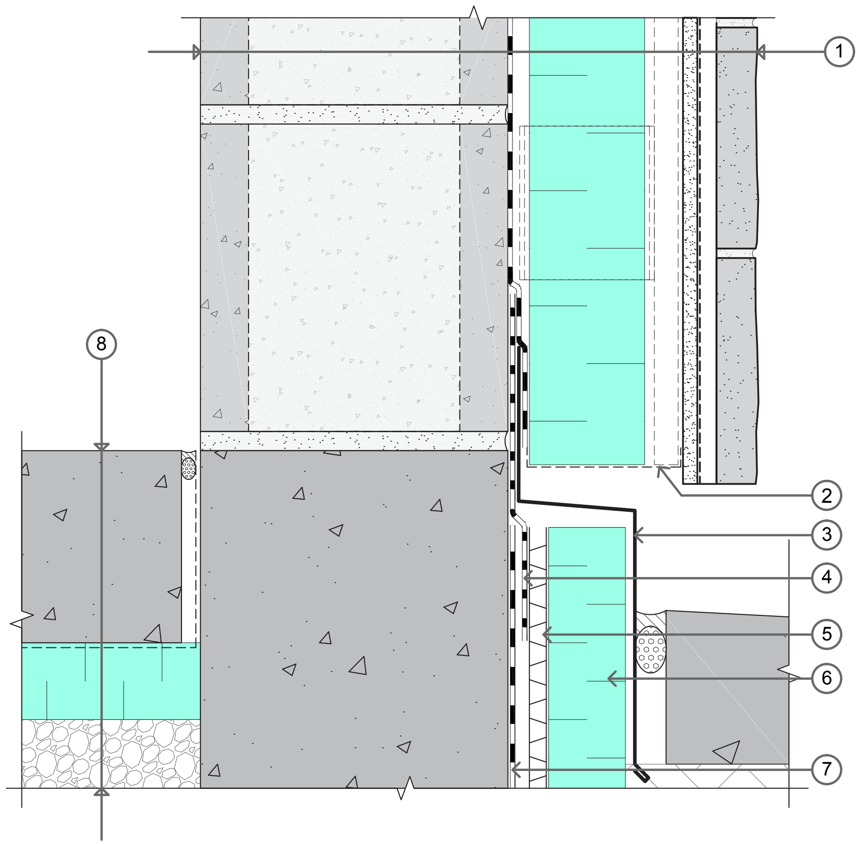
1. Typical Assembly:
   - Single-wythe CMU wall
   - Fluid-applied or self-adhered sheet AB/WRB
   - Exterior insulation
   - Intermittent cladding support clip with 1-inch vertical Z-girt
   - Cement backer board
   - Crack isolation membrane
   - Adhesive thinset mortar
   - Adhered masonry veneer with grouted joints
   - Clear water repellent
2. Insect screen
3. Sheet-metal flashing with 1/2-inch hemmed drip edge
4. Fluid-applied AB/WRB flashing membrane or flexible self-adhered flashing membrane
5. Drainage composite (optional)
6. Rigid XPS foundation insulation
7. Damp-proofing
8. Typical Assembly:
   - Concrete floor slab
   - Vapor barrier
   - Rigid XPS insulation
   - Capillary break

Critical Barriers



Detail Discussion

- The sheet-metal flashing protects the rigid XPS foundation insulation and damp-proofing from UV exposure.
- Insulating below the slab and exterior of the foundation wall is an alternative approach to the thermal break shown in Chapter 1, Detail 1-D.



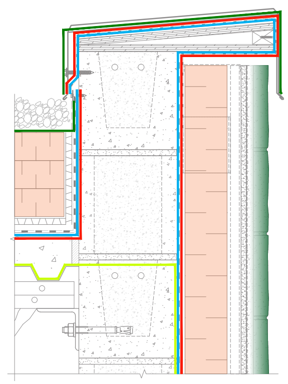
Typical Foundation

Detail 6-D

LEGEND

1. Typical Assembly:
   - Single-wythe CMU wall
   - Fluid-applied or self-adhered sheet AB/WRB
   - Exterior insulation
   - Intermittent cladding support clip with 1-inch vertical z-girt
   - Cement backer board
   - Crack isolation membrane
   - Adhesive thin-set mortar
   - Adhered masonry veneer with grouted joints
   - Clear water repellent
2. Inverted roof membrane assembly
3. Standing-seam sheet-metal coping with gasketed washer fasteners
4. High-temperature self-adhered membrane
5. Preservative-treated blocking
6. Insect screen

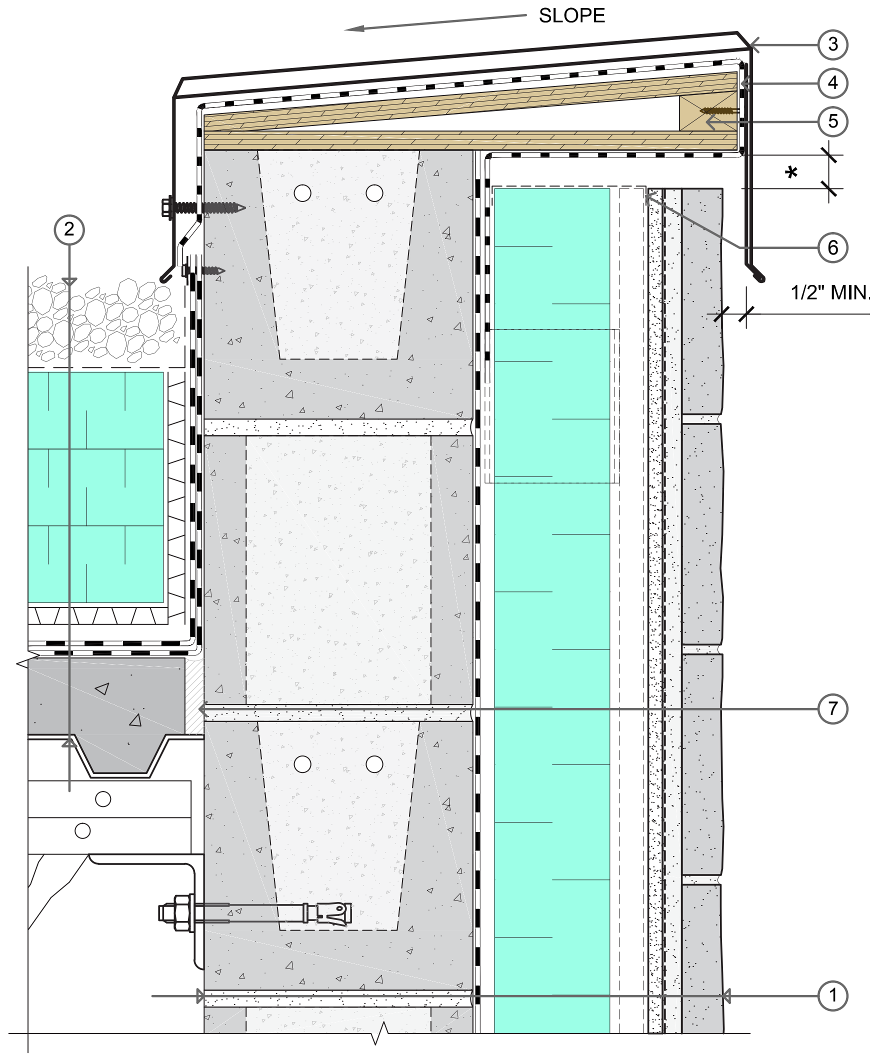
Critical Barriers



- WSS
- WRB
- AB
- Thermal Envelope
- VR

Detail Discussion

- The sheet-metal parapet cap with hemmed drip edge is held off the adhered masonry veneer face to promote ventilation through the rainscreen cavity.
- The fluid-applied or self-adhered sheet AB/WRB field membrane, the high temperature self-adhered membrane at the parapet, and the roof assembly provide the AB and WRB continuity in this detail. The CMU also contributes to airtightness where fully grouted.
- A insect screen around the insulation and vertical Z-girt cavity prevents insects and debris from entering the rainscreen cavity, while still allowing ventilation.



Typical Parapet at Inverted Roof System

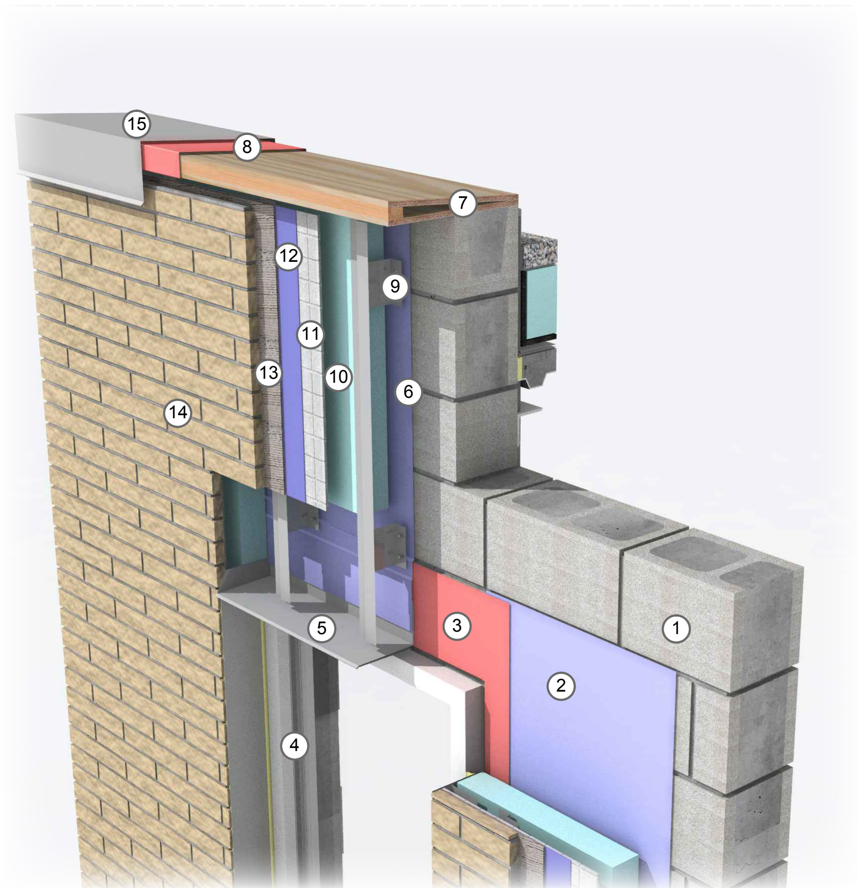
Detail 6-E

LEGEND

1. Single-wythe CMU wall
2. Fluid-applied or self-adhered sheet AB/WRB field membrane
3. Fluid-applied or self-adhered sheet AB/WRB head and jamb prestrip membrane
4. Storefront window
5. Sheet-metal head flashing with 1/2-inch hemmed drip edge and end dams beyond
6. Fluid-applied or self-adhered sheet AB/WRB field membrane
7. Sloped preservative treated blocking
8. High-temperature self-adhered membrane
9. Intermittent cladding attachment support clips with 1-inch Z-girt
10. Exterior insulation
11. Cement backer board
12. Crack isolation membrane
13. Adhesive thinset mortar
14. Adhered masonry veneer with grouted joints
15. Standing-seam sheet-metal coping with gasketed washer fasteners

3-D Detail Discussion

- Three-dimensional cutaway sections on the next three pages represent two-dimensional details of this assembly.
- In all details, WRB and WSS elements are shingle-lapped to encourage water shed in both the rainscreen cavity and at the masonry veneer face.
- As shown in Detail 6-F and Detail 6-G, exterior insulation fits between the intermittent cladding supports clips. When using XPS rigid board insulation, the insulation may require notching around clips. Where needed, the exterior insulation should be supported with intermittent fasteners such as mechanical impaling pins.
- End dams are formed at the ends of the sheet-metal head flashing shown in Detail 6-F to direct water away from the rainscreen cavity and back to the exterior.

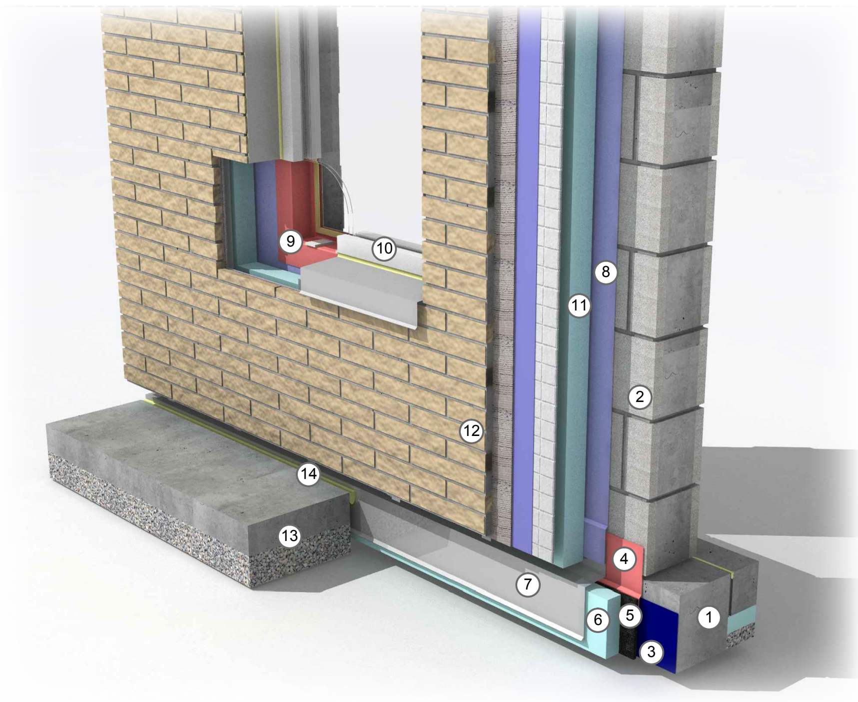


Parapet Assembly Cutaway Section

Detail 6-F

LEGEND

1. Concrete foundation element
2. Single-wythe CMU wall
3. Below-grade damp proofing
4. Fluid-applied AB/WRB flashing membrane or self-adhered flashing membrane
5. Drainage composite (optional)
6. Below-grade rigid XPS insulation
7. Sheet-metal base flashing with 1/2-inch hemmed drip edge for rigidity
8. Fluid-applied or self-adhered sheet AB/WRB field membrane
9. Fluid-applied or self-adhered sheet AB/WRB field membrane
10. Storefront window
11. Exterior insulation
12. Cement backer board, crack isolation membrane, thinset mortar, adhered masonry veneer with grouted joints
13. Hardscape over gravel fill
14. Sealant over backer rod

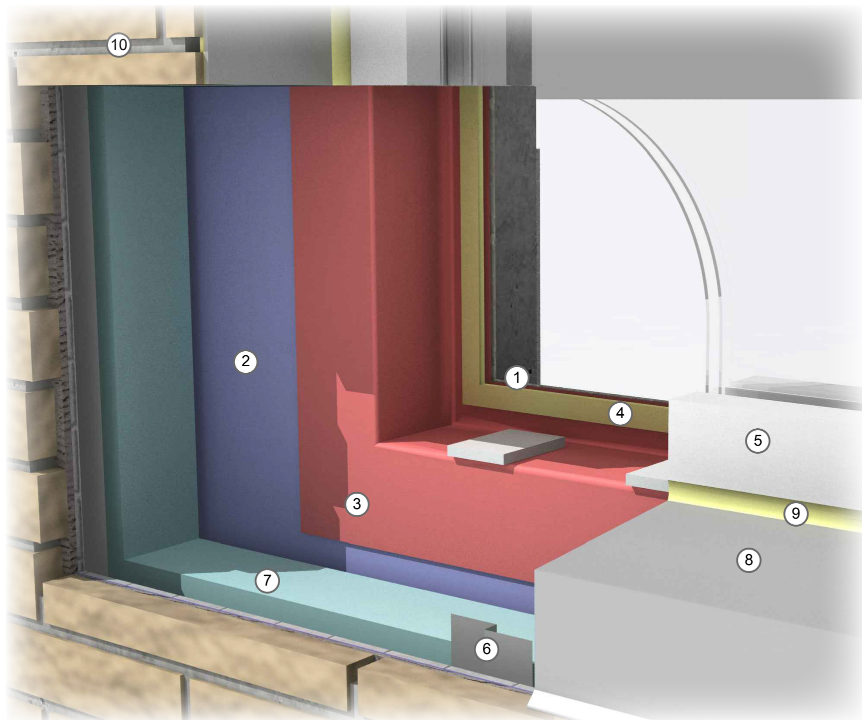


Base of Wall Section Model

Detail 6-G

LEGEND

1. Continuous back dam angle at rough opening perimeter, minimum 1 inch tall, with window fastened through back dam angle per window manufacturer recommendations
2. Fluid-applied or self-adhered sheet AB/WRB field membrane
3. Fluid-applied or flexible self-adhered AB/WRB sill flashing membrane
4. Continuous AB sealant, tied to continuous seal at window perimeter
5. Storefront window
6. Intermittent standoff clip with 1-inch Z-girt
7. Exterior insulation
8. Sheet-metal sill flashing with 1/2-inch hemmed drip edge, end dam into bed joint at jamb veneer beyond
9. Sealant over bond break
10. Cement backer board, crack isolation membrane, thinset mortar, adhered masonry veneer with grouted joints



Window Jamb / Sill Cutaway Section

Detail 6-H