CHAPTER 4:

INTEGRALLY INSULATED CMU WALL

Masonry system 4 is a mass wall system with a single-wythe concrete masonry unit (CMU) wall structure, often comprised of split face block, and integral insulation. The components of this system, from interior to exterior, are described in Fig. 4-1. This system is appropriate for low-rise commercial applications; an example project application is shown in Fig. 4-2 on page 4-2.

Building Enclosure & Control layers

As noted in the Introduction, an above-grade wall system controls liquid water, air, heat, and possibly water vapor to function as an effective and durable environmental separator. Control of these elements, specific to this wall system, is provided by the following control layer systems and/or materials:

- Water control layer, primarily comprising the mass CMU wall
- Air control layer, comprising the air barrier system

INTERIOR

- Single-wythe CMU wall with water-repellent admixture
- Core insulation (or grout, where required)
- Clear water-repellent

EXTERIOR

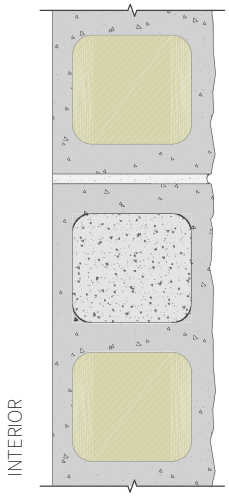


Fig. 4-1 Typical System 4 components from interior to exterior

- Thermal control layer, comprising thermal insulation and other low conductivity materials
- Vapor control layer, comprising vapor retarding materials

For a summary of the relationship between building enclosure loads, control layers, and associated systems and materials, Refer to Fig. i-13 on page i-21 of the introductory chapter.

Fig. 4-3 illustrates the water-shedding surface and control layer locations. The control layers for typical system details are also provided adjacent to each detail at the end of this chapter.

Fig. 4-2 CMU wall with integral insulation example project application

As shown in Fig. 4-3, the water-shedding surface occurs at the CMU wall face. The water control layer occurs at and within the CMU wall structure; the CMU wall structure is also the air control layer under certain provisions as discussed later in this chapter. The thermal control layer consists of the intermittent insulated core. This system has no defined vapor retarder control layer.

Water-Shedding Surface

The water-shedding surface is a system that serves to reduce the water load on the enclosure. A general discussion of the water-shedding surface is provided in the Water-Shedding Surface discussion on page i-19.

The CMU block and mortar provide the water-shedding surface of this system. Additional water-shedding surface components include sheet-metal flashings and drip edges, sealant joints, and fenestration systems as shown on the details included at the end of this chapter.

Water-repellent admixtures are added to the block and mortar of this system and a surface-applied clear water repellent is also recommended. These repellents serve to encourage water shed—along with other measures such as tooled "V" or concave shape (preferred) mortar joints, sufficient sheet-metal parapet cap design, and other general design recommendations as discussed in the Northwest Concrete Masonry Association (NWCMA) TEK Note on Rain-Resistant Architectural Concrete Masonry.[1]

The water-shedding surface is most effective when free of gaps; therefore, movement joints and joints around fenestrations and penetrations should be continuously sealed with a backer rod and sealant.

Water Control Layer

The water control layer is a continuous control layer that is designed and installed to act as the innermost boundary against water intrusion. For this system, the CMU block, mortar, and grout (inclusive of any integral water repellents) provide the water control layer.

The water control layer is made continuous with the help of flashing membranes at parapet tops, fluid-applied flashings at fenestration rough openings, sealant joints, and fenestration systems as shown on the details included at the end of this chapter.

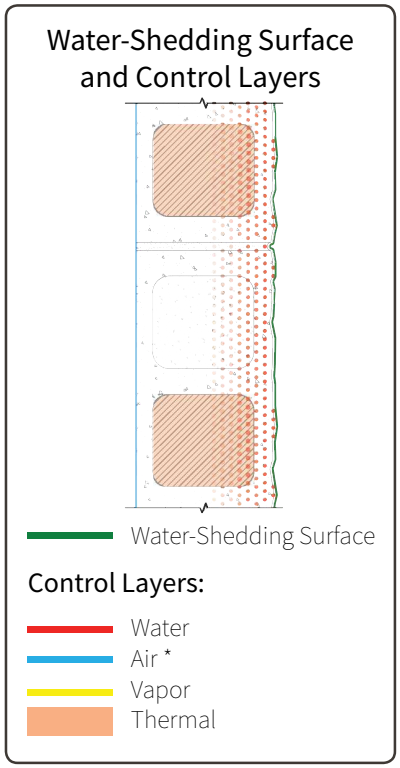


*Fig. 4-3 System 4 water-shedding surface and control layer locations. *when an air barrier material is applied to the interior face of the CMU wall*

To increase the rain penetration resistance of this system, a Class IV vapor permeance fluid-applied WRB system may be applied to the inside face of the system, or an elastomeric coating applied to the exterior CMU wall face may also be considered. The WRB system may be a Class III vapor permeance fluid-applied membrane when carefully considered for the project-specific application. Refer to the Elastomeric Coatings discussion on page i-62 for additional information on elastomeric coatings.

Air Control Layer

The air barrier system provides the air control layer. In addition to controlling air, this layer also assists with controlling liquid water, heat, and water vapor. A general discussion of the air control layer and the air barrier system is provided in the Air Control Layer discussion on page i-26.

The air barrier system for this wall system is typically satisfied through "deemed to comply" options within Section C402.4 of the 2012 International Energy Conservation Code[2] (IECC)and Section 502.4 of the 2014 Oregon Energy Efficiency Specialty Code[3] (OEESC). These deemed to comply options include:

- "Concrete masonry walls coated with one application either of block filler or two applications of paint or sealer coating" as a deemed-to-comply air barrier system provided all joints are sealed."
- "A Portland cement/sand parge, stucco, or plaster minimum ½-inch in thickness" as a deemed-to-comply air barrier system."

The 2015 Washington State Energy Code[4] (WSEC) and 2015 Seattle Energy Code[5] (SEC) do not include deemed-to-comply air barrier materials or systems because the whole building is required to meet air leakage requirements per C402.5. The Code Airtightness Requirements discussion on page i-43 further addresses whole-building air leakage requirements.

Where a fluid-applied WRB system is used at the interior face of this wall system or where an exterior elastomeric coating is applied, these membranes—along with fenestration rough opening membranes—will typically form the air barrier system.

Vapor Control Layer

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

This system has no vapor retarder and utilizes the IBC Section 1405.3[6] vapor retarder exception for "construction where moisture or its freezing will not damage the materials." Note that the partially grouted cells do have some vapor-retarding properties but are not relied upon for control of vapor diffusion.

Thermal Control Layer

The thermal control layer controls heat flow and assists with controlling water vapor.

In this wall system, the core insulation is the primary material that forms the thermal control layer. At transition details, the thermal control layer includes insulation at the roof assembly, slab, and foundation elements. Windows and doors that penetrate this wall are also part of the thermal control layer.

The CMU wall of this system is also a thermal mass; thus, it may provide thermal mass benefits as addressed in the Mass Wall Considerations discussion on page i-42.

Fig. 4-4 Installation of foam-in-place CMU core insulation

Insulation Selection

This wall system uses core insulation to meet thermal performance requirements of the energy code. Insulation may be loose fill such as perlite but is commonly a resinous, foam-in-place insulation product. Foam-in-place insulation is injected through ports in the CMU mortar joints following the construction of the CMU wall and grouting similar to that shown in Fig. 4-4.

Thermal Performance and Energy Code Compliance

This wall system is typically classified as a mass above-grade opaque wall system for energy code compliance purposes. Prescriptive energy code compliance values for a mass wall are summarized in Table 4-2 on page 4-8 and describe:

- The minimum insulation R-values for a *prescriptive insulation R-value method* strategy.
- The maximum system U-factors for a *prescriptive assembly U-factor method* strategy. Note that the equivalent effective R-value of this U-factor has been calculated and is denoted in parenthesis ( ).
- The effective thermal performance of this system is dependent on the properties of the CMU (including density, size, and web configuration) and is also impacted by the grout schedule and core insulation type. System thermal performance values may be determined from the Thermal Catalog of Concrete Masonry Assemblies published by the National Concrete Masonry Association.[7]
- Footnote (2) for compliance by *exception* when insulation and project use requirements are met. The following exception applies to the 2014 OEESC[3] provided the following conditions are met:

"1) At least 50 percent of cores must be filled with vermiculite or equivalent fill insulation; and

2) the structure encloses one of the following uses: gymnasium, auditorium, church chapel, arena, kennel, manufacturing plant, indoor swimming pool, pump station, water and wastewater treatment facility, storage facility, restroom/concessions, mechanical/electrical structures, storage area, warehouse (storage and retail), motor vehicle service facility)."

Similarly, under the 2015 WSEC4 provisions, the following exception applies, provided the following conditions are met:

"1) At least 50 percent of cores must be filled with vermiculite or equivalent fill insulation; and

2) The building thermal envelope encloses one or more of the following uses: Warehouse (storage and retail), gymnasium, auditorium, church chapel, arena, kennel, manufacturing plant, indoor swimming pool, pump station, water and waste water treatment facility, storage facility, storage area, motor vehicle service facility. 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 and must comply with the appropriate mass wall R-value from Table C402.1.3/U-factor from Table C402.1.4."

A grouted area calculation chart is provided in Table 4-1 to assist with determining the area percentages of grouted cores versus ungrouted cores (e.g., cores available for insulation fill).

Project-specific thermal performance values for an opaque above-grade wall should be used for energy code compliance and determined from a source that is approved by the authority having jurisdiction. Thermal performance sources may include the Appendices of the 2015 WSEC,[4] ASHRAE 90.1,[7] COMcheck,[8] thermal modeling and calculation exercises, or other industry resources.

For all energy code compliance strategies except the *prescriptive insulation R-value method strategy*, this wall system's U-factor will need to be calculated or determined from tables; however, it may or may not be required to be less than the prescriptive U-factors in Table 4-2 on page 4-8.

The Thermal Performance and Energy Code Compliance discussion on page i-33 and Fig. i-26 on page i-39 describe the typical process of navigating energy code compliance options.

Table 4-1 Percent ungrouted / grouted area based on grouted cell spacing[21]

Precent Ungrouted Area/Percent Grouted Area				
Horizontal Grout Spacing (Inches)	**Vertical Grout Spacing (Inches)**			
	48	40	32	24
48	69/31	67/33	63/37	56/44
40	67/33	64/36	60/40	53/47
32	63/37	60/40	56/44	50/50
24	56/44	53/47	50/50	-

Movement Joints

CMU is a concrete-based product. It, along with the mortar, will shrink over time due to initial drying, temperature fluctuations, and carbonation. Not only will shrinkage movement need to be considered, but differential movement between the CMU structure and other structural elements due to deflection, settlement, and various design loads will need to be addressed.

Consider crack control within the CMU to increase the rain penetration resistance of this system. Material properties and reinforcing methods of the CMU structural wall should be implemented to reduce cracking; however, control joints within the CMU wall also need to be implemented to provide a plane of weakness to reduce shrinkage stresses and provide continuity of the water-shedding surface at these locations. Control joints in CMU can be constructed in a number of ways. Regardless of the method used, a continuous backer rod and sealant joint is installed at the joint as shown in Fig. 4-5 on page 4-8 to assist with water-shedding and to provide a continuous water control layer.

Refer to the Movement Joints discussion on page i-48 for more information on locating joints and sealant joint best practices.

Structural Considerations

The CMU block wall of this system provides the primary structure of this system. It is the responsibility of the Designer of Record to ensure that all structural elements of the wall are designed to meet project-specific loads and local governing building codes. Generic placement of the grout, reinforced elements, and supports/anchors are demonstrated within the details of this chapter and are provided for diagrammatic purposes only.

Table 4-2 System 4 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
4	Integrally Insulated CMU	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; when using exterior insulation: R-16 ci

[2] Exception: integrally insulated concrete block complying with ASTM C90 with all cores filled, with 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 wastewater treatment facility, storage facility, warehouse (storage and retail), motor vehicle service facility, mechanical/electrical structures (OEESC only), and restroom/concessions (OEESC only). Under the WSEC, 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.

Fig. 4-5 Vertical CMU control joint

CMU Wall

The CMU in this system complies with ASTM C90.[10] Mortar designed for the CMU conforms to ASTM C270[11] or ASTM C1714[12] when specifying preblended mortar. The mortar type selected should be appropriate for the CMU application; Type S is typically specified. Grout components should comply with ASTM C 476[13] while aggregate within the grout should comply with ASTM C 404.[14]

Block and mortar are both specified with a water-repellent admixture as discussed in the Water Repellents discussion within this chapter. Additionally, refer to the Northwest Concrete Masonry Association (www.nwcma.org) for additional information on specifying block, mortar, and grout.

The CMU and mortar joints of this system should be installed in conformance with industry-standard best practices, manufacturer requirements, and guidelines outlined in the NWCMA Tek Note on Rain-Resistant Architectural Concrete Masonry;[1] appropriate product selection and installation of CMU and mortar materials is necessary to provide a durable and water-resistive cladding system.

The specifics of architectural characteristics and structural properties of the block, mortar, grout, and reinforcing should be designed and reviewed by a qualified Designer of Record. Various industry resources are available to assist with CMU wall design and are listed in the Resources section at the back of this guide.

Corrosion Resistance

For sheet-metal flashings that are integrated within this system (including through-wall flashings and sheet-metal drip flashings), it is best practice to provide components that are manufactured of ASTM A666[15] Type 304 or 316 stainless steel, which are nonstaining and resistant to the alkaline content of mortar and grout materials. Where stainless steel sheet-metal flashing components are not economically feasible or aesthetically desirable, prefinishing sheet-metal may be considered. Where used, this guide recommends the base sheet metal is a minimum G90 hot-dipped galvanized coating in conformance with ASTM A653[16] or minimum AZ50 galvalume coating in conformance with ASTM A792.[17] Coating the exposed top finish of the sheet metal with an architectural-grade coating conforming to AAMA 621[18] is recommended.

Water Repellents

Both integral water-repellent admixtures and a surface-applied clear water repellent are used in this system and assist with reducing the water absorption of the CMU wall and encourage water shedding. Water-repellent admixtures should be used in both the CMU and the mortar. Admixture within block units should comply with NCMA TEK 19-7,[19] while mortar admixture should comply with ASTM C1384.[20] More discussion on surface-applied clear water repellents is provided in the Surface-Applied Clear Water Repellents discussion on page i-59.

Both the CMU and mortar admixtures as well as any surface-applied water repellent should have known compatibility performance.

Pricing Summary

A pricing summary for this system is provided on Table 4-3 on page 4-12. 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 is valid for 2018. 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 versions of two- and three-dimensional system details and cutaway sections, sample project specifications, and ongoing updates to references and resources included within this guide.

Chapter References

1. Northwest Concrete Masonry Association. *Tek Note: Rain-Resistant Architectural Concrete Masonry.* (Mill Creek, WA: Northwest Concrete Masonry Association, 2014).

2. International Code Council. *2015 IECC International Energy Conservation Code.* (Country Club Hills, IL: International Code Council, Inc., 2015).

3. 2014 Oregon Energy Efficiency Specialty Code. (Adopted by Oregon Building Codes Division, effective July 1, 2014).

4. 2015 Washington State Energy Code, Commercial Provisions. Chapter 51-11C WAC (filed by Washington State Legislature, January 19, 2016).

5. 2015 Seattle Energy Code, 2015 Washington State Energy Code as Amended by the City of Seattle. (Adopted by Seattle Department of Construction and Inspections, July 1, 2016).

6. International Code Council. *2015 International Building Code.* (Country Club Hills, IL: International Code Council, Inc., 2014).

7. American Society of Heating, Refrigerating, and Air-Conditioning Engineers. A*NSI/ASHRAE/IES Standard 90.1-2016 Energy Standard for Buildings Except Low-Rise Residential Buildings, IP ed.* (Atlanta: ASHRAE, 2016).

8. U.S. Department of Energy. COMcheck (version 4.0.7). Windows or Online. Washington, D.C.: U.S. Department of Energy, 2017, https://www.energycodes.gov/comcheck.

9. National Concrete Masonry Association. *Thermal Catalog of Concrete Masonry Assemblies, 2nd ed.* (Hendon, VA: National Concrete Masonry Association, 2012).

10. ASTM International. *ASTM C90-16a Standard Specification for Loadbearing Concrete Masonry Units.* (West Conshohocken, PA: ASTM International, 2016).

11. ASTM International. *ASTM C270-14a Standard Specification for Mortar for Unit Masonry.* (West Conshohocken, PA: ASTM International, 2014).

12. ASTM International. *ASTM C1714/C1714M-16 Standard Specification for Preblended Dry Mortar Mix for Unit Masonry.* (West Conshohocken, PA: ASTM International, 2016).

13. ASTM International. *ASTM C476-16 Standard Specification for Grout for Masonry.* (West Conshohocken, PA: ASTM International, 2016).

14. ASTM International. *ASTM C404-11 Standard Specification for Aggregates for Masonry Grout.* (West Conshohocken, PA: ASTM International, 2011).

15. ASTM International. *ASTM A666-15 Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.* (West Conshohocken, PA: ASTM International, 2015).

16. ASTM International. *ASTM A653/A653M-15e1 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.* (West Conshohocken, PA: ASTM International, 2015).

17. ASTM International. *ASTM A792/A792M-10(2015) Standard Specification for Steel Sheet, 55% Aluminum-Zinc Allow-Coated by the Hot-Dip Process.* (West Conshohocken, PA: ASTM International, 2015).

18. American Architectural Manufacturers Association. *AAMA 621-02 Voluntary Specification for High-Performance Organic Coatings in Coil-Coated Architectural Hot-Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates.* (Schaumburg, IL: American Architectural Manufacturers Association, 2002).

19. National Concrete Masonry Association. *TEK 19-7 Characteristics of Concrete Masonry Units with Integral Water Repellent.* (Hendon, VA: National Concrete Masonry Association, 2008).

20. ASTM International. *ASTM C1384-12a Standard Specification for Admixtures for Masonry Mortars.* (West Conshohocken, PA: ASTM International, 2012).

21. National Concrete Masonry Association. *TEK 6-2C R-Values and U-Factors of Single Wythe Concrete Masonry Walls.* (Hendon, VA: National Concrete Masonry Association, 2013).

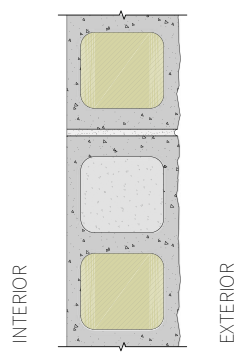
Table 4-3 System 4 integrally insulated CMU pricing summary

System 4: Integrally Insulated CMU					
System Component		Baseline Product	Alternate (call for estimate)	Baseline Cost/ft^2 (incl. labor)	
				Low	High
INTERIOR					
1*	Structural CMU wall	8"x8"x16" standard split-face block with integral block and mortar water repellent; partially grouted	No specified alternate	$20.00	$27.50
2	Optional	Groundface block and colors alternates	No specified alternate	$0.75	$2.75
3	Rebar	Standard code reinforcement; minimum Category D requirement	Additional reinforcing	$2.00	$5.00
4	Core insulation	Resinous foam insulation at block cores	Perlite insulated cores	$1.25	$1.75
5*	Clear water repellent	Surface-applied clear water repellent	No specified alternate	$1.75	$2.50
EXTERIOR					
Total cost to install 10,000 sq ft wall area w/easy drive-up access -->				$25.75	$39.50

Pricing Summary Discussion

- Low and high baseline costs are based on baseline products and installed labor costs. Call for an estimate for alternative product pricing.
- Baseline costs provided will vary based on product-specific conditions as well as project location and should be used as an estimate only.
- Block prices are for typical units as noted. Pricing can vary based on size, color, and finish and should be confirmed with the unit manufacturer.
- *See the Resources section of this guide for a list of resources related to this component.

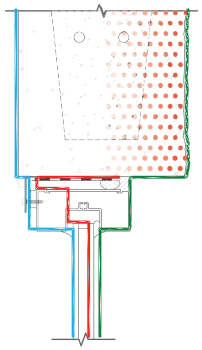
System Plan View



LEGEND

1. Typical Assembly:
   - Single-wythe CMU wall with water-repellent admixture at block and mortar
   - Core insulation or grout
   - Clear water repellent
2. Sealant over backer rod
3. Fluid-applied flashing membrane
4. Continuous air barrier sealant, tie to continuous seal at window perimeter
5. Continuous back dam angle at rough opening perimeter, minimum 1-inch tall, with window fastened through the back dam angle per window manufacturer recommendations
6. Storefront window

Water-Shedding Surface and Control Layers



Water-Shedding Surface

Control Layers:*

- Water
- Air
- Vapor
- Thermal

* when an air barrier material is applied to the interior face of the CMU wall

Detail Discussion

- To promote watershed away from the window and wall below, consider a sheet-metal flashing with hemmed drip edge as shown in Fig. 4-6. This flashing is sealed into a kerf in the underside of the CMU rough opening head.
- Air control layer continuity is provided by the grouted and insulated CMU cores, the fluid-applied flashing membrane at the rough opening, and the air barrier sealant transition to the storefront window.
- The backer rod and sealant at the window perimeter provides continuity of the water-shedding surface between the CMU wall and storefront window face.

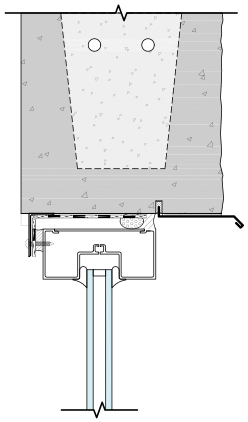
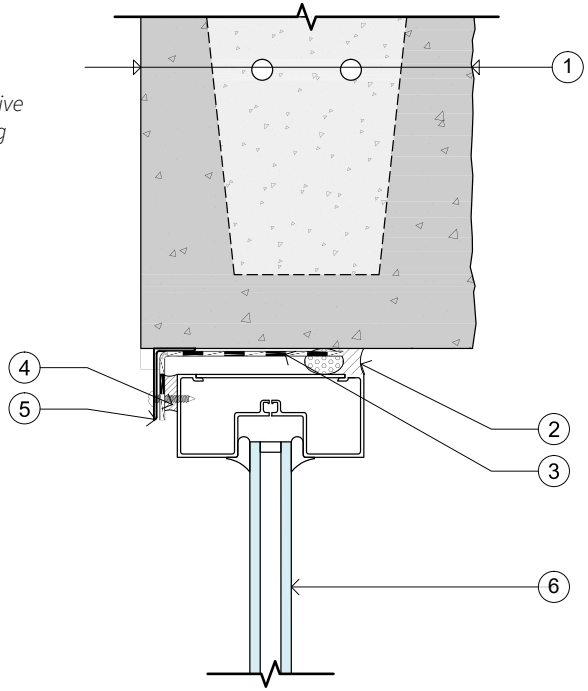


Fig. 4-6 System 4 alternative sheet-metal head flashing



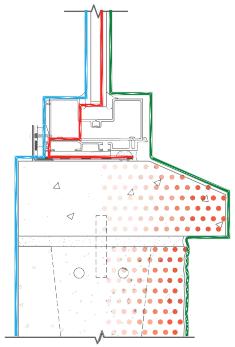
Storefront Window Head

Detail 4-A

LEGEND

1. Typical Assembly:
   - Single-wythe CMU wall with water-repellent admixture at block and mortar
   - Core insulation or grout
   - Clear water repellent
2. Storefront window
3. Minimum ¼-inch intermittent shims
4. Fluid-applied flashing membrane
5. Wept sealant or backer rod
6. Sloped precast concrete sill
7. Continuous air barrier sealant tied to continuous seal at window perimeter
8. Continuous back dam angle at rough opening perimeter, minimum 1-inch tall, with window fastened through the back dam angle per window manufacturer recommendations

Water-Shedding Surface and Control Layers

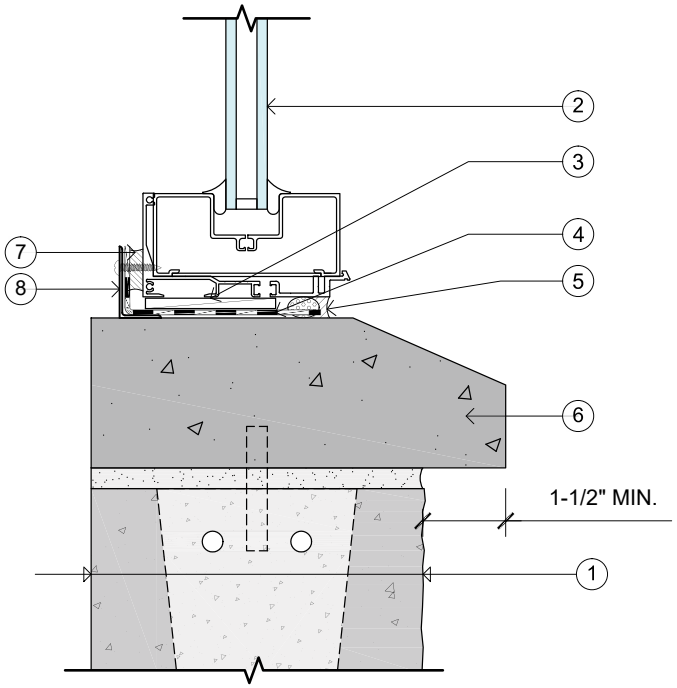


Water-Shedding Surface

Control Layers:*

- Water
- Air
- Vapor
- Thermal

* when an air barrier material is applied to the interior face of the CMU wall



Detail Discussion

- Intermittent shims support the window frame and allow the window rough opening to drain to the exterior. The exterior backer rod and sealant joint at the sill is wept at quarter points along the sill to drain the rough opening.

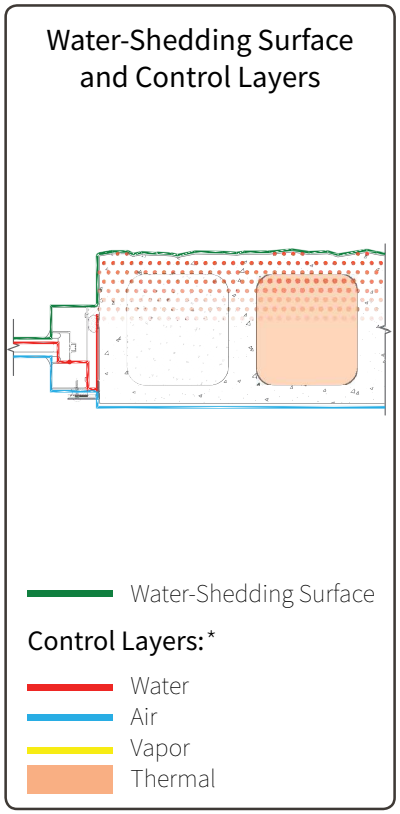
- When a sill can is used with the storefront system, a fluid-applied flashing membrane and wept sealant joint at the rough opening should still be used as shown in this detail.

Precast Windowsill

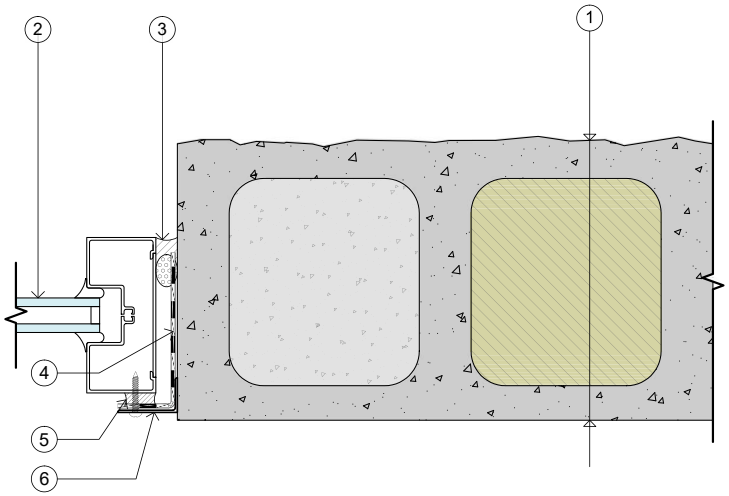
Detail 4-B

LEGEND

1. Typical Assembly:
   - Single-wythe CMU wall with water-repellent admixture at block and mortar
   - Core insulation or grout
   - Clear water repellent
2. Storefront window
3. Sealant over backer rod
4. Fluid-applied flashing membrane
5. Continuous air barrier sealant tied to continuous seal at window perimeter
6. Continuous back dam angle at rough opening perimeter, minimum 1-inch tall, with window fastened through the back dam angle per window manufacturer recommendations



* when an air barrier material is applied to the interior face of the CMU wall



Detail Discussion

- A fluid-applied flashing membrane is recommended at the window rough opening due to it's self-terminating properties.

- The continuous back dam angle shown allows for perimeter attachment of the storefront window without the need for F-clips or similar anchors, which often inhibit the air barrier sealant (and thus, the air control layer) at the window perimeter. Project-specific window attachment methods should be confirmed with the window manufacturer during the design phase of the project.

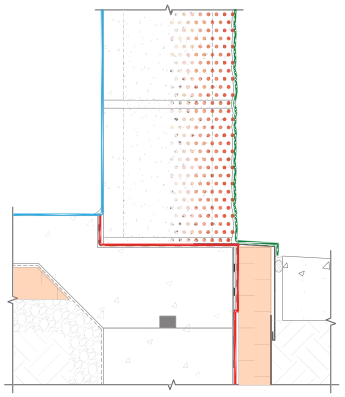
Storefront Window Jamb

Detail 4-C

LEGEND

1. Typical Assembly:
   - Single-wythe CMU wall with water-repellent admixture at block and mortar
   - Core insulation or grout
   - Clear water repellent
2. Continuous air seal
3. Typical Assembly:
   - Thickened concrete floor slab
   - Vapor barrier
   - Rigid XPS insulation
   - Capillary break
4. Sheet-metal base-of-wall flashing with hemmed edge
5. Rigid XPS insulation
6. Fluid-applied or self-adhered flashing membrane
7. Damp proofing

Water-Shedding Surface and Control Layers



Water-Shedding Surface

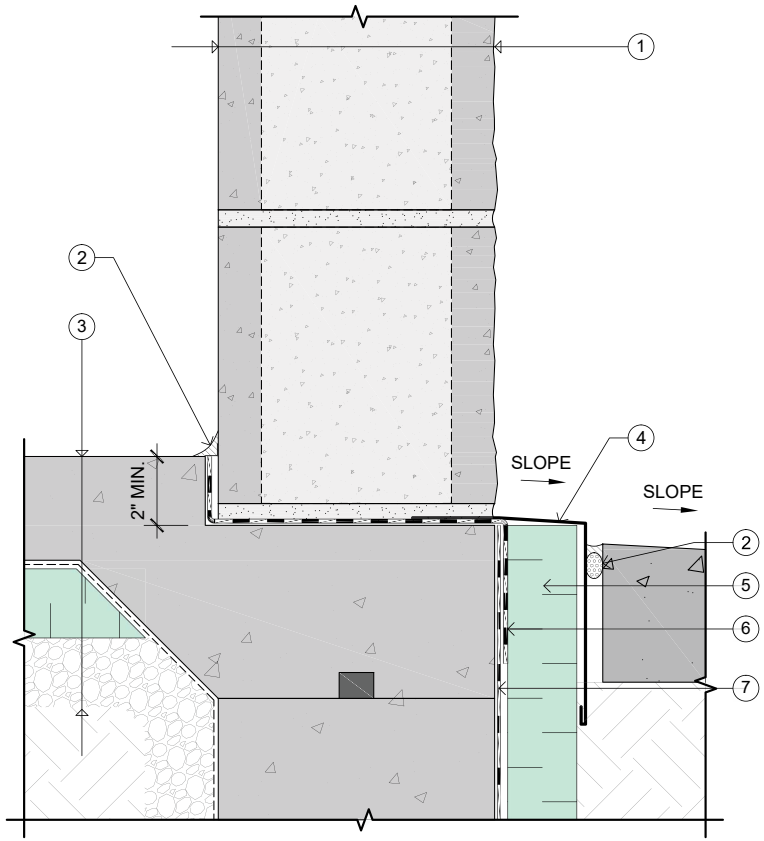
Control Layers:*

- Water
- Air
- Vapor
- Thermal

* when an air barrier material is applied to the interior face of the CMU wall

Detail Discussion

- The base-of-wall sheet-metal flashing protects the rigid XPS foundation insulation from UV exposure and damage. The hemmed edge strengthens the sheet-metal flashing. Acceptability of this sheet-metal flashing placement should be confirmed with the project's structural engineer.
- A step at the thickened concrete floor slab perimeter encourages water that may exist at the wall base to collect below the finished floor elevation. This guide recommends a minimum 2-inch step.
- The continuous sealant joint at the interior floor line provides air control layer continuity from the CMU wall assembly to the concrete floor slab.
- See the next pages for an alternative floor slab detail.



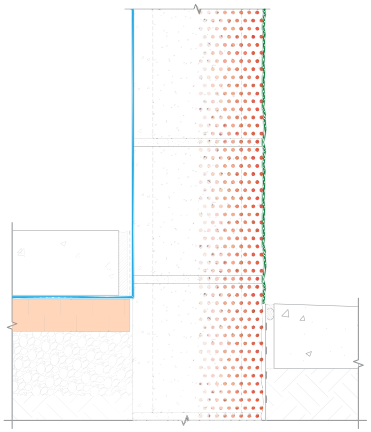
Thickened Concrete Slab/Foundation Detail

Detail 4-D

LEGEND

1. Typical Assembly:
   - Single-wythe CMU wall with water-repellent admixture at block and mortar
   - Core insulation or grout
   - Clear water repellent
2. Typical Assembly:
   - Concrete floor slab
   - Vapor barrier
   - Rigid XPS insulation
   - Capillary break
3. Slab isolation joint
4. Damp proofing (optional)
5. Hardscape sealant joint

Water-Shedding Surface and Control Layers



Water-Shedding Surface

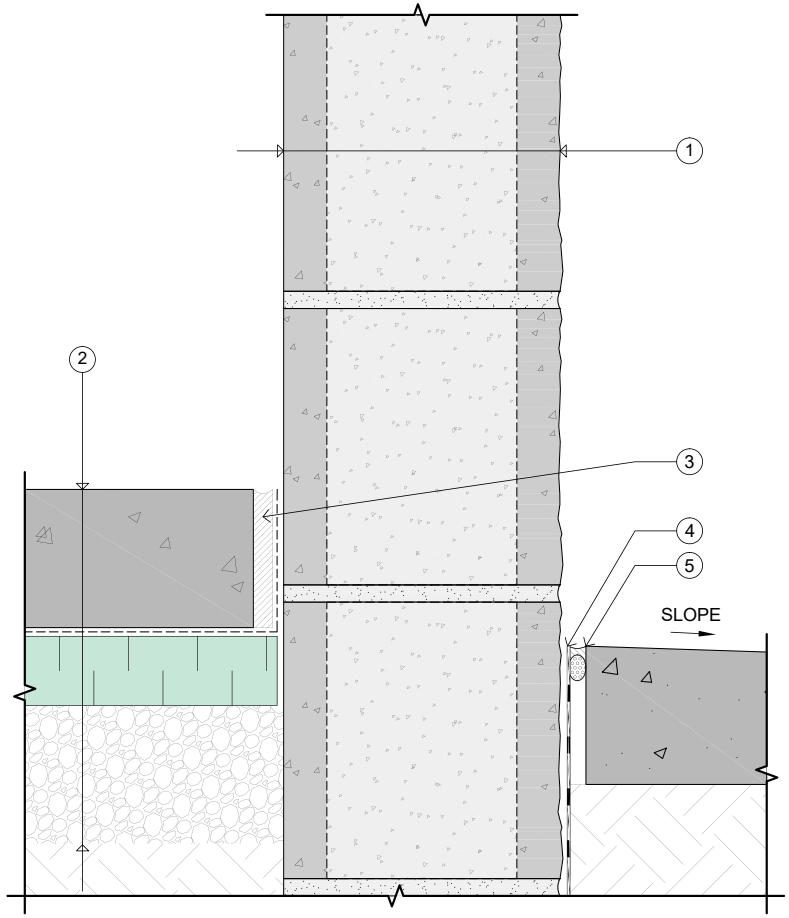
Control Layers:*

- Water
- Air
- Vapor
- Thermal

* when an air barrier material is applied to the interior face of the CMU wall

Detail Discussion

- See Detail 4-D on the previous page for an alternative floor slab detail.
- The thermal performance of the concrete floor slab assembly may be improved by providing a thermal insulation break between the floor slab and CMU wall.



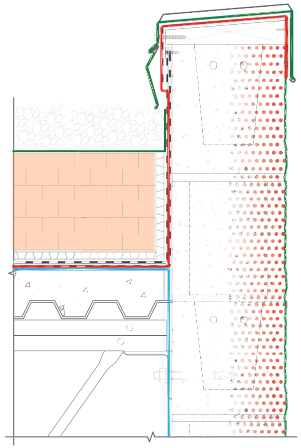
Concrete Slab/CMU Foundation Detail

Detail 4-E

LEGEND

1. Typical Parapet Assembly:
   - Inverted roof membrane
   - Single-wythe CMU wall with water-repellent admixture at block and mortar
   - Core insulation or grout
   - Clear water repellent
2. Inverted roof membrane system
3. Typical Assembly:
   - Single-wythe CMU wall with water-repellent admixture at block and mortar
   - Core insulation or grout
   - Clear water repellent
4. Sloped standing-seam sheet-metal coping with gasketed washer fasteners
5. Preservative-treated blocking
6. High-temperature self-adhered membrane

Water-Shedding Surface and Control Layers



Water-Shedding Surface

Control Layers:*

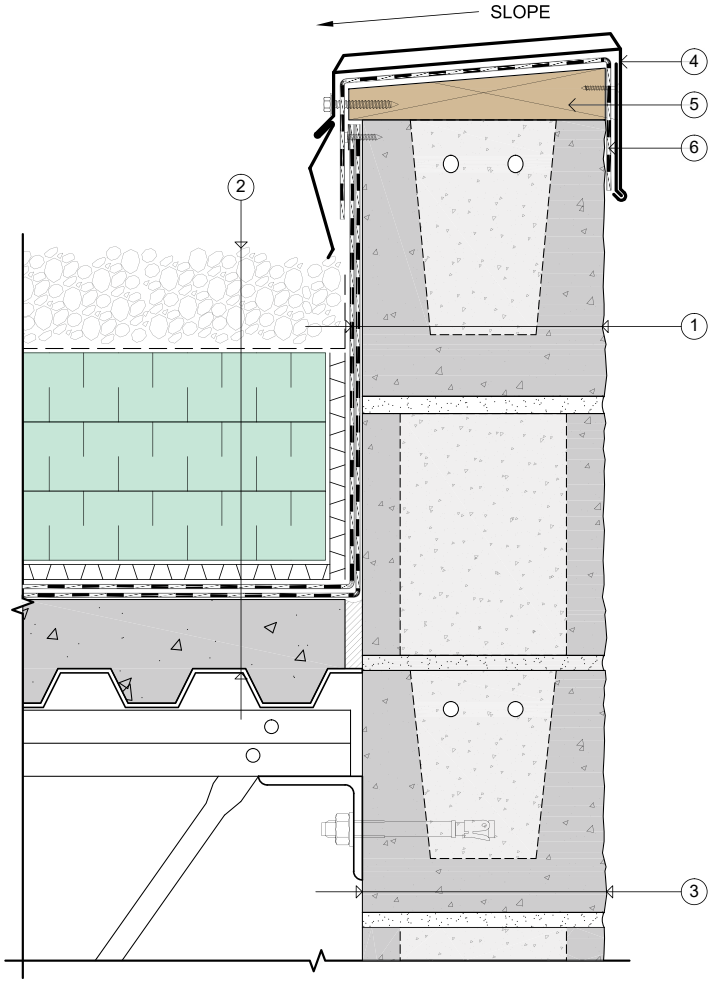
- Water
- Air
- Vapor
- Thermal

* when an air barrier material is applied to the interior face of the CMU wall

Detail Discussion

- The sheet-metal coping with hemmed drip edge sheds water away from the wall top and CMU wall face below. It is recommended that the sheet-metal cap counterflash the top course of block by a minimum of 3-inches.

- When a fluid-applied membrane is applied to the interior face of the single-wythe CMU (to increase the rain penetration resistance and/or to assist with airtightness), as discussed in Water Control Layer on page 4-3, this membrane should extend onto the bottom of the roof structure and should be continuous around anchors.



Parapet at Inverted Roof Membrane System

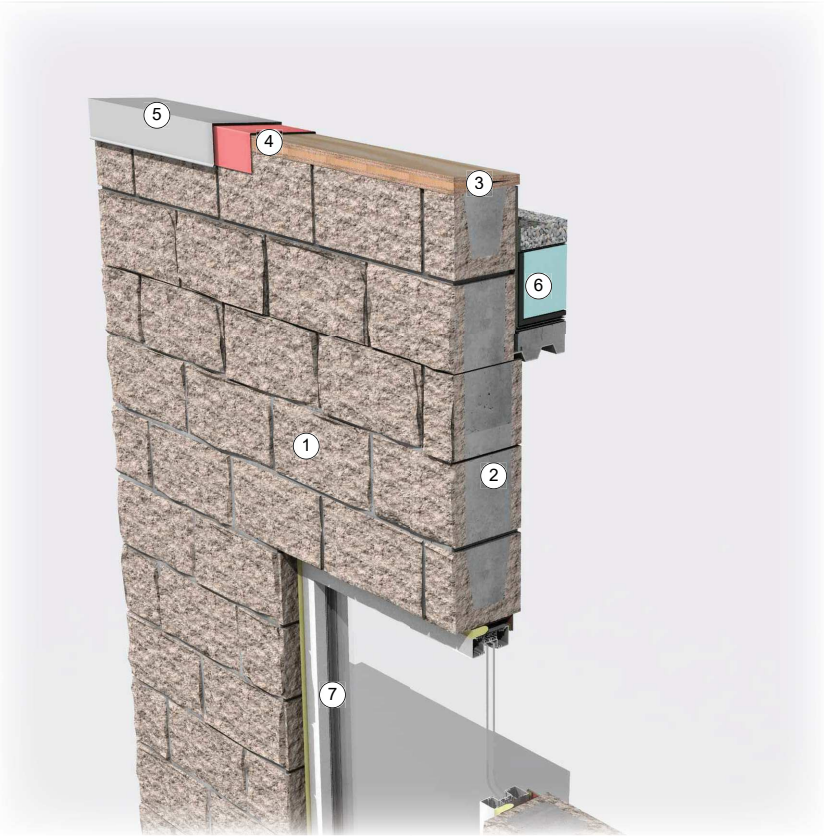
Detail 4-F

LEGEND

1. Single-wythe CMU wall with water-repellent admixture within block and mortar
2. Partially grouted CMU wall
3. Sloped, preservative-treated wood blocking
4. High-temperature self-adhered membrane
5. Sloped standing-seam sheet-metal coping with gasketed washer fasteners
6. Inverted roof membrane assembly
7. Storefront window

3-D Detail Discussion

- Three-dimensional cutaway sections on the next three pages represent two-dimensional details of this system.
- This system is deemed to comply with some energy code exceptions when at least 50% of the CMU cores are insulated as discussed in Thermal Performance and Energy Code Compliance on page 4-5. Some cores may be grouted as shown in Detail 4-G and others insulated as shown in Detail 4-H.
- The high-temperature self-adhered membrane and standing-seam sheet-metal coping protect the top of the wall from water. The sheet-metal drip edge deflects water away from the wall face.
- Detail 4-I describes a typical rough opening with continuous back dam angle. The sill back dam angle creates a sill pan below the window; intermittent shims below the storefront window promote drainage at the sill and out through the sealant joint weeps.
- As shown in Detail 4-H, insulation below the thickened concrete floor slab and exterior of the foundation wall provides additional protection against heat loss at the wall-to-slab interface. The sheet-metal flashing protects the XPS insulation from UV and damage.

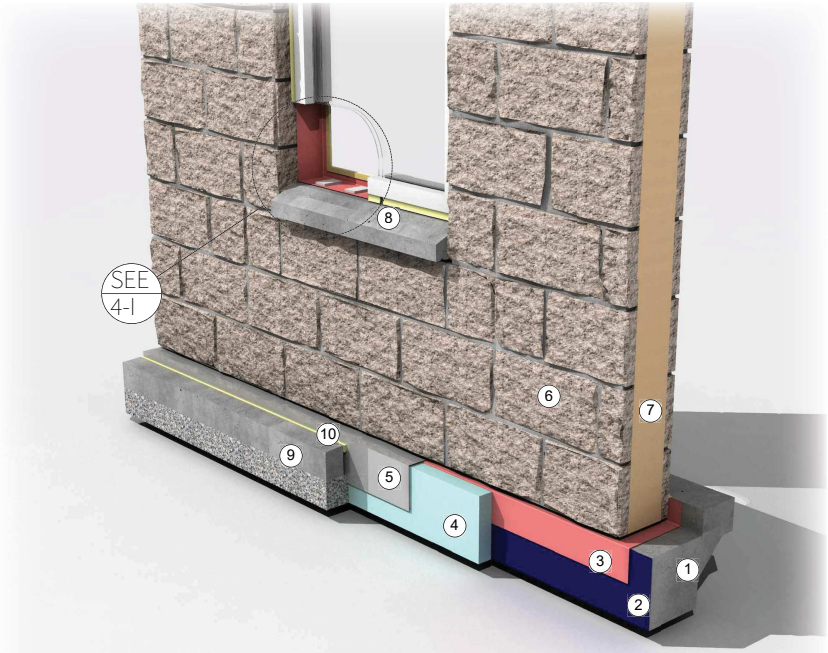


Parapet Section Cutaway

Detail 4-G

LEGEND

1. Thickened concrete floor slab and foundation element
2. Damp proofing
3. Fluid-applied or self-adhered flashing membrane
4. Rigid XPS foundation insulation
5. Base-of-wall sheet-metal flashing
6. Single-wythe CMU wall with water-repellent admixture within block and mortar
7. Core insulation
8. Sloped precast concrete sill
9. Concrete sidewalk or other hardscape, sloped away from structure
10. Continuous hardscape sealant joint
11. Continuous sealant joint at wall-to-slab interface

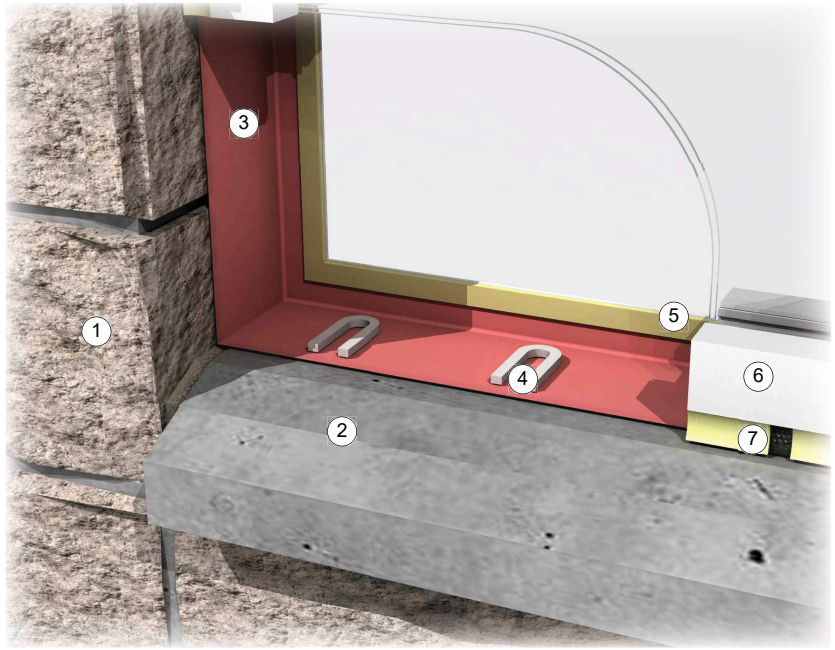


Base-of-Wall Cutaway Section

Detail 4-H

LEGEND

1. Single-wythe CMU wall with water-repellent admixture within block and mortar
2. Sloped precast concrete sill
3. Fluid-applied flashing membrane at rough opening and continuous perimeter back dam angle
4. Minimum ¼-inch intermittent shims for drainage
5. Continuous air barrier sealant tied to continuous seal at window perimeter
6. Storefront window
7. Wept backer rod and sealant joint



Window Jamb and Sill Cutaway Section

Detail 4-I