

TechNote

Window and Door Flashing: Code Requirements and Best Practices

Flashing at exterior windows [1a] and doors [1b] is critical for shedding rain water to ensure a dry and durable building. Missing or inadequately-installed flashing can lead to water intrusion, moisture damage to building materials, and indoor air quality issues. Resulting homeowner call-backs may be costly, requiring removal of finishes and even replacement of structural elements.

This TechNote provides an overview of building code requirements and best practices [2] for flashing at window and door frames. The focus is on common flashing applications for new construction. Although each window/door manufacturer may have its own set of flashing instructions, the strategies and general principles apply to the vast majority of flashing situations.

There are two key principles for effective flashing at windows and doors to allow water to drain down the face of the wall [1c] and away from the building:

- **Integrate** flashing with the **water-resistive barrier (WRB)**, e.g., house wrap.
- Install membranes **shingle-fashion** where the top layer of the WRB or flashing laps over the bottom layer to prevent water draining behind the bottom layer.

FLASHING 101

Flashing detailing depends on the selection of **(1) window type (flanged or non-flanged)** and door type (with or without **integral molding**); and **(2) window/door installation sequence (windows/doors installed before or after the WRB)**. The following graphics show the essential steps for installing window or door flashing; these align with installation guidelines from most product manufacturers.

Terminology

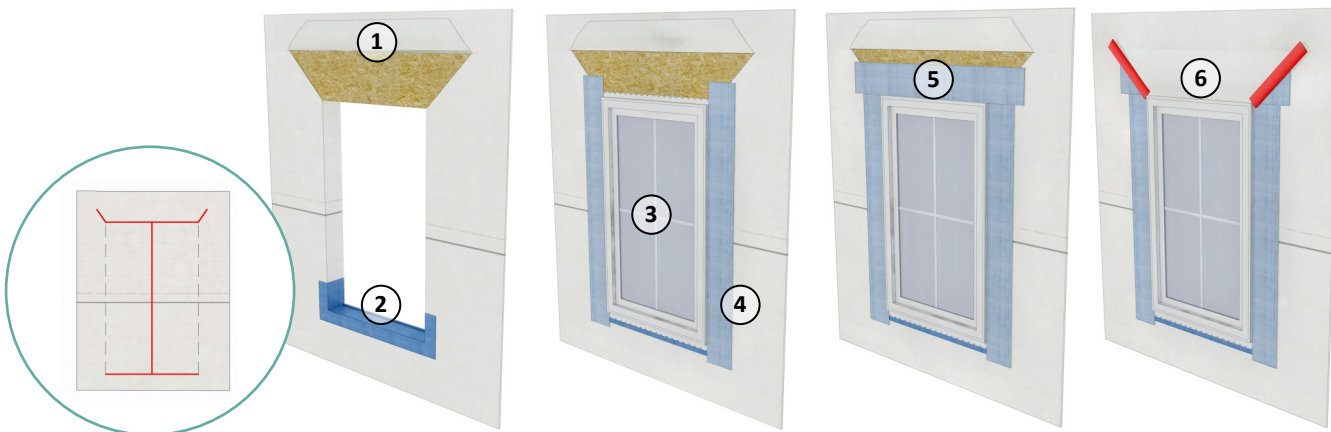
Flashing. Water-resistant product that prevents water penetration at the gaps between the window/door frame and the rough opening.

Jamb Flashing and Head Flashing. Flashing installed at the sides (jamb) and top (head) of the window/door.

Sill or Pan Flashing. Flashing installed at the base of the rough opening to allow water which may enter through or around the window/door to drain out.

Water-Resistive Barrier (WRB). Material providing a drainage surface to protect the wall assembly [1d, 1e] from rain water. Also referred to as a Weather-Resistant Barrier.

Figure 1. Example flashing steps for a flanged window installed after house wrap. See Best Practices for additional details.



Step 1. Prepare the WRB at the rough opening: cut house wrap at red line (see inset), fold in at jambs, and fold up at head.

Step 2. Install pan flashing: cover the rough sill and extend onto the face of the wall/WRB.

Step 3. Install the window: according to manufacturer's instructions.

Step 4. Install the jamb flashing: over window flange and pan flashing and extend above the head flange.

Step 5. Install the head flashing: over and beyond the jamb flashing (and over the drip cap if installed).

Step 6. Integrate the WRB: fold down the house wrap flap and tape diagonal seams with construction tape.

Code Considerations

The International Residential Code (IRC) establishes minimum flashing requirements, but does not provide detailed installation guidance. Section R703.4 of the 2015 IRC requires flashing to be in accordance with the following:

- Flashing shall be applied shingle-fashion in a manner to prevent water intrusion into the wall assembly and building.
- Flashing at exterior window/door openings shall extend to the surface of the exterior wall

finish (for face-sealed wall assemblies such as stucco on solid masonry) or to the water-resistant barrier (commonly behind siding/cladding).

- Flashing at exterior window/door openings shall be installed according to the window/door manufacturer installation instructions or those of a flashing manufacturer. Where not addressed by the manufacturer, pan flashing shall be installed at the sill of exterior window

and door openings, be sealed or sloped to direct water out, and shall incorporate flashing or protection at the head and sides.

- Flashing shall be installed continuously above all projecting wood trim.
- Products used as flashing must comply with specific standards: self-adhered membranes with AAMA 711; fluid-applied membranes with AAMA 714; mechanically attached flexible flashing with AAMA 712.

Design Considerations

Windows, and **sliding glass doors**, are generally flanged (finned) or non-flanged (block frame).

Entry doors are generally non-flanged. Non-flanged windows and doors are available with factory-applied trim (integral brick mold). Windows and doors are installed either before the WRB or after the WRB. Manufacturers commonly require a caulk/sealant at the top and side flanges, but not at the bottom flange (to allow drainage). A caulk/sealant may not be required where self-adhesive flashing is installed.

Sequence. The installation sequence of flashing and WRB products can depend on builder preferences and subcontractor (trade) responsibilities. For example, if the framer installs windows during framing, and the siding contractor installs the house wrap, the windows are installed before house wrap and the trades must coordinate to ensure proper flashing.

Flashing can be flexible or rigid. Flexible flashing can be mechanically fastened (e.g., Kraft paper or polyethylene laminated products) or self-adhesive. Self-adhesive flashing (common for jamb and head flashing) is commonly available in rolls of 4, 6, and 9 in. (or greater) widths, and with release paper backing (peel and stick). Self-adhesive flashing tape should not be confused with construction tape (also referred to as builder tape or house wrap tape). Self-adhesive flashing can also be formable/stretchable to allow installation around corners (common for pan flashing and curved windows).

Pan Flashing can be rigid metal or plastic (one piece or multiple pieces), flexible self-adhesive membrane, a combination of rigid and flexible, or liquid-applied. Formable self-adhesive pan flashing is commonly 6 in. wide for 2x4 frame walls and 9 in. wide for 2x6 walls. Also referred to as sill flashing, although some pan flashing products require separate sill flashing.

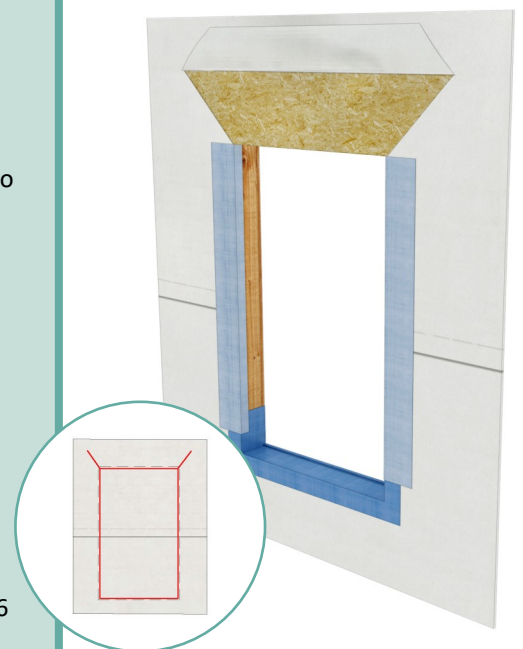
WRB: Common products include house wraps, #15 asphalt felt, and Grade D building paper. Rigid foam insulation and drainable sheathing/tape systems (ZIP System) have become more common. Liquid-applied and self-adhesive membranes are not common.

Compatibility. Make sure all flashing, WRB, caulk/sealant, and window/door products are compatible (e.g., some window manufacturers may require a 100% silicone caulk; some asphalt-based self-adhesive flashing may damage some types of vinyl). Further, a spray adhesive primer may be recommended for self-adhesive flashing for some substrates and during adverse weather or cold temperatures.

Figure 2. Example alternative preparation of house wrap at rough opening for extreme wind/rain (coastal) conditions [3, 4]

This is one alternative method of preparing the house wrap at the rough opening for extreme conditions:

- Cut the house wrap at the red line (no jamb flaps) and install pan flashing
- Install self-adhesive flashing onto the sides/jamb and face of the exterior wall—overlap the pan flashing by at least 2 in.
- Apply sealant to the inside-top corners of the rough opening (at the header)
- Then install the window and flashing in the same manner as shown in Figure 1, steps 3 through 6



Pan flashing. Pan flashing should extend up the rough jamb at least 6 in. and onto the wall surface at least 2 in. When air sealing around the window/door frame from the interior, do not inadvertently obstruct the drainage path of the pan flashing.

Back dam. A back dam should be installed to collect and drain water from the sill pan. A back dam can be integral to a rigid, manufactured sill pan or site-built (e.g., 3/4 in. corner or beveled

wood siding, covered with self-adhered pan flashing). Note some products may increase the rough opening height.

Jamb flashing. Jamb flashing should extend beyond the lower and outer edges of the pan flashing, and above the head flange but at least 1 in. below the top of the head flashing.

Drip cap. If the top of the window/door unit does not slope toward the exterior or have a pronounced drip edge, install a metal or vinyl

drip cap for added protection at this vulnerable location, particularly where not protected by a porch or overhang.

Head flashing. Head flashing should extend at least 1 in. beyond the jamb flashing.

House wrap. The horizontal edge of the house wrap flap above the window/door (Figure 1) can be sealed if desired for air sealing purposes using construction tape; use a sealant applied under the flap to avoid reverse-lapping.

Figure 3. Example flashing steps for a flanged window installed before house wrap. See Best Practices for additional details.

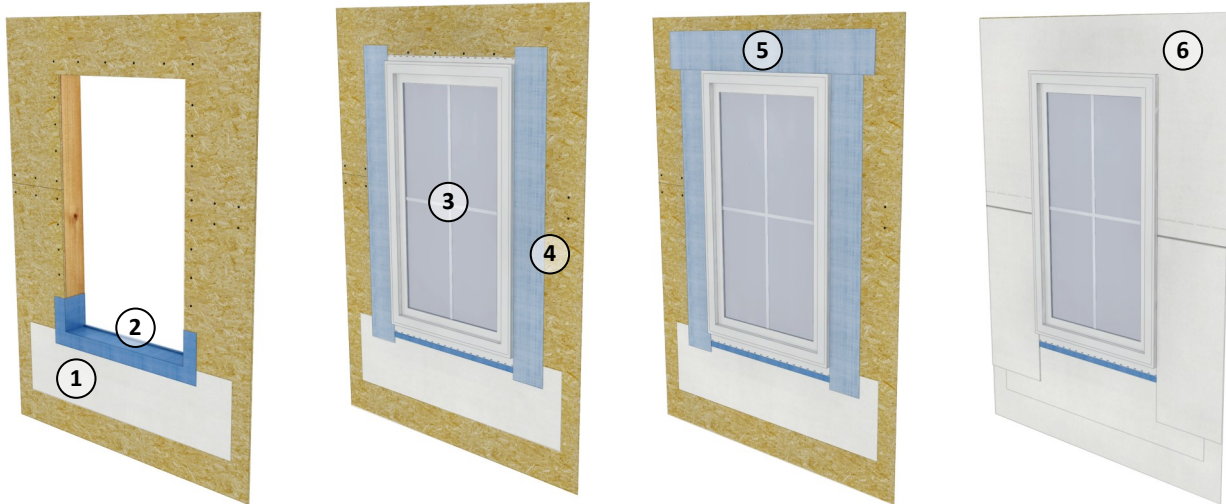


Figure 4. Example flashing details for a flanged window installed over rigid foam insulation sheathing installed as the WRB.



The flanged window in this example is installed directly over the foam sheathing that is installed as the WRB. The flashing steps are similar to installing a flanged window before house wrap (Figure 3) except the house wrap apron in step 1 is not required, and instead of integrating house wrap in step 5, construction tape is installed above the head flashing (the construction tape acts as counter-flashing).

Note: This detail would be the same for a drainable sheathing/tape assembly (ZIP System).

Step 1: Prepare the WRB at the rough opening: install a small section of house wrap below the sill (referred to as an “apron”); alternatively, install self-adhesive pan flashing with split backing (where the release paper backing can be removed incrementally) to seal to the house wrap later.

Step 2: Install pan flashing: cover the rough sill and extend onto the face of the wall/WRB.

Step 3: Install the window: according to manufacturer instructions.

Step 4: Install the jamb flashing: over window flange and pan flashing and extend above the head flange.

Step 5: Install the head flashing: over and beyond the jamb flashing (and over the window drip cap if installed).

Step 6: Integrate the WRB: Install house wrap shingle-fashion, integrated with the apron, and seal house wrap at jambs and head using sealant (beneath the house wrap) or construction tape.

Foam. Continuous exterior rigid foam insulation can be installed before the WRB, over the WRB, or as the WRB. Different details may be required for siding/cladding and at windows/doors to accommodate the additional thickness of the exterior foam sheathing.

Flanged windows are commonly installed directly over the exterior foam sheathing where the foam sheathing does not exceed 1.5 in. thick. Some window manufacturers do not allow fastening the window flanges through the foam unless the window is also supported by approved jamb clips or screws through the window frame. Some window manufacturers may require installing the window with the entire flange in direct contact with wood framing— this would require extending/adding framing at the perimeter of the rough opening to match the thickness of the foam sheathing.

Figure 5. Example flashing steps for an entry door with integral brick mold installed after house wrap. See Best Practices for additional details.

Step 1. Prepare the WRB at the rough opening: cut and fold house wrap (similar to Figure 1).

Step 2. Install pan flashing: for a slab or foundation wall application, align the front edge for a continuous slab or foundation wall application, or fold down for a step down slab; it is important to integrate a back dam with the finish flooring/trim.

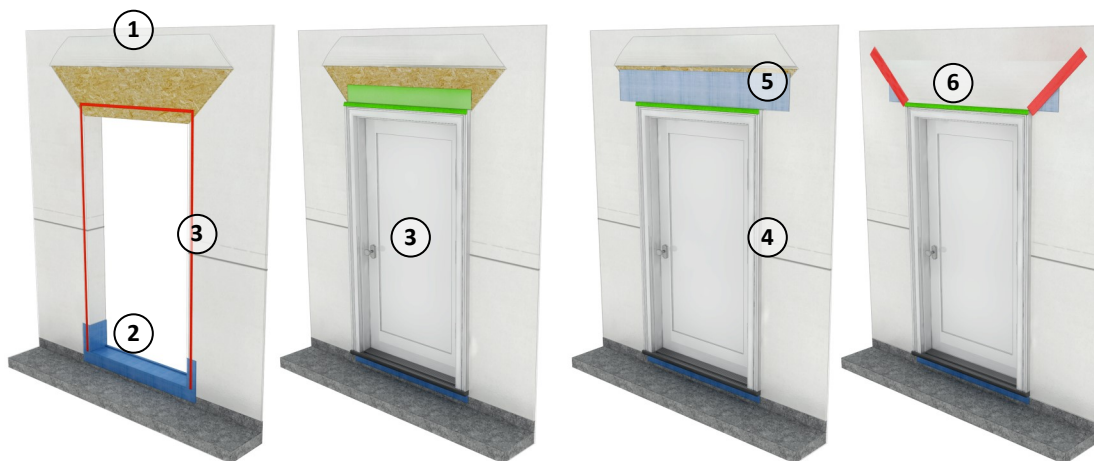
Step 3. Install the door: where sealant is used under the door threshold, ensure that water is allowed to drain out of the pan flashing. For this example, apply sealant at the WRB/brick mold interface at the top and sides (shown in red). Install a drip cap of metal, plastic, or other approved material (shown as green) above

the brick mold (as required by the door manufacturer, particularly where not protected by a porch or overhang) in a bead of sealant and secure to the wall.

Step 4. For this example, the sealant acts as the jamb flashing. After installing the door, apply additional sealant where the brick mold meets the house wrap.

Step 5. Install the head flashing: over the vertical leg of the drip cap.

Step 6. Integrate the WRB: fold down the house wrap flap and tape diagonal seams with construction tape.



Alternative to sealant at the brick mold: some manufacturers offer a double-sided, self-adhesive flashing product specifically designed for non-flanged windows and doors with and without brick mold. The head and jamb flashing are adhered to the door frame before the door is installed. After the door is installed, the head and jamb flashing are adhered to the WRB.

Recommendations

Design Phase

- Ensure that flashing is integrated shingle-fashion with the WRB, window/door frames, and architectural elements (decorative trim), as required.
- Check that caulks, sealants, and adhesives are compatible with the WRB and windows and doors.
- Show all flashing details and installation sequences on plans, specifications, and scopes of work for subcontractors.

Construction Phase

- Inspect all flashing components during construction for proper shingling and integration with the WRB.
- Don't rely on sealants or caulks as a substitute for flashing.
- Install all products in accordance with manufacturer's specifications, local building codes, or (where applicable) specifications established by the licensed design professional.

Resources

- [1] Home Innovation Moisture Management Series (www.HomeInnovation.com/MoistureManagementVideos)
a. [Windows](#), b. [Doors](#), c. [Exterior Walls](#), d. [Drainage Cavity Walls](#), e. [Internal Drainage Plane](#)
- [2] ASTM E 2112 – 07: *Standard practice for installation of exterior windows, doors, and skylights.*
- [3] FMA/AAMA 100-12 (Methods A, B, and C): *Standard Practice for the Installation of Windows with Flanges or Mounting Fins in Wood Frame Construction for Extreme Wind/Water Conditions.*
- [4] FMA/AAMA/WDMA 300-12: *Standard Practice for the Installation of Exterior Doors in Wood Frame Construction for Extreme Wind/Water Conditions Exposure.* Fenestration Manufacturers Association (FMA), American Architectural Manufacturers Association (AAMA), and Window and Door Manufacturers Association (WDMA).