
# Where Has All the Counterflashing Gone?

## Underscoring Counterflashing Function and Value in Commercial Low-Slope Roofing and Waterproofing

**By Sam S. Zalok, PE, and John N. Karras, PE**

The use of counterflashing in buildings has a lengthy history. Though perhaps not the earliest definition, *The Architect's and Builder's Pocket-Book* (1886) defines counterflashing as "laid between courses of brick, and turned down over the flashings." Historically, the importance of competent counterflashing at masonry walls, including roof-to-masonry transitions such as residential chimneys, has been appreciated by sophisticated builders. Nevertheless, defects in the application of residential counterflashing persist. Derek Hodgin spotlights this aspect of the counterflashing discussion in his March 2020 *IIBEC Interface* article, "The Most Common Problems with Residential Counterflashing."

While counterflashing at masonry walls and residential applications remains its own meaningful discussion, counterflashing at walls, penetrations, and curbs of low-slope roofing and waterproofing is also worthy of dedicated attention. In spite of this, the authors increasingly find that some design professionals and some roofing installers downplay or disregard the importance of counterflashing over the vertical termination of the roofing/waterproofing base flashing when a cavity wall (and through-wall flashing system) is not present above the base flashing. Instead, these practitioners include the minimally acceptable base flashing detail permitted by some roofing/waterproofing manufacturers: a termination bar securing the membrane over mastic, with elastomeric cap sealant along the base flashing's sky-facing edge (*Figure 1*).

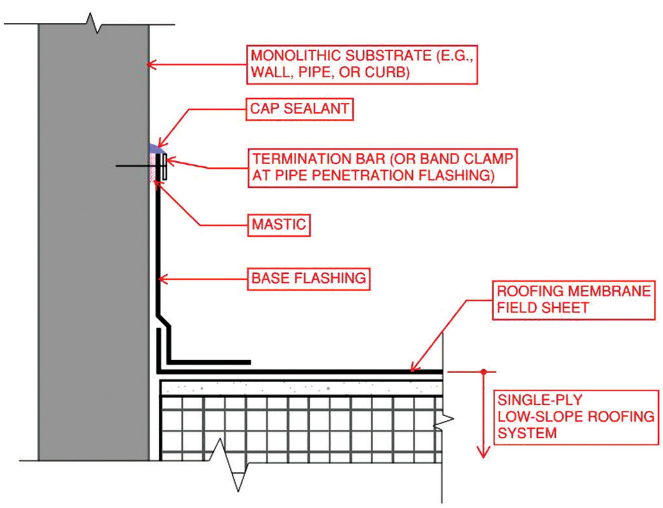


*Figure 1 – Generic fully adhered base flashing detail lacking counterflashing.*

Why would one omit counterflashing for such conditions? In interactions with design/construction professionals, we hear such rationales as:

- Pursuit of cost savings (for example, counterflashing is labor intensive).
- Counterflashing is not required by the building code.
- Counterflashing is not required by the roofing/waterproofing manufacturer.
- Unawareness of the benefit of counterflashing.
- Perception that counterflashing is redundant to cap sealant along the vertical termination of the underlying base flashing.

## DEFINITIONS, FUNDAMENTAL PRINCIPLES, AND DESIGN CONSIDERATIONS

For the design professional whose focus is not roofing, the abundance of counterflashing terminology produced by accepted (but varied) industry sources can be confusing and can distract from the fundamental importance of the feature. With this in mind, we compile counterflashing terminology, infused with fundamental principles and design considerations.

### Counterflashing (General)

ASTM D1079, *Standard Terminology Relating to Roofing and Waterproofing*, defines counterflashing as "formed metal or elastomeric sheeting secured on or into a wall, curb, pipe, rooftop unit, or other surface to cover and protect the upper edge of a base flashing and its associated fasteners." Counterflashing is sometimes referred to as "cap flashing."

#### *Considerations*

The cover-and-protect function of counterflashing is central to this article, and we consider it to include the following:

- Diverts water traveling down the overlying wall away from the vertical termination of the underlying base flashing and away from base flashing fastener penetrations;
- Protects the underlying base flashing and its termination components (for example, elastomeric cap sealant) from damaging ultraviolet light (UV) exposure; and
- Protects the top portion of the underlying base flashing and its termination components from physical damage.

The importance of this function cannot be overstated, especially given that the base flashing portion of a roofing/waterproofing assembly is inherently vulnerable to water penetration relative to the field sheet. Even when new, thermoplastic, thermoset, and modified-bitumen membranes—when adhered to a monolithic vertical substrate—are not suited to resist water that breaches the upper termination from traveling into the roofing assembly or building.

To compensate, some manufacturers provide "cut-off" mastics (or proprietary tapes) intended for application between the base flashing and substrate behind the termination bar. But without counterflashing, the roofing/waterproofing system's water penetration resistance relies on the compression provided by the termination bar (or a stainless steel band clamp in the case of a pipe penetration), the continuity of the mastic, and the ability of the elastomeric sealant to block water.

Termination bar compression is itself a susceptible line of defense, since substrate irregularities and the discrete nature of the fasteners cannot achieve a perfect uniform compression seal. This is especially true at such penetrations as hollow structural section (HSS) steel tube columns, where the stainless steel band clamp can achieve compression at the column corners but, unlike round penetrations, does not compress along the wall of the column. The mastic behind the termination bar is "blind"—that is, not visible upon base flashing installation—so its continuity cannot be verified. Additionally, the integrity of the cap sealant is susceptible to deterioration, given that its geometry is not engineered for durability and, when exposed, is prone to UV-related deterioration (for example, embrittlement,

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crazing, or splitting) that often creates premature failures or breaches (*Figures 2, 3,* and *4*). In conjunction with UV deterioration, the cap sealant can be vulnerable to tearing and premature failure from thermal cycling of its substrates and within itself. These effects are accelerated if sealant is installed without a proper joint profile or bond break to promote two-sided adhesion. The termination bar fasteners (especially if exposed) may also provide pathways for leakage.

Contemporary counterflashings are typically produced from metals such as stainless steel, prefinished galvanized steel, red copper or tin-zinc-copper, prefinished aluminum, or elastomeric or fluid-applied membranes. The transverse joints of metal counterflashings are often lapped and sealed where water-shedding performance is appropriate. Where watertight performance is required, copper or stainless steel is typically considered and detailed with riveted/soldered nonmoving transverse joints and expansion joint provisions.

## Surface-Mounted Counterflashing

Counterflashing that does not return into or behind the cladding on the wall façade above is referred to as surface mounted. This type of counterflashing is also sometimes referred to as "Philadelphia flashing," or in some manufacturers' details, as a "reglet," although most sources define a reglet as a slot, as we do hereinafter. Surface-mounted counterflashing, when metal, can be a one- or two-piece assembly secured to the vertical substrate with gasketed mechanical fasteners (*Figure 5*). The sky-facing portion of the counterflashing often incorporates a flared-out edge, intended to receive elastomeric sealant.

When the substrate below the counterflashing is a pipe penetration, surface-mounted metal counterflashing is typically referred to as a "rain collar," but is

*Figure 2 – Deteriorated cap sealant at penetration base flashing lacking counterflashing.*

*Figure 3 – Deteriorated cap sealant at wall base flashing lacking counterflashing.*

*Figure 4 – Deteriorated cap sealant at pipe penetration lacking counterflashing.*

also sometimes referred to as a “rain shield,” “umbrella flashing,” “storm collar,” or “collar flashing.” The rain collar is often stainless steel, secured to the pipe penetration with a band clamp, and like a surface-applied counterflashing on a wall, the sky-facing edge is flared to receive sealant.

***Considerations***

The sealant at the sky-facing edge of surface-mounted counterflashing or rain collar carries similar deterioration risk as the cap sealant along a termination bar (that is, when counterflashing is omitted). However, even upon sealant deterioration, the counterflashing itself maintains vital UV and physical protection to the underlying sealant at the top of the base flashing, significantly extending its service life and water penetration reliability.

The authors are sometimes told that stainless steel rain collars are prohibitively labor intensive to fabricate in the field. However, in today’s roofing/waterproofing marketplace, prefabricated rain collars can be sourced from manufacturers and shipped direct to project sites, much like general sheet metal counterflashings (*Figure 6*).

## CASE STUDY

The authors were engaged to investigate an existing approximately five-year-old two-ply modified-bitumen roofing assembly at a building with reported water leakage problems. The scope of the assignment included review of relevant original project documents, field survey, and diagnostic water penetration testing. Given reported water leakage locations, the roof perimeter became a focus of the investigation. Our review of the original design documents showed that the original design included a reglet-set receiver in an exposed concrete rising wall, and base flashing membrane terminating on top of the downturned leg of the reglet receiver. We would not have considered the designed reglet receiver “counterflashing” as it was not shown shingle lapping over the base flashing in a manner that could divert water away from or protect the base flashing. Review of the roofing manufacturer’s contemporaneous specifications showed that the manufacturer required either reglet-mounted or surface-mounted counterflashing over the base flashing termination. Ultimately, the modified-bitumen base flashing was installed on the exposed concrete wall with a termination bar and cap sealant, but lacked counterflashing. Water penetration tests replicated a leakage path down the concrete wall, behind the termination bar and cap sealant, and below the membrane.

*Note: Although the focus of this article is flashing systems on monolithic walls that do not have through-wall flashing, as building enclosure consultants, we note that even when counterflashing is present, these flashing systems will be inherently less reliable than when the overlying substrate (for example, the wall) above the base flashing is protected by a waterproofing system with through-wall flashing to evacuate water from the overlying wall assembly before it reaches the base flashing. For example, on an exposed cast-in-place concrete wall, even with a competent surface-applied counterflashing, a crack in the wall will create a pathway for water leakage that bypasses the counterflashing into the roofing assembly or building. One roofing manufacturer, on their surface-applied counterflashing detail, aptly notes, “Masonry and concrete walls/curbs must be waterproofed and maintained in order for any surface-mounted termination to be effective.”*

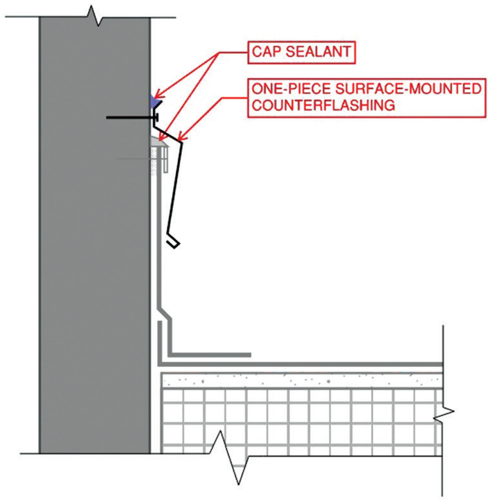


*Figure 5a – One-piece surface-mounted metal counterflashing.*

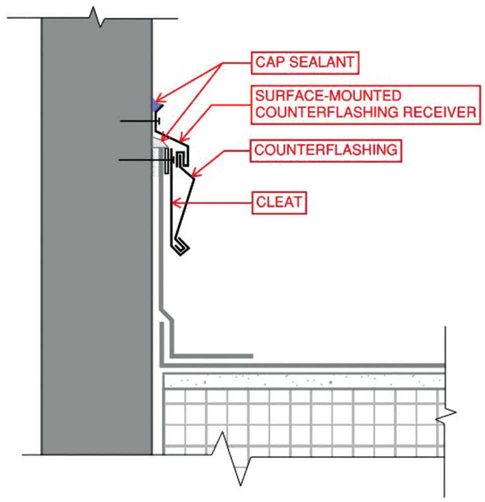


*Figure 5b – Two-piece surface-mounted metal counterflashing.*

*Figure 6 – Prefabricated stainless steel rain collar.*

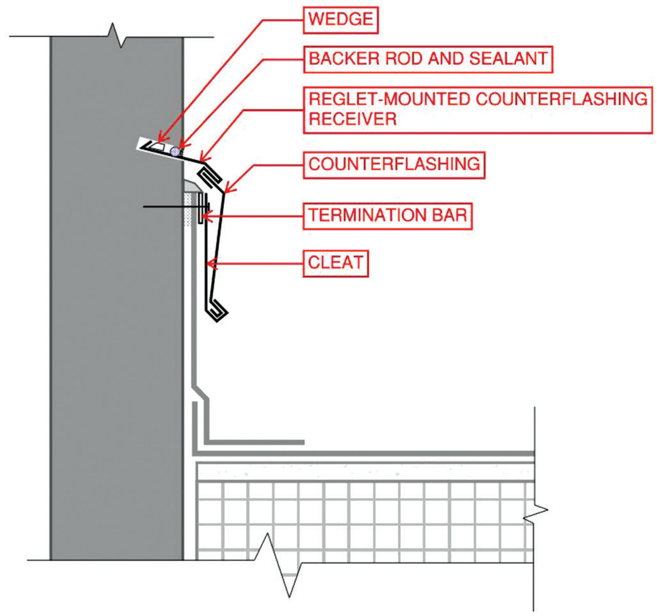


*Figure 7 – Two-piece reglet-mounted metal counterflashing.*

## Reglet-Mounted Counterflashing

Reglet-mounted counterflashing (*Figure 7*) is a one- or two-piece metal counterflashing with a horizontal leg or receiver with a short, upturned back edge that is inserted into a reglet (that is, horizontal slot) in the substrate. The reglet is either preformed in precast concrete panels, cast with plastic formwork into cast-in-place concrete, or saw-cut in cured precast concrete and cast-in-place concrete or masonry wall assemblies. The reglet can be formed in concrete substrates at a positive slope to facilitate drainage. The reglet is not applicable at pipe penetrations such as steel tube columns or prefabricated mechanical curbs. The horizontal leg (or receiver in a two-piece assembly) is secured to the back wall of the reglet with metal wedges or mechanical fasteners, and the reglet is filled with sealant or mortar.

### *Considerations*

Unlike its surface-mounted counterpart, reglet-mounted counterflashing is less reliant on sealant, given that it extends into the substrate (typically by about ½ to ¾ in. [13 to 19 mm]). This extension can capture a limited amount of the water that penetrates an overlying wall (but it should not be mistaken for the significantly increased protection from an overlying through-wall flashing, which is outside the scope of this article). The height and depth of the reglet must be carefully considered in the context of the wall assembly (for example, to avoid undermining a masonry wall with an excessively deep reglet; to avoid damaging reinforcing steel in a concrete wall; or to accommodate depth of backer rod and sealant and metal wedges). With any counterflashing option, the designer must consider not only the field of the overlying wall, but also the conditions at vertical joints of cast-in-place or precast concrete walls. At such vertical joints, reglet-set counterflashing is a better choice than surface-applied counterflashing, given that the latter, since it does not extend into the vertical joint, may result in a leakage vulnerability at each vertical joint (*Figure 8*). Note that at vertical movement joints, the termination bar and counterflashing should only be secured to one side of the joint to accommodate differential movement.

## Skirt Flashing

A skirt flashing is a sheet metal counterflashing with a vertical leg and bottom-hemmed drip edge. This type of counterflashing is also sometimes referred to as "slip-type flashing," and it is typically incorporated at mechanical (or roof hatch) curb penetrations behind the downturned integral leg of the equipment/hatch (*Figure 9*).

### *Considerations*

It is important to consider that rooftop equipment that covers an opening in a roofing assembly must function as an extension of the building enclosure. This is a common oversight—particularly at mechanical penetrations where the focus of the equipment design is often limited to mechanical performance—leading to the failure to scrutinize the interface between the equipment and roofing. For example, mechanical units (e.g., exhaust fans) often bear on a curb covered with base flashing of the low-slope roofing system. If the integral

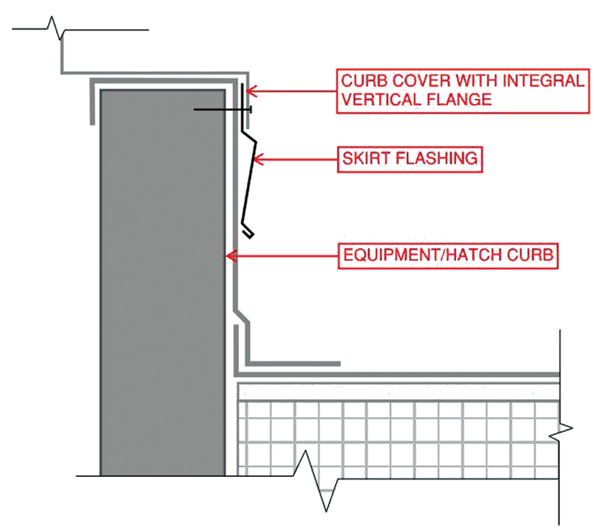


*Figure 9 – Metal skirt flashing.*

*Figure 8 – Vertical joint in precast concrete wall system.*

*Figure 10 – Gap between downturned flange of exhaust fan and base flashing.*

flange of the curb cover does not overlap the base flashing sufficiently to shed water, the curb-to-mechanical unit interface will be susceptible to water leakage from wind-driven rain. Some roofing manufacturers specify that the skirt flashing is required if the downturned leg of the equipment's curb cover is less than 4 in. (100 mm).

This water leakage vulnerability is exacerbated when the plan dimensions of the equipment's downturned leg are sufficiently larger than the base-flashed curb such that a gap remains between the back side of the leg and the base flashing (*Figure 10*). When such a gap is present, so too is a heightened air leakage vulnerability. Consequently, design and construction teams should ensure that mechanical equipment curbs include not only a sufficiently tall counterflashing, but also provisions for an air seal between the curb cover and the base flashing.

## Elastomeric Membrane Counterflashing

Counterflashing that is an elastomeric sheet is commonly referred to as "membrane counterflashing," and sometimes referred to as "strip flashing." Such counterflashings include an adhered back side, and they must (if they are to be left exposed) have a UV-stable composition. Uncured neoprene and uncured EPDM are common membrane counterflashing materials for roofing applications, particularly around pipe penetrations.

### *Considerations*

Unlike metal counterflashing, elastomeric membrane counterflashing must come in intimate contact with the base flashing and relies on an adhesive bond for waterproofing performance; adhesion and chemical compatibility between the counterflashing and base flashing membranes must be verified. If the membrane counterflashing is bonded to substrates that will move differentially (for example, a metal boot base flashing to a metal duct), the membrane must be detailed to accommodate the variance in movement at their junction. Membrane base flashings have been utilized successfully by the authors at such conditions as the following:

- HSS column penetrations (*Figure 11a*) where, as described previously, a band clamp does not provide continuous compression on the "flats" of the HSS member, warranting use of a pliable/uncured membrane that can conform to the HSS shape and traverse over the underlying band clamp
- Sheet metal ducts (*Figure 11b*) where the membrane can conform to the rectilinear shape of the duct and the duct cannot accept mechanical fasteners (to attach metal counterflashing) without risk of air leakage or other duct-related performance problems

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*Figure 11a – Elastomeric membrane counterflashing at HSS column.*

*Figure 11b – Elastomeric membrane counterflashing at duct penetration.*

### Fluid-Applied Counterflashing

Increasingly, modified-bitumen, thermoplastic, and hot-rubberized-asphalt manufacturers are offering fluid-applied counterflashing membrane options. The technology associated with these membranes is not quite as new as their use in recent decades as base flashing membranes (for example, in conjunction with modified-bitumen field roofing) or as the roofing/waterproofing membranes themselves. Common chemistries for these counterflashings are polymethyl methacrylates (PMMAs) and polyurethane methacrylates (PUMAs).

#### *Considerations*

The primary benefit of fluid-applied counterflashings is that they are—if properly designed and installed—self-terminating. This means that when applied to a suitable vertical surface and fully cured, the top edge of the flashing can have a reasonable expectation for watertight performance (provided the wall above is watertight and the extent of this seal is properly integrated with respect to the wall system above).

Fluid-applied counterflashings are also useful for addressing irregularly shaped penetrations, which are notoriously difficult to counterflash with metal or elastomeric options. Like elastomeric membrane counterflashings, but unlike metal counterflashings, adhesion and chemical compatibility between the counterflashing and base flashing membranes must be verified. Additionally, scrutinizing the track record of counterflashing/base flashing membrane combinations is prudent. For example, PMMA options have been employed with modified-bitumen base flashings by various manufacturers for a decade or more, whereas PMMA use with thermoplastic membranes is a more recent market innovation.

One potential drawback to fluid-applied counterflashing—a concept that is inherent to fluid-applied membranes in general—is that these systems can require extensive surface preparation and are more workmanship sensitive than elastomeric sheets and, in some cases, than metal. Additionally, some fluid-applied membranes have performance characteristics that do not permit them to be installed over changes in substrates when differential movement is anticipated. The authors also note that odors associated with some of the liquid-applied counterflashing chemistries must be acknowledged and addressed in the construction logistics plan—particularly for occupied buildings.

## REQUIREMENTS

In interactions with some design and construction professionals, we too often hear opinions expressed that counterflashings over the base flashing of low-slope roofing/waterproofing have been omitted because they are not "required." We explore this notion in the context of the International Building Code (IBC), accepted roofing standards, and select manufacturer requirements.

### International Building Code on Counterflashing

The 2018 version of the IBC is not adopted by all jurisdictions, but requirements relative to counterflashing do not vary significantly between other versions of the code. For certain steep-slope roof coverings (for example, clay and concrete tile, slate shingles, wood shingles, and wood shakes), the IBC includes prescriptive requirements related to the inclusion of counterflashing in a roof system. For example, for wood shingles, Section 1507.8.8 includes, "At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's instructions." In low-slope roofing sections of the IBC (for example, modified bitumen and thermoplastic), the code does not include a similar prescriptive requirement for counterflashing.

Does this mean that counterflashing is not required by the code? Not necessarily. This is because the general Weather Protection section of IBC Chapter 15, Section 1503.2, Flashing, requires, "Flashing shall be installed in such a manner so as to prevent moisture entering the wall and roof." We interpret this as, effectively, a performance- based requirement that defers the determination of whether counterflashing is required to the project's design professionals. Although certainly neither foolproof nor as reliable as a through-wall flashing system that evacuates water from the overlying wall above the base flashing (for the reasons described above), counterflashing significantly improves the long-term water penetration resistance of base flashing terminations. Omitting counterflashing increases reliance on the exposed cap sealant shown in *Figure 1* (and, by extension, reliance on the owner to continually inspect and maintain this sealant); therefore, the argument to omit counterflashing is not supported by Section 1503.2.

### National Roofing Contractors Association

Counterflashing is a concept found in many locations of the widely accepted body of National Roofing Contractors Association (NRCA) manuals. For example, the *NRCA Architectural Metal Flashing and Condensation and Air Leakage Control* (2018) manual defines a minimum base flashing overlap dimension (4 in. [100 mm]), describes techniques for making transverse joints, highlights the necessity to isolate dissimilar metals to avoid galvanic reactions, and lists minimum metal thicknesses for flatness and weatherability of counterflashings.

### Sheet Metal and Air Conditioning Contractors' National Association

Like NRCA, information related to counterflashing is widespread in the Sheet Metal and Air Conditioning Contractors' National Association's (SMACNA's) *Architectural Sheet Metal Manual Seventh Edition – 2012 (SMACNA Manual).* Notably, the manual states that "removable counterflashing is cost effective for work installation sequencing and for roofing system repairs. All membrane roofing should have removable counterflashing" (for example, *Figures 5b* and *7*). In addition to general guidance outlined in the text, the *SMACNA Manual* offers a robust array of metal counterflashing details that are a useful reference for counterflashing design. Moreover, supporting our previous statements about providing counterflashing and avoiding reliance on exposed cap sealant alone, the *SMACNA Manual* notes, "Sealants require continuous maintenance and should be avoided in the design of water-shedding elements if a reasonable alternative exists."

### Manufacturer Requirements

The 2015 IBC and many technical specifications the authors have reviewed related to low-slope roofing or waterproofing require following the recommendations of the selected membrane manufacturer—at a minimum. We find that some design and construction professionals think that the membrane manufacturer does not care whether counterflashing is provided, and that, therefore, a design lacking counterflashing is sufficient as long as it is warrantable. We reviewed a sample of low-slope roofing and waterproofing manufacturer requirements (standard details and three-part specifications) and found several instances where the manufacturer, understandably and appropriately, suggests that they *do* care. Some examples include:

- One manufacturer of multiple low-slope roofing options provides several base flashing termination detail options that include various combinations of the features described in this paper (for example, mastic or lack thereof, and counterflashing or lack thereof). Each counterflashing detail has an associated warranty duration limitation. For example, for projects seeking a warranty of greater than 20 years, reglet-set counterflashing is a minimum requirement. This same manufacturer requires reglet-set counterflashing at the joints of precast concrete wall panels.
- One manufacturer of multiple low-slope roofing options highlights a common requirement: "Regular maintenance of counterflashing and sealants required. Not included as part of the...warranty."

As with any part of an architectural design, review of the specified manufacturer's current requirements for detailing and warranty eligibility should be part of the design development. On the topic of warranty, though, the authors caution that warranty eligibility should never supplant prudent, project-specific design. We acknowledge the importance of warranty eligibility in the context of business operations of building-owner clients. With that said, we note the following select excerpts from roofing manufacturer warranty exclusions:

- "Deterioration of flashings where water has been allowed to enter behind the base flashing from sources other than through the [roofing system] or base flashing"
- "Failure of owner to use reasonable care in maintaining the [roofing system]"

The authors suggest that such exclusions are supportive of the case to include counterflashing in design. In the case of the former, in the event of a water leakage failure at base flashing, one could argue (similar to the performance-based nature of IBC Section 1503.2 discussed previously) that omission of counterflashing might permit water to be "allowed to enter behind the base flashing." In the case of the latter, for a design that omits counterflashing, a reasonable owner's capital program might not include sufficient inspections to avert cap sealant deterioration, thereby exposing the owner to voiding of the warranty. In any case, for most roofing warranties, sealant is often excluded and cited as a "maintenance item."

## SUMMARY

In the increasingly competitive roofing/waterproofing industry, the use of counterflashings to assist in the transition of the roofing/waterproofing system to a myriad of differing vertical conditions remains a prudent design measure. Counterflashing increases the reliability of the transition and is supportive of long-term building enclosure performance with a reasonable maintenance demand at this critical condition.


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