

## THROUGH-WALL FLASHING

### INTRODUCTION

Masonry exterior walls have been used for centuries as both the primary load-bearing and exterior waterproofing systems for buildings. Stone and brick masonry type wall units, structurally bound together by mortar, create a very durable exterior building skin. Historically, masonry structures prevented the passage of water to the interior by the mass of excessively thick wall construction and/or protection with a cementitious stucco parging. Over time, cost has driven changes from mass masonry construction to a thinner masonry veneer with an alternative backup assembly such as metal stud framing. With this construction change, the flow of water through and within the façade system must now be managed. Approaches to moisture management vary from a simple mass construction evaporative theory to the introduction of a more complex and critical through-wall flashing component.

### TYPICAL LOCATIONS

The ongoing pursuit for building design uniqueness introduced decorative window wall assemblies, building projections and high-low roofs. Each feature results in distinct challenges for water management. Before we can discuss typical flashing locations, we must first delineate between what is known as a “barrier” versus “drainage” type wall assembly. A barrier wall is an assembly whereby mass masonry, coatings and/or sealants prohibit the passage of water through the exterior surface. On the other hand, a drainage wall is typical in today’s environment and assumes the passage of penetrating water through the exterior skin. Water typically falls within a cavity air space down until it reaches an obstruction or interruption in the wall system continuity, where a flashing is installed. Drainage wall assemblies are consistent with veneer construction whereby the exterior wall is composed of single

wythe units. Typical flashing locations are as follows:

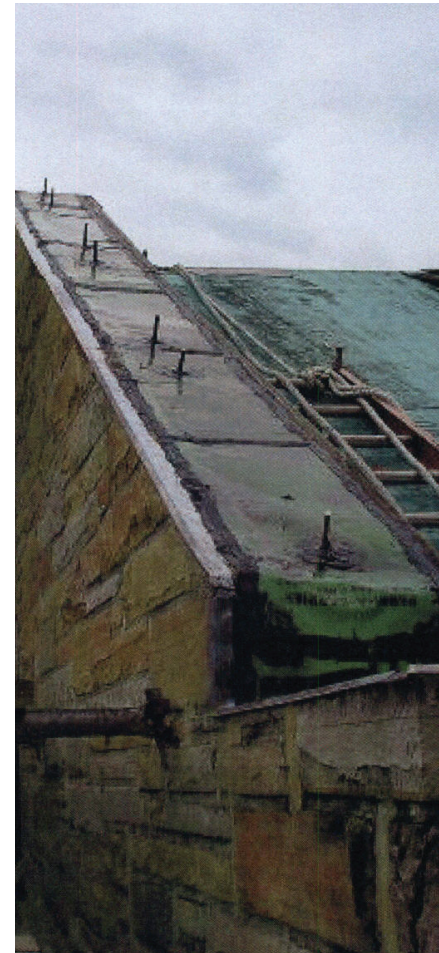
**1. Masonry Openings:** Wall openings (i.e. doors, windows, louvers) interrupt the normal vertical passage of water within a drainage wall assembly. Collection of penetrating water should be made at both head and sill locations. Care needs to be made such that fasteners do not compromise the water tight integrity.

**2. Wall Base:** Whether a wall is 10 or 30 feet high, the development of a head of water will exist. Installation of flashing at this location will eliminate the passage of water resulting in interior floor finish damage. Please note the importance in determining an accurate exterior grade line to ensure the wall outlet source is not dammed up from the back filling operation.

**3. Floor Lines:** On any multi-story building, it is common practice to introduce flashing lines at floor levels typically at perimeter shelf angle locations. Care needs to be taken that the flashing is placed on the shelf angle and not courses above. It is important that the heel of the flashing be supported, ensuring against lap seam failure.

**4. High/Low Roofs:** It is common for masonry penthouses to project above the main building platform. It is imperative that this head of water be collected and dissipated out onto the roof plane. Care needs to be taken so that roof membrane base flashings are terminated below the weep level.

**5. Balconies/Terraces:** On a similar note to high/low roofs, perimeters of balconies and terraces should possess integral through-wall flashing with any horizontal waterproofing element. Care should be taken regarding substantial backing for flashing adherence, blockouts for door thresholds and handrail mounting brackets.



Precast coping bed flashing with dowels, flexible membrane and metal drip edge

**6. Cavity Interruptions:** In the event that process piping penetrates the backup assembly, adequate flashing of same should be considered.

**7. Coping Walls:** If walls are capped with a material other than sheet metal, bed flashing should be considered. Commonly this is associated with anchorage and flashing for precast coping units.

### COMPONENTS

Through-wall flashing comprises multiple components. The functioning capacity relies heavily on skilled craftsman as well as the attention to details. The following is a list of typical

parts commonly found in through-wall flashings, either in new construction or restoration type work.

**1. End Dams:** The containment of water laterally is accomplished through a damming mechanism at the end of a flashing run, typically of formed metal or membrane.

**2. Top Termination:** A common failure in most flashing exists when the top free edge is not properly sealed or secured. A compression bar and caulk joint resists against cavity mortar damage and water seepage in behind an unprotected top edge. It is common that the location of this termination be at least 8 inches above the horizontal flashing leg.

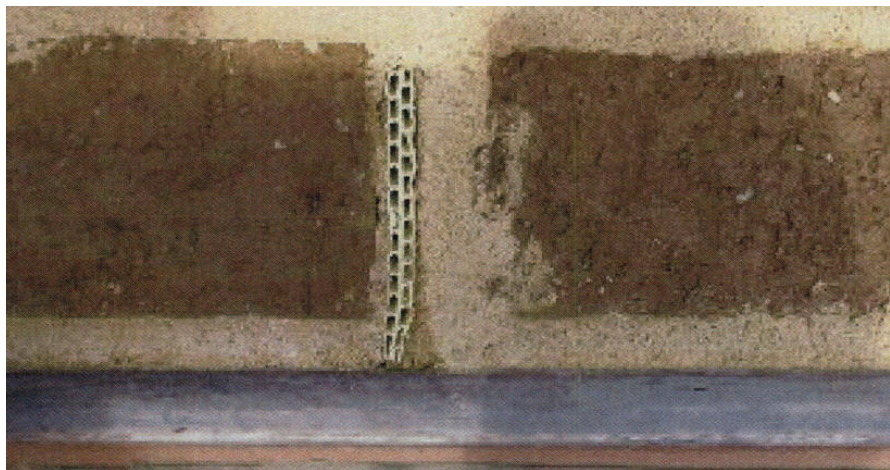
**3. Lap Splices:** Whenever a lengthy run of through-wall flashing is encountered, lap splices will exist. Sheet metal is commonly provided in 8-10 foot lengths. Typical lap protection should consist of in-seam sealant and extra layer of membrane stripping ply prior to the full flashing run. In addition, sheet metal shall lap a minimum of 4 inches and be provided with a splice cover plate at expansion joints.

**4. Weep Outlets:** The dissipation of accumulated penetrating water is accomplished through a series of weep outlets typically spaced at 24 inches on center. The various types of weep outlets include ropes, plastic tubes, cell vents or open head joints. However, cell vents and open head joints are the most desirable type because they quickly dissipate accumulated cavity water. In any event, it is critical the weep outlets are placed directly onto the flashing plane and not elevated on top of the bed joint mortar.

**5. Wall Ties:** The lateral stability of any masonry veneer system is accomplished using wall ties to the backup assembly spaced in accordance with the local building code requirements. This component is important particularly when localized flashing repairs are made. Common types of wall ties include triangular adjustable or corrugated flexible, both of which should be made with stainless steel or special coating to resist against



Typical flashing detail depicting top termination, flexible membrane, metal drip edge and end dam



Cell vent weep outlet placed on top of flashing line and not on bed mortar

corrosion.

**6. Drip Edge:** Many times, the horizontal extension of the flashing component is left short due to unwanted ultraviolet exposure. This concern is overcome with the introduction of a sheet metal drip edge. The sheet metal acts as a horizontal closure piece ensuring entrapped water will escape directly to the outside of the veneer system. Aesthetics become a concern with this exposed flashing component.

**7. Membrane:** In today's environment, the use of a self-adhering flexible membrane product is common. Distinct advantages include ease of site fabrication, being somewhat self-sealing and puncture resistant. This product acts as the primary line of defense either alone or in conjunction with a drip edge.

**8. Mortar Netting:** It is extremely difficult to ensure against mortar accumulation within the cavity airspace. As such, it is common practice to

employ mortar netting, which acts as a filter to keep the cavity clean at the weep plane.

**9. Fasteners:** Components such as wall ties and termination bars must be adequately fastened to the backup assembly. Suitable fasteners should possess a non-corrosive finish.

**10. Corners:** Flashing runs generally possess inside and outside corners. Proper detailing at these locations is critical to ensure watertight integrity. Sometimes pre-molded shapes are introduced but in most instances hand forming is preferred.

**11. Sealants:** There are various type of adhesives used at flashing lines. Butyl and/or silicone-based products are commonly installed to seal off the top termination bar edge and act as embedment material for rigid metal shapes.

## DESIGN CONSIDERATIONS

Buildings are built with varying





Excessive cavity with secondary metal closure piece



Inadequate flashing step down transition detail

products and acceptable tolerances. As such, a universal solution for flashing installation is not practical. There are many factors which should be considered when establishing design parameters for a through-wall flashing component. Profile is the configuration in the wall of a flashing component. It consists of the vertical and horizontal runs from the top termination to outer wall surface. Establishing an adequate profile is important so as to render a water tight condition. Cavity size varies depending upon the wall design and could range from 1-3 inches deep. This dimension creates some issues in adequately closing up this gap. The configuration of the backup assembly and cavity size dictate

the flashing design.

Depending upon the situation, the flashing component could be a multiple piece element. (i.e. drip edge, cavity closure piece, flexible membrane). When installing the flashing component, extreme care should be considered when analyzing discontinuities. Discontinuities are an interruption in the flashing run consisting of terminations and vertical step-up/down differences. The transition between two planes is essential. Another factor to consider is the substrate condition. Irregular surfaces should be leveled and voids filled to establish a smooth working plane. Finally, regarding

repairs, temporary shoring of remaining masonry units commonly dictates the number of lap splices in a flashing run. Flashing will be placed in sections to accommodate shoring jacks being removed one at a time. Due to varying site conditions, it is necessary to ensure the proposed remedial repair detail can be installed as designed. It is not uncommon to modify the approach to conform to actual building tolerances.

#### MEANS OF IDENTIFYING FAILURES

Owners continue to battle the elements when maintaining their assets. Water intrusion is a major problem when considering the detrimental by-products of client dissatisfaction, interior finish

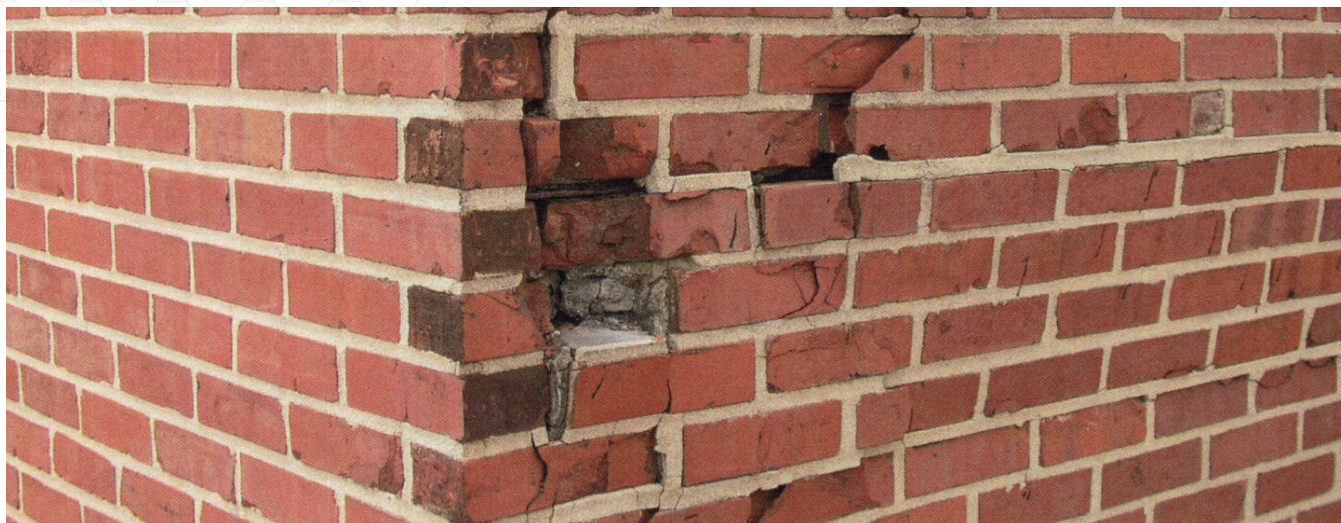


Irregular foundation wall surface in need of leveling



Brick replacement in sections to accommodate veneer dead load above





Masonry distress from trapped water and resulting steel beam corrosion activity

damage and mold development. In many instances, through-wall flashing problems are misinterpreted as roof or window leaks. In fact, a closer assessment will determine inadequacies with the through-wall flashing component. Listed below are some common indicators that a potential flashing problem exists.

1. **Interior Finish Damage:** Water stains, peeling wallpaper, acoustical ceiling tile damage and carpet saturation are all by-products of water intrusion.
2. **Brick Spalling:** In climates subjected to freeze/thaw cycle, brick defacing is not uncommon. This is an indication that water is trapped in the cavity and saturating the masonry surfaces.
3. **Wall Staining:** Efflorescence is the

accumulation of salt deposits on the masonry surface. The staining is a result of moisture vapor drive from the interior to exterior surface. Functioning through-wall flashing would allow entrapped water to dissipate and mitigate against this aesthetic issue.

4. **Omission of Weep Outlets:** As previously noted, weep outlets are a critical component to the functioning capacity of through-wall flashing. The omission of these outlets at an intended flashing line allows water to accumulate within the cavity space and possibly infiltrate through any minor detail flaw.

5. **Mold Development:** Drainage walls are designed for water infiltration. Properly installed through-wall flashing will render a building envelope watertight. Mold development will

exist when this envelope has been compromised.

6. **Corrosion/Lintel Failure:** Corrosion staining on masonry surfaces is an indication of inadequate structural steel protection. If shelf angles and lintels are properly flashed, corrosion staining should not be evident. There is an additional concern that ongoing exposure of structural steel to drainage water will result in corrosion and loss of section, possibly rendering the support unsafe.

7. **Sealants:** Façade sealants are placed in a liquid state but cure as a solid. If bubbles are visible in sealant joints, there is a likelihood that trapped moisture existed during the curing process.



Mass Masonry Wall: Note mortar displacement, omission of weep outlets and excessive corrosion/deflection of the lintel support from trapped moisture.

**8. Residue Rundown:** Leaching is a result of water entrapment and biological or atmospheric contaminants bleeding out from the cavity space.

### MATERIAL SELECTION MATRIX

The selection of what type of material to use for a through-wall flashing can be based on many factors or characteristics as demonstrated in the following table. Prior to the selection of a material, careful consideration should be given to these factors. Materials should be chosen only when they meet the majority of the needs identified, not based on designer, contractor or owner preferences or “brand-loyalties”.

Above all, consideration should be given to the fact that, unless a specialized situation exists, the maintenance, repair or replacement of through-wall flashings is likely to be a costly project that will involve the removal of portions of the exterior building envelope. It is best to place materials within the wall that will last as long as possible.

### RELATED CONSIDERATIONS

As façade systems have become lighter-weight and thinner the need for through-wall flashings has increased. In current industry terminology, a through-wall flashing is a material installed within the wall to direct moisture to the exterior. The moisture could be from various sources such as condensation, rain, snow or other miscellaneous sources. The flashing itself typically provides for protection of the interior wall system against water intrusion. Additional consideration must be made to the following items, all of which have become necessary due to the evolution of façade systems:

- Shelf angle anchorage
- Cavity inspection
- Veneer/cladding anchorage
- Weather conditions
- Non-corrosive components
- Volatile organic contents (VOC)/fumes
- Expansion joints

Shelf angles are a necessity in modern drained cavity wall systems. The purpose of shelf angles relieves the weight of the façade from bearing on itself to hanging from the structural system. Shelf angles are commonly supported from the structure with hangers. These hangers are either welded or bolted to the shelf angles. This attachment sometimes causes problems with flashing continuity



Steel shelf angle in need of extension to ensure adequate brick support

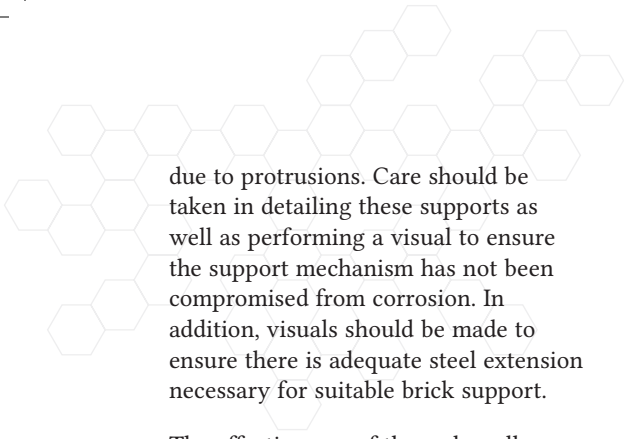
### MATERIAL SELECTION MATRIX

FLASHING TYPE	COMMON USE	UV RESISTANCE	RIGIDITY/ MOVEMENT	ATTACHMENT	DURABILITY/ USEFUL LIFE	CONSTRUCTABILITY/ EASE OF DETAILING	SUBSTRATE PREPARATION/ COMPATIBILITY	AESTHETICS	COST
<b>METALS</b>	NC	Good	Stiff	Mechanical/ Embedment	Good	Difficult	Minimal/Consider Galvanic Corrosion	Exposed edge/ clean lines/ staining possible if copper	\$\$\$
<b>FLUID APPLIED MEMBRANES</b>	NC	Fair	Flexible	Adhered	Fair	Easy	Smooth Even Substrate Required/Do not apply to painted or wet substrate	No exposed edge/staining possible	\$
<b>MODIFIED BITUMEN/ RUBBERIZED ASPHALT (PEEL-AND-STICK)</b>	R	Poor	Flexible	Adhered	Good	Easy	Smooth Even Substrate Required/Do not apply to painted or wet substrate	Uneven exposed edge	\$
<b>MODIFIED BITUMEN (HOT-APPLIED)</b>	NC	Good	Flexible	Adhered	Fair	Moderate	Smooth Even Substrate Required/Do not apply to painted or wet substrate	Uneven exposed edge	\$\$
<b>EPDM/NEOPRENE (LOOSE-LAID)</b>	R	Good	Flexible	Mechanical	Fair	Easy	Smooth Substrate/ Sound Substrate for Termination Bar	Uneven exposed edge	\$
<b>EPDM (FULLY-ADHERED)</b>	R	Good	Flexible	Adhered	Fair	Moderate	Smooth Even Substrate Required/Do not apply to painted or wet substrate	Uneven exposed edge	\$
<b>PLASTICS OR PVC PREFORMED SHAPES</b>	NC	Poor	Stiff	Mechanical	Fair	Difficult	Minimal Surface Preparation/Minimal Compatibility Issues	No exposed edge	\$\$
<b>ASPHALT COATED COPPER</b>	R	Good	Stiff	Mechanical/ Embedment	Good	Moderate	Minimal Surface Preparation/Minimal Compatibility Issues	No exposed edge/staining possible	\$\$

#### NOTES

1. Common use refers to the predominant application between new construction (NC) or restoration (R).
2. UV Resistance refers to the material characteristics of the types of flashing shown and their relative resistance to degradation by exposure to UV.
3. Rigidity/Movement refers to the stiffness of the material with respect to accommodating movement of the building.
4. Attachment refers to the primary method of securing the types of flashing shown. Note that the attachment typically refers to a “mechanical” termination bar at the top of the flashing, fully “adhered” or “embedment”.
5. Durability/Useful Life refers to typical expected life of the flashing materials shown.
6. Constructability/Ease of Detailing refers to the level of difficulty when installing the flashing shown in accordance with typical industry standards.
7. Substrate Preparation/Compatibility refers to the type of surface preparation required to properly install the material and if any incompatibilities exist with other products.
8. Aesthetics refers to the impact of the building façade of the exposed portion of the flashing (if any).
9. Cost refers to the relative order of magnitude comparison between the various types of flashing shown, the more \$ the more expensive the system in a typical application.





due to protrusions. Care should be taken in detailing these supports as well as performing a visual to ensure the support mechanism has not been compromised from corrosion. In addition, visuals should be made to ensure there is adequate steel extension necessary for suitable brick support.

The effectiveness of through-wall flashing is dependant upon a viable cavity for drainage. If the cavity is filled with mortar, brick fragments, stone chips, or dust or other debris during construction, the ability of the flashings to properly drain the cavity will be impaired. Also, debris in the cavity can result in damage to the flashings, negating even the best of detailing and installation efforts. Inspection of the cavity during construction should be performed frequently in order to minimize debris development. Mortar net can be installed to mitigate this concern.

Excessive water penetration may compromise the anchorage of a veneer system. A tactile response test or use of pachometer can be employed to confirm the presence of wall ties and acceptable lateral stability. Any suspect condition should be reported. Care should be taken to avoid unnecessary wall tie penetrations through flashings.

As with most exterior construction practices, weather must be considered.

The installation of through-wall flashings and cavity membranes should always be performed within the manufacturer's recommended temperature range. Installation in wet conditions or freezing temperatures should be avoided.

Flashing repairs are an expensive proposition. As stated, the use of durable products is imperative. Consideration should be made when analyzing product longevity particularly as it pertains to corrosion. All metals (i.e. drip edge, termination bar) and fasteners should be of stainless steel or specialized coating to resist corrosion attack from the cavity moisture. In addition, charts should be reviewed to ensure against corrosion development from dissimilar materials in contact with one another.

In most instances, flashing repairs are performed on occupied structures. Most products rely on primers to promote satisfactory substrate adhesion. In addition, coating of structural steel lintels and shelf angles is desired to mitigate against corrosion development. Coatings and primers typically possess solvents from their volatile organic contents (VOC). Samples should be installed necessary to establish acceptable tolerances for solvent fume emission.

Flashing runs can be lengthy at times

and encompass expansion joints in the repair zone. This creates an issue as it pertains to sealant cure while in contact with a "green" mortar. Suitable primers should be submitted and/or pull tests performed to confirm satisfactory sealant adhesion if installed less than 28 days from brick replacement.

## RELATED DEFINITIONS

### Through-wall flashing

A material installed within the wall to direct moisture to the exterior.

### Barrier Wall

An exterior wall system designed to keep all water out.

### Mass Wall

An exterior wall system whose primary line of defense against moisture intrusion is multiple masonry units. These types of wall systems are typically stone or brick masonry and are found in older buildings.

### Curtainwall

An exterior wall system supported or "hung" from the primary structural system.

### Drained Cavity Wall

A wall system designed to mitigate the effects of moisture infiltration due to rain, snow and condensation by incorporating a flashing system that directs water to the exterior.

## Other valuable resources available from the Sealant, Waterproofing & Restoration Institute

SWR Institute *Applicator*,  
a technical journal

Applying Liquid Sealants:  
An Applicator Training Program

Below Grade Waterproofing Manual

Clear Water  
Repellent Handbook

A Practical Guide to Waterproofing  
Exterior Walls

Sealants:  
The Professional's Guide

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