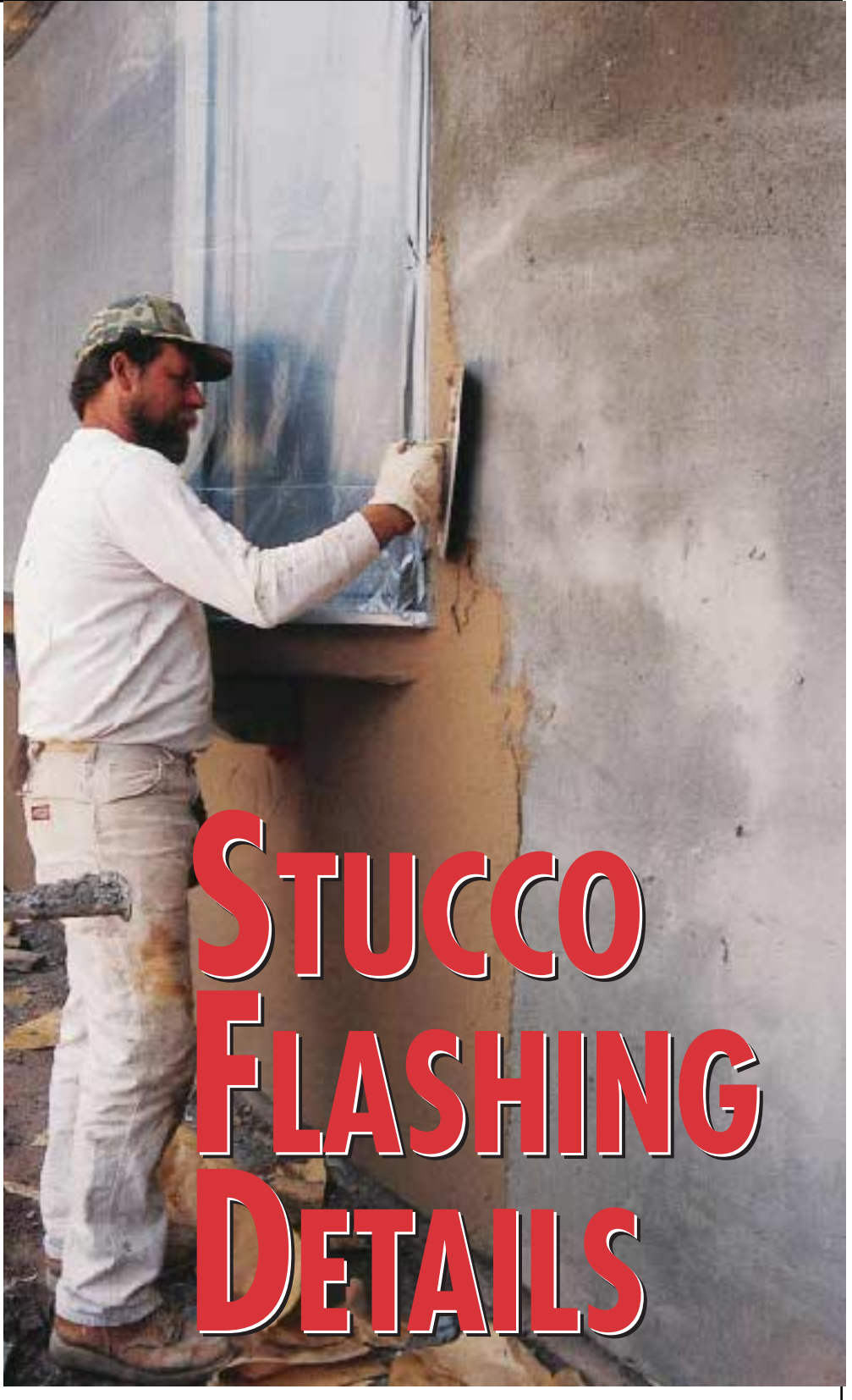
Stucco Flashing Details



Carefully installed flashing paper and caulk are the keys to preventing leaks

by Ron Webber

There are three stucco wall systems in use today: traditional three-coat stucco, so-called one-coat or synthetic stucco systems, and EIFS (Exterior Insulating Finish Systems). While water damage in EIFS walls has made the news in recent years because of class-action lawsuits, the fact is water can and does penetrate the finish in all three systems. This is especially true in houses with little or no roof overhang, where excessive amounts of water can run down the wall.

The solution to building a water-tight stucco wall is to view it as a system in which all parts must be correctly installed, particularly at penetrations, joints, openings, and other areas susceptible to leaks. Too often, however, the stucco finish gets all the attention, while the underlying protective membranes and flashings — which are the main defense against water intrusion — are overlooked.

In my 24 years as a stucco contractor, I have gone beyond the minimum requirements of the code to devise flashing details that have withstood the test of time. In this article, I will explain the materials and techniques I use to prevent leaks in stucco walls. In every case, you can tell if you have installed the flashing and building papers correctly by imagining the path water will take if you were to spray the wall with a hose before applying the plaster. If the water can flow freely over the paper from layer to layer without ponding or finding its way inside, then the wall is properly flashed.

Lath Paper

I work primarily with one-coat and traditional stucco, both of which rely on water-resistant membranes in conjunction with flashing at all wall openings and penetrations to direct any water that makes it through the stucco down towards the bottom of the wall. EIFS systems, which are applied directly over foam, originally relied on a water-tight skin to keep all water out. But because water from leaks at penetrations can

become trapped behind the foam, EIFS manufacturers are developing systems that also use a water-resistant membrane behind the foam.

The *UBC* currently requires Grade D (10-minute) paper for the membrane. While this is adequate, during periods of heavy rain, the water will eventually saturate the paper and find its way to the wood framing through any holes and tears. If left unchecked, this moisture can damage the structure, but at the very least will cause excessive expansion and contraction of the wood frames. The resulting cracks in the stucco base and finish coats are not only unsightly, they could allow even greater water intrusion, leading to more cracks.

The code also calls for horizontal laps of 2 inches and vertical laps of 6 inches. I think these minimum overlaps should be doubled. I have seen water travel sideways and back up behind the overlaps, especially if the paper has wrinkled, which it tends to do when it gets wet.

Heavier paper. To break the cycle of leaks leading to cracks leading to more

Leakproof Window Flashing

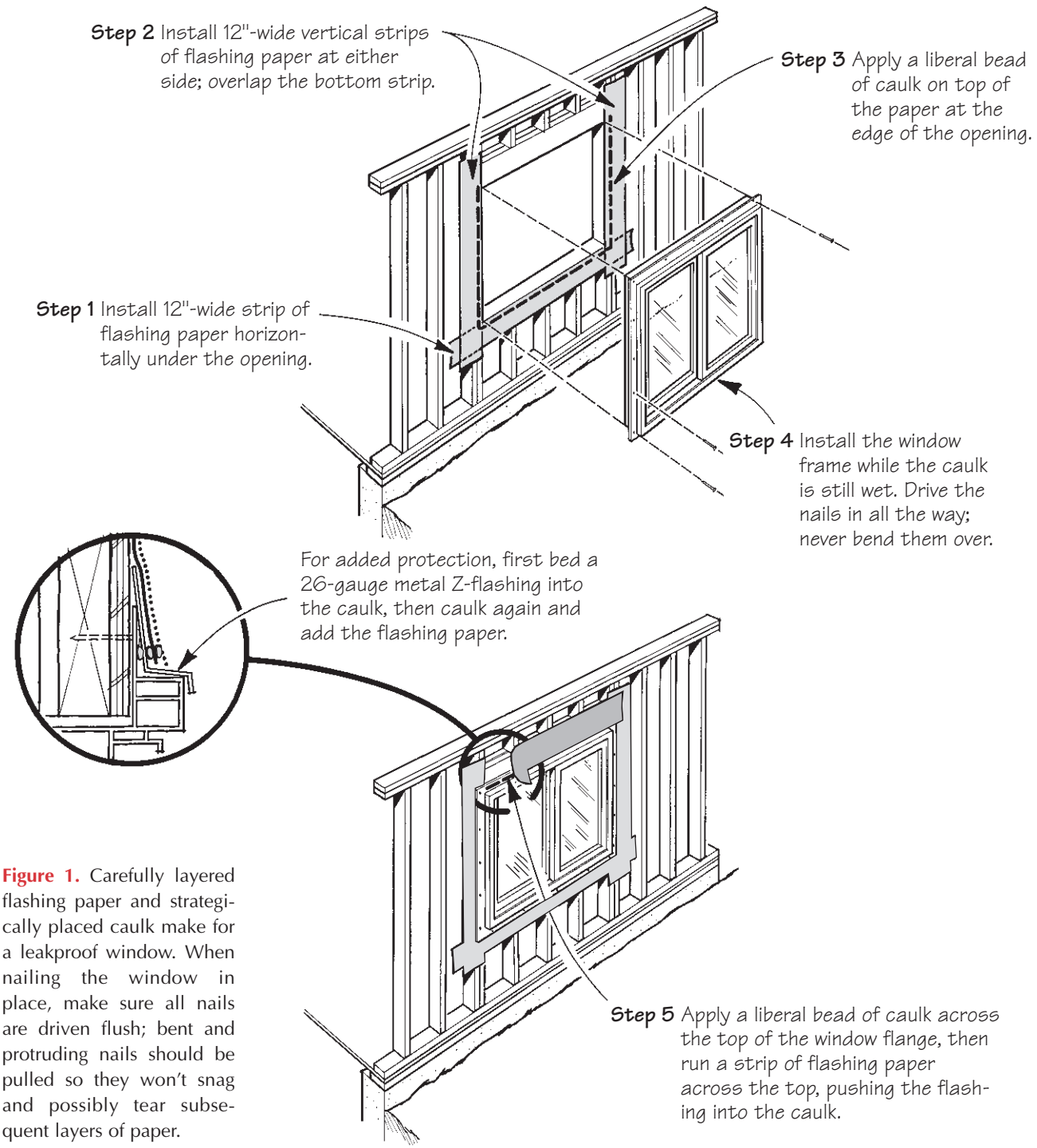


Figure 1. Carefully layered flashing paper and strategically placed caulk make for a leakproof window. When nailing the window in place, make sure all nails are driven flush; bent and protruding nails should be pulled so they won't snag and possibly tear subsequent layers of paper.

leaks, I recommend upgrading the paper. I have done extensive testing of various papers, and at a minimum I prefer to use a 28-pound, 30-minute paper, which is made by a number of companies (see "Sources of Supply"). The 30-minute paper is easier to fold and bend than heavier (60-minute) paper, and unlike lighter weight paper, it is more resistant to splitting when exposed to moisture, sunlight, and extreme temperature changes.

I have also tested Dupont's Tyvek Stuccowrap, although I haven't yet used it for as long as the other papers, and I find it has a number of advantages when installed behind stucco. Tyvek bends more easily than paper and it's less likely to tear during installation. Tyvek flashing paper is not available, but Dupont does make a special tape, which I have found to be easy to work with at seams and joints. Tyvek is also dimensionally stable, both when wet and when subjected to wide temperature swings, so the holes around nails and staples won't gradually grow larger the way they do in conventional building papers. In addition, Tyvek won't wrinkle like building paper when it gets wet, an important advantage because wrinkles are a likely place for holes to develop. Stuccowrap also appears to be beneficial to the stucco curing process. By not drawing the water out of the scratch coat, it allows the stucco to hydrate more effectively, developing greater strength and density.

Flashing Paper

Around openings and penetrations, many stucco contractors use sisal kraft paper, which sandwiches a layer of asphalt paper between brown kraft paper, but we have experienced many problems with it. Sisal kraft paper is easily cut by sharp objects, such as the corner of window frames; when wet, it develops wrinkles that make it difficult to get it to lie flat, leading to rips if the winds pick up.

One alternative is Moistop, which is made by sandwiching kraft paper between two layers of polyethylene. It bends easily around flashing and holds up well over time. Moistop does not wrinkle when wet like sisal kraft, but it does rip in the wind.

I now prefer to use Future Flash, a 20-mil rubberized asphalt membrane sandwiched between 4-mil polyethylene on the face and polyester on the back. One reason is its strength: During fall and winter we can get winds that blow 50 miles an hour or more, and Future Flash won't tear apart like sisal kraft and Moistop. Paper products won't stretch either, whereas Future Flash has 128% elongation.

I also like Future Flash because it's not self-sticking, so any water that does make its way behind the membrane has a chance to find a way out. If all the horizontal laps are sealed, they may create a dam that will catch water. When water-testing stucco walls, I have watched water that leaked through nail penetrations run down the backside of the paper and find its way out again between the overlaps.

At horizontal surfaces, I prefer to use Vycor (formerly called bituthene), a rubberized-asphalt and poly membrane originally designed for use as roof flashing. It's thick enough to be durable, and adheres well to itself and to most other materials. Vycor also seals itself around any fasteners that are driven through it, and it's self-sticking in temperatures above 60°F. When it's very hot, though, Vycor becomes so sticky it can be difficult to handle, especially when working alone. Vycor will also bleed if left exposed, so it must be used only where it will be covered by other materials.

Figure 2. For doors installed over wood subfloors, the author uses a soldered metal pan at the sill, making sure the metal deck-to-wall flashing overlaps the side flanges and that the flashing paper around the opening is properly layered. All doors should be securely shimmed and nailed through the jambs to prevent cracks in the stucco from door movement.

Figure 3. Flashing paper should be used behind wood or foam plant-ons used to trim openings. The plant-ons should be completely wrapped with flashing paper, which must also be properly woven into each course of lath paper for proper drainage.

Caulk

We also use a lot of caulk, both to repair pinholes and tears in the paper and to seal flashing at penetrations and openings. Caulks vary greatly in quality, and so do the conditions under which they are applied. A caulk that works well in hot, dry weather may not perform as well in cool, damp conditions; similarly, a caulk may have to bond to surfaces that are moist or dirty, shiny or dull.

Rather than rely on the published specs, I have experimented with a wide range of caulks in my shop and in the field (see "Sticking Caulk"). The best caulk I have found is Quad Advanced Formula Sealant from OSI. It performs well on all surfaces, including Tyvek, which gave most other caulks lots of trouble. Pro Choice Neoprene caulk from Gibson Homans was a close second, along with Pecora/Dynatrol I-XL, a polyurethane rubber sealant that develops a good skin even when applied to moist surfaces. These are premium caulks that cost a little bit more up front, but they make up for it with easy installation in a variety of conditions and with good durability over time.

Flashing Details

The areas of a stucco-clad building that are most susceptible to leaks are windows and doors, sidewall penetrations, and horizontal surfaces. In each case, proper flashing can prevent leaks, but all too often the flashing is either poorly installed or omitted altogether. Standard flashing details are difficult to come by, so over the years I have developed flashing systems that combine code-required techniques with methods of my own that have endured the test of time.

Flanged Windows

Vinyl or aluminum windows with nailing flanges will drain properly only if the lath and flashing papers are correctly layered as follows (see Figure 1).

Step 1: Install a strip of flashing paper horizontally under the opening.

Step 2: Install vertical strips of flashing paper at either side, making sure to overlap the bottom strip.

Step 3: Apply a liberal bead of caulk on top of the flashing paper at the edge of the opening.

Step 4: Install the window frame while the caulk is still wet. If you've used enough caulk, it should squeeze out from behind the flange. Drive the nails in all the way; never bend them over. A bent-over nail may look okay now, but it will eventually rip or puncture the flashing paper, and could interfere with proper layering of the flashing and water-resistant membranes.

Step 5: Apply a liberal bead of caulk across the top window flange, then run a strip of flashing paper across the top, pushing the flashing into the caulk. For extra protection, we sometimes install a 26-gauge metal Z-flashing or water table over the top of the flange. This flashing extends about 3/8 inch beyond the window corners to keep water away from the frame, which we have found to be susceptible to leaks.

When you install the building paper, roll it out horizontally, starting at the bottom of the wall and working your way up. Pay attention to the overlaps, and carefully weave in the flashing material as you go. I like to see 4-inch horizontal and 12-inch vertical laps.

Window frames should have a drip edge and stucco key at the outside edge of the sill; otherwise, water can run back under the sill, behind the stucco, and enter the wall through any holes in the flashing paper. When installing window frames, be careful not to jiggle or shift the frame too much. This could loosen the joints, creating a crack where water can get through. Also make sure any weep holes are big enough to drain freely. If the weep holes are too small or can be easily plugged, hard driving rain water can back up over the inside edge of the window and onto the sill.

Flashing for Clad Doors

Doors are susceptible not only to water that falls on them directly, but also to backsplash from dripping eaves and overhangs. As with windows, each step in the flashing is critical to preventing leaks.

Step 1: If the door will be installed over a wood floor or subfloor, start by placing a metal pan with soldered corners at the sill, fastened in place with one nail driven through each of the wall fins into the edge of the stud (Figure 2). The fins on the metal pan should overlap the metal deck-to-wall flashing at the bottom of the wall by a minimum 6 inches. If space is tight, make sure the sheet-metal sub carefully caulks the overlap.

Step 2: Next, install strips of flashing paper vertically, flush with the sides of the opening. The strips should be long enough to cover the pan flanges at the bottom and to extend under the full width of the flashing paper that will be installed at the header.

Step 3: Caulk the flashing paper 1/2 inch from the opening, then install the door jamb. Use a big enough bead so that

the caulk squeezes out when you nail the door flanges. After the door flanges have been attached, shim and fasten the jambs to the studs using a pair of nails or screws 4 inches from top and bottom and 16 inches on-center in between. This will keep movement in the jamb from causing cracks in the stucco.

Step 4: Lay a generous bead of caulk over the flange at the door head, then bed a final strip of flashing paper in it. Make sure the paper overlaps both the nailing flange and the side strips of flashing paper.

Plant-Ons

In many stucco installations, windows and doors are trimmed with built-up details called "plant-ons." Made of either foam or wood, these extra layers create additional joints and corners that are prime candidates for leaks. The key to

Flashing Penetrations

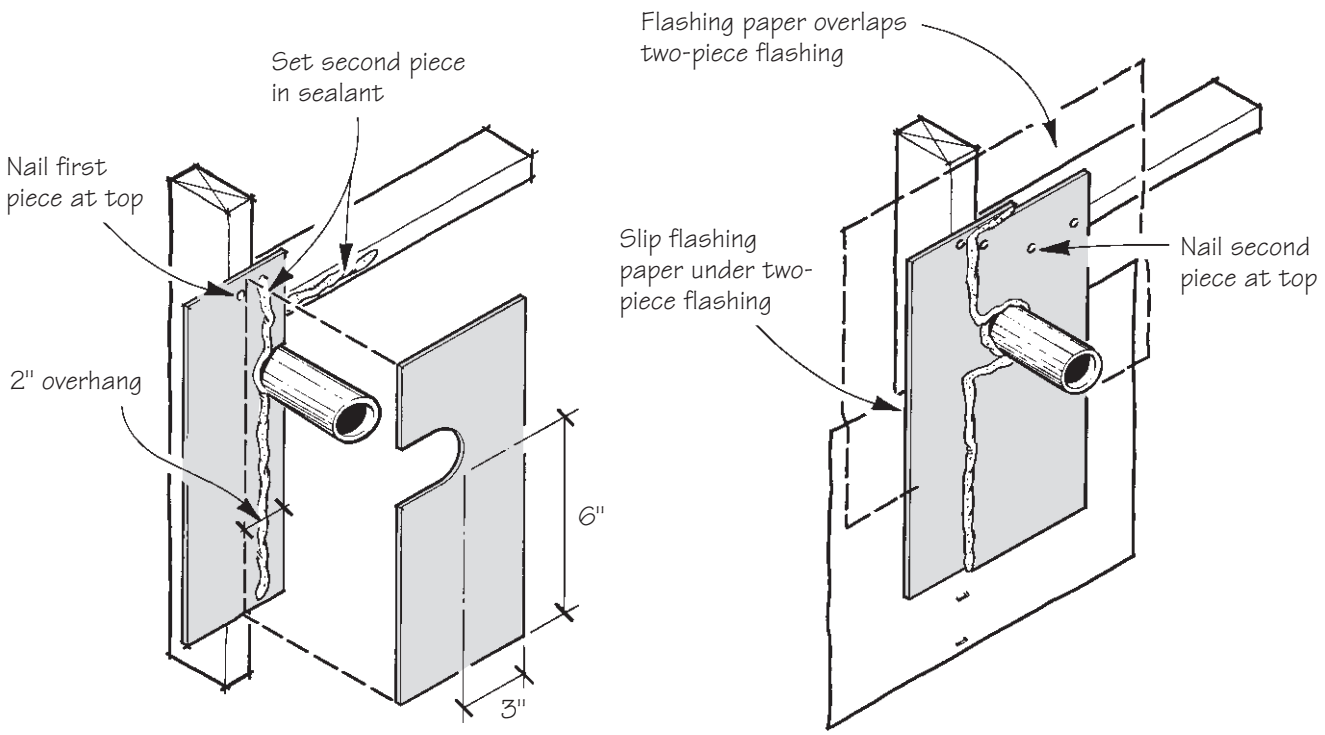


Figure 4. To flash wall penetrations, the author uses a two-piece sheet-metal collar (illustration), which is caulked to the fixture, then overlapped with flashing paper. A one-piece collar works well when the fixture falls in the center of a stud bay (photo, left). The integral flanges on attic and exhaust vents provide enough support for the stucco, but should still be caulked and carefully overlapped with flashing paper (photo, right).

preventing leaks at plant-ons is to use two pieces of paper. One piece runs continuously behind the plant-on to protect the sheathing; a second piece runs from under the window or door frame over the plant-on (Figure 3). Avoid folds or bends that will create a dam for water, and be careful not to tear the flashing paper when covering the ends of the plant-on.

Install vertical plant-ons after the bottom plant-on has been fully flashed. Run one piece of flashing paper behind the vertical plant-on, and over the horizontal plant-on. A second strip of flashing paper, used to cover the vertical plant-on, should also overlap the horizontal plant-on.

Install horizontal plant-ons at window and door heads last, again making sure the flashing is correctly layered and overlaps the side plant-ons so that water drains to the outside, down and away from the framing.

We use a hammer tacker to hold the flashing paper in place until we are ready to install the lath, being careful not to put any holes in the paper. We place staples only at the edges of the flashing paper, where they will be covered by the window or door frame and caulking. Any holes created by the staples at the outside edge will be covered by overlapping building paper.

All plant-ons should be installed a minimum of 1 inch from the edge of the window or door frame so as to allow enough space for the flashing paper to easily run out and over the plant-on. If the plant-ons are installed too close to the frame, the flashing paper may create a groove or trough that will allow water to pond.

Wall Penetrations

Vents, utility supply lines, and electrical outlets are all prime candidates for leaks. For all of these penetrations, the key to a good flashing detail is to provide adequate backing around the penetration. For electrical outlets, supply pipes, spigots, and other small penetrations located near studs, use a two-piece sheet-metal collar (Figure 4).

Carefully cut the profile of the pipe or outlet out of each half of the collar, and allow for the two halves to overlap by at least 2 inches. Nail the collars only at the top so you can slip flashing paper under the lower halves (you may have to install extra blocking in the wall for nailing). After caulking the sheet metal to the outlet or pipe (all copper pipes should be sleeved in PVC to prevent corrosion), layer flashing paper over the top and sides of the collar, making sure to overlap the lower sheet of paper by 4 inches or more.

Where an outlet or pipe falls near the middle of a stud bay, use a one-piece sheet-metal collar to provide solid backing for the stucco. Again, caulk around the cutout and nail only the top of the collar, leaving the bottom flapping so it can overlap building paper slipped up from below. Overlap subsequent layers of paper so that they provide continuous drainage to the outside.

The same flashing principles apply to larger penetrations, like exhaust vents and attic vents. Most of these fixtures have integral flanges, so no additional collar is needed. But the paper must be layered carefully and should be caulked to the flange. If the paper rips in the wind, it should be replaced.

Where Fascia Butts a Wall

Another weak spot in the weather barrier is the intersection of a fascia or eaves return and a wall. Because the roof pitch directs so much water to these areas, we take extra precautions against leaks. Whenever possible, we coordinate our flashing work with the framing crew so that we can apply a full 36-inch-wide strip of Vycor over the wall before the subfascia and trim boards are nailed in place (Figure 5). The self-sticking membrane should overlap any lath paper on the bottom, but should be overlapped by paper on the top and sides, so that any water spilling onto the wall will drain downward.

Equally important is a kick-out flashing at the edge of the eaves. This metal flashing is really the first line of defense, because it catches any water coming off the roof and directs it away from the wall surface (for kick-out detail, see "Installing Water-Managed Synthetic Stucco," 9/98). As with all other flashing details, the building paper should be layered properly so that water drains to the bottom of the wall.

Figure 5. Flashing where roof trim meets a wall should be done before the framing is complete. The author protects the wall with a full-width sheet of self-adhering membrane, which overlaps lower courses of flashing paper at the bottom, but is itself overlapped by paper at the top and sides. It's also essential to install a metal kick-out flashing on the roof to direct runoff away from the wall.

Sticking Caulk to Paper: A Hands-On Comparison

I have experimented in my shop to find out how well various caulks and tapes stick to different types of paper. Some of the 12-inch-square paper samples I used were fresh out of the box, others approximated the damp or dusty condition of a job site. I applied three beads of sealant: a 3/8-inch bead right out of the tube; a 3/8-inch bead which I tooled to flatten it; and another flattened bead used to adhere a second piece of paper. I allowed the samples to dry for about 48 hours, then submerged them in water for 72 hours. This level of exposure to water is severe, but I felt that it was justified because I have worked on jobs where caulk was exposed to heavy rain and runoff for 24 hours or more.

After taking the samples out of the water, I pulled and tugged the beads to see how well they had adhered. The results, which are shown in the chart below, aren't scientific, but are based on careful observations from which I was able to form an opinion about which caulks worked best relative to the others.

In general, the tooled caulk adhered better than the straight 3/8-inch bead, probably because of the increased surface area. Most of the caulks didn't stick well to Tyvek Stuccowrap, possibly because of its ridged surface. Two of the caulks — VIP's Elastomeric Ter-Polymer and Polyseamseal — softened significantly and all but lost their adhesion.

Clearly, the Quad caulk performed best with all membranes. Three other caulks — Rainbuster No. 900, Pro Choice Neoprene, and Dynatrol I-XL — were close seconds.

I also experimented with EZ Seal, a tape manufactured by Fortifiber consisting of hot-melt glue on paper, and with Tyvek Tape. While most contractors will not be applying saturated tape, both of these products performed well, although it was difficult to peel away the EZ Seal's backing paper to expose the adhesive, even after the tape had dried in the sun.

— *R.W.*

Base Receiving Material

Product/Manufacturer	Homewrap		Stuccowrap		60-min paper		Future Flash		
	damp dirty	clean	damp dirty	clean	damp dirty	clean	shiny dirty	dull dirty	dull clean
896 Silicone Pecora 800/523-6688	P	P	P	P	M	M	G	G	G
Silicone II GE 800/255-8886	P	P	P	P	P	F	F	G	G
PL Polyurethane Caulk Chemrex 800/828-0253	P	P	P	P	G	G	G	G	G
Elastomeric Ter-polymer Sealant VIP Waterproofing Systems 800/228-5537	F	P	P	P	P	P	P	P	P
Polyseamseal Darworth 800/624-7767	P	P	P	P	P	P	P	G	P
Rainbuster No. 900 Top Industrial 800/473-1617	M	F	P	M	G	G	G	G	G
Quad Advanced Formula Sealant OSI Sealants 800/321-3578	G	G	G	G	G	G	G	G	G
Pro Choice Neoprene Caulk Gibson-Homans 800/433-7293	G	G	G	G	G	G	F	M	G
Dynatrol I-XL Pecora 800/523-6688	F	M	F	F	G	G	G	G	G

Key: **Poor adhesion P Fair adhesion F Moderate adhesion M Good adhesion G**

Flashing Horizontal Surfaces

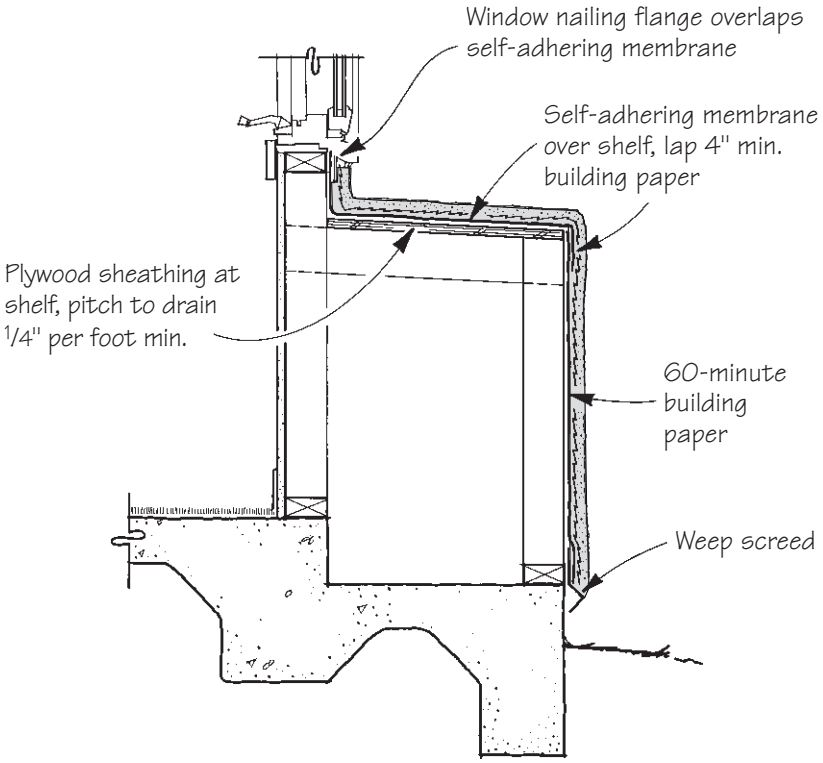


Figure 6. Leaks at parapets, pot shelves, and other horizontal surfaces can cause framing lumber to swell and crack the stucco. To promote drainage, the horizontal framing must be adequately sloped and should be fully flashed with a self-adhering membrane. The stepped slab also serves to contain leaks.

Horizontal Surfaces

Horizontal stucco surfaces, such as balcony railings and pot shelves at recessed windows, are especially prone to leaks because they are fully exposed to the weather. Unless they are carefully detailed, water from repeated soakings or ponding will eventually penetrate the stucco base and finish coats and wet the underlying framing. When the wood swells from this extra moisture, it causes the stucco to crack, which leads to more leaks, more swelling, and more cracks.

We always inspect the framing before flashing a horizontal surface to make sure that it slopes 1/4 inch per foot — more, if possible — so that water will drain freely. If the framing is level or, worse, sloped back toward the building, we won't touch it till the problem has been corrected.

On a properly sloped horizontal surface, we apply a layer of Vycor adhered directly to the sheathing and extending down over the edges to overlap any building paper coming up the sides (Figure 6). If the surface is in front of a window, we run the membrane under the bottom nailing flange and onto the sill plate. Similarly, where the horizontal surface meets a wall, we run the membrane up the wall where it will be overlapped by building paper. As with all of our flashing, we're careful not to tear or punch holes in the paper, and we make sure that the paper is layered so that water will drain away from the building.

Use as few nails as possible on the horizontal surface, and caulk or patch every rip, tear, or hole.

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Sources of Supply

Davis Wire Co.
5555 Irwindale Ave.
Irwindale, CA 91706
800/350-7851, ext. 217
Super Kraft Asphalt Sheathing Paper
Circle #16

Dupont
P.O. Box 70805
Wilmington, DE 19880-0705
800/448-9835
Tyvek StuccoWrap, Tyvek Tape
Circle #17

Fortifiber Company
300 Industrial Dr.
Fernley, NV 89408
800/773-4777
www.fortifiber.com
Jumbo Tex Weather Resistive Paper, Moistop EZ-Seal Window & Door Flashing
Circle #18

Grace Construction Products
62 Whittemore Ave.
Cambridge, MA 02140
617/876-1400
Vycor
Circle #19

Hal Industries
9681 187th Street
Surrey, B.C. Canada V4N 3N3
604/888-0777
30-min. Breather Paper
60-min. Breather Paper
Circle #20

Leatherback Industries
P.O. Box 594
Hollister, CA 95023
800/538-5950
Heavy Duty 60-min. Plaster Kraft Paper
Circle #21

MFM Building Products Corp.
P.O. Box 340
Coshocton, OH 43812
800/882-7663
Future Flash
Circle #22