# Low-Slope Roofing Details That Work

## Positive slope and easy drainage are keys to success

BY DOUG HORGAN

Photos by Doug Horgan; Illustrations by Tim Healey

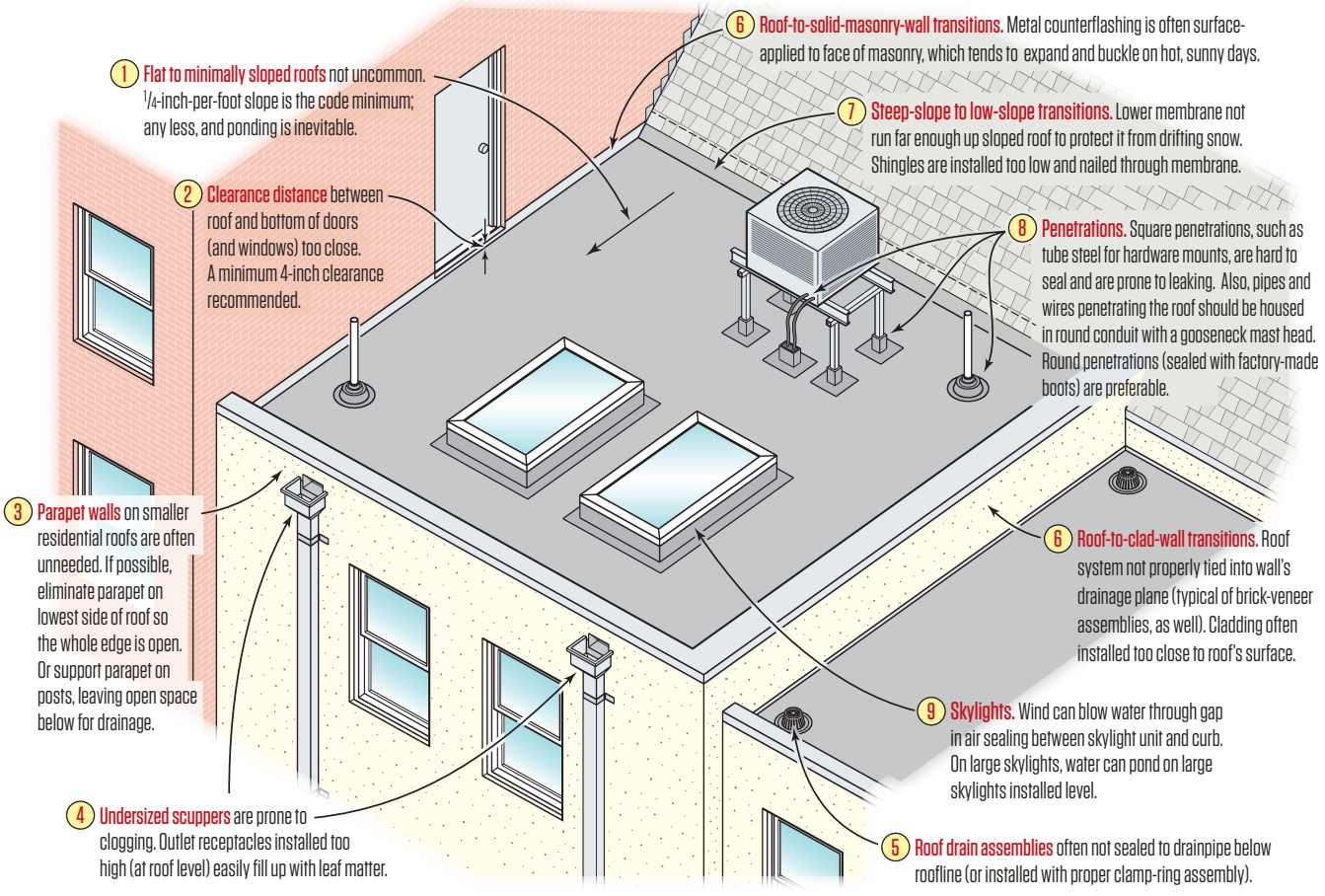
Low slope ("flat") roofs are challenging to build, and fail more often—and more disastrously—than steep roofs. Most have no redundancy: A tiny leak goes right into the house. A lot of stored water can build up, so a leak can be a very big problem instead of a little stain on a ceiling. The seams have to be watertight, so the work must be done perfectly. High turnover in the trade means inexperienced crew members.

For all these reasons, we've had the chance to learn a lot about what can go wrong with low-slope roofs. Some of these lessons have been learned on our own projects, although most were learned by repairing other contractors' roofs. I'd like to share those trouble spots and explain what we do to prevent the problems we've seen.

By "low slope" roofing, we mean any roof that is pitched at less than 4 inches of rise in 12 inches of run, or 4/12 pitch. Regular asphalt shingles and standard skylights will work at pitches of 4/12 or greater, but at lower pitches, you have to use different materials. That includes soldered metal roofing or synthetic membranes. Metal roofs, even fully soldered systems, have drawbacks for low-slope applications. So in this story, I'm going to focus on details for membrane roofing, and in particular, TPO (thermoplastic polyolefin) membranes.

I've written on this topic for *JLC* before (see: "Low Slope Roofing: Troubleshooting in Advance," Jan/16; "Draining Low-Slope Roofs," Oct/15; and "Steep-Slope to Low-Slope Transitions," Apr/14). Those stories focused on troubleshooting roof failures; in this story, I'll

## Low-Slope Roofing — Common Trouble Spots




### TYPICAL TROUBLE SPOTS

Membrane roofing materials are flexible, tough, and durable. Short of a tree branch dropping through them, they can stand up to conditions on a roof. Trouble can occur, however, at joints, seams, penetrations, and intersections. The illustration above shows areas where careful attention is important.

**1. Roof Slope.** Dead-level or backward-sloping roofs are prone to ponding. Be careful to maintain a slope of at least 1/4 inch per foot.

**2. Threshold Clearance.** 8 inches of clearance above the roof is recommended for door and window sills. Where that's not possible, shoot for at least 4 inches (the minimum for good working room).

**3. Parapets.** Most residential roofs don't actually require parapets. If possible, eliminate the parapet at least on the lowest roof edge to allow water to flow easily off the roof.

**4. Scuppers.** Compounding the parapet-wall issue, scuppers are often too small and too few to allow good drainage. Size scuppers at least 8 inches high and 12 inches wide. Mount receptors (conductors) low on the wall.

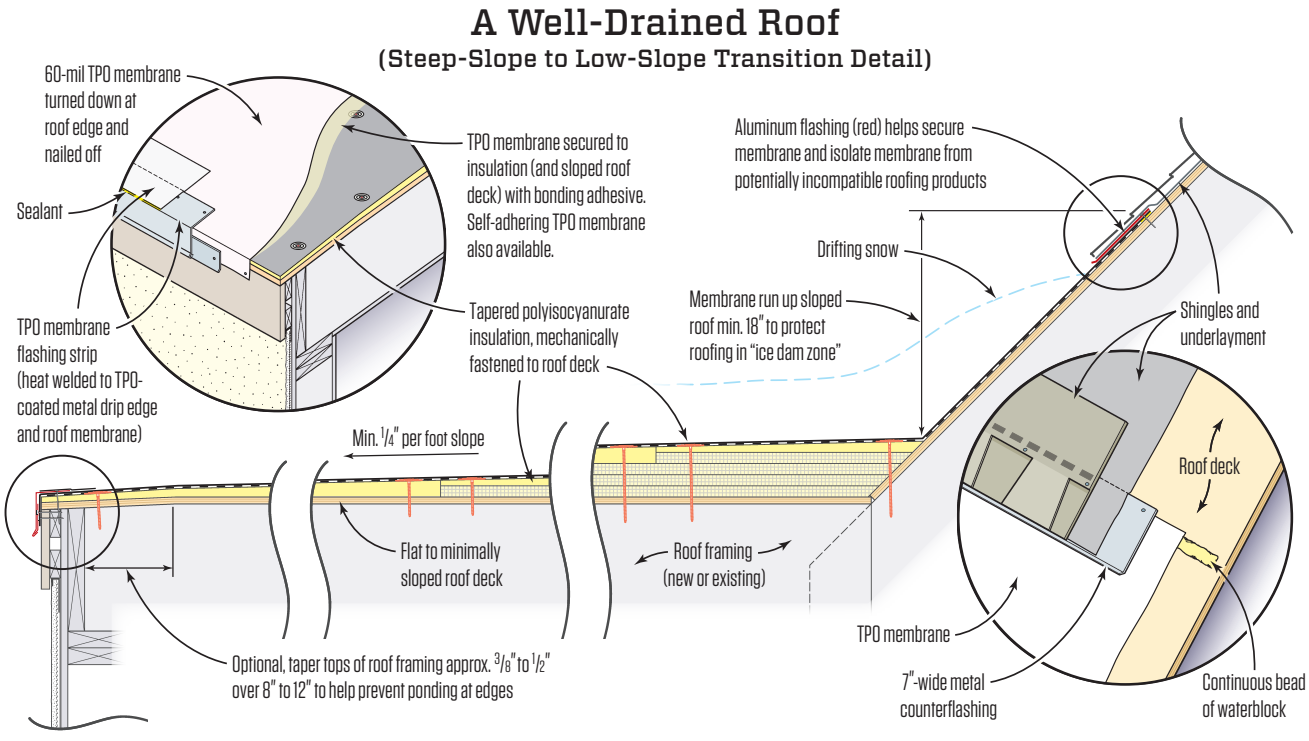
**5. Roof Drains.** A poor seal between the drain and the roofing is a typical cause of serious leaks. Use a clamp-ring drain to prevent this.

**6. Roof-to-Wall Transitions.** Roofing must be properly tied into abutting walls.

**7. Steep-Slope to Low-Slope Transitions.** Lower flat-roof membrane may not run far enough up the slope to protect against drifting snow and ice. Allow at least 18 to 24 inches of rise for the membrane.

**8. Penetrations.** Use factory-made boots and seal carefully.

**9. Skylights.** Skylights may leak from wind-blown rain or ponding water. Slope skylights and seal against air penetration.




A "slope kit" consisting of tapered foam sheets adds slope to a dead-flat roof. A wide-open roof edge is preferable to scuppers because it is less likely to clog. Tapering the rafters at the edge of the roof helps counter the buildup of layers at the edge. Extending the membrane up the adjoining steep roof protects against drifting snow and ice buildup.

focus on solutions that avoid those failures in the first place.

When we encounter trouble on any membrane roof, the problems are always related to joints, edges, and penetrations. Let's take a look at the details that work in those situations.

## SLOPE

Roofing-association manuals, as well as the code book, specify a minimum slope of 1/4 inch per foot for low-slope roofing. One cool trick is to use a "slope kit," consisting of sheets of foam that are tapered to provide the necessary slope. You can order the foam in different slopes. If, for instance, you wanted to add 1/4 inch per foot to a dead-flat roof, you would get foam that ranges from 1/2 inch thick to 1 1/2 inches thick over 4 feet. You'd start at the bottom edge with a 1/2-inch-to-1 1/2-inch piece, and then at the up-slope side, place a sheet of 1-inch flat foam and layer another piece of the tapered foam on top of it. You would continue on in a similar fashion up the roof to the high point.

## ROOF EDGES

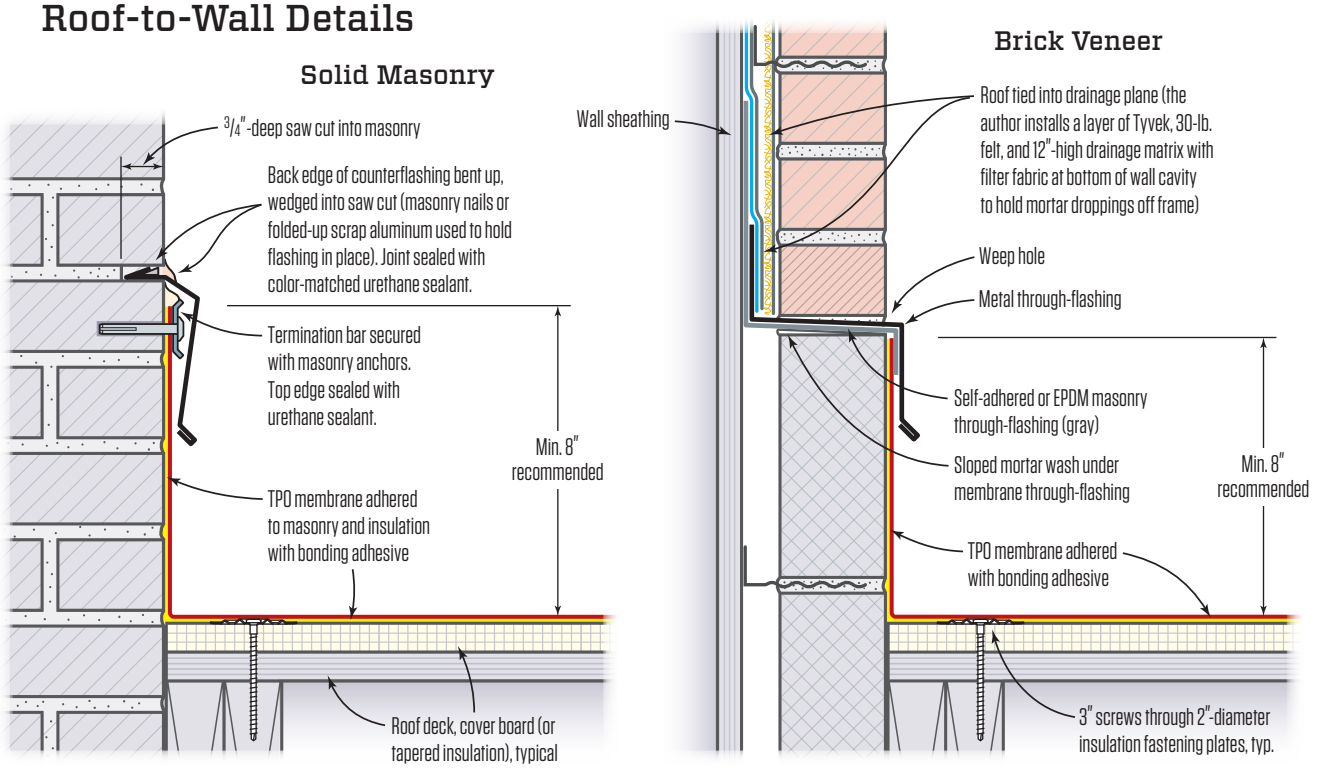
When it comes to drainage, open roof edges are preferable to roof drains or scuppers in a parapet wall. Roof drains and scuppers are both prone to clogging and they involve complicated detailing that is hard to do right. Most houses in our area don't actually need parapets: The main purpose of a parapet is to keep wind from sucking the membrane off the roof of a large building, and in our location, the wind forces don't make this necessary for residences.

At roof edges, multiple layers of material sometimes create a raised edge or a backward slope. To avoid this, we recommend tapering the framing at the roof edge to add a little slope pitching toward the outside. Just cutting a taper of 3/8 inch to nothing over 8 inches, or 1/2 inch to nothing over a foot, is enough to keep all those outside layers below the level of the main roof.

Metal drip edge at the roof edge is difficult to seal against water intrusion. The metal expands and contracts and puts a stress on any sealant you may apply at lap joints. To effectively waterproof this area, we like to follow a detail supplied by manufacturers that calls for running the membrane all the way to the roof edge and down over the fascia. Then we apply the drip edge on top of the membrane, and seal in the top of the metal with another strip of roofing.

As an alternative in locations prone to sliding snow and ice, you could implement a similar method: Attach a strip of roofing to the edge first, apply drip edge over this edge strip, and then apply the main roof membrane on top of this. This isn't necessary in our D.C. area, but it could be a better alternative in a colder climate.

## Roof-to-Wall Details




For solid masonry, the author recommends running the membrane 8 inches up the wall. The membrane is secured at the top with a termination bar and counterflashed.

Masonry veneer requires a through-flashing that ties into the weather-resistive barrier behind the masonry.

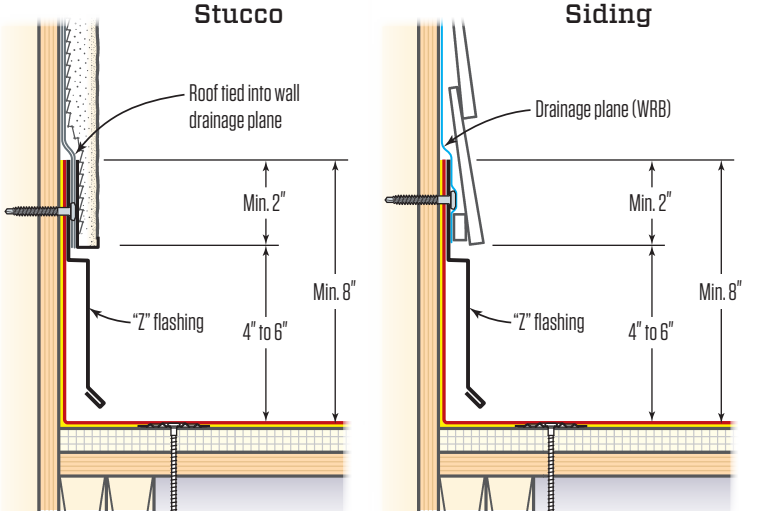
### WALL CONNECTIONS

According to the roofing-association manuals, roofing should lap up the wall at least 8 inches at roof-to-wall intersections. In practice, we've had good results with a 4-inch lap, but any lower than that is taking a risk.

When we attach to solid masonry, we generally use a termination bar—a strong piece of metal that we fasten into the wall, that clamps the roofing to the wall. We seal the top of that with sealant, and then we add another flashing over top of it which is set into a 3/4-inch kerf cut into the masonry—deep enough to keep the metal from working itself out of the kerf with expansion and contraction as it heats up or cools off.

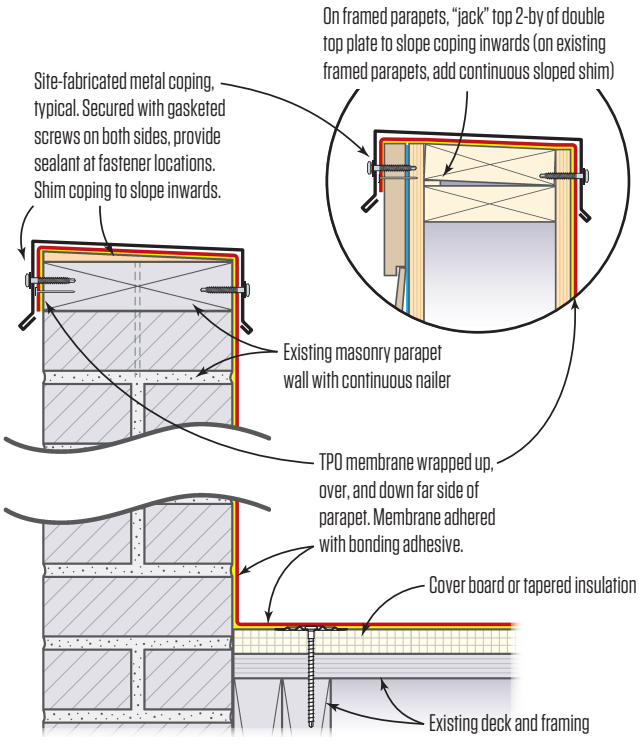
With brick veneer, you can't just kerf into the wall and embed a flashing in this way. Instead, you have to install a through-flashing into the wall that goes all the way back to the wall and ties into the drainage plane.

Under siding, it's enough to run the roofing up the wall and apply flashing over the roofing. Be sure to allow enough clearance between the siding and the roof to allow for reworking the roof in the future.

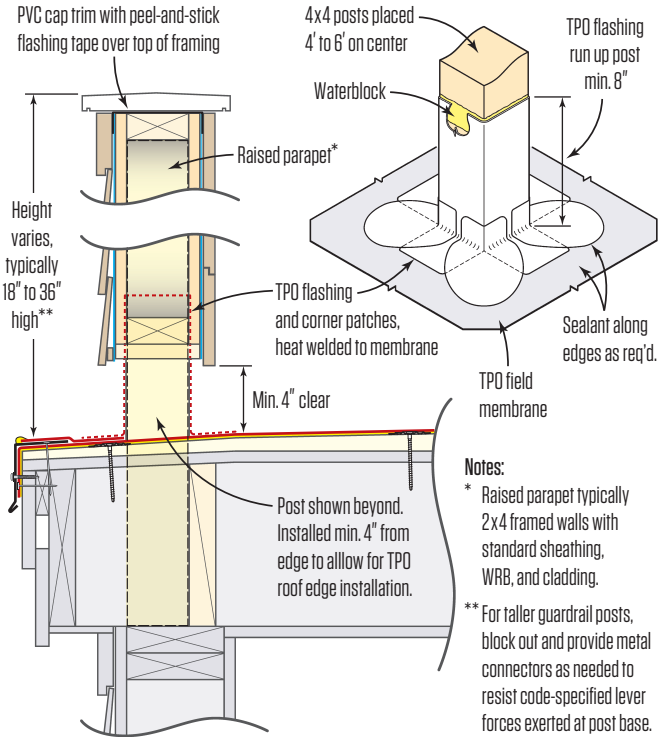



To tie the roofing into stucco or lap siding, the author recommends a "Z" flashing that laps under the weather-resistive barrier.

## Parapet Details

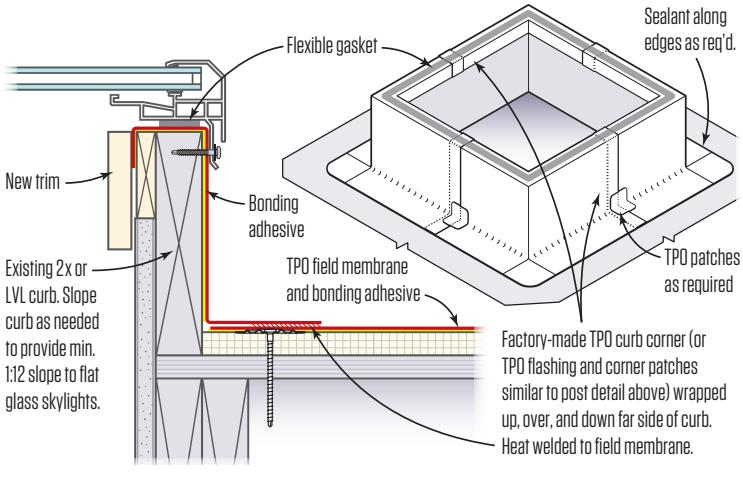



## Raised Parapet at Drainage Edge




When roofing wraps up and over the top of a parapet wall, waterproofing the coping or trim is less critical. For optimum drainage at the roof's lowest edge, the author prefers a parapet raised on posts as shown above, with the post base wrapped in membrane. The tops of parapets should be shimmed for slope to prevent standing water from collecting.

## Sealing Skylights




Preformed skylight curb corners help with wrapping membrane up and into the skylight curb. Skylights should be gasketed to block the intrusion of wind-blown water.

### PARAPETS AND SKYLIGHT CURBS

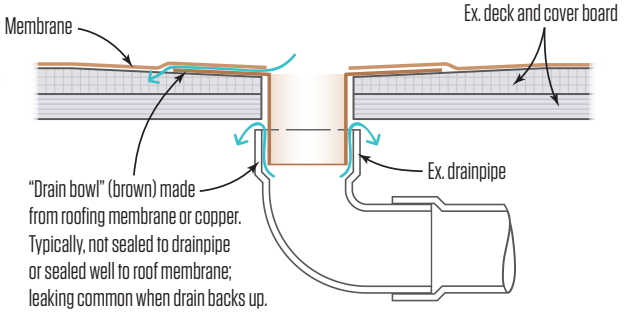
Parapet walls and skylight curbs are similar elements that receive very similar treatment. The pieces of metal on top of parapet walls are not sufficient to keep water out of the assembly, because they develop leaks at the joints due to expansion and contraction. So it's important to run the roof membrane up the parapet, over it, and down onto the other side, and then cap that with the metal.

In an ideal world, you would even slope the top of the parapet a little bit so that water that makes it onto the membrane will run off instead of pooling. Once the membrane is wrapped over the parapet, the metal piece is essentially decorative.

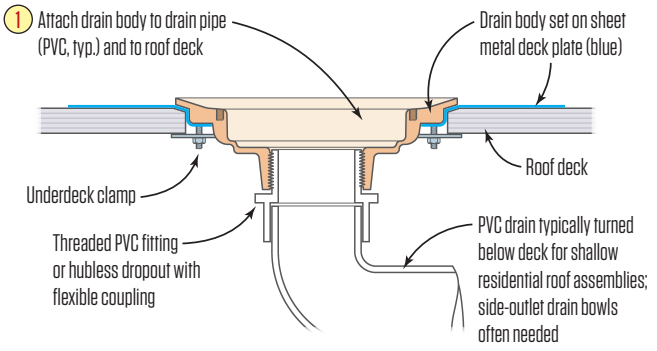
Skylights are a similar situation. The membrane roofing should lap up onto the skylight curb and over it. The curb should be pitched to the outside for drainage. Air-sealing between the skylight unit and the curb is an often-neglected detail that we try to pay attention to, because if there's a gap and the wind is blowing the wrong way, it will suck water right through it.

## Roof Drains

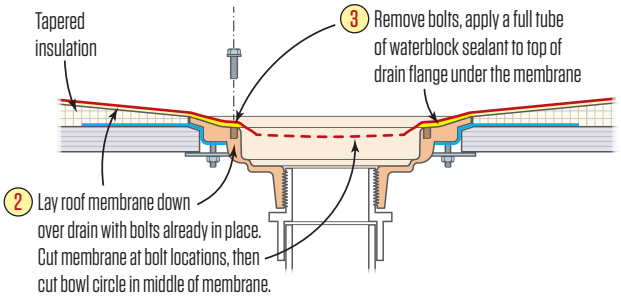
### Poorly Detailed Drain



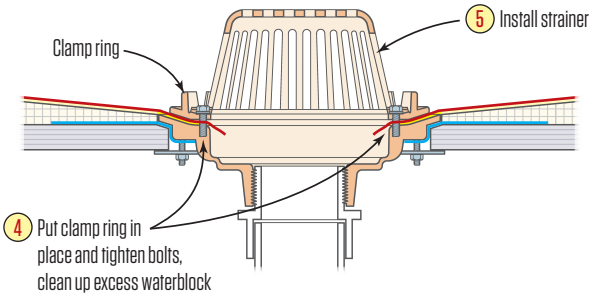

### Clamp-Ring Drain: Step 1




### Clamp-Ring Drain: Step 2




### Clamp-Ring Drain: Step 3




Common flaws in roof drain detailing allow leaks between the membrane and the drain body, and leaks between the drain body and the drainpipe. To avoid this scenario, the author recommends using a clamp-type drain that locks the membrane into the drain body. Watertight pipe connections are also crucial for preventing water from leaking into the building.

### ROOF DRAINS AND SCUPPERS

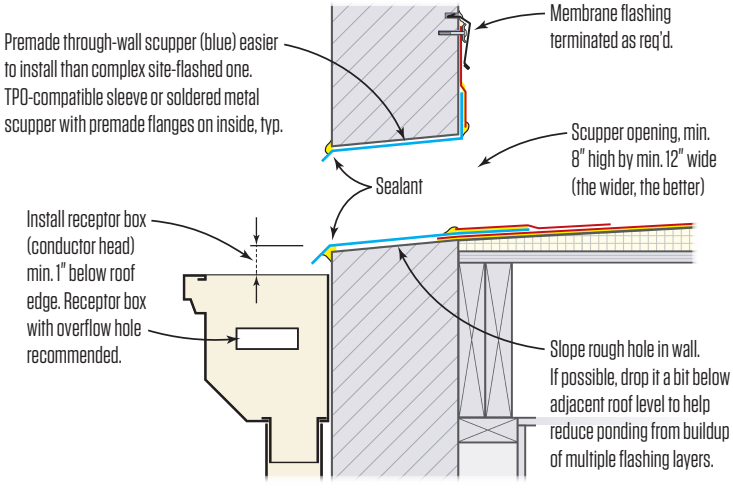
I'm not a fan of roof drains: They're high maintenance, they tend to clog, and there are many ways to do them wrong. I've seen a lot of leaky roof drains. Typically, what happens is that the pipes clog, and if you don't have a perfect seal between the drainpipe and the roofing, the water will back up, overflow the pipe, and run into the house.

Clamp-ring drains are designed to seal the membrane to the top of the drain body. If the pipe backs up, water can't get into the house, and it runs off the roof through the overflow. These are the only acceptable drains on roofs, but whenever there's a choice, I would prefer an open roof edge to any kind of roof drain.

I feel the same way about scuppers as I do about roof drains: They're tricky to detail, and the smaller they are, the more prone they are to clogging with leaves and debris. I have seen 4-inch-tall openings clog; we now recommend 8 inches for scupper opening height and at least 12 inches for width (the wider, the better).

*Doug Horgan is vice president for best practices at Bowa.*

## Scupper Detail




Drain receptors (conductors) are best positioned an inch or more below the scupper outlet so that clogs won't create leaks into the wall or ponding on the roof. Scuppers should be pitched to the outside.