# Troubleshooting Roof Leaks

## PROBLEMS & SOLUTIONS

Careful flashing at penetrations and edges can prevent most roof leaks

by Harrison McCampbell

As an architect who has worked with the roofing industry since 1977, I often inspect leaking roofs. I have found that poor flashing details — at penetrations, at roof edges, or where a roof changes planes — are much more likely to be the cause of a leak than the roofing itself. Similarly, many leaks are caused by the use of insufficient or inadequate fasteners for sheathing, flashing, or roofing, and by the attempt to substitute caulk or roofing cement for flashing.

The cost of installing the roof on a new building usually amounts to less than 5% of the total construction cost. Yet some lawyers estimate that 60% to 80% of construction lawsuits involve roof failures. Often, it's a small leak that quickly grows into a big, expensive problem.

The following problems are among the most common I encounter. In every case, the leak could have been avoided had the installer used common sense and paid more attention to detail.

# Fasteners

***Problem:* No support at sheathing edges.** The plywood sheathing on this flat roof was installed without blocking under the edges. If someone walks on the roof, the roofing may crack when the sheathing flexes at the plywood joints.
***Solution:* Use H-clips or solid blocking** at plywood edges, or use tongue-and-groove plywood roof sheathing.

***Problem:* Smooth-shank nails don't hold.** Smooth-shank common nails used to fasten roof sheathing can work themselves loose over the years, especially if a roof deck is walked on. Rising nail heads can eventually poke through the roofing.
***Solution:* Use ring-shank nails for roof sheathing.**

## Some Rules of Good Roofing Practice

◊ Never permit ponding on flashings or roofing. All roofs and flashings should have positive drainage, with a slope of at least 1/4 inch per foot.

◊ Install flashing to accommodate anticipated movement, either by building settlement or by expansion and contraction from temperature swings.

◊ Install counterflashing at a height of at least 8 inches above the roofing surface.

◊ Plan generous overlaps (at least 4 inches) of flashings to limit the entry of wind-driven rain. Overlaps on shallow-pitched roofs need to be more generous than on steeply pitched roofs.

◊ Use minimum 24-gauge flashing, which is better able to resist wind damage than the code-required 26-gauge.

◊ Locate roof drains either at the midspan of a structural member, which will be the low point when the member has deflected, or along an exterior wall.

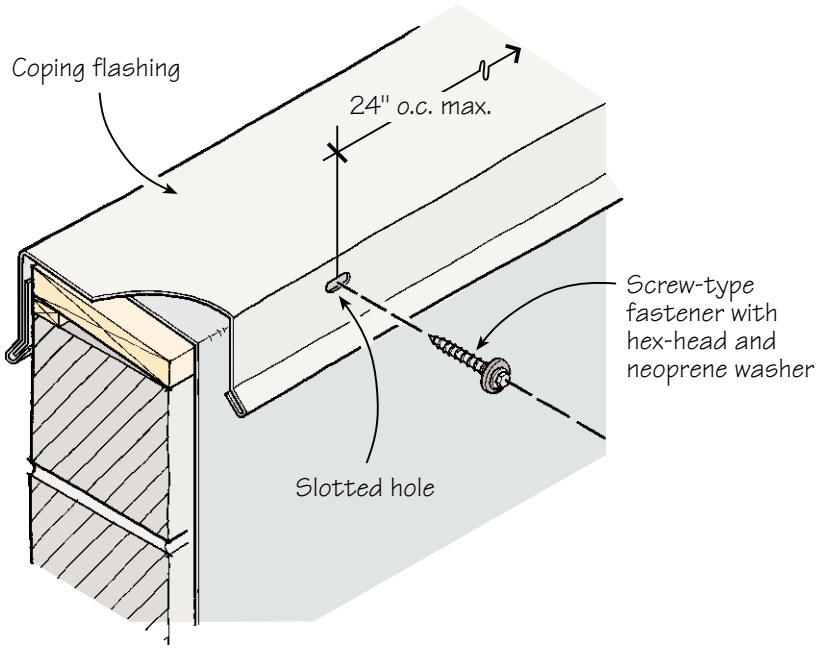
# Fasteners

***Problem:*** ***Flashing is incorrectly fastened.*** There are three problems with the coping flashing on this parapet wall:

- **The flashing has been fastened on the horizontal face**, instead of the vertical.
- **The flashing has been nailed** instead of screwed.
- **No allowance has been made for expansion and contraction** of the metal flashing, nor for differential movement between the metal flashing and the wood nailer, which expand at different rates.

An exposed fastener on the horizontal surface of the flashing is a potential leakage point. If flashing is attached with nails instead of screws, the last hammer blow can leave a concave dimple in the flashing, encouraging ponding around the nail hole.

If long runs of flashing are installed without allowing for expansion and contraction, the moving flashing can work nails back and forth until they loosen.




***Solution:***

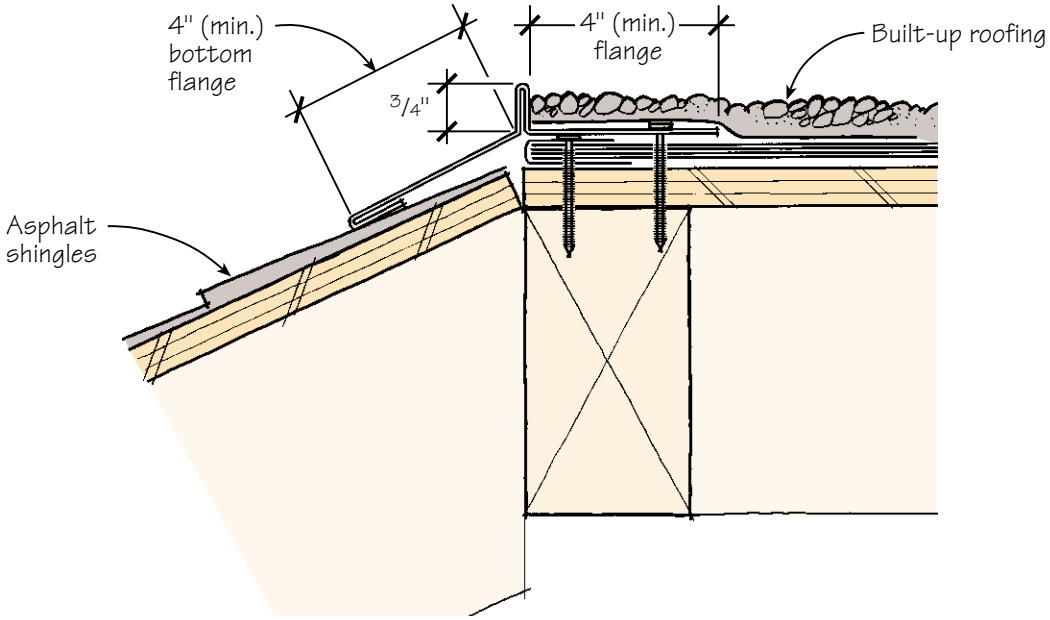
**Attach flashing on a vertical surface** rather than a horizontal surface.

**Use hex-head screws with neoprene washers** rather than nails if it is necessary to use exposed fasteners.

**Install fasteners in slotted holes,** which allow the flashing to move with changes in temperature.

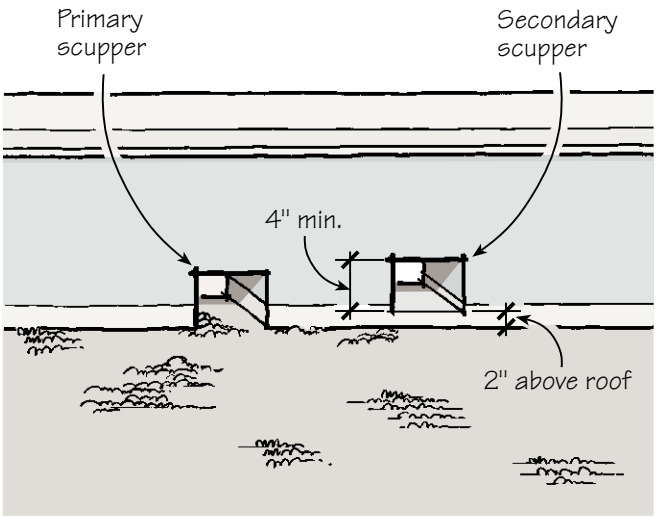
# Flat Roofs

***Problem:*** ***Because no gravel stop was installed,*** the asphalt flood coat and the roofing gravel are migrating down the face of the shingle roof.
***Solution:*** ***Install a 3/4-inch-high sheet-metal gravel stop,*** with a flange at least 4 inches wide, under the edge of the built-up roofing. The stop should also include a bottom flange, extending at least 4 inches over the top course of asphalt shingles.




***Problem:*** ***Edge flashing was not nailed.*** The installer forgot to attach the edge flashing to the roof before the built-up roofing was installed. When the roofing material later contracted, it pulled the entire flashing away from the edge of the roof.
***Solution:*** ***Don't forget to fasten the flashing*** to the sheathing or nailer with nails or screws.

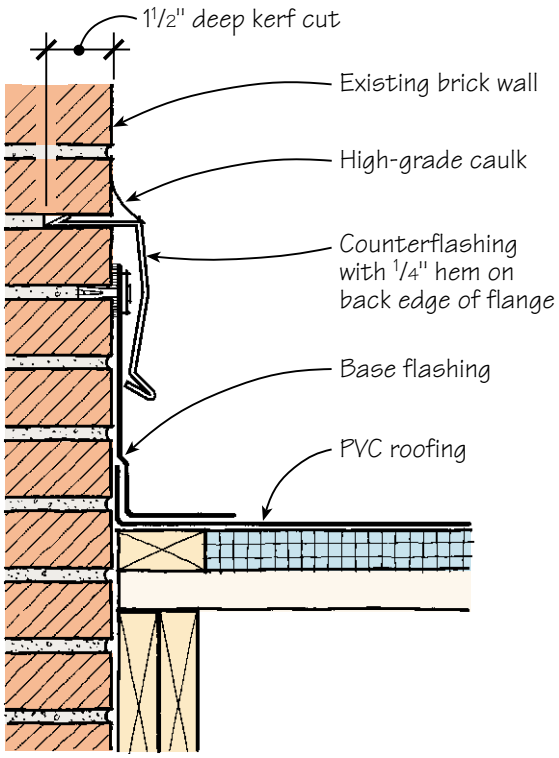
# Flat Roofs




***Problem:*** ***No overflow scupper***. The parapet wall around this roof has only one scupper on each side, with no overflow scupper. If the primary scupper becomes blocked — by a tennis ball, for example, or in this case, a soda can — then not only are leaks likely to occur, but ponding water on the roof could get heavy enough to threaten the structural integrity of the roof framing.
***Solution:*** ***Install a secondary scupper*** 2 inches higher than the primary scupper to drain excess water in case the primary scupper becomes blocked.

***Problem:*** ***Clogged roof drain.*** Failure to clear away leaves from a drain strainer can cause ponding.
***Solution:*** ***Remind homeowners to check roof drains and scuppers regularly,*** and to clean them at least once a year — preferably more often. An overflow scupper is needed here, as well — no roof should ever depend upon a single drain.

# Counterflashing




***Problem:*** ***Counterflashing is pulling away from the chimney.*** In the top photo, expansion and contraction have caused a failure of the caulk used to seal the surface-mounted counterflashing to the chimney. In the bottom photo, a too-shallow flange in the counterflashing has allowed water to get behind the flashing when the brick gets saturated in a heavy rain.

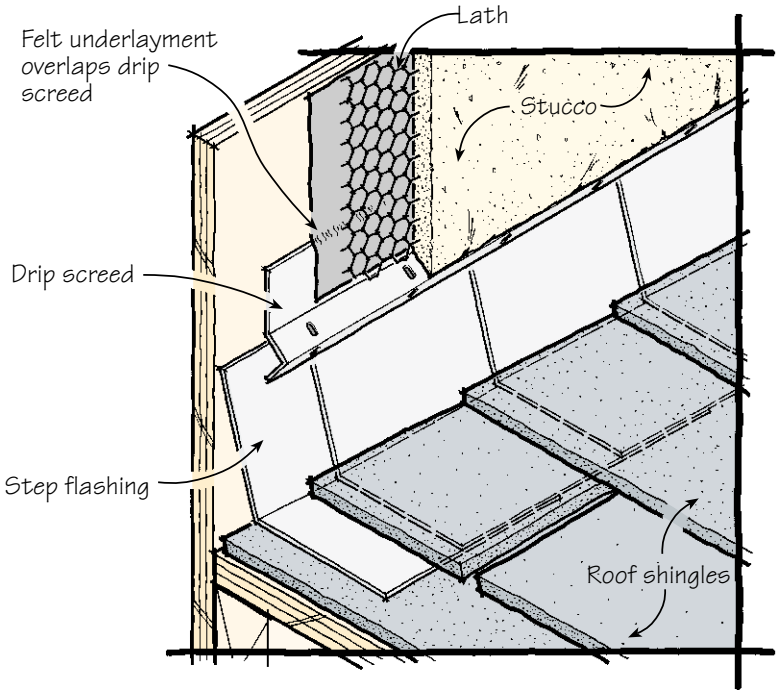
***Solution:*** ***Install the counterflashing between courses of brick as the chimney is being laid up.*** The minimum width flange for counterflashing inserted into a brick chimney is 1 1/4 inches.

For existing masonry, cut a 1 1/2-inch-deep kerf into a mortar joint with an abrasive blade. Run a bead of caulk along a 1/4-inch hem turned up on the back edge of the flange, then slide the flange into the kerf. The hem will compress slightly, holding the flange in place. Finally, caulk the top of the flange where it enters the kerf to keep excess water out.

# Counterflashing

***Problem:*** ***Failure of caulk between stucco and flashing.*** Don't depend on caulk or roofing cement to keep water out of a crack anywhere on a roof, especially if the crack is between dissimilar materials, which expand and contract at different rates. Caulk has its uses, but it should not be relied upon as the primary barrier against water entry.

***Solution:*** ***Install overlapping flashings*** that permit some movement. When stucco will be used above counterflashing, the counterflashing should be installed first, behind the stucco, and the felt underlayment should be lapped over the counterflashing.



# Asphalt Shingle Roofs

***Problem:*** ***No drip edge.*** If asphalt shingles are installed without a drip edge, it's only a matter of time before the plywood sheathing and fascia begin to rot. Water dripping off the edges of the roofing is drawn by capillary action to the exposed edges of the plywood sheathing.

***Solution:*** ***Install a metal drip edge at rakes and eaves.*** The main purpose of a metal drip edge is to interrupt the wicking of water to the sheathing edges.

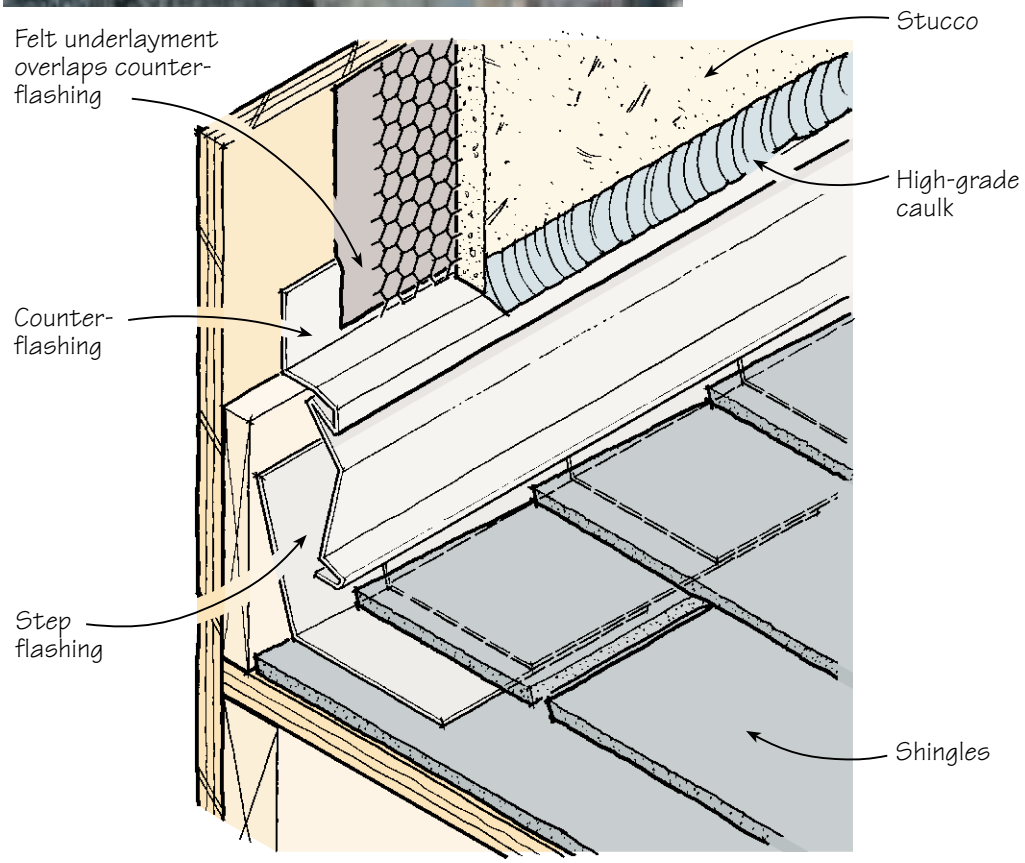
***Problem:*** ***Felt underlayment incorrectly lapped*** under (instead of over) the metal drip edge. Any water that may get under the shingles — for instance, from wind-driven rain — should be carried by the felt underlayment over the top of the drip edge.

***Solution:*** ***Lap the felt underlayment over the drip edge.***

# Asphalt Shingle Roofs

***Problem:*** ***Valley shingles were not tabbed or spotted with roofing cement.*** The large volume of water that collects in a valley can back up under uncemented shingles.

***Solution:*** ***In a closed valley, embed valley shingles in roofing cement.*** Always clip the top corner of the valley shingles at a 45-degree angle. This prevents debris from getting caught in the shingles and accumulating in the valley, and it also directs water toward the valley centerline. For extra protection, install a self-adhering eaves membrane under valleys.



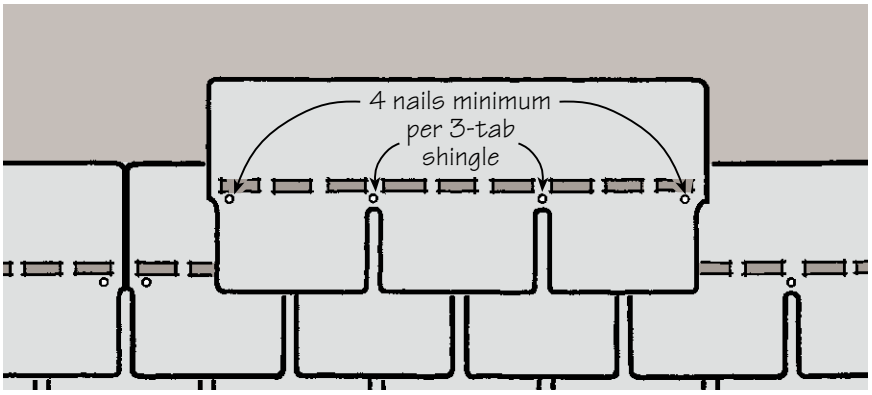
# Asphalt Shingle Roofs

***Problem:*** ***Exposed roofing nails.*** Exposed roofing nails are sometimes a source of leaks.
***Solution:*** ***Cover exposed nail heads with a dab of roofing cement,*** when exposed nails can't be avoided — as on cap shingles.

***Problem:*** ***Excessive shingle overhang.*** This installer apparently believed that increasing the overhang on the first course of shingles would help direct the water into the gutter, and would substitute for metal drip edge. Eventually, however, the shingles crease under their own weight and break off, exposing the edge of the sheathing beneath.
***Solution:*** ***Shingles should overhang 1/2 inch to 3/4 inch*** beyond the metal drip, according to recommendations from the Asphalt Roof Manufacturers Association.

# Asphalt Shingle Roofs

***Problem:*** ***Slipping shingles.*** Shingles can slip when the manufacturer's fastening instructions are not followed. Improper practices include using too few fasteners, and overdriving and underdriving the fasteners.
***Solution:*** ***Follow the shingle manufacturer's fastening instructions*** as printed on the bundle wrappers.




***Problem:*** ***The owner calls to report a roof leak.***
***Solution:*** ***Not every leaky roof is the fault of the contractor.***

***Harrison McCampbell,*** *AIA, of Nashville, Tenn., is an architect, roofing consultant, and member of the teaching faculty of the Roofing Industry Educational Institute.*