Photo: Dave Molloy

Roofing With Asphalt Shingles

Details and best practices for installing durable roofs

BY JLC STAFF WITH MICHAEL CHOTINER

More than 80% of homes in the U.S. have asphalt-shingle roofs. Asphalt shingles are popular for several reasons: for the money, they offer good value to homeowners; there's a wide, good-better-best range of materials to choose from; and of all prevalent roofing materials, asphalt shingles are easiest to install.

But you still have to do it right. In this article, we'll cover the essentials of roofing and reroofing with asphalt shingles, including techniques and details for tear-off, layout, underlayment, flashing, and shingle installation.

The fundamental material choice is between strip-type and laminated shingles, both of which are built on fiberglass mats. (We know of no U.S. manufacturer that still makes organic-mat shingles.) Visually, most strip shingles have a flat, three-tab design (no-cutout designs are also available), while heavier laminated "architectural" shingles exhibit variations in thickness, shading, and butt-edge design that produce more random or irregular patterns similar to wood singles or shakes. Length of warranty is widely considered a measure of quality, with heavier shingles carrying longer warranties. Most warranties cover prorated material cost, but not tear-off or replacement labor (some manufacturers offer more generous terms to their certified installers).

TEAR-OFF

Consider local recycling of both the existing asphalt materials and any metal flashing and fasteners. To avoid damage from falling debris, cover shrubs and garden beds with tarps, and tack up tarps under roof overhangs to protect siding and other exterior surfaces. After tear-off (and at the end of each day during reroofing), use a magnet to "sweep" nearby pavement, lawn, and landscape beds to pick up stray nails.

Tear off asphalt shingles from a seated position (photo, right). Start at the peak and work down toward the eaves using a shovel-like, serrated stripping tool such as the Shingle Eater (shingleeater.com) to get under shingles and pry out fasteners. Workers should wear safety harnesses secured to a stable anchor point. Three workers can typically tear off about 4 squares of roofing per hour.

Strip only as much area as you can cover with underlayment the same day. Replace unsound sheathing, re-nail loose sheathing, and drive flush any protruding nail heads.

FALL PROTECTION

In March 2013, OSHA issued a directive (STD 03-11-002) that rescinded and replaced its Interim Fall Protection Compliance Guidelines with a standard that requires residential construction workers who are working 6 feet or more off the ground (or within 6 feet of a roof edge or opening) to be prevented or protected from falling by means of a net, a harness, or a guardrail.

As a practical matter, harnesses and guardrails are most feasible for residential projects. Harnesses, which arrest a fall before the worker hits the ground, are less expensive and are easier to set up. Ideally, they are anchored to framing at the highest point on the roof to minimize the need for repositioning (see "Fall Protection for Roof Work," Dec/13).

Guardrails prevent a fall by creating a physical barrier. When used instead of harnesses, they must be installed at both eaves and rake edges, and around any roof openings that are 6 feet or more above the floor below. Manufactured guardrail systems, such as those from Acro Building Systems (acrobuildingsystems.com), are probably the easiest and least expensive option. Acro's Steep Pitch Guardrail (for eaves) and Open-Edge Guardrail (for rakes) include steel base plates that are fastened through keyhole slots so they can be interleaved with shingles, then removed without creating leaks (right). The posts have integral brackets sized to receive OSHA-compliant curbs and rails.

Asphalt Shingle Classification

Max. Wind Speed (mph)	Required Class	Impact Resistance	Fire Resistance
150	D	Class 4	Class A
120	C	Class 3	Class B
90	B	Class 2	Class C
60	A	Class 1	

< most resistant least resistant >

Wind: ARMA (Asphalt Roofing Manufacturers Association) has developed a classification system for selecting shingles based on the wind zone designation for a specific region. **Impact:** UL 2218 ranks shingles in four classes, from least resistant (Class1) to impact damage from hail and flying debris, to most resistant (Class 4). **Fire:** Most laminated asphalt shingles carry a Class A fire rating; most strip shingles are Class C. **Algae:** Shingles with "–AR" appended to the product name resist staining from organic growth for eight to 15 years.

UNDERLAYMENT

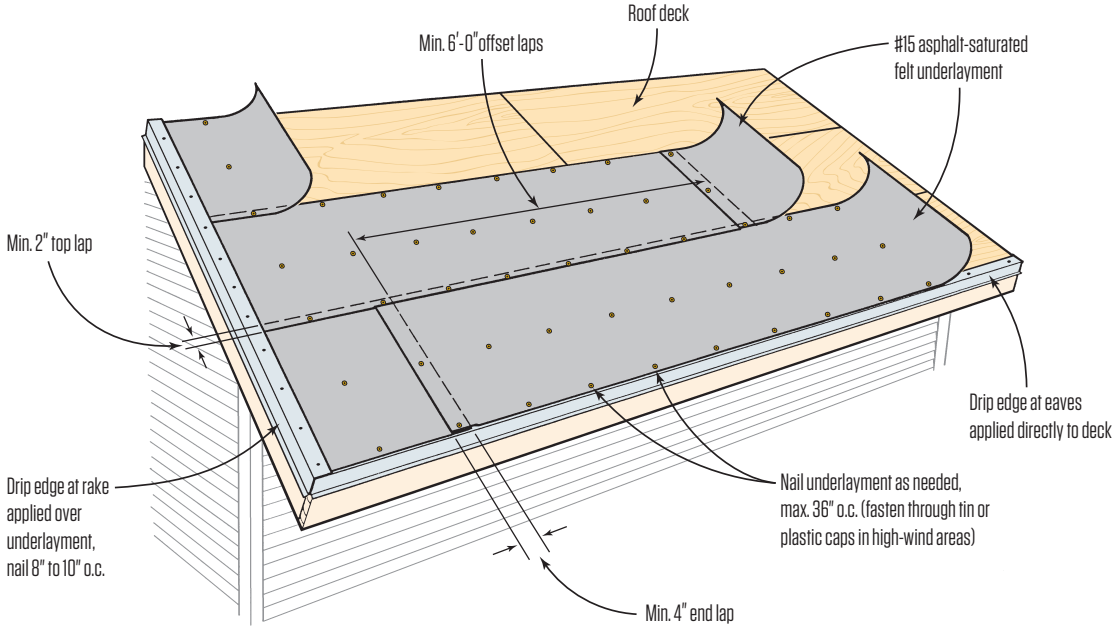
A variety of materials, including asphalt felt, synthetic sheeting, and self-adhering membranes, may be used under asphalt shingles, either separately or in combination.

Asphalt felt is the most economical underlayment material. Those who still use #15 or #30 felt value its vapor permeability, which they claim enables moisture to dissipate through evaporation (see "Whatever Happened to 30# Felt?" Jan/13). The downside is that paper-based felt is prone to tearing and puckering when left exposed and subject to wet/dry cycling. Fiberglass-reinforced asphalt felt is said to be more tear-resistant and less slippery.

Synthetic underlayment is made from polyethylene or polypropylene, is stronger and lighter than asphalt felt, and comes in wider, longer rolls that cover the roof faster (see "Do Synthetic Underlayments Make for Better Roofs?" Jan/13). Synthetics don't soften or wrinkle when exposed to moisture and are said to offer better footing than felt, even when wet. Most synthetics can be left exposed to sunlight for up to a year. A couple of brands—GAF's Deck-Armor and VaproShield's SlopeShield—are vapor permeable and are recommended for unventilated roofs. Impermeable or not, all synthetic underlayments are at least twice as expensive as felt.

Self-adhering membranes have a continuous adhesive backing that is self-healing, which means the material seals around fasteners that puncture it. However, any of the three basic formulations—rubberized asphalt, butyl rubber, or acrylic—may be incompatible with some other building materials, including caulks. sealants, and underlayment (see "Working With Flexible Flashing," Apr/14). Because of their high cost (about $100 per square), peel-and-stick membranes are usually applied in "problem areas," such as eaves and valleys, and in combination with metal flashing at chimneys, vents, and other roof penetrations (see pages 50–51).

Standard Underlayment for Roofs 4:12 and Steeper



DRIP EDGE

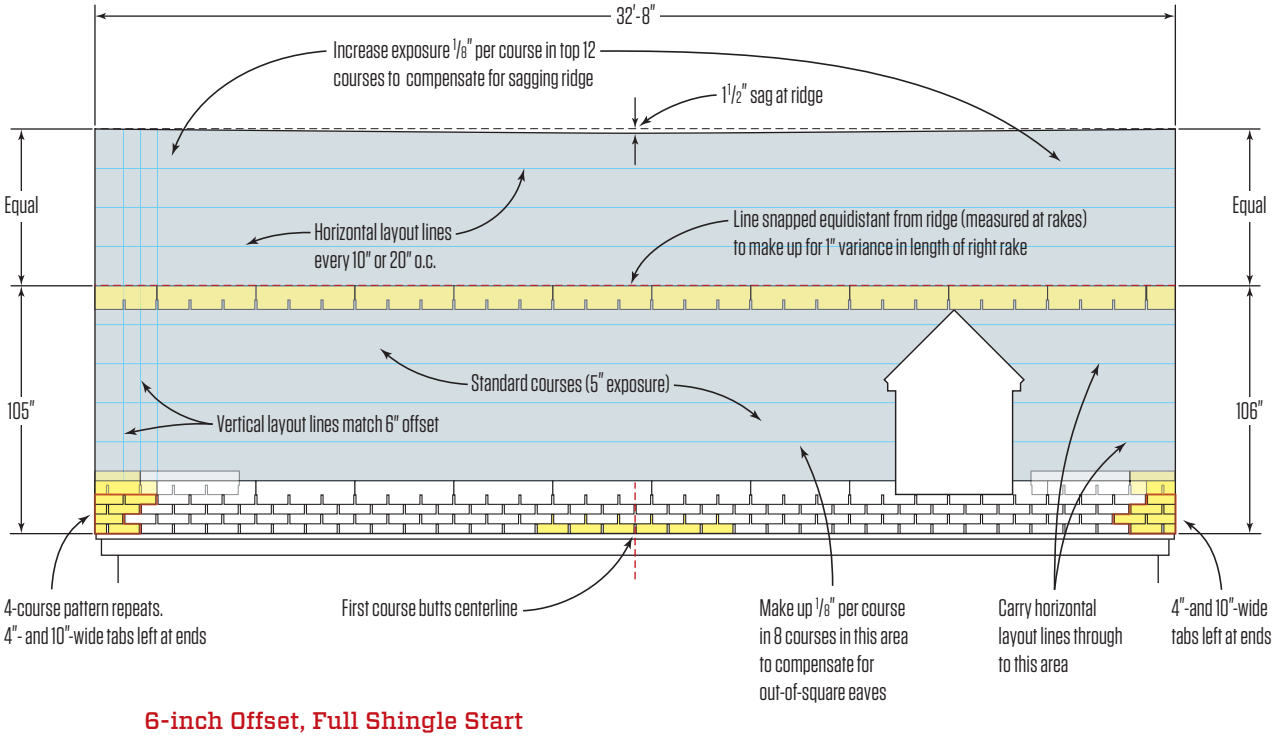
Prefabricated metal drip edge is designed to protect the absorbent edges of sheathing and to drain water away from fascia and rake trim. For a custom look, bend drip edge flashing from copper, aluminum, or other corrosion-resistant metal that matches or complements other roof flashing or trim color.

There is some disagreement about whether drip edge should be applied under or on top of self-adhering membranes. While we recommend following manufacturer instructions to preserve product warranties, best practice at the eaves is to install drip edge directly on the sheathing, apply any self-adhering membrane on top, then overlap that with a compatible underlayment. Along the rake, apply underlayment first, then fasten the drip edge on top, making sure it overlaps the drip edge at the eaves.

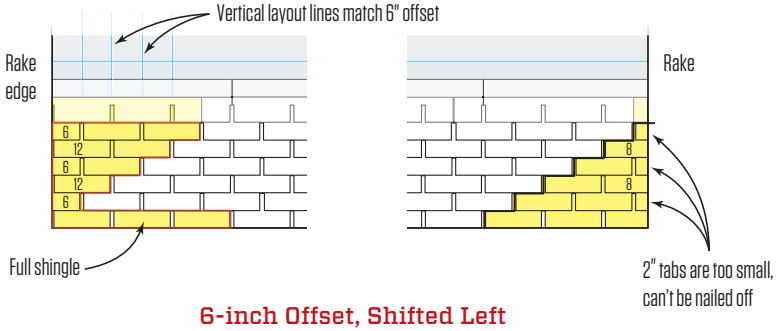
When a single length of drip edge isn't long enough, overlap end joints at least 1 ½ inches. At the rake, pieces higher on the roof should overlay pieces lower on the roof to promote drainage. Fasten drip edge flashing with compatible 1 ½-inch nails spaced 8 to 10 inches apart.

Laying Out 3-Tab Shingles

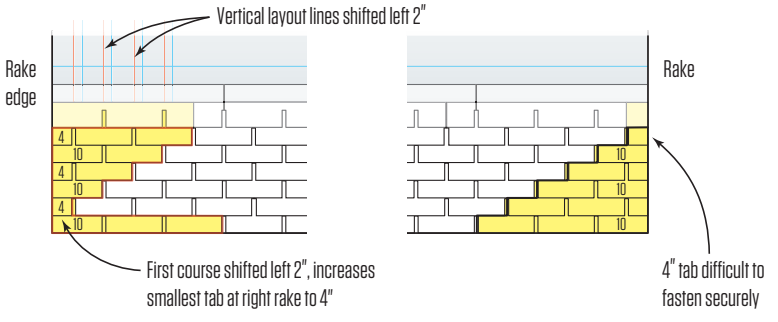
6-inch Offset, Symmetrical Rake Layout



6-inch Offset, Full Shingle Start



6-inch Offset, Shifted Left



First finish course. In this example, if shingle layout begins with a full shingle (left), it leaves a too-narrow 2-inch tab every other course on the other rake. Shifting the layout 2 inches to the left solves this problem, but 2 courses in the six-course pattern still require a narrow, difficult-to-fasten 4-inch tab (below left). The best layout (shown on roof) is a four-course pattern laid out from the centerline.

Out-of-square roof. Courses are parallel to eaves until they reach the dormer. To make up for the out-of-square roof before reaching the top of the dormer, increase exposure for eight courses by 1/8 inch in the area left of the dormer. Transfer course lines to infill the right side of the dormer.

Sagging ridge. To prevent cap shingles from exaggerating the 1 1/2-inch sag in the ridge, increase course exposure by 1/8 inch (from center to rakes) in 12 courses in the upper portion of the roof.

SHINGLE LAYOUT

Most roof dimensions are not an even multiple of standard shingle sizes, so fractional shingles will be needed to fill out courses. Tabbed shingles will look better if the fractional pieces are the same size at each rake. (This is less critical for laminated shingles because the finished appearance is meant to be more random.) Determining where to begin requires some preliminary measurements (see "Shingle Layout," opposite page).

Horizontal alignment. First find the midpoint along the eaves and, using the 3-4-5 triangle method, snap a line to the ridge at a right angle. (If dimensions at the ridge differ from that of the eaves by no more than an inch, you may be able to cheat the drip edge flashing at the rakes to split the difference.) Next, measure along the eaves from the centerline to each rake, then divide by the length of a shingle (typically 36 to 40 inches). Divide the remainder in half, and if the result is less than 3 inches, arrange for all fractional shingles to run along one side of the roof. Otherwise, arrange for fractional pieces at each rake to be approximately the same size. This may require using a different offset and working the first course from the centerline out to the rakes (see "Shingle Layout," opposite page). Ensure that starter strip seams are offset from seams in the first finish course. Once the first course is in place, install subsequent courses beginning at the rake.

Vertical alignment. Although exposure marks are printed on many shingle brands, best practice is to snap a horizontal line every three to five courses to ensure that your shingle line isn't wandering. Also measure from the eaves to the ridge to see if you need to make up for a bowed or sagging ridge line that will be accentuated by the cap shingles (see "Shingle Layout," opposite). You can shrink or stretch shingle exposure ⅛ inch per course, so calculate the number of courses you'll need to make up for any discrepancy. (For example, you can make up 1 ½ inches by adjusting the exposure ⅛ inch in 12 successive courses.) As with many remodeling details, best appearance may be achieved when materials are installed out of square to match existing visual lines.

SHINGLING AROUND A DORMER

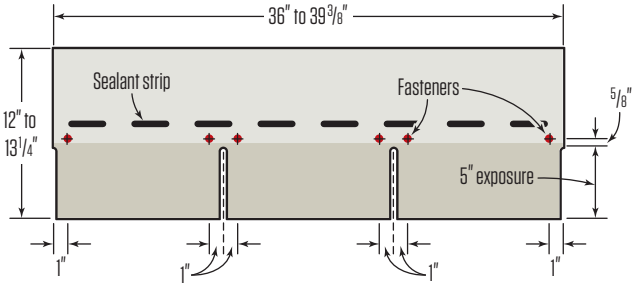
Install courses normally on the larger adjacent roof area, snapping lines frequently to ensure proper exposure (see "Shingle Layout," opposite). When shingle courses clear the dormer ridge, snap a horizontal line to the rake and measure down to align the remaining courses on the other side of the dormer.

To improve speed, production roofers snap a line above the dormer ridge first, then install shingles above and below simultaneously. This requires one infill course.

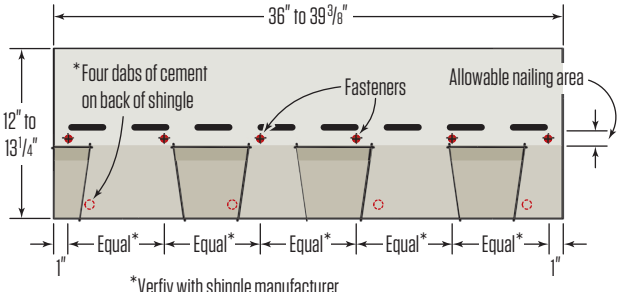
Six-Nail Method

(For High Winds or Steep Slopes)

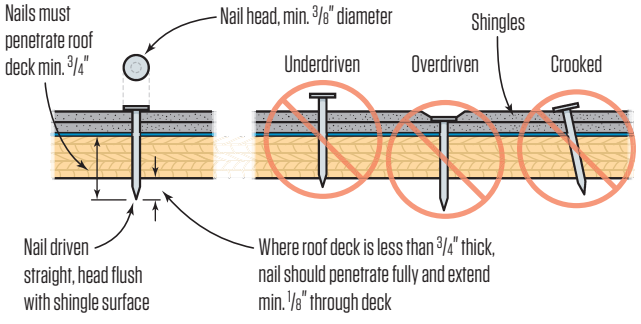
3-Tab Shingles



Laminated Shingles



Properly-Driven Nails



NAILING

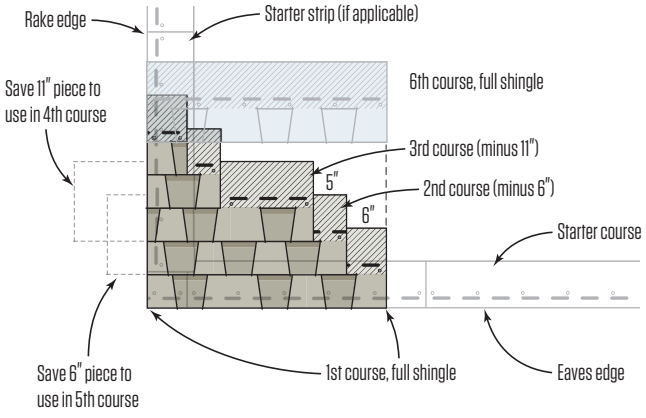
Use hot-dipped galvanized nails; stainless steel nails add cost, but are ideal for coastal areas. For most installations, four nails per shingle are required; in high-wind zones, fasten with six nails per shingle (see "Six-Nail Method," above).

To prevent blow-offs, drive nails straight and flush. Pneumatic nailers improve speed but can affect quality unless used with care. Seal an over-driven nail head with roof cement and drive a new nail next to it. For a mis-driven, angled nail, drive the head flush, then repair it as you would an over-driven nail.

INSTALLING SHINGLES

After installing drip edge and underlayment along the eaves and rakes, apply one course of starter strips. You can buy precut starter strips or make them by ripping shingles in half lengthwise. Starter strips should overhang the eaves drip edge by about ½ inch. Follow manufacturer instructions to determine shingle offset to avoid alignment of joints (see illustrations at right). Avoid pieces narrower than 6 inches at rakes, and don't drive nails closer than 3 inches to the roof edge. For added wind protection at rakes and around penetrations, bed shingle "tabs" in a quarter-size dot of roof cement applied at regular intervals about 1 inch in from the edges (to avoid squeeze-out).

Offsets for Laminated Shingles



VALLEY FLASHING

Open valleys (right) feature a prominent strip of metal flashing (typically copper or aluminum), which easily sheds water and snow and provides protection from wind-driven rain when properly fabricated and installed. For long valleys, overlap flashing at least 12 inches (lower piece under upper) and avoid seams near eaves where snow, ice, and debris can accumulate. In high-wind areas, caulk flat seams or hem and interlock seams—especially on shallow-pitched roofs. To allow for expansion and contraction, fasten copper using copper tabs clipped to hemmed edges.

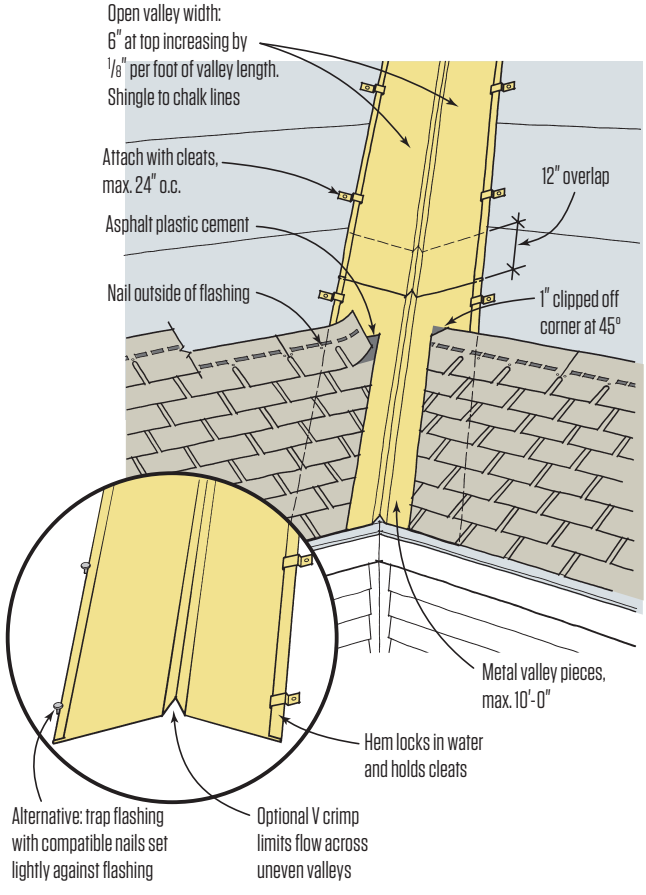
Where steep roofs of unequal pitch meet, use a W-shaped valley flashing; the raised ridge running down the center slows the flow of water and reduces the chance of leaks from overwash.

Closed-cut valleys (opposite page) install faster because they require cuts on just one side. Where roof planes are of unequal size or pitch, locate the cut edge on the larger, steeper roof plane where possible to avoid driving water between shingle layers. Seal layers along the cut edge with roof cement for added protection.

In the "Tamko" closed-cut variant (far right, opposite), shingles from one side of the roof are laid through the valley. Then full shingles are laid end to end along a line offset 1 inch from the center of the valley. The remaining roof plane is shingled, with square-cut shingles forming a sawtooth pattern at the valley.

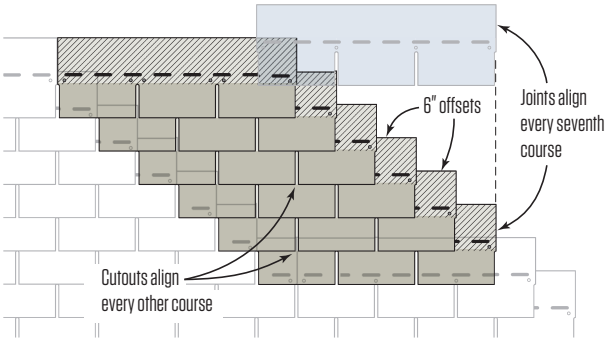
Woven valleys (not shown) are sometimes used with tabbed shingles and require the most installation time. They are not recommended with heavier laminated shingles, although they are sometimes appropriate for short, shallow valleys at crickets and small dormers.

Open Valley

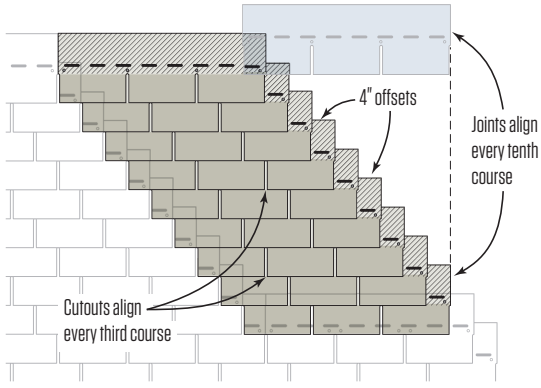


Offsets for 3-Tab Shingles

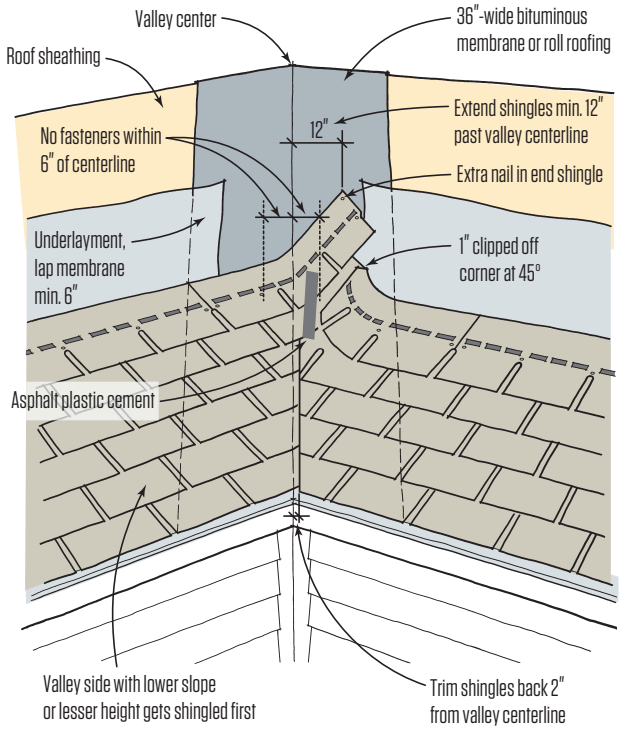
6-inch Offset



4-inch Offset



Closed-Cut Valley



'Tamko' Valley

In the "Tamko" valley, one slope (the shallower, if applicable) is completed first, with its courses running through the valley by at least 12 inches **(A)**. Next, full shingles are nailed end-to-end along a chalk line; a bead of roofing mastic adds insurance against uplift **(B)**. The opposite slope is completed with square-cut corners toeing the valley line **(C)**. A dab of mastic glues the sawtooth tips to the valley starter **(D)**.

EXISTING FLASHING

Best practice is to replace existing metal flashing with new material rather than rely on someone else's workmanship. The exception is copper through-wall counterflashing at masonry—provided it is properly installed, shows no signs of corrosion, is compatible with new step flashing metal, and is of a heavy enough gauge that it can withstand temporarily being bent upward while other flashing work is completed under it. Otherwise, install new counterflashing (see "Chimney Flashing Details," page 51, bottom right).

CHIMNEY & DORMER FLASHING

Joints where a dormer or masonry chimney penetrates the roof deck will leak if not properly flashed (see illustrations at right).

If there is no cricket behind a chimney, build one that matches the roof pitch. Make sure that cricket valleys are properly flashed (see "Valley Flashing," page 48) and that they channel water away from the masonry corners.

Take care to ensure that new and existing flashing is compatible to avoid corrosion from galvanic reaction (see "Galvanic Series," below).

Use a self-adhering membrane as a first layer (some manufacturers may require a primer to improve adhesion to masonry). When retrofitting masonry step flashing and counterflashing, follow the details shown to ensure secure fastening and proper drainage.

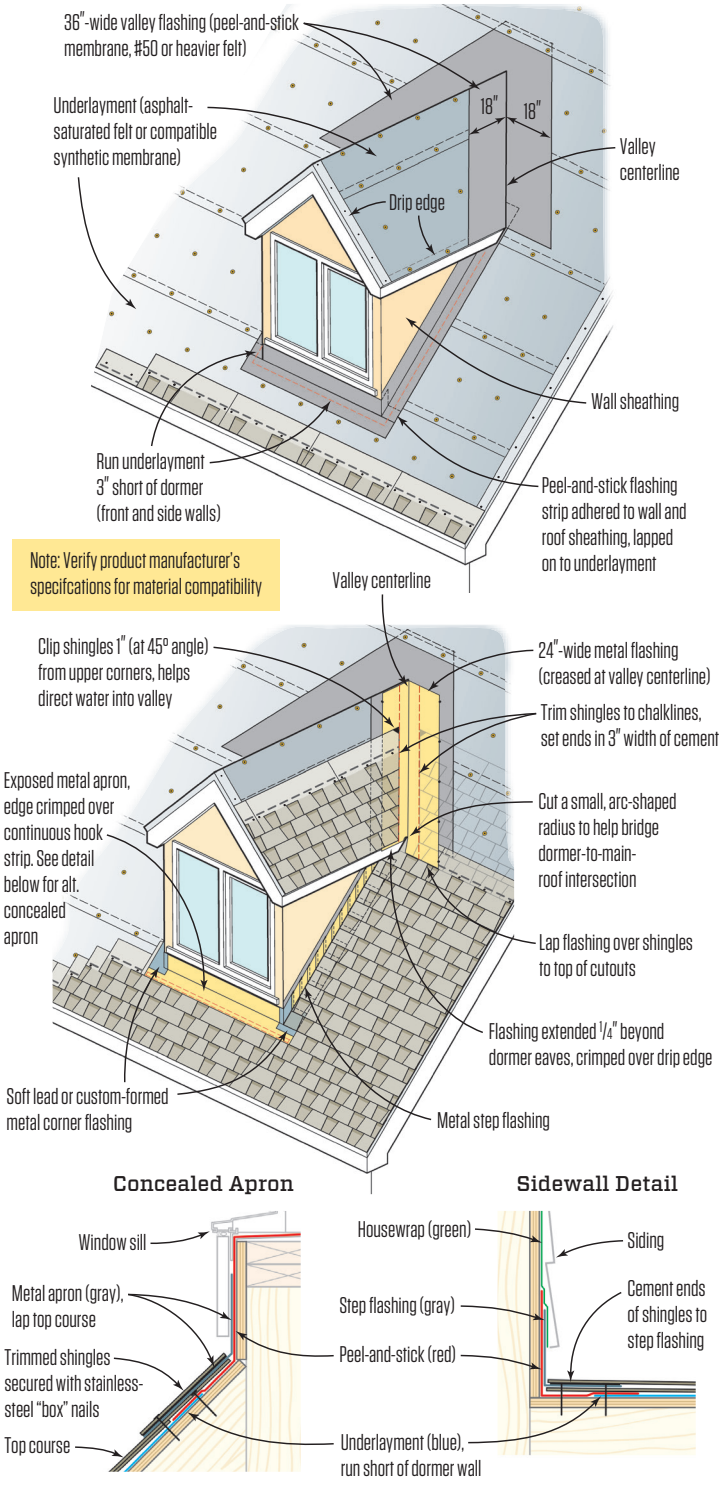
GALVANIC SERIES*

When different metals come in contact, the more "active" metal will corrode. The farther apart metals are in the galvanic series, the greater the potential corrosion.

Zinc, galvanized steel	Active
Aluminum	
Cast iron	
Carbon steel	
Lead	
Tin	
Brass, bronze	
Copper	
Silver solder	
Stainless Steel	Passive

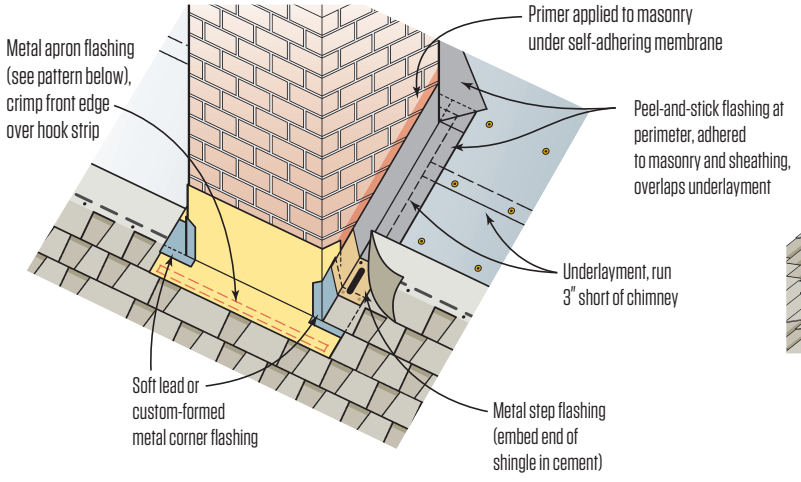
*only common construction metals listed

Dormer Flashing Details

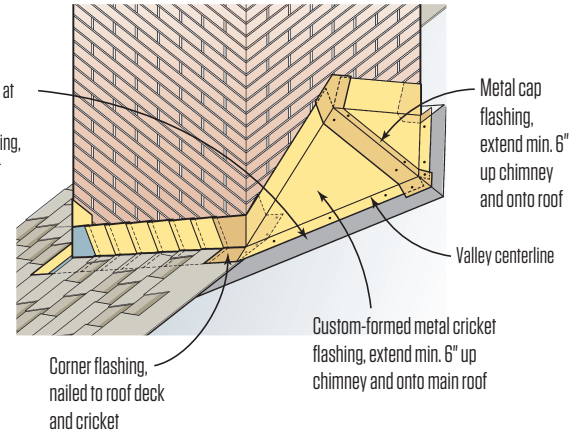


Chimney Flashing Details

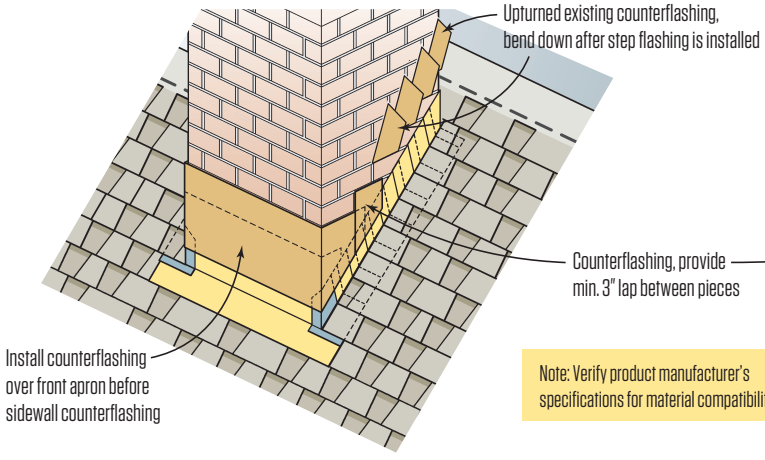
1. Base Flashing, Front and Sides



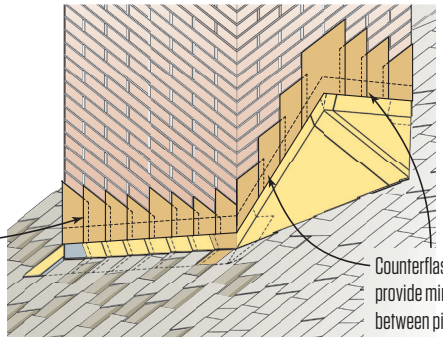
2. Cricket Flashing



3. Counterflashing, Front and Sides

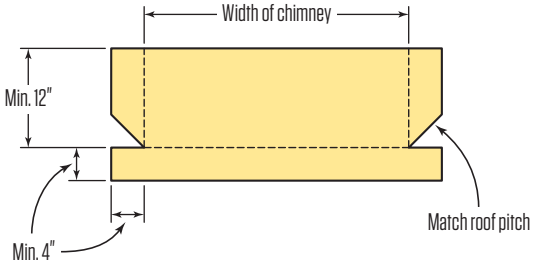


4. Counterflashing, Rear

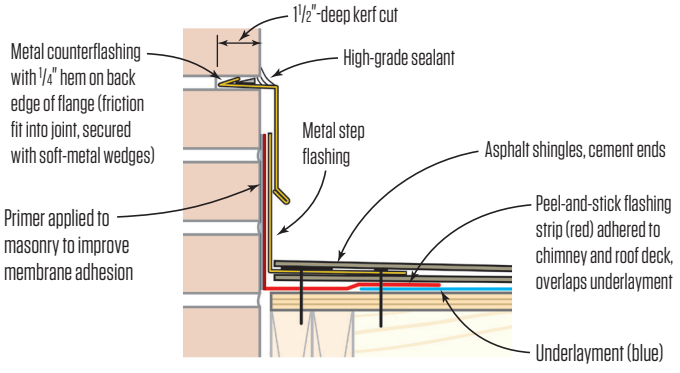


Note: Verify product manufacturer's specifications for material compatibility

Front Apron Pattern



Roof-to-Chimney Flashing

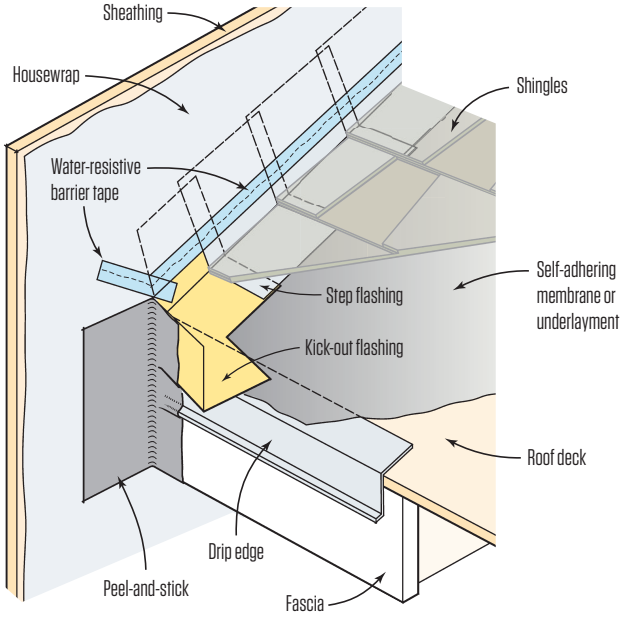


FLASHING VENT PIPES

Every roof has at least one vent stack (usually PVC or ABS) poking through it. The inexpensive boots commonly used to flash these penetrations rarely last as long as the roofing does. A better solution is to wrap the pipe with a compatible peel-and-stick flashing, then cover it with metal that both integrates into the roofing to promote drainage, and also hides the pipe. One of the best premade solutions we've seen is a metal "plumbing vent flange" (above) from F.J. Moore Manufacturing (fjmooremfg.com, 800.658.2331).

Available in copper or in galvanized or painted steel for a variety of pipe diameters, it can be used for new work or mounted over an existing rubber boot. The base can be adjusted on site to match the roof pitch. The company also makes a "special pitch" model for new work, which consists of a sleeve and base plate of galvanized steel or copper custom-soldered to match a specified pitch.

Kick-Out Flashing at Roof-to-Wall Connection



KICK-OUT FLASHING

Kick-out flashing diverts water away from siding and trim where roof eaves intersect with exterior walls. While it is possible to site-bend metal into a workable kick-out flashing—especially when also flashing with self-adhering membranes or tape—prefabricated plastic or metal kick-out flashing is inexpensive, looks good, and is easy to install.

RIDGE VENTS

Contrary to conclusions drawn during the 1990s, recent research suggests that venting has less effect on asphalt roofs than do shingle color and site orientation of the roof. There are, however, many good reasons to vent a roof (see "Roof Ventilation Update," Oct/07), but one of the most compelling is to meet the manufacturer's warranty requirements. Check the shingle wrapper: If venting is required for the roofing you are using and the roof you are considering is unvented, raise the issue with the homeowner before you start the roof work.

Where ridge venting is used, extend and cap the vent material across the entire length of the ridge (right) to avoid a pinched look at rakes or gable ends (inset).

Michael Chotiner is a contributing editor to JLC.