Assess roof damage as soon as possible after a storm because hail-caused splits are most obvious then. Impact marks fade as surface wood fibers recover. Inspect the roof when it's dry because it's easier to see new splits then. That's because wet wood swells, so the splits tend to close up. Note that splits caused by hail occur at the moment of impact, and hail-caused depressions which don't cause splitting at the time will not cause future splitting (Figure 13-5 B).

Hailstones can sometimes actually puncture a shingle. Punctures are usually rounded and the exposed underlying wood has a fresh wood color (Figure 13-5 C).

■ **Natural Weathering** After 10 years' weather exposure, about a third of all edgegrain shingles, and about two-thirds of slashgrain and flatgrain shingles, split naturally. These splits usually begin, and are widest, at the butt of a shingle, though some splits originate at nail holes.

Natural splits normally have rounded edges and eroded interiors. These splits usually have a V-shaped cross-section and don't extend the full depth of the shingle. Wood near the bottom of the split often has a fresher wood color because it hasn't been exposed to the weather for as long.

The extent of weathering depends on how steep the roof slope is as well as the roof slope direction. South-facing shingles installed on a low roof slope will weather fastest and the most.

■ **Repairing Wood Roofs** Shingles with hail-caused splits which aren't aligned with joints or weathered splits normally need not be repaired. You can repair a wood shingle or shake by replacing it, or by under-shimming the damaged shingle or shake with a galvanized steel sheet, aluminum sheet or a roofing felt shim. A roof is considered beyond economical repair when the repair cost exceeds 80 percent of the replacement cost. This equates roughly to 30 hail-caused splits per square for cedar shingles, and 25 hail-caused splits per square for cedar shakes.

It isn't practical to repair old, badly-weathered roofs. In general, it's better to replace shingle roofs older than 20 years, shake roofs older than 25 years, and roofs damaged by severe weather conditions.

Roofing Demolition

If a tear-off is necessary, strip shingles down to the deck. When you remove any roof, start the tear-off at the ridge and work down the slope, as shown in Figure 13-6. This method is especially necessary when you remove wood shingles or shakes installed over spaced sheathing. Otherwise, broken material will fall through the open sheathing into the attic.

Figure 13-6 Remove shingles starting at the ridge

Dislodge wood shingles, shakes, slate and metal roofing panels with a crowbar, removing two to three courses at a time. Remove tile shingles by hand. When you remove asphalt shingles, roll roofing or a built-up roof, use a flat spade shovel to pry up material. File a notch into the blade of the shovel so you can remove shingle nails along with the shingles. If you don't remove the nails, parts of the old shingles will remain under the nails and make the deck surface uneven and bumpy. And the old nails will pop up through new underlayment unless you use roll roofing for underlayment.

If the shingles don't fall apart when you remove them, stack them into bundles for removal. If the shingles are old and brittle, collect and remove them with a scoop shovel and carry them to the edge of the roof with a wheelbarrow.

Some roofers prefer to take off the paper and asphalt shingles all at the same time. Then they can roll the shingles into the paper and roll the whole lot down the roof as a unit. This method reduces the amount of mess left to clean up at the end.

If you have to tear off more than one layer of shingles, remove only one layer at a time. Use a spud or a spud hammer (Figure 13-7) to remove a gravel roof. Spread tarps along the ground under the edges of the roof to help collect debris falling off the roof.

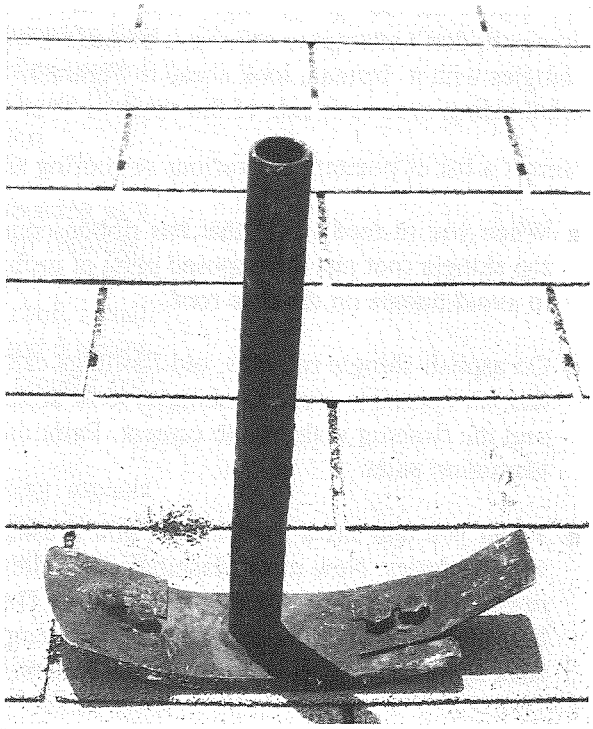

Figure 13-7 Spud hammer

If you must remove siding during a tear-off, for instance at a dormer wall, mark and store the pieces in an ordered way so you can reinstall each piece in its original location. Use existing nail holes as a guide when replacing the material.

After you've removed the old shingles and underlayment, level and repair the deck, if necessary. Replace rotted, damaged and warped sheathing, or delaminated plywood. Cover all large cracks, knotholes, loose knots and resinous areas with sheet metal patches nailed to the deck. Remove all loose or protruding nails or hammer them into the deck. Some roofing contractors recommend that gaps between spaced sheathing be filled in with boards, or that the entire roof area be covered with plywood. You don't necessarily need a solid deck under new shakes, and in humid climates it's a good idea to keep the spaced sheathing.

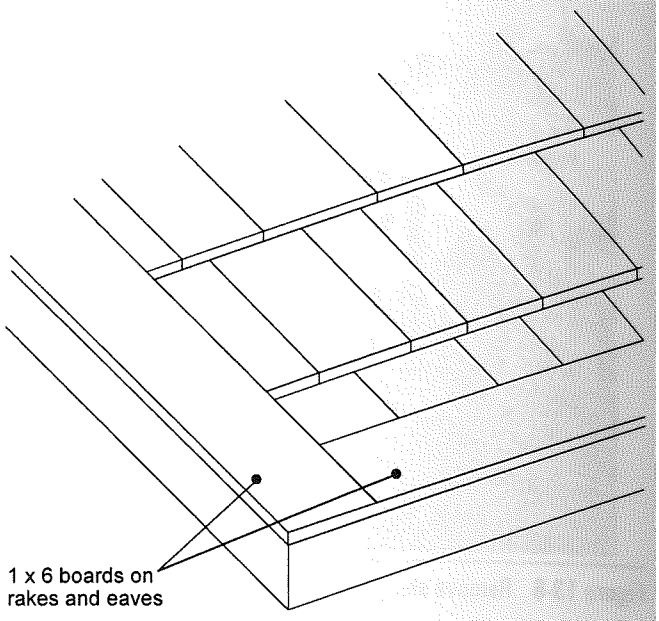

Figure 13-8 New edging strips

If the fascia board or trim is broken or rotted, or if the drip edge is broken or rusted, now is the time to replace them. To install a new drip edge when you're re-roofing over existing shingles, trim the old shingles back from the edge of the roof. If the old roof is wood shingle, cut the shingles back from the eaves and rakes 5½ inches and install a 1 x 6 in their place over the new drip edge. That's shown in Figure 13-8. Also, remove the old hip and ridge units. If there's a concealed metal cover underneath, don't attempt to remove it because it would probably take a lot of shingles with it. Instead, look ahead to Figure 13-13 to see how to install beveled siding over each side of the ridge.

Here's a list of pointers for various re-roofing situations:

- When you re-roof a roof that has ribbon courses, remove the entire top shingle (not just the exposed part) of each ribbon course by hand to avoid humps on the new roof.

- On asphalt shingle re-roofs, old flashings can often be raised. When this isn't possible, cut new shingles to fit around the old flashing, and seal the flashing with plastic cement. Paint the cement and vent with aluminum paint.

- When you tear off a gravel roof, you'll usually have to replace the vent flashings. New metal flashings and valleys are a must when you re-roof with wood shingles or shakes. That's because the bond between wood and plastic cement is only temporary, since wood will soak up water and release the plastic cement.

- Carefully remove any metal flashing demolished during a roof tear-off and use it as a pattern for new flashing.

- If metal counterflashing at the chimney and other vertical surfaces hasn't deteriorated, try to temporarily bend it up and out of your way and reuse it.
- Use a flat pry bar to remove a gutter and reassemble it on the ground the same way it was installed at the eaves. When you reinstall the gutter, drive the spikes into fresh wood, instead of into the old hole.
- If the roof deck is warped, but otherwise in good condition, straighten the deck by driving nails through the old shingles into the rafters.

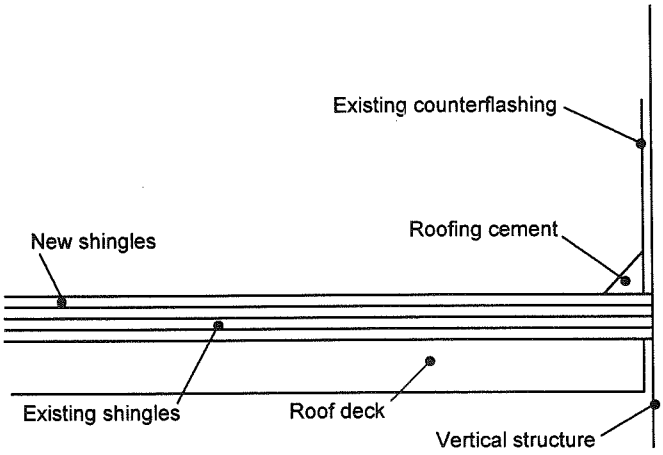

Figure 13-9 Sealing a roof-wall juncture with plastic cement

New Flashing

On a re-roof, try to install new flashing under existing metal counterflashing if you can. But sometimes that's impossible. Then you'll have to replace both the flashing and the counterflashing. That adds considerably to the cost. Here's a relatively inexpensive alternative. Seal the top and outside surfaces of the new metal flashing with roofing cement (also referred to as *bull*), then lay in a 4-inch-wide strip of felt and smooth it into the roofing cement. Then coat the felt with a ⅛-inch-thick layer of roofing cement and spray the coating with a good grade of aluminum paint.

If you don't install new metal flashing, seal the juncture between the horizontal and vertical surfaces with a 1½-inch-wide bead of roofing cement applied at a 45-degree angle with respect to both surfaces. See Figure 13-9. Cover the joint with aluminum paint for longer-lasting protection.

When it's not economically feasible to install new counterflashing at a chimney on a wood shingle or shake roof, you must install step flashing. On a shake roof, install metal flashing 13 inches long and extend it 4 inches up the wall and 4 inches under the shingle. On a wood shingle roof, install metal flashing 7 inches long and extend it 2 inches up the wall and 3 inches under the shingle. Reinforce the juncture with a felt strip, then cement and paint the joint as described above.

When you install flashing against a vertical side wall using asphalt shingles over old asphalt shingles, terminate the new shingles within ¼ inch of the existing flashing and embed the shingle ends in a 3-inch-wide bed of roofing cement. Then seal the joint with a bead of cement.

When you install flashing against a vertical side wall using asphalt shingles over old wood shingles, nail an 8-inch-wide strip of 50-pound smooth roll roofing over the old roof at the juncture of the shingles and the vertical wall. Drive nails in two rows on 4-inch centers along both edges

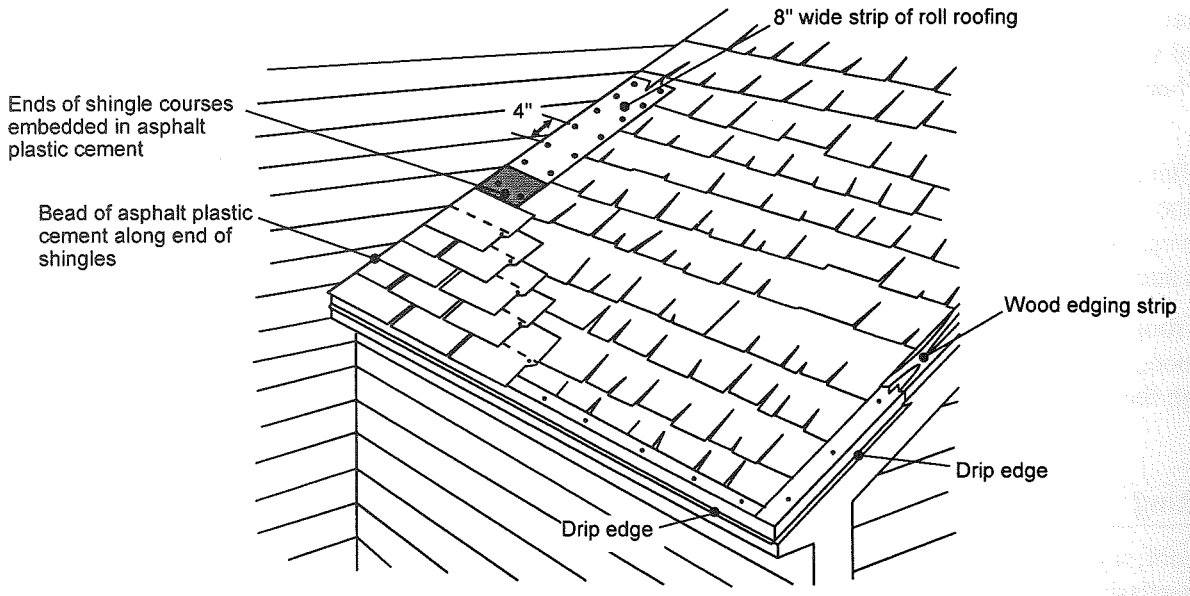

Figure 13-10 Flashing against a vertical wall when re-roofing over wood shingles

of the strip. Always use roofing nails when you re-roof over an existing roof. Embed the ends of new shingles in roofing cement applied to the strip, then seal the end joint with a bead of roofing cement, as in Figure 13-10.

When you install a metal valley on a shingle re-roof, don't use water guards at the metal edges because it won't lie flat enough to produce a smooth roof.

If an existing asphalt shingle roof has an open valley, build up the exposed part of the existing valley to the level of the existing shingles by installing a 90-pound mineral-surfaced roll roofing filler strip. Then you can install a new open valley, woven valley or a closed-cut valley.

Re-Roofing

Whether or not you must tear off the existing roof covering depends on the type of roof or the number of layers or weight of the existing roof covering. Re-roofing with no tear-off obviously takes less time and no underlayment is required between roofs. Also, the existing roof provides additional protection and insulation.

Three layers of shingles is usually the most a roof can support. Most building inspectors as well as many insurance companies follow this rule. However, be cautious about relying too much on that three-layer guideline. There are plenty of roofs that aren't structurally sound enough to carry the load of *two* layers of shingles, let alone three. The load-bearing capacity of a roof depends on many factors, including the rafter size, strength and

spacing and the strength of the roof sheathing material. Also, remember that the per square weight of shingles varies not only with shingle type, but also with the exposure amount (this is especially true of wood shingles and shakes). Finally, keep in mind the fact that wood shingles and shakes absorb water and thus weigh far more wet than dry. If you have any doubt about the ability of a particular roof to support another layer, consult a structural engineer. Of course, it might be cheaper to just tear off the existing roof, especially since the engineer might say to tear it off anyway.

Incompatible Substrates

The existing roof covering determines not only whether or not tear-off is necessary, but also what roof covering options are available when no tear-off is required.

You must completely remove certain types of shingle roofs before you install a new roof covering. Because of the irregular surface, never attempt to install new shingles over a shake roof. Never install new shingles over tiles, slates or metal panels because it's too hard to nail down the new roof. A built-up roof with an aggregate surface isn't often resurfaced with shingles due to its rough surface. Also, the roof slope is usually too low for most shingles and the combined weight of aggregate, and new roofing is often too much for the roof frame. *Always* ask a structural engineer before you take on a job like this.

Asphalt Strip Shingles over Asphalt Shingles

You can install new asphalt strip shingles over old ones if you first smooth the substrate by nailing down warped shingles and replacing missing ones. Split a warped shingle and nail down the resulting two shingles. A new asphalt shingle roof will sag over missing shingles.

When you re-roof with asphalt shingles over asphalt shingles, the easiest way is to match the existing shingle pattern. Don't install asphalt strip shingles over dissimilar types of asphalt shingles, such as T-lock, giant individual and hexagonal shingles.

When you re-roof over asphalt shingles, no underlayment is required because the original roof serves that purpose. When you re-roof over existing wood shingles, some building codes require that you install 30-pound felt between the existing and new roofs.

The "Butting-Up" Method

When re-roofing over wood, asphalt shingles or roll roofing, install the new roof using the "butt-up" (or "butt and run") method. This means you install the tops of the new shingles flush against the butts of the old shingles,

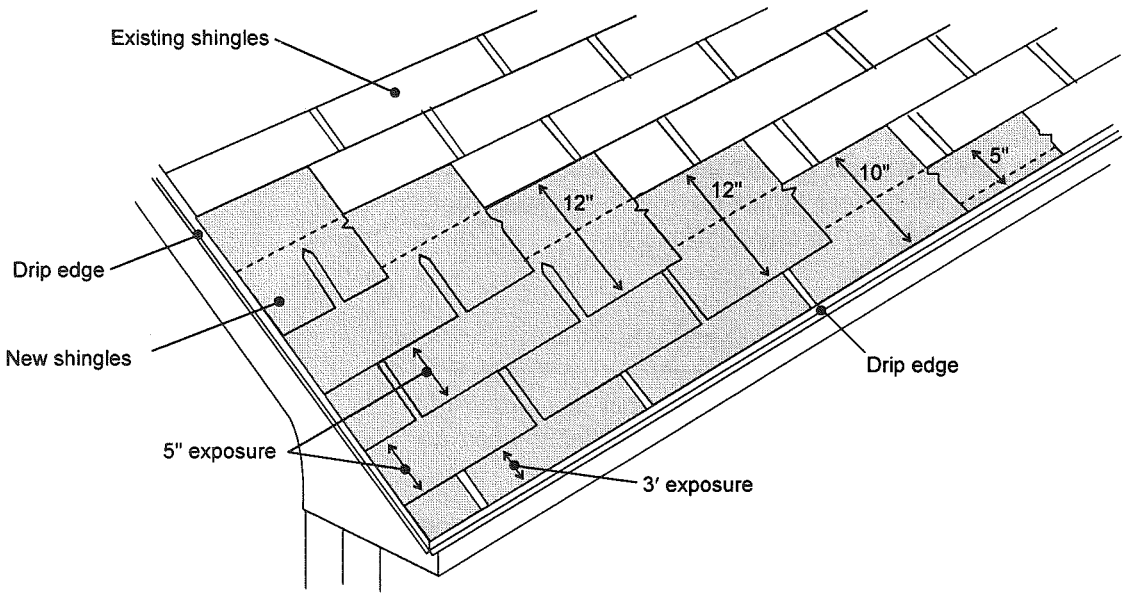

Figure 13-11 Application of new asphalt shingles over existing asphalt shingles

as shown in Figure 13-11. I recommend that you use this method because it's the easiest way to avoid all the problems associated with excessive shingle buildup. A re-roof with excess shingle buildup is unattractive. Furthermore, such a roof is more easily damaged by hail and foot traffic.

For these same reasons, it's equally important to offset overlaps when you re-roof with T-lock shingles over T-lock shingles. (Although T-lock shingles are practically never seen in the western U.S., they're still used in the Southeast.) This also applies to re-roofing with roll roofing over roll roofing.

When re-roofing using three-tab or strip shingles using the butt-up method, you can install the starter course one of two ways. The preferred method is to cut the shingle tabs and tops to make a strip whose width is equal to the exposure of the old shingles (normally 5 inches). Install the resulting strip over the exposed part of the first row of shingles of the old roof. If you're using self-sealing shingles, locate the factory-applied adhesive strips adjacent to the eaves. Remove about 3 inches from the end of the first starter-course shingle to prevent the cutouts and joints of the first course of shingles from being aligned over the joints of the existing starter-course shingles.

Overlay the new starter course by a first course of 10-inch-wide shingles made by cutting 2 inches from the shingle tops. This course will cover the new 5-inch starter course plus the 5-inch exposed part of the second row of shingles of the old roof. That's also shown in Figure 13-11. An easier, but less desirable, method is to cut and install two rows of 10-inch-wide shingles for both the starter course and first shingle course. You'll get a

bulge along the bottom of the original second course of shingles. It's also less wind-resistant along the eaves. In either case, apply a spot of roofing cement under each tab of the first course of shingles for added wind resistance.

Install succeeding shingle courses using full-width shingles with their heads butted up against the butts of the old shingles. The full-width shingles will be 2 inches lower than those installed on the old roof. The exposure of the first shingle course is 3 inches and that of the succeeding courses is 5 inches. The difference in exposure isn't apparent, especially if gutters are installed at the eaves.

If the exposure of the old roof is greater than 5 inches or if the old roof is crooked horizontally, remove the old shingles. If the exposure is less than 5 inches, the quantity of new shingles required will be greater than that required for a standard 5-inch exposure roof. Here's Equation 4-2 from Chapter 4:

$$\textbf{Percentage-of-Increase Factor} = \frac{\textbf{Recommended Exposure}}{\textbf{Actual Exposure}}$$

Use this formula to find out how many shingles you'll need. For example, a 4-inch-exposure roof will require:

$$\text{Percentage-of-Increase Factor} = \frac{5 \text{ in.}}{4 \text{ in.}} = 1.25$$

That's 25 percent more shingles. Using the same formula, a 4½-inch-exposure roof will require 11 percent more shingles.

▼ **Example 13-1:** A 30-square re-roof is required over strip shingles with a 4-inch exposure. Assuming that the recommended exposure is 5 inches, find the number of squares of shingles required to cover the roof with strip shingles with a 4-inch exposure.

From the formula above, the Percentage-of-Increase Factor is 25 percent. So you'll need 30 squares x 1.25, or 37.5 squares of shingles.

Asphalt Shingles over Wood Shingles

If wood shingles don't provide a good nailing surface for asphalt strip shingles, but are otherwise in good condition, smooth and improve the surface by installing beveled 1 x 4s or 1 x 6s ("horse feathers" or feathering strips) against the old shingle butts. That's shown in Figure 13-12. Also, put a beveled siding board on each side of the ridge (Figure 13-13).

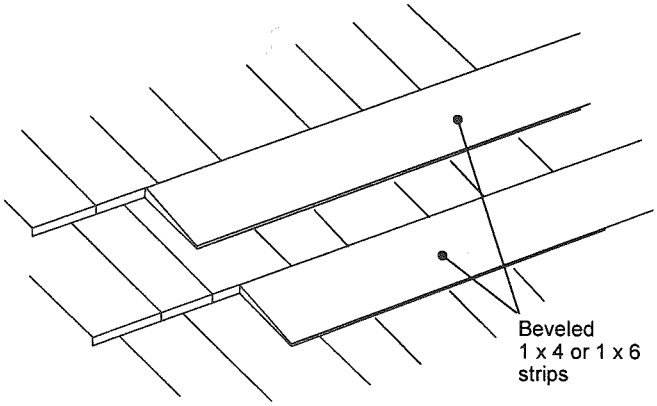

Figure 13-12 "Horse feathers" or feathering strips

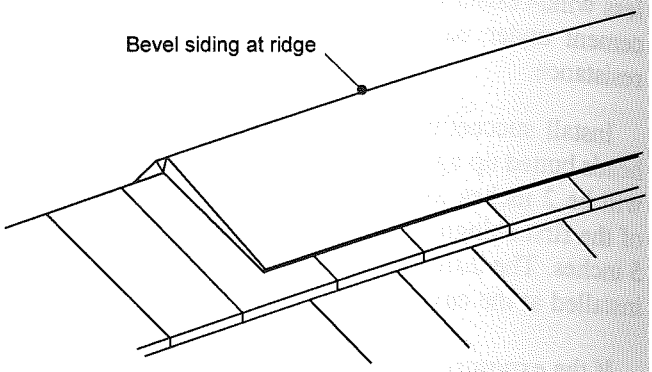

Figure 13-13 Beveled siding board at ridge

If shingles and trim at the eaves and rake are badly weathered in areas subject to high winds, you'll also need to trim the wood shingles back from the eaves and rake so you can install 1 x 4 or 1 x 6 edging strips (see Figure 13-8). Install a new drip edge at the same time. This lumber provides a smooth surface as well as a nailing surface for the new roof.

Asphalt Shingles over Built-up or Roll Roofing

You can install asphalt shingles over a built-up roof after you scrape off the aggregate surface, and provided the roof slope is at least 2 in 12. There's no need to reseal the BUR if the felts are in good shape. If there's rigid insulation between the sheathing and the felts, install a plywood nailing substrate over the insulation before you apply new shingles.

You can install asphalt strip shingles over roll roofing, provided the old surface is smooth and the roof slope is at least 2 in 12. Split any buckles or blisters and nail the roll roofing flat against the sheathing. Nail down any lapped joints that have separated.

Installing T-Lock Shingles over an Existing Roof

Use T-lock shingles over a rough roof and you won't have to tear off the old roof. Start the roof by installing a starter strip made from 9 inches of the top part of the shingles, as shown in Figure 13-14, or by installing a 9-inch-wide starter roll (Figure 13-15). Make the first shingle course by cutting the tabs from whole shingles (Figure 13-16). For succeeding courses, install whole shingles (Figure 13-17). You can salvage the tabs you cut off of the starter course to finish the roof directly beneath each side of the ridge.

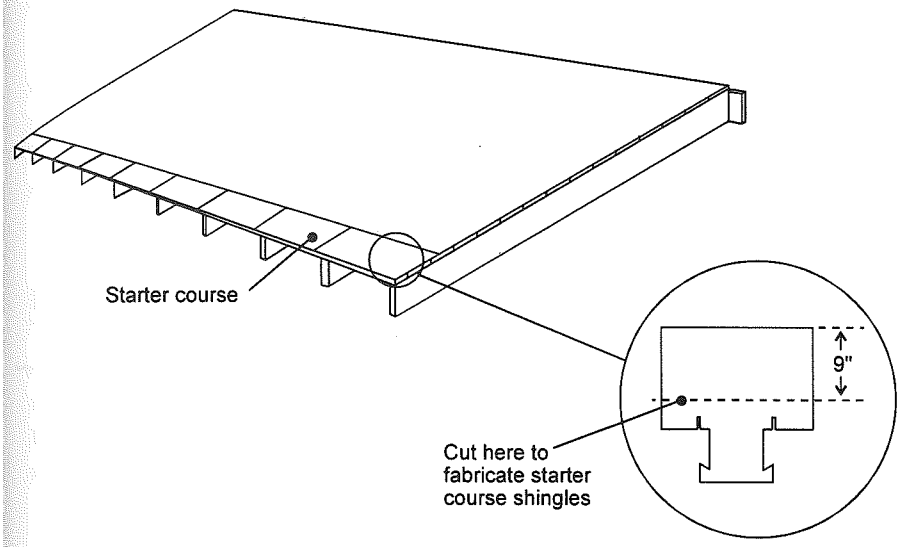

Figure 13-14 Fabricating the starter course from T-lock shingles

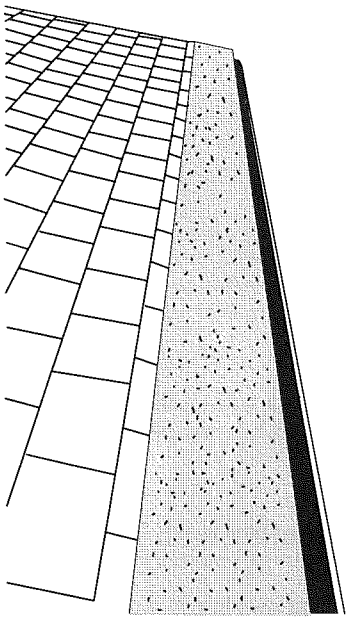

Figure 13-15 Prefabricated starter roll

To install a smooth T-lock shingle re-roof over an existing T-lock roof, try to match the new shingles and old shingles. Also, install shingles of the new roof ½ inch lower than the old shingles to avoid an excessive buildup of shingles. The simplest way to do this is to start the first shingle course with an additional ½ inch overhang that you can trim off later.

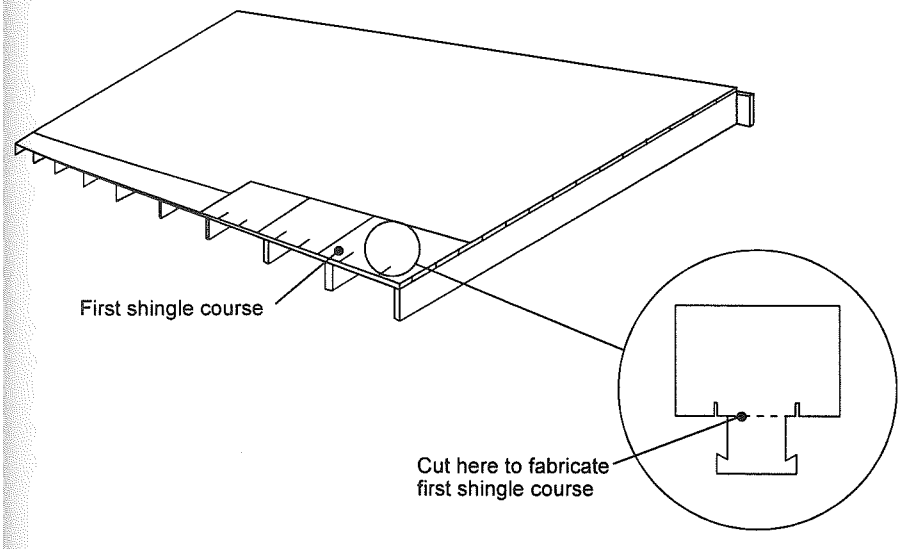

Figure 13-16 Installing the first course

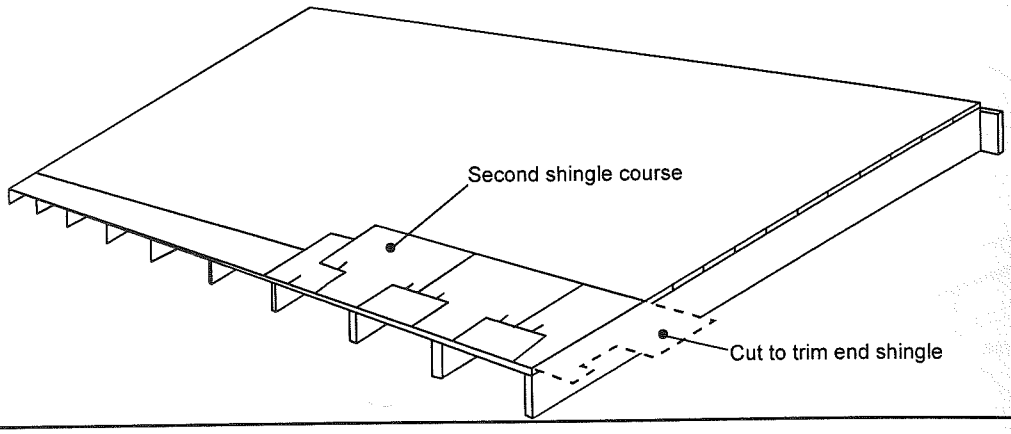

Figure 13-17 Installing subsequent courses

Re-roofing with Wood Shingles and Shakes

You can apply wood shingles over any type of asphalt shingle, roll roofing or smooth-surface built-up roofing, provided the roof has a slope of at least 3 in 12, and the substrate is capable of holding nails. You can install wood shingles over an aggregate-surfaced roof as long as the shingles are installed over spaced sheathing applied to the top of the old roof, as in Figure 13-18. In addition to spaced sheathing, you'll need to install a 1 x 6 along the eaves, rakes and on each side of the ridge. Also install 1 x 4s along the edges of the valleys in order to receive new metal valley flashing. Spaced sheathing has the added advantage of providing good air circulation.

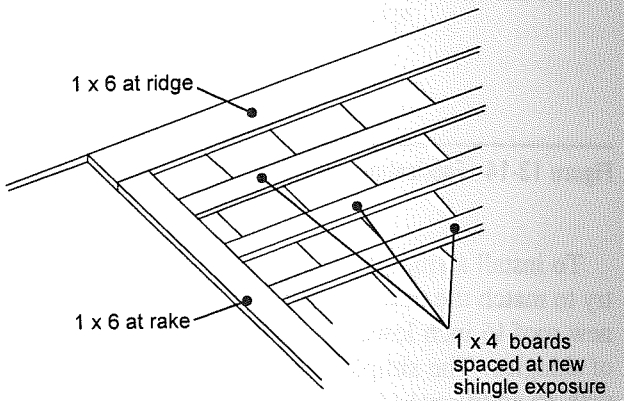

Figure 13-18 Spaced sheathing over an existing roof

You can apply new wood shingles over old wood shingles. If the surface is rough, install feathering strips against the old shingle butts (Figure 13-12).

You can install shakes over any type of asphalt shingles, wood shingles, roll roofing or smooth-surface built-up roofing that's not leaking, provided the roof is slope is at least 4 in 12.

Re-Roofing with Roll Roofing

You can install roll roofing over roll roofing, provided the old surface is smooth. Never install roll roofing over any type of asphalt shingle or over an aggregate-surfaced built-up roof.

Re-Roofing with Metal Panels

You can install metal panels over all types of asphalt shingles, wood shingles, roll roofing and built-up roofs, provided that the roof has an adequate slope. Check the manufacturer's specifications.

Re-Roofing with Tiles

You can install roofing tile over all types of asphalt shingles, roll roofing, and built-up roofs if the old roof is fairly even or can be made even economically. Also, the roof must have an adequate slope, and the roof frame and deck must be designed to carry the load. If in doubt, consult an engineer.

Re-Roofing with Slate

You can install slate over all types of asphalt shingles, roll roofing, wood shingles and built-up roofs. The roof slope must be at least 4 in 12 (unless flat-roof construction is desired) and the roof frame and sheathing must be strong enough to carry the added load.

Slates used to re-roof over wood shingles must be long enough to span two courses of wood shingles in each course. Spanning two courses of wood shingles provides the slates with two points of support. That is, each slate will rest on two wood shingle butts. A shorter slate, spanning a single course of wood shingles, has a single point of support and wouldn't lie well. The slates you use for this re-roof job measure at least 18 inches long. You install them with four punched nail holes instead of the usual two. Although their length makes these slates heavier and more difficult to handle, their only other disadvantage is a tendency to break under foot traffic.

Estimating Re-Roofing

The material quantities required for a re-roof are about the same as those required for a new roof. When you re-roof (as compared to roofing over a new wood deck), there's more labor involved due to the demolition and shingle trimming required. But this may be offset by the fact that it's usually not necessary to install felt under a re-roof.

When you estimate a re-roof, or tear-off and re-roof project, work out your estimate while you're on the roof. That way you can assess the old roof, including the condition and number of layers of shingles. Remember that it's easier to remove nails than staples, so notice how the old roof was attached. You can also check the condition of framing members, sheathing, fascia, drip edge, vents, vent caps and flashing. If the deck has deteriorated to the extent that it will no longer hold a nail, you'll have to replace that as well.

When you're going to tear off a roof, it's sometimes very hard to judge ahead of time how much sheathing you'll have to replace. This is especially true at the eaves, since you can't see that area from inside the attic. Estimate those repairs on a "cost-plus" basis.

You can often spot rotten deck areas by walking over the roof. A rotted deck will sag under your weight and will feel bouncy as you walk over it. That will be most apparent near the ridge, or on the north side of a house where the sun doesn't shine as directly.

Attic Ventilation

Insulation, weatherstripping and caulking make a home more airtight and confine water vapor in the house. Eventually, most of the water vapor passes through the ceiling and accumulates in the attic. In cold weather, in a poorly-ventilated attic, this warm moist air condenses when it reaches the cold underside of the roof sheathing. In hot weather, hot moist air tries to escape through gaps in the roof covering. The end result can be a buckled and rotten deck, deteriorated underlayment and blistered shingles. Many re-roofing jobs result from inadequate attic ventilation.

With proper ventilation, air circulates freely throughout the attic carrying away the water vapor before it can condense. Never cover vent openings during cold weather, and make sure that soffit vents are not blocked by insulation.

Obstructions in ventilators, louvers and screens[1]	Multiply required net area in square feet by:[2]
¼ inch mesh hardware cloth	1
⅛ inch mesh screen	1¼
No. 16 mesh insect screen (with or without plain metal louvers)	2
Wood louvers and ¼ inch mesh hardware cloth[3]	2
Wood louvers and ⅛ inch mesh screen[3]	2¼
Wood louvers and No. 16 mesh insect screen[3]	3

[1] In crawl-space ventilators, screen openings should be no larger than ¼ inch; in attic spaces no larger than ⅛ inch.
[2] Net area for attics determined by ratios in Figures 13-22 through 13-24.
[3] If metal louvers have drip edges that reduce the opening, use same ratio as shown for wood louvers.

Figure 13-19 Ventilating area increase required for louvers and screens in crawl spaces and attics

Putting a new roof on a building which lacks proper ventilation is like painting over a rotten board. Call the owner's attention to any ventilation problem. That will save you money in the long run because you'll avoid expensive call-backs. It will also establish your reputation for know-how and quality workmanship. And besides that, a ventilation problem may void the shingle manufacturer's warranty.

A rule of thumb for adequate attic ventilation is to allow 1 square foot of net free vent opening for:

- each 150 square feet of horizontal attic surface when the roof has no vapor barrier; or
- each 300 square feet of horizontal attic surface when the roof has a vapor barrier or when half the vent openings are located at the ridge and the other half are located along the eaves.

When you calculate the net free vent opening, be sure that the vent screen is taken into consideration, because screens vastly reduce the free area of the vent.

The gross ventilation area depends on the type of vent openings, as shown in Figure 13-19.

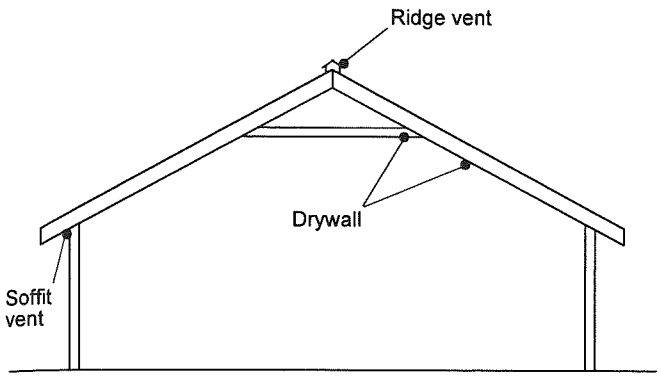

Figure 13-20 Installing a drywall trough over a cathedral ceiling

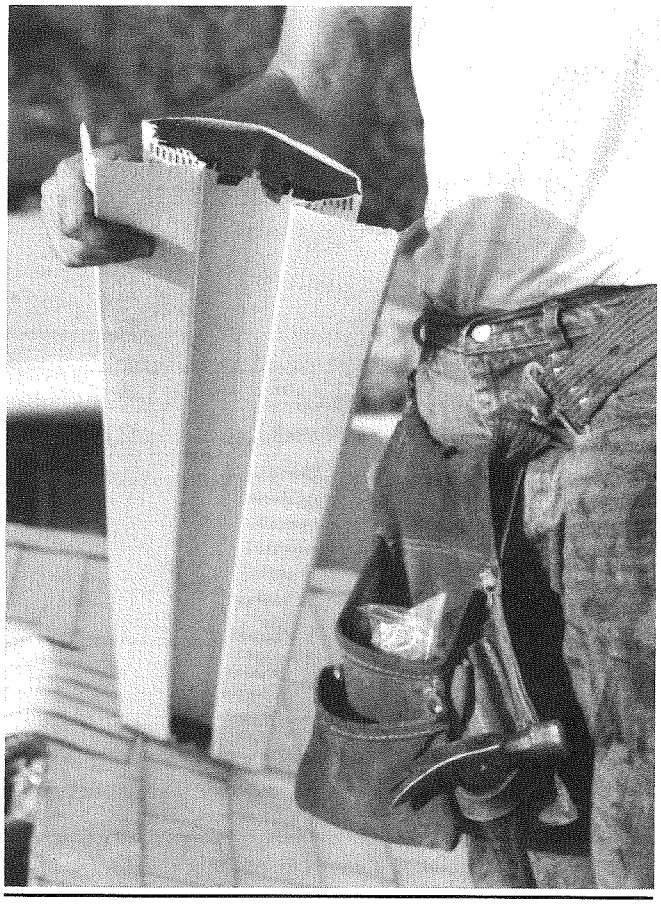

Figure 13-21 Continuous ridge vent

Continuous Ridge Vent

Drywall installed over a cathedral or attic ceiling forms a trough to collect hot air, as shown in Figure 13-20. Use a continuous vinyl or aluminum ridge vent like the one in Figure 13-21 over the trough. A continuous ridge vent is a good solution because it lets hot air escape, even when there's no wind, through a 2-inch-wide strip cut along the ridge. Run a ridge vent to within 18 inches of each end of the ridge.

Gable, Hip and Flat Roofs

Here's a more detailed approach to calculating proper attic ventilation for gable, hip and flat roofs. The minimum net area required for proper roof ventilation depends on the total ceiling area, the location of the vents and the type of roof design. See Figures 13-22 through 13-24.

You can see in Figures 13-25 and 13-26 that there are a variety of inlet vents for soffits. Make sure that inlet vents are evenly distributed so there won't be dead air spaces. In humid areas like Florida, use perforated aluminum soffit material like that shown in Figure 13-27 to provide inlet ventilation.

In a gable roof, install outlet vents as high as possible (Figure 13-28).

An alternative to tearing out and reconstructing existing ventilation systems is to recommend the installation of attic exhaust fans.