# Putting on a Concrete-Tile Roof

## It takes nimble feet, a strong back and attention to flashing details to do it right

by J Azevedo

Most people with even a little construction experience would not hesitate to install an asphalt-shingle roof, yet they quake at the idea of putting on concrete tile. Maybe it's the mystery of flashing, where the undulating tile profile meets the straight line of ridge, or worse yet, the angled line of hip or valley. Maybe it's the uncertainty of laying a material that won't bend, not even a little, and is too thick to slip under a skylight flashing. Or, maybe it's simply the idea of moving all that weight around. After all, an average roof might need 16 tons of tiles, and that number carries with it the image of hauling coal, growing older daily and falling deeper in debt.

After presenting the case for choosing a tile roof in a previous issue *(FHB* #60, pp. 36-41), I started to wonder whether there was in fact a bona fide basis for the amateur's reluctance to roof with concrete tile. To find out whether it's a job best left to the professional, I went up on the roof with one: Marlen DeJong, principal in the modestly named A-1 Tile Company of Everson, Washington. After spending a week watching him install roofs on three houses over the course of a summer, I have concluded that tile roofing, though physically demanding, should not intimidate a conscientious builder. The interlocking tile is virtually foolproof. The only tricky spots—and these do require careful attention to detail—are the "joints" in a roof: the ridge, rake, valleys, hips and roof penetrations.

**Readying the roof**—A tile roof requires a little more preparation than a shingle roof. Special attention must be paid to setting fascia, applying felt underlayment and nailing on horizontal battens. DeJong asks the carpenters to run the eave fascia ⅝ in. past the rake and to set it 1½ in. above the plywood roof sheathing (top photo, facing page). Like a shingle starter course, the raised fascia lifts the first course to the same pitch as the other courses.

The felt underlayment forms a second line of defense should any water somehow sneak past the tile. DeJong uses 30-lb. roofing felt, 36 in. wide, lapped 3 in. at each course. At the eave, where the raised fascia would dam the water, he installs an "anti-ponding strip," which is a preformed sheet-metal flashing (available from most roofing-tile manufacturers) that takes the felt (and any runoff) smoothly over the raised fascia. In areas that get snow, Dejong doubles the felts along the eaves and seals their edges with roofing tar to seal out any water that might get beneath the tiles as a result of ice damming.

At the ridge, DeJong normally takes the felt over the peak and down the other side a foot or so. If there are ridge vents, however, he holds both the sheathing and the felt back 2 inches from the peak. At valleys, he runs the felt from one slope across the valley and a few feet up the other side and cuts the opposite felt to lie right down the center of the valley (variations include interlacing the felts, and even adding another strip vertically down the valley). DeJong lays standard valley flashing on top of the felt (middle photo, facing page). The flashing is 24 in. wide and shaped like a "W" in profile, with the long edges turned up and inward to contain runoff. The flashings are secured with 8d nails bent over their long edges. Where valley flashings overlap, the bottom piece can be nailed near its top edge. The next piece overlaps it by 6 in., and the joint is sealed with roofing cement. Where the valley flashing meets the anti-ponding strip, he crimps the valley to match the change in pitch.

Felts and flashings are the weak spots in a roof that is supposed to last better than 50 years. DeJong offers his customers upgrades—copper or lead flashings instead of painted galvanized steel; double felts or 45-lb. felt instead of 30 lb.—but almost no one goes for it, an attitude that seems shortsighted.

**Battens**—With the roof felted, DeJong starts to lay out the battens—the horizontal strapping (typically 1x4s or 1x6s) that will support the tile. The battens define the course spacing, so the layout must be precise (bottom photo, facing page). First, he staples ¼-in. by 2-in. lath over each rafter. The lath raises the battens, allowing any moisture to drain down to the gutters. Then he sets the first batten parallel to the eave, with its uphill edge 14½ in. back from the front edge of the eave fascia. He goes then to the ridge and sets a batten 1¾ in. down from the peak. Next comes a calculation to determine the course spacing. He divides the distance from the ridge batten to the eave batten by 13½ in. (the ideal course). If the result is not a whole number (and it seldom is), he takes the next highest number of courses and divides the distance by that number to get the course spacing. If you don't like math, don't worry. Tile manufacturers provide tables that give course spacing for any roof. Once DeJong has the spacing, he marks out the courses on the felt, snaps chalklines, and nails down the remaining battens, staggering the joints between them.

The only complication in laying the battens is when two roof slopes of unequal length meet as one at the ridge, such as at staggered eaves. In that case, the course spacing for one roof must be used on the other side as well. That usually results in a short course at the eave.

**Loading the roof**—With a roof that averages 16 tons, three things are certain: you don't want to carry the tiles up a ladder; you don't want to stack them all in one place; and you don't want to move a tile very far once you put it down. Fortunately, roofers have worked out a system for avoiding the three "don'ts."

Tiles arrive on pallets, and suppliers will either deliver them to the roof or arrange delivery at extra cost. From there it is up to the roofer to unload and distribute the tiles.

DeJong guides a pallet, swinging from a boom truck, to a spot near the ridge and has it lowered until the front just rests on the roof. He dons a pair of heavy gloves and unloads a bundle of six tiles near the peak. He continues this way along the ridge, spacing the bundles 2 ft. o. c. Then he moves down three battens and lays another row of bundles. He works his way down the roof; the last row of bundles rests on the third batten up from the eaves. Any extra tiles go back up near the ridge or near hips.

Before stacking the roof, DeJong looks at the batch dates on the pallet wrappers. Each batch may vary slightly in shade, so he keeps all tile from the same batch on one section of roof. Other roofers like to distribute tiles to mix the variations into the roof.

**Laying the field**—The large interlocking field tiles go down without much trouble and cover a roof quickly. DeJong starts from his left as he lays the first eave tile (bottom photo, facing page), hooking the lug on the bottom of the tile over the first batten and holding it back from the rake about 1 in. to 2 in. The next tile interlocks with the first along their common edge (called the "waterlock"). As he continues along the eave, DeJong checks the waterlock on each tile to make sure it's clean.

Sometimes a bit of the slurry color coating on the tile has clogged the waterlock, and he must scrape this out or the tiles will not fit neatly. He lays them loosely, with a gap of 1/32 in. to 1/16 in. to allow for structural movement. When he gets to the opposite rake, he hopes to end the course with either a whole tile or a half tile. If this doesn't happen, he can usually adjust the course, squeezing the tiles or pulling them apart slightly to fit. The goal is to have one of the three tile "barrels" (the ribs or humps of a tile) at each end of the course to direct water away from the rake, toward the watercourses on the field tiles. When he is satisfied with the fit, he drops an 8d galvanized nail through the hole in each tile and taps it snug. How snug? "If you break the tile, you know it's too tight." Yet, you don't want to leave it sticking up. If you do, it will pop the corner off the next tile up the first time you walk on it.

Once the first course is nailed, DeJong measures in from the rake to the second joint and makes a mark. He marks other joints about every 10 feet along the course, and then snaps parallel lines all the way to the ridge. These marks will serve as guides to keep the courses aligned vertically up the roof.

DeJong lays the second course much the same as the first, only he starts with a half tile instead of a whole one (to learn how to cut and break tiles, see the sidebar on p. 61). He continues this way, course by course up the roof, staggering the joints and lining them up to the chalk marks, thumping each tile with the rubber handle of his hammer and listening for the telltale rattle of a tile that is not lying flat against its neighbors or the batten. As he falls into the rhythm of laying field tile, he seems to deal out these 10-lb. tiles with all the ease of a casino blackjack dealer.

On roofs with less than a 12-in-12 pitch, he nails only every other course. Above that, or if called for by the manufacturer's specifications or local codes, he nails every tile. On really steep pitches or in high-wind areas, he also fastens down the nose of each tile with a copper hurricane clip (available through the tile supplier).

**Hips and valleys**—Hips and valleys are basically mirror images and the tiling is much the same. It's a matter of getting the angles right and holding the cut pieces in place.

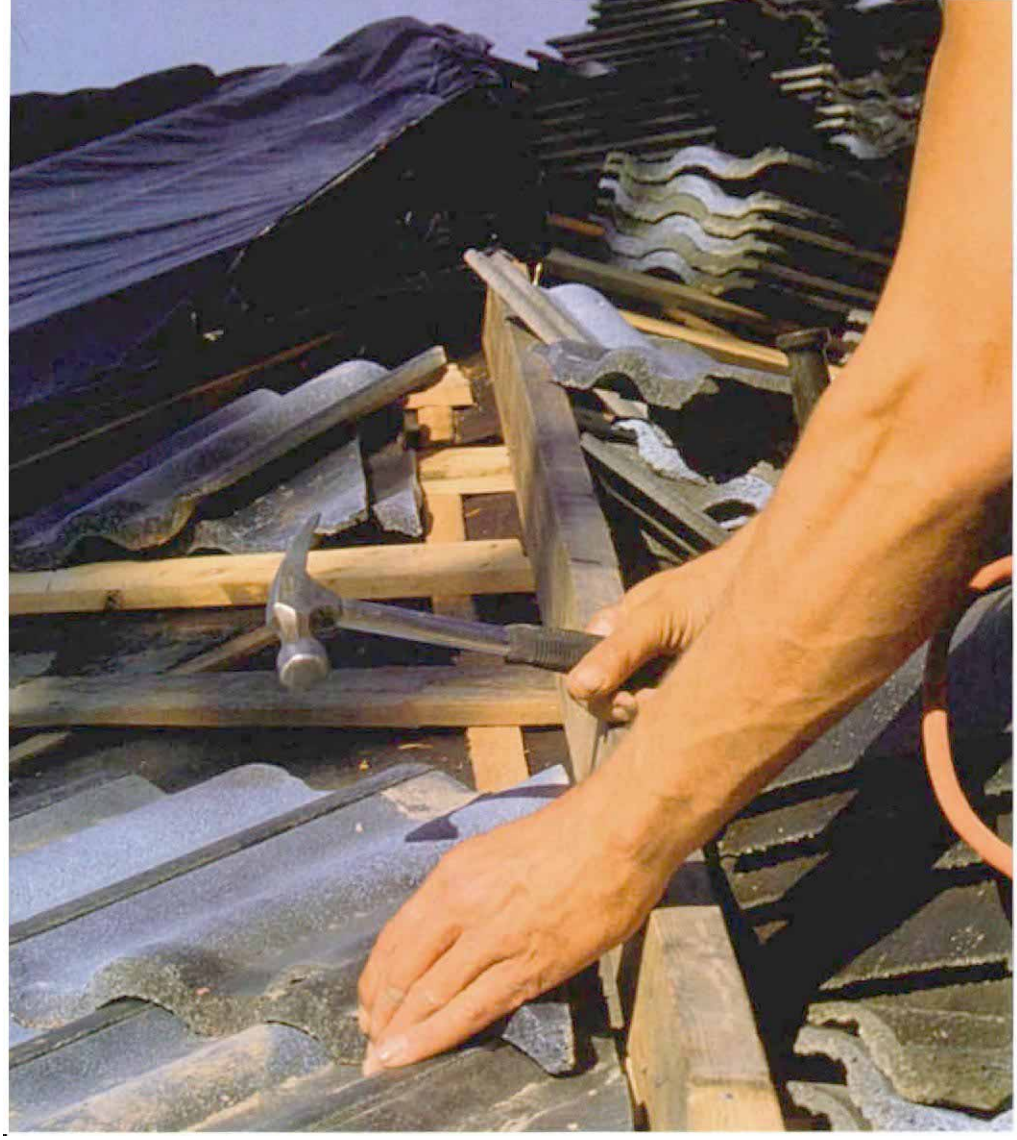
To tile a hip, DeJong starts by toenailing a 2x4 nailer on edge along the hip, holding the lower end back about 4 in. to 5 in. from the eave. Then he lays field tile as close as he can to the nailer without cutting any tiles. Near the nailer, he can use broken tiles that he has been saving. After DeJong runs a circular saw along a chalkline snapped parallel to the hip (bottom left photo, next page), he blows off the dust and tosses the scrap. The cut pieces should fit tightly against the nailer (top photo, next page) once he inserts two standard field tiles into each course.

DeJong fastens the cut pieces two different ways, depending on their size. For large pieces,

**At the eave, a raised fascia supports a sheet-metal "anti-ponding strip." The strip acts as a starter course to raise the level of the first course of tile into plane with the rest of the roof.**

**Valley flashings are 2 ft. wide, with an angled lip along both edges that directs runoff back toward the flow line. DeJong secures the flashings to the roof with 8d galvanized nails driven outside the flashing edges; he then bends them over the lip.**

**Before the battens go down, DeJong staples lath to the deck over each rafter. This allows any moisture that may sneak under the tiles to escape easily. Here DeJong begins the first course of tile, hanging tile lugs on the first batten.**



***Hip trim.*** **It's most efficient to gang-cut angled tiles for hip or valley intersections. Note in the foreground (left photo) the position of the nail holding the chalkline. The distance from it to the corner of the tile to its right is the same as the distance from the tile nearest the hip to the edge of the nailer. Trimmed hip tiles tuck against the 2x4 nailer (top photo). Short pieces are supported at their lower edges with a nail driven horizontally into the 2x4. Asphalt roofing cement, along with flashing tape, can also be used to glue smaller tiles to their neighbors. Hips are finished with trim tiles affixed to the 2x4 nailer with 8d galvanized nails topped with a dab of asphalt cement (photo above). The shim under the second trim tile ensures a sturdy base for the tile.**

which still have part of the lug, he hooks the tile over the batten, drills a hole near the top, and nails it in place. For small pieces, he drives a nail partway into the deck near the nailer as a platform to support the edge of the tile. He hooks the bottom edge with another nail driven sideways into the nailer.

If a small angled tile finishes off the eave course where flashing prevents him from driving nails, he cements the piece to the next whole tile with sticky black roof tile cement (Fields Corp., 2240 Taylor Way, Tacoma, Wash. 98421; 206-627-4098) in the top 2 in. of the waterlock. Once the tiles are set, he then tapes the two tiles together to hold them until the cement sets up. DeJong flashes the joint by molding 4-in. flexible flashing tape (Aluma-Grip-701, Hardcast Inc., Box 1239, Wylie, Texas 75098; 214-442-6545) down from the top of the nailer and onto the tile.

Finally, he caps the hip with special trim tiles (small photo, below left). He test-fits a hip tile, like putting a saddle on the nailer, and checks that the bottom edges just rest on the barrels of the adjacent field tiles. If the nailer is too low, he shims it with lath. Then he starts the hip with a bullnose end cap nailed to the nailer. He spreads tile cement over the nail, drops a standard hip tile down on the nailer, slides it down into the cement until the bottom lug catches on the tile below and nails it in place. He continues up the hip to the apex, where he either miters the hips to meet the ridge (a ridge tile will later slip under this mitered joint) or caps it with a special apex tile. In either case, he flashes under the apex with flexible flashing or lead.

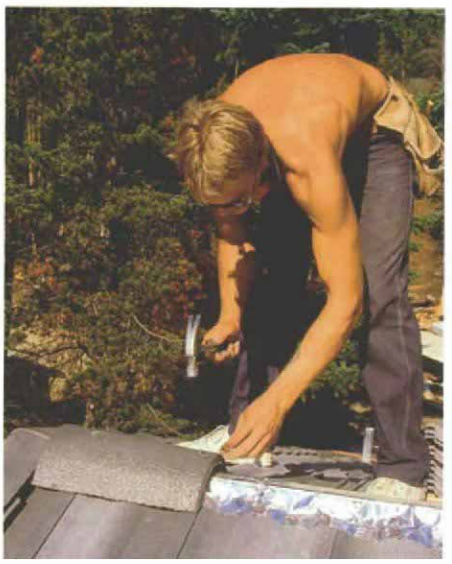
Some roofers prefer to bed the hip tiles in mortar. If you choose to do this, be sure not to pack the joint. Just tuck mortar under the edges. Otherwise, the mortar will wick water up into the hip.

Like hips, you can cut and fit valley .tiles one at a time or cut the whole row at once. But when it comes to securing cut tiles to the roof, DeJong alters his technique. For large pieces, he strings a length of 14-ga. galvanized wire through the nail hole and ties the wire back to a nail driven just outside the valley (top photo, facing page). In this way he avoids punching holes in the valley flashing. If any of the cut tiles tips or rocks, he sticks a chunk of broken tile underneath to support it (some roofers tuck mortar under the cut edge).

**Rakes and ridges**—Rakes are trimmed with special tiles that are nailed to the rake fascia. Rake tiles resemble hip tiles but are formed to a tighter "V." They are interchangeable for right and left rakes.

Balancing precariously on the eave corner, DeJong sets the first rake tile on the end of the eave course and slides it up against the nose of the next field tile up. He holds the side of the rake tile plumb and carefully drives two nails through the prepunched holes. Working his way up the rake, he butts a rake tile against each course of field tiles until he gets within

*No holes in the valleys.* At valleys, tiles are secured without penetrating the flashing. On the near side, a tile is wired to a batten. On the far side, DeJong tapes a piece of tile to its neighbor. Asphalt cement between the short piece and the overlapping tile will further secure it.



Rake tiles that are V-shaped in section trim the gable ends of roofs. At the top, they are mitered and sealed with asphalt. Trim tiles similar to the hip tiles finish off the ridge.

DeJong's preferred method to seal chimneys and sidewalls against the weather is with lead step flashings shaped to fit the irregular contours of the tile.

Another way to tile up a sidewall, chimney or skylight is with a sidewall flashing. Tile edges overlap the raised lip of the sidewall flashing, spilling runoff into the flashing channel.

**A vent is sealed by folding the site-cut tabs of a lead jack over the lip of the vent.**

one tile of the ridge. Ridge and rake will meet at the apex, so he first must prepare the ridge.

Along the ridge he has already toenailed a vertical 2x3 nailer, stopping it back 6 in. from the gable end. The top course of field tile nearly butts this nailer. Now he molds flexible flashing tape down the nailer and onto the tiles, as at the hips, to seal the ridge joint. At this point he can cut the apex of rake and ridge.

DeJong miters the opposing rake tiles at the peak so that they meet with a neat, tight joint. He drills another nail hole in each trim piece, sets nails in the rake as spacers to hold the pieces plumb and square to the rake, and nails the mitered trim with two nails each.

To cap the ridge, DeJong butts a ridge tile square against the mitered rakes (bottom left photo, previous page) and nails it to the 2x3 nailer, as at the hips. Another way to do this detail is to notch the bottom of the ridge tile so that it overlaps the mitered rake joint. He goops the mitered seam and stuffs more tile cement into the arch of the ridge tile where it meets the rake. At first the shiny black cement looks unsightly and out of place, but it will eventually fade and the color then will blend with the tile.

DeJong completes the ridge by lapping trim tile, nailing and cementing the joints as he did on the hips. When he gets close to the opposite end, he checks the distance remaining and adjusts the spacing to get the last ridge tile to meet the apex of the rake. Or, he simply cuts the last tile to fit.

**Chimneys and** skylights—DeJong tiles right up to the base of a chimney or a skylight as if it were a ridge. If it works out that this last course is short, he cuts the tiles and uses the bottom portions, drilling them for nails and shimming them as necessary to maintain the roof pitch. Then he seals the joint with Aluma-Grip tape, and caps that with rigid counter-flashing (sometimes called "headwall flashing"), which extends down 6 in. over the barrels of the tiles below. Incidentally, he uses this same detailing where a roof meets a headwall.

To flash a bottom corner of a boxed-in chimney, DeJong cuts a 12-in. by 16-in. rectangle of 2½-lb. lead sheeting and bends it in half lengthwise. He spreads tile cement on the bottom half and presses the flashing into the corner, with the bottom edge even with the headwall flashing. The lead can be molded to conform to the shape of the tile below.

DeJong prefers the step-flashing system for sealing along chimneys or sidewalls (bottom center photo, previous page). He lays the next tile course right up to the side of the chimney and sets another bent, gooped, 12-in. by 15-in. piece of lead step flashing atop that tile, with the nose of the flashing even with the nose of the tile.

Once he works flashing up to the top of a skylight or a chimney, DeJong fits in a piece of rigid "back flashing"—a sheet-steel "V" that extends up the back curb of the skylight and 16 in. up the roof. At the sides, the back flashing extends 6 in. past the edge. DeJong blocks under the flashing with battens and tile pieces to raise it up just high enough that it sets on top of the step flashing. To make the joint, he cuts down the crease of the last step flashing almost to the corner of the curb and folds the vertical flap around the corner and against the back curb. He also cuts down the top flap of the back flashing to the corner and bends it around the corner and against the side. When the fit is right, he pulls the back flashing, goops all the overlapping flaps and corners with roof tile cement and presses the back flashing back down into place. The next course of tiles runs across the top, sitting on the back flashing.

If the skylight or chimney is wider than 4 ft., DeJong hires a carpenter to frame a cricket. Then he tiles around it as he would a valley.

The other way to flash the side is with a single piece of sidewall flashing (sometimes called J-flashing). This is a sheet-metal pan turned at a right angle to go up the wall. It has a raised lip along the outer edge of the pan like valley flashing. The flashing rides on battens, and the edges of tiles drop into this pan, which channels water down the side and spills it onto the course below the chimney or skylight.

At least one skylight company (Velux-America Inc., P. O. Box 3268, Greenwood, S. C. 29648; 800-888-3589) offers its own tile-compatible flashing kit using the sidewall flashing approach (bottom right photo, previous page). If you buy these skylights, you should probably consider getting the flashing as well. It's not hard to install, despite the instructions.

The flashing at the base of the Velux skylight shown here is made of ribbed lead sheeting. Before one can be installed, the protruding barrels of the tiles need to be lopped off so the sheet will lie flat. Also, the noses of the side tiles are notched to clear the lip of the sidewall flashing, and the tiles are tied back with wire to avoid puncturing it.

**Tiling around a vent pipe**—Flashing around a plumbing vent is quite a bit easier than sealing larger openings. The secret is the malleable lead jack (photo above).

DeJong tries to coordinate his work with the

plumber. Ideally, he would like the vents to come up between the battens, in the center of a tile. This location produces the neatest, most water-tight job with the least fuss. The vents should project about 15 in. above the deck.

As he tiles up to the vent, DeJong measures, marks, and cuts the tile to fit around it, and then sets the tile in place. He slides a lead roof jack over the vent and onto the top of the tile, square to the roof. With the rubber handle of his hammer, he dresses the jack to conform to the curves of the tile, and he trims the back of the flashing even with the back of the tile. He slides the jack up, goops roof-tile cement around the hole in the tile, and slides the jack back down, bedding it in the cement. Then he folds inward site-cut tabs in the top of the jack to seal the vent.

**Safety**—To help you keep your footing, DeJong recommends you wear rubber-soled shoes (athletic sneakers or deck shoes). Concrete dust is slick; blow off the roof after you cut tiles. And, stay off a wet roof.

On steep pitches, the situation gets more precarious, and safety becomes more critical. For modestly steep pitches, say 8-in-12 or 12-in-12, stay off the tiled portion, walk on the battens and make "ladders" to get across tiled slopes. Steeper than that, plan to hang on the batten with one hand, and consider a scaffold or safety net at the eave to give you a second chance. Or, maybe this is the time to call a professional. The National Tile Roofing Manufacturers Association (NTRMA, 3127 Los Feliz Boulevard, Los Angeles, Calif. 90039; 800-248-8453) makes available a list of tile manufacturers, who can in turn recommend competent installers. □

*J. Azevedo overcame his acrophobia to research this article. Photos by the author.*

## *Cutting and breaking concrete tile*

**Concrete tiles are only sand and cement; you can cut them with a carborundum wheel mounted on your circular saw. Still, abrasive masonry wheels are exasperatingly slow, and you will wear out several on a tile roof. If your roof is cut up by a lot of hips, valleys, and skylights, DeJong recommends that you consider buying a diamond blade. He cuts tile with a 12-in. diamond blade mounted on a portable electric cut-off saw (for more on these tools, see *FHB* #62, pp. 80-84). The diamond chews through tile about as fast as a circular-saw blade cross-cuts 2x fir.**

**Breaking tiles is easy, but getting them to break where you want takes a little more finesse. DeJong generally breaks, rather than cuts, half tiles for starting courses at the rake. First he cuts or chips off the lugs and reinforcing ribs down the center of the underside of the tile. Then he cradles the tile, face side up, in his arms like a baby and raps the center with a hammer. If all goes well, and it generally does, the tile splits in half down the center (photo below right).**

**To drill a small hole in a tile, DeJong uses a standard masonry bit. For larger holes, as for vent pipes, he scores a square with his diamond blade and knocks out the opening with his hammer. —*J. A.***

**After laying out a chalkline parallel to the hip, DeJong uses a 12-in. dia. blade to make clean, fast cuts in the concrete tile.**

**To divide a tile without a saw, remove the lugs from the center of the tile's underbelly, flip it over and give it a rap in the middle with a hammer.**