

ROOFING

CLAY AND CONCRETE TILE

Concrete and clay tiles are popular roofing materials in hot climates. But tile can provide a durable roof in any climate zone, provided steps are taken to deal with the prevailing conditions.

ESTIMATING CLAY AND CONCRETE TILE

- Field tile is usually sold in full pallets, and accessories in full boxes. Consult the manufacturer's information for the number of field tiles per square, the number of squares per pallet, and the number of tile accessories packaged per box.
- It takes about 90 concrete field tiles to cover a square of roof area when using a 3-in. top lap.
- Add 3% to field tile quantities for waste and breakage.

SHEATHING AND UNDERLAYMENT

Sheathing Options for Tile

A tile roof can be installed either over a solid sheathing or spaced sheathing.

Underlayment Options for Tile

- For slopes 4:12 and over, solid sheathing and 30-lb. felt will do. See Underlayment for Tile Roofs, below.
- On solid sheathing, 1x2 battens are mounted to the roof deck over the underlayment and between the roof eaves and the ridge. Battens are required on roofs with slopes in excess of 7:12, and are generally recommended on all tile installations. See **Underlayment and Batten Layout**, below, for underlayment application over solid sheathing.

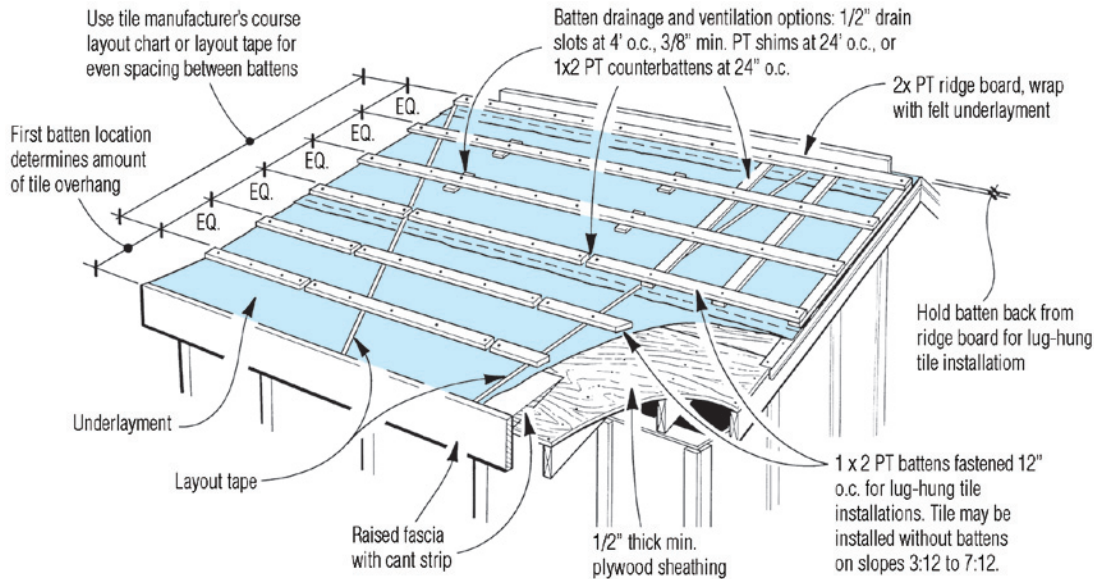
FIGURE: UNDERLAYMENT FOR TILE ROOFS

Roof Slope	Use Conditions	Underlayment (based on standard size tile with 3" min. overlap)
More than 20:12 slope	Normal Conditions	One layer of 30# asphalt-saturated felt (min.)
	Heavier/Thicker tile application	One layer of 40# A-S, coated felt.
	In areas with severe weather	Two layers of 30# A-S felt or one layer of 40# (A-S, coated felt) recommended
8:12 to 20:12 slope	Normal Conditions	Two layers of 30# A-S felt recommended, but one layer of 40# (A-S, coated felt) recommended
	Heavier/Thicker tile application	One layer of 45# min. A-S, coated felt.
	In areas with severe weather	Two layers of 30# A-S felt or one layer of 40# A-S coated felt acceptable
4:12 to 8:12 slope	Normal Conditions	Two layers of 30# A-S felt or one layer of 40# A-S coated felt recommended
	Heavier/Thicker tile application	One layer of 45# min. A-S, coated felt.
	In areas with severe weather	On lower slopes an upgraded underlayment system and/or waterproof membrane is recommended.
Less than 4:12 slope	All Conditions	At these slopes, tile is considered decorative. A more stringent underlayment, waterproof membrane system, and reduced tile exposures may be required.

Estimating Clay and Concrete Tile

Sheathing and Underlayment

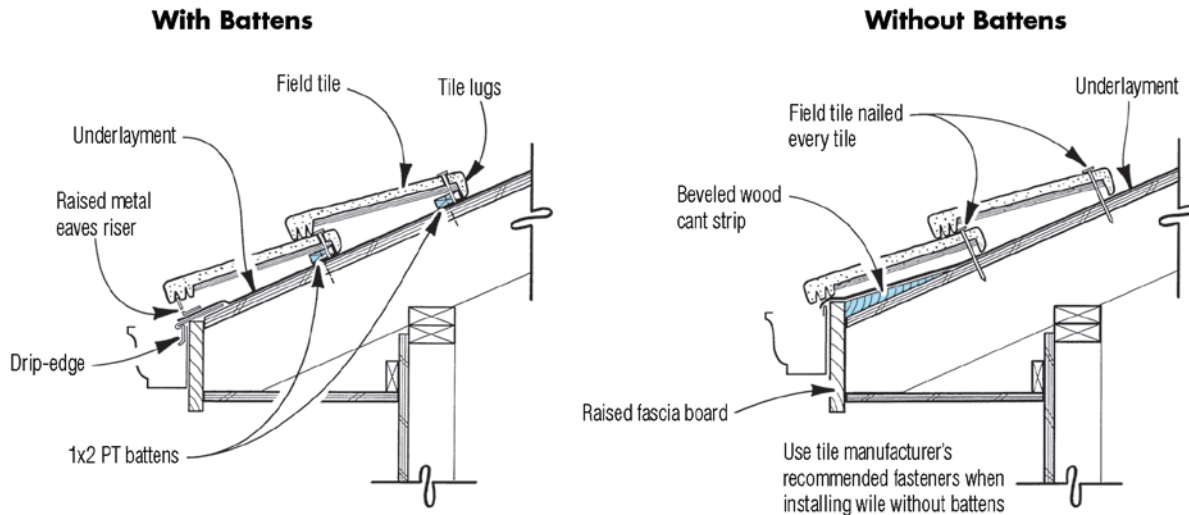
FIGURE: UNDERLAYMENT AND BATTEN LAYOUT



When installing clay and concrete tile over solid sheathing, cover the plywood with 15- or 30-lb. felt paper and install strapping over the plywood, cutting notches or shimming under battens for drainage. For optimum drainage and ventilation, install counterbattens.

- Check manufacturers' suggested layout procedures. Each manufacturer should supply information regarding batten spacing and kick-strip installation, as well as a layout calculation chart for its product.
- Tiles on shallow slopes must be installed over a waterproof low-slope roof, either built-up or single-ply. In this case, the tiles are mostly decorative, although they do shield the membrane against ultraviolet light, high winds, and mechanical damage.
- Flat concrete tiles should be installed over preservative-treated battens (**Eaves Details for Roofing Tile**, below). In climates with snow accumulation, install the counter battens over battens that run from ridge to eaves (**Underlayment and Batten Layout**, above). These enhance drainage and ventilation, and help to keep the roof uniformly cold, which lessens the chance of ice damming.

FIGURE: EAVES DETAILS FOR ROOFING TILE



Sheathing and Underlayment

Loading the Roof with Tile

Tile installed with battens and on raised metal eaves riser (left): Underlayment should overhang drip-edge and be completely weathertight.

Tile installed without battens (right): Check with the tile manufacturer for proper nail type and nailing depth. A continuous cant strip stops water from collecting along raised fascia board. Underlayment should overhang drip-edge and be completely weathertight.

LOADING THE ROOF WITH TILE

Gable Roofs

On a gable roof, stack the tile to properly distribute the weight of the tile during installation. This avoids overloading the roof framing system at its weakest point, the midspan of the rafters.

- Pick tiles from different pallets to avoid color patterning.
- Starting from the right, lay out the stacks in numbers as shown at left in **Loading the Roof**, below, beginning with the fourth course. Space stacks about 12 in. apart.
- Repeat the procedure every fourth course. Odd numbers of courses should have two additional tiles for each additional course on each stack along the ridge.

Hip Roofs

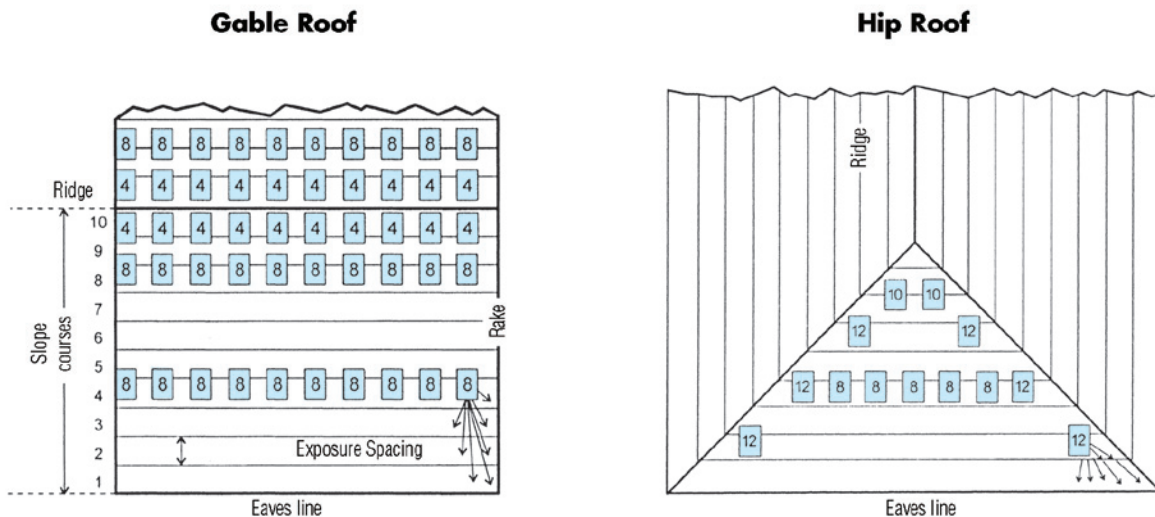
Loading a hip roof is the same as loading a gable roof except that the number of tiles in stacks at the far left may vary due to the size of the roof (**below**).

Loading the Roof
with Tile

Cutting Tile

Tile Roofing for
High Wind Zones

FIGURE: LOADING THE ROOF



Properly loading the roofing tile avoids overloading the framing system at its weakest point, the midspan of the rafters.

CUTTING TILE

Straight cuts at rakes can be made by scoring a line on the tile, then breaking it with a roofing hatchet. Although this leaves a rough edge, it will be covered by the rake tiles.

Valley and hip cuts. Use a power saw — a cut-off saw or a standard tile saw — and a diamond blade. Tiles may be cut wet or dry. When dry cutting, workers should wear respirators because of the fine dust. Also sweep any accumulated dust off the roof so that it does not stain the tiles or cause a fall.

TILE ROOFING FOR HIGH WIND ZONES

In high-wind zones, waterproofing includes:

1. Keeping wind-driven rain out.
2. Preventing the tiles from getting smashed by wind-borne projectiles or being lifted by high winds.

Solving these requires a waterproofing underlayment beneath the tiles, along with good mechanical fastening.

Choosing the right materials. A durable roof starts with the correct tile, underlayment and battens:

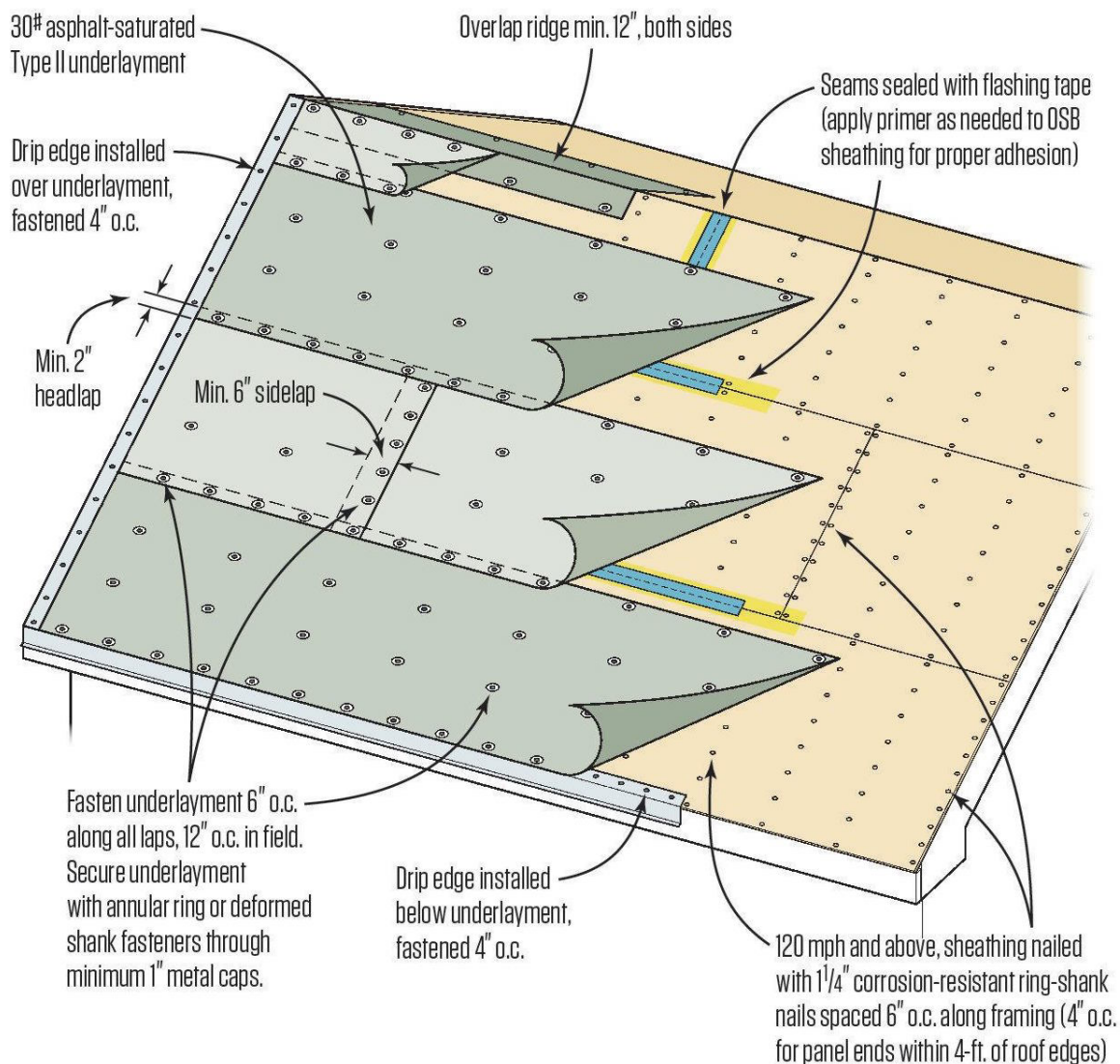
- **Tile:** Concrete and clay roof tiles used in high-wind and hail zones should be rated for impact. The test—FM4473—evaluates tile durability by firing ice balls at a test assembly. Class 3 tiles can withstand impact from 1 3/4-inch-diameter ice balls; Class 4 materials can withstand impact from 2-inch-diameter ice balls.

- **Underlayment:** Use a synthetic underlayment if possible. Synthetics last longer, weigh less and shed water better than felt.
- **Battens:** Wood battens are acceptable, but it's better to use an engineered product that will last as long as the tile, especially in wet climates where the battens may be subject to rot.

Waterproofing

Underlayment. On a concrete and clay tile roof, the underlayment and flashings provide the actual waterproofing.

FIGURE: SINGLE-LAYER UNDERLAYMENT



Avoid waterproofing membrane (e.g. continuous peel-and-stick membrane or asphalt-adhered cap sheet) before installing battens and tile.

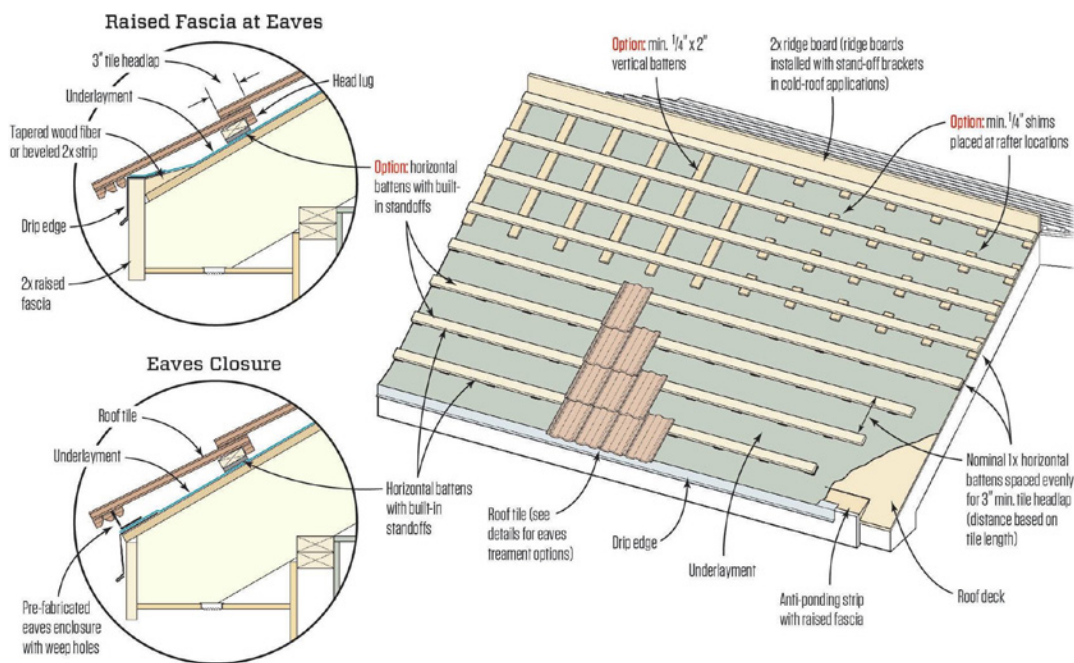
Waterproofing the roof deck. For a complete waterproofing system:

1. Seal all seams in the roof deck, using one of the following:
 1. Minimum 4-inch-wide peel-and-stick tape applied over all sheathing joints.
 2. Closed cell spray foam. This is an alternative to peel-and-stick tape. Apply the foam to all panel joints from the attic side.
2. Install synthetic underlayment with all seams taped. Follow the manufacturer's installation instructions for the underlayment product you are using.
3. Integrate the flashing with the underlayment. Metal flashing is required at junctures between the roof and sidewalls, at roof edges, in valleys, and around skylights, plumbing stacks, and other penetrations.
4. Apply a waterproofing membrane—such as a continuous peel-and-stick membrane or a 90-lb. cap sheet adhered with hot asphalt—over the underlayment system.

Note that the underlayment serves as a slip-sheet for the peel-and-stick membrane. Applying peel-and-stick directly to sheathing over the entire roof would be simpler, but is not recommended because it cannot be removed for reroofing without damaging the sheathing. In fact, it's not permitted by some jurisdictions.

Battens. Install tiles over a batten system that provides airflow and drainage. Battens are a good idea even if the tile profile doesn't require because there are fewer penetrations through the waterproofing membrane. Typically, three corrosion-resistant 8d ring shank nails are needed per 36- or 48-inch batten (24-inch-on-center nailing minimum).

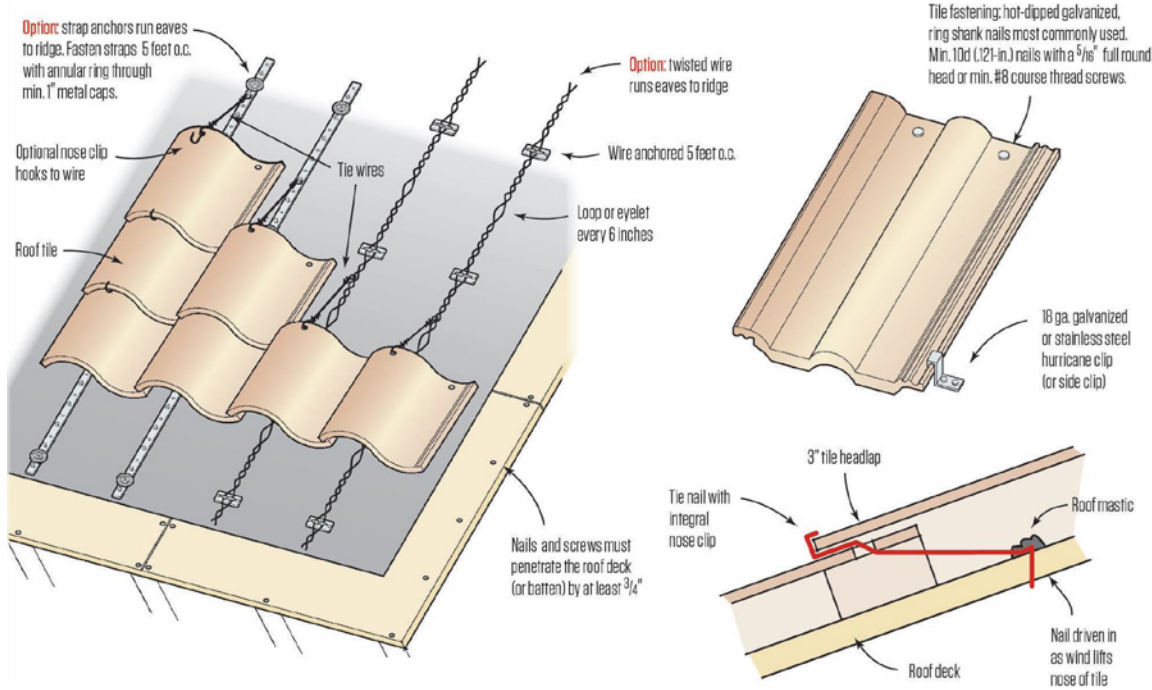
FIGURE: BATTEN LAYOUT



Horizontal battens over vertical counterbattens will promote positive drainage and airflow, and thus are recommended in all climate zones (though you may be able to get away without counterbattens in very dry climates.) Horizontal battens are also available with built-in standoffs.

FIGURE: WIND-RESISTANT TILE FASTENERS

Tile Roofing for High Wind Zones



- Two fasteners per tile will provide the required uplift resistance for a 130-mph wind zone. Hot-dipped galvanized, ring-shank nails (minimum 10d, or .121 inch, with a 5/16-inch, full-round head) or minimum #8 course-thread screws fit the bill.
- Nails and screws must penetrate the roof deck or batten by at least 3/4 inch.
- In a high wind, the most intense uplift pressures on roofing are along eaves edges and along hips and ridges.
- Hurricane clips or twist-wire connectors are also permitted.
- In seismic zones, twist-wire connections have the added advantage that they can absorb some of the shock of a minor earthquake.

Note: all metal components must be compatible.

FIGURE: FASTENING TILE IN HIGH-WIND AREAS

	Roof Slope	Solid Sheathing with Battens	Solid Sheathing without Battens ¹	Eaves Course	Perimeter Tile and Tile on Cantilevered Area ²
Fastening required on roofs 40 feet or less above ground (measured to the eaves) in areas with wind velocities up to 80 miles per hour	3:12 to 5:12	one 10d nail every tile	one 10d nail every tile	one 10d nail and one clip every tile ³	one 10d nail every tile
	5:12 to less than 7:12	one 10d nail every tile	one 10d nail every tile	one 10d nail and one clip every tile ³	one 10d nail every tile
	7:12 to less than 12:12	one 10d nail every tile	N/A	one 10d nail and one clip every tile ³	one 10d nail every tile
	12:12 and over	one 10d nail and clip every tile	N/A	one 10d nail and one clip every tile ³	one 10d nail every tile
	All slopes	one 12 d nail or two 10d nails and one clip every tile			
Fastening between 80 and 120 m.p.h.	All slopes	two 10d nails and one clip every tile			

For high-wind areas and tall buildings, the UBC currently requires one nail in the head of every tile, plus one nose clip for eaves tile and an extra nail for rake tiles. The National Tile Roofing Manufacturers Association recommends two nails or a nail and a clip for every tile in seismic and high-wind areas, and three fasteners for perimeter tiles. Check with your local officials for new code developments if you work in high-wind or seismic zones.

Notes: 1: For slopes exceeding 7:12, battens are required. **2:** Perimeter nailing areas include the distance equal to three tiles (but not less than 36") from the edges of hips, ridges, eaves, rakes, and major roof penetrations. **3:** You can use two nails per tile instead of clips.

COLD-CLIMATE TILE ROOFING

In cold climates, build a "cold roof" using counterbattens, whether or not the attic is ventilated.

The steeper the roof, the better. A steeper roof will reduce snow loading as well as promote airflow through the counterbattens.

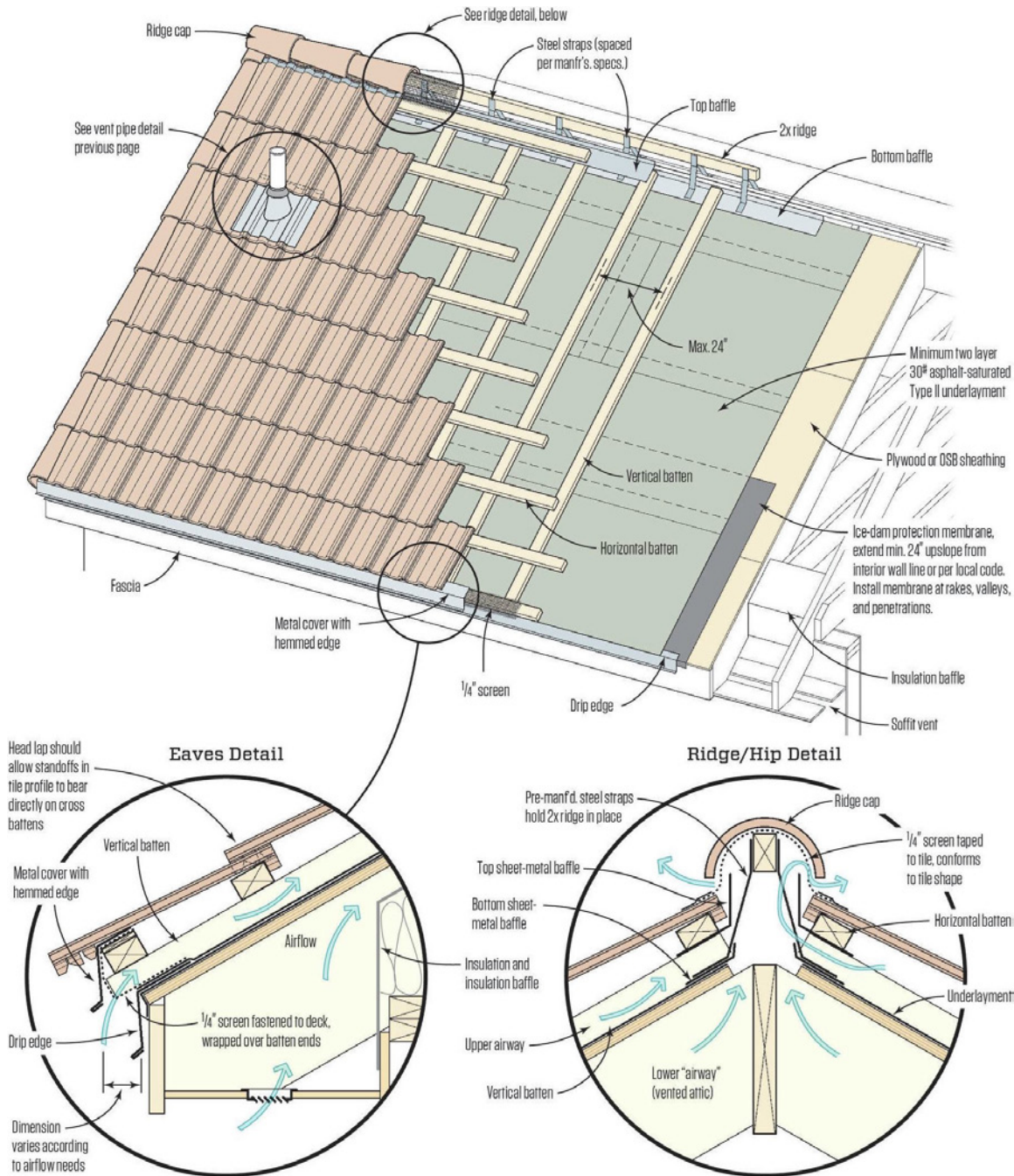
Tile Roofing for High Wind Zones

Cold-Climate Tile Roofing

Counterbatten System

FIGURE: COLD-CLIMATE TILE ROOF

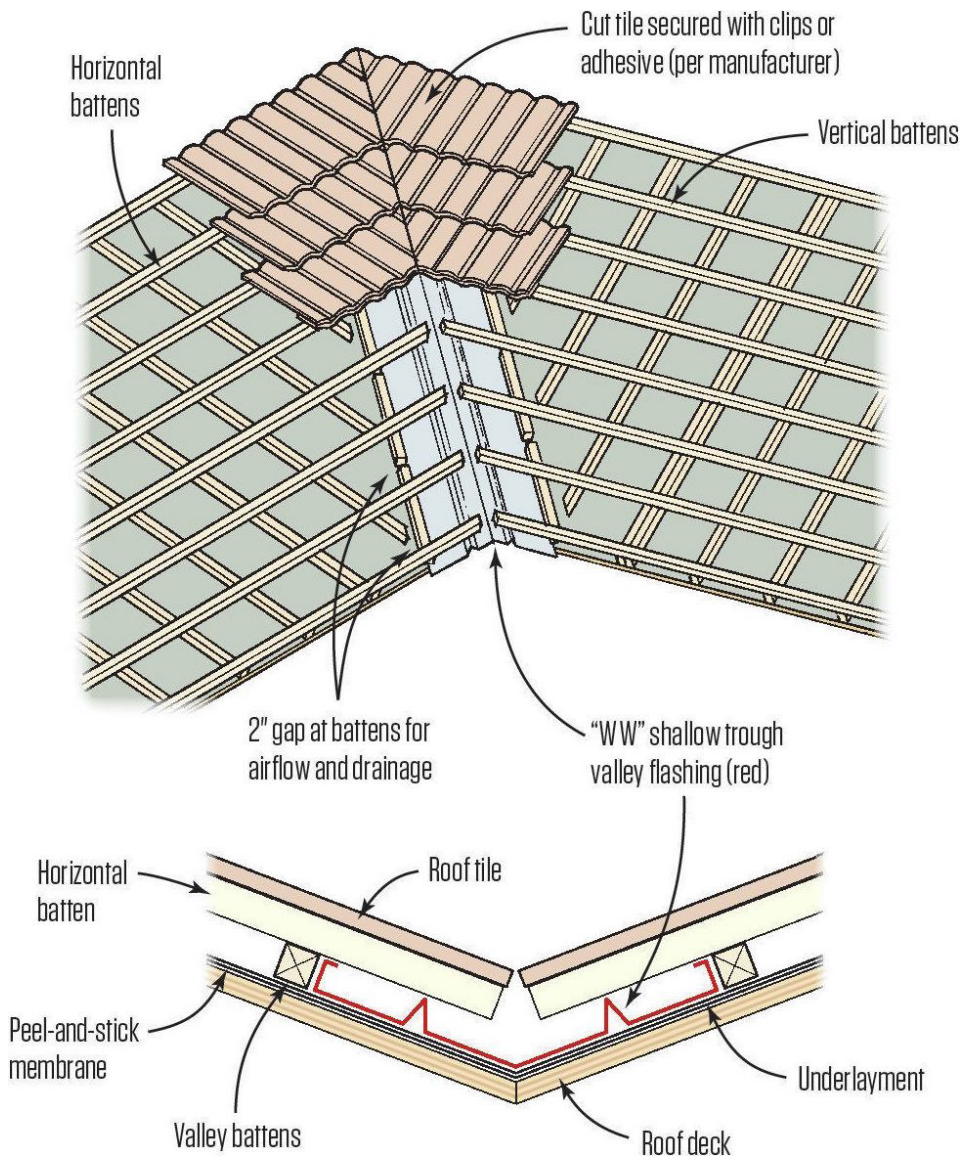
Cold-Climate Tile
Roofing



- Use 2x vertical battens with the eaves intake and ridge outlet baffled to keep out wind.
- Depending on snow accumulation and roof pitch, 2x cross battens may be required to support snow loads. In extremely cold and snowy climates, or with long, low pitch (around 4:12) roofs that require more ventilation space to promote airflow, vertical battens taller than 1 1/2 inches (for example, 2x4s on edge) may be required. Be sure to consult an engineer for this application.
- Brackets may be needed to prevent tall battens from tipping under live loads.
- When the attic is ventilated, install ridge boards with standoff brackets to allow attic airflow to exhaust.
- Underlayment. A double layer of 30-lb. felt is considered good practice.
- Ice Protection: In areas prone to ice dams, install a self adhering waterproofing membrane from the eaves to a point 24 inches inside (or above) the exterior wall line. Some code jurisdictions require more ice protection.

Detailing Valleys

FIGURE: CLOSED VALLEY

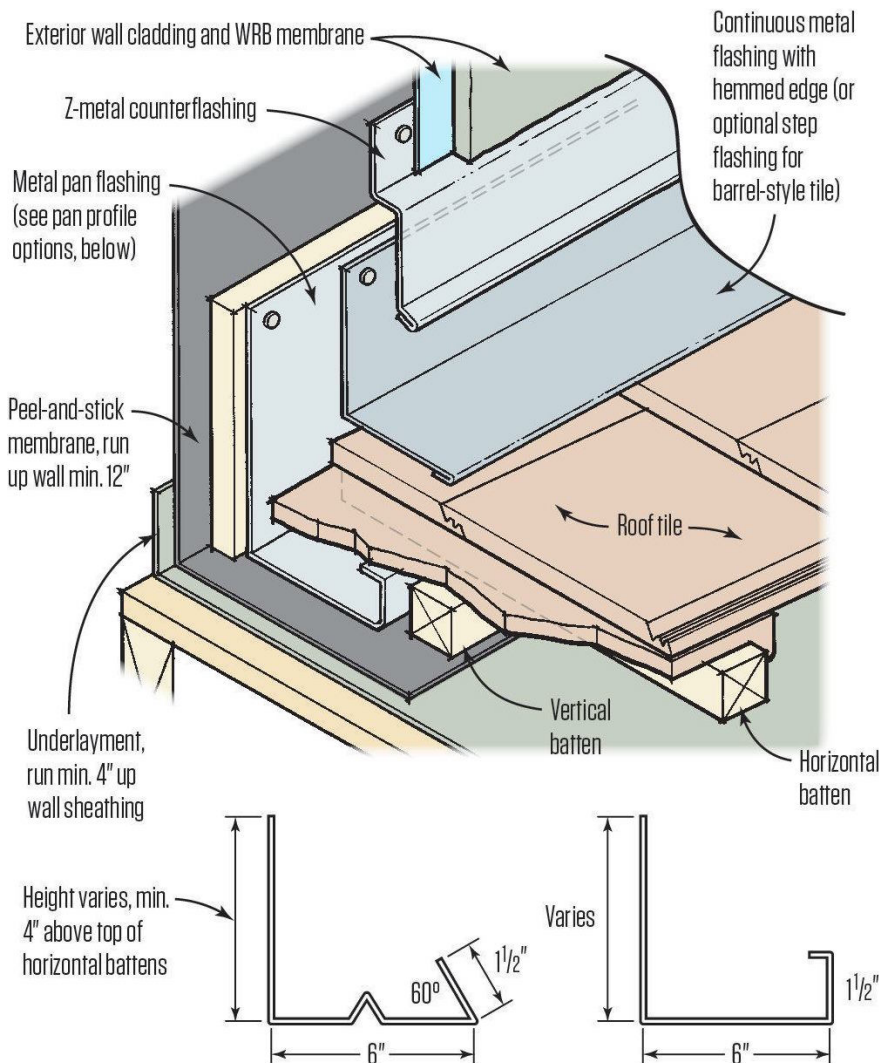


- While not required by code, peel-and-stick is recommended along valleys.
- Long valleys are difficult to vent.
- Battens that run along the valley should be segmented, and vertical battens should be gapped so they do not intersect the diagonal valley battens.
- Closed valleys using “WW” metal (with added standoffs to support cross battens), will be less likely to get clogged with debris.
- Valley metal for tile roofs should have upturned edges to contain the water flowing down them.

FLASHING

Flashing for tile roofing must serve two purposes: 1) to limit the amount of water that gets under the tile, and 2) to keep water out of the roof deck. This requires a dual-layer flashing around penetrations and at roof-wall intersections.

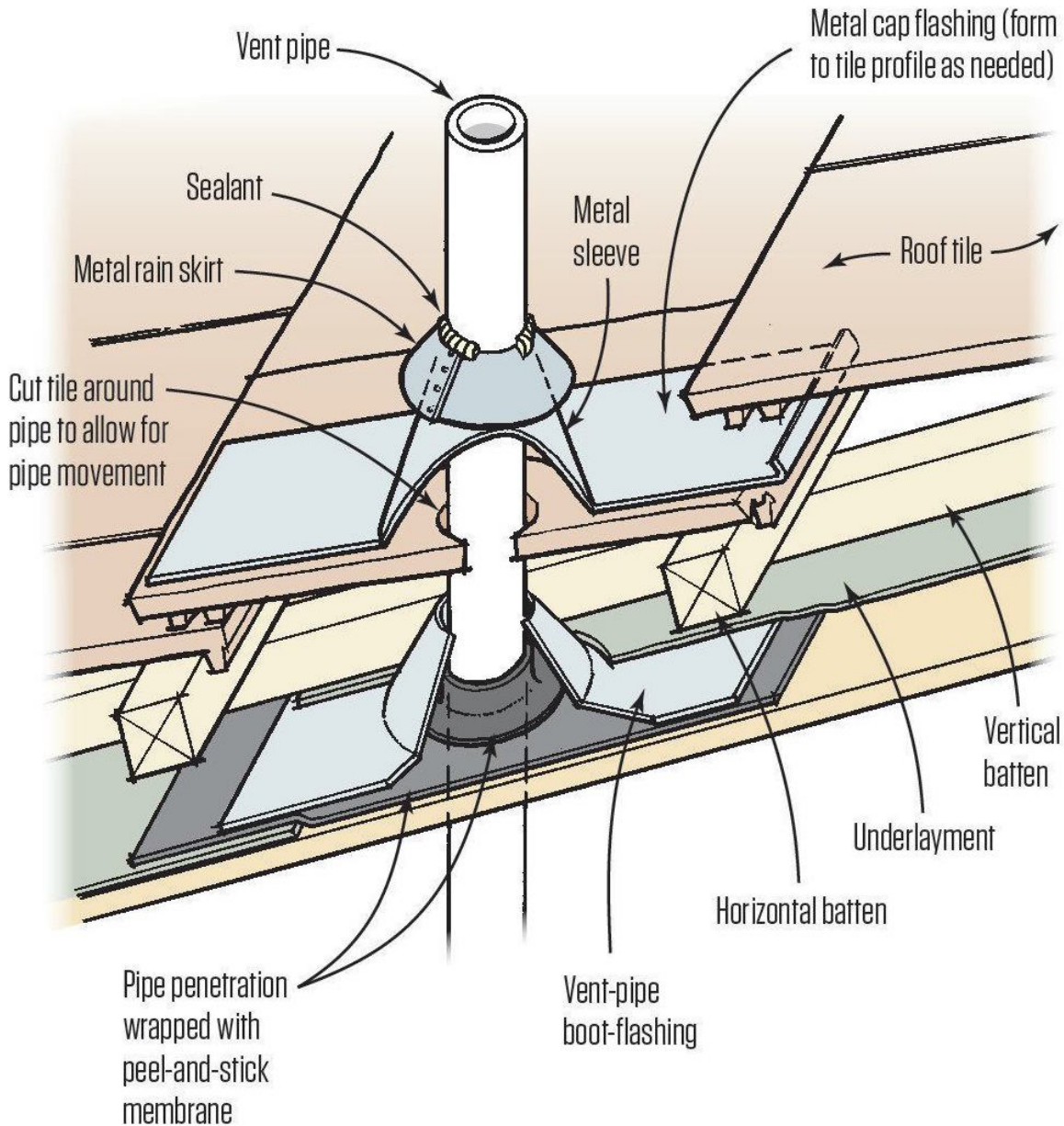
FIGURE: FLASHING WALL INTERSECTIONS



Where the roof meets a sidewall, extend underlayment at least 4 inches up the wall and add a wide peel-and-stick that extends up the wall as well as onto the roof plane. Use a metal flashing with an upturned edge to contain water. It should be padded out from the wall to allow for a robust counterflashing.

FIGURE: FLASHING VENT PIPES

Flashing



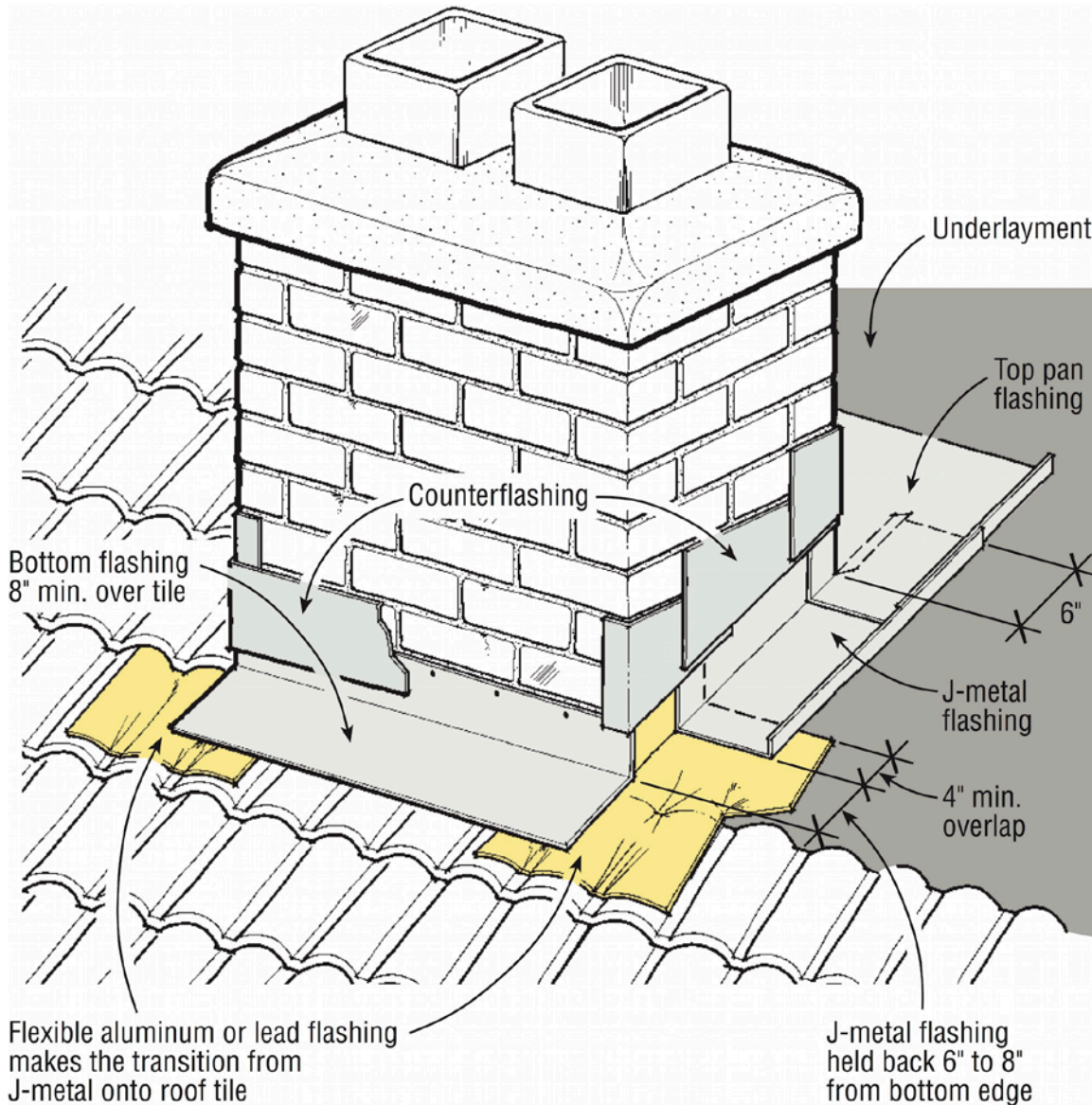
Vent pipes need to be flashed above and below the tile.

In cold climates, vents for combustion heating appliances should be boxed in a chimney to isolate them from the roof and reduce the chance that snow will melt around them. If possible, place the stack high on the roof, with the top of the stack above the ridge to prevent heated exhaust air from blowing across the roof surface and melting snow.

Crickets are a must above chimneys, skylights, and other large penetrations projecting through the roof.

FIGURE: FLASHING LARGE PENETRATIONS

Flashing



The sides of chimneys, dormers, and skylight curbs receive pan flashing, a rigid sidewall flashing that typically comes in 10-foot lengths. At the lower corners of a dormer or chimney, the pan flashing terminates onto a piece of aluminum or lead flashing, which conducts the water onto the top of a course of tiles below the roof penetration.