

## Installation General Information

Tile roofs can be used for a wide range of roof slopes from a minimum slope of 2-½:12 to a maximum slope of 24:12.

Improper installation of a tile roof is the primary cause of its failure — a key reason for architects interested in overall quality to understand the basics of installation and recognize potential pitfalls. Two areas where quality installation is mandatory are the underlayment and the flashings.

National installation guidelines should be followed for all roof tile installations. There are three major installation guidelines to reflect three distinct weather conditions: moderate climates, high-wind zones and cold and snow. Now in its fourth edition, *The Concrete and Clay Roof Tile Installation Manual for Moderate Climate Regions* was created by the tile manufacturers and the Tile Roofing Institute, together with the Western States Roofing Contractors Association. With diagrams and recommendations covering every aspect of tile roof systems, the manual addresses installation concerns of roofers, contractors, architects, and building officials.

For proper installation techniques in areas prone to high wind, architects should look to hurricane-aware Florida, where much research has been done on the adherence of roof tile to roof decks. New guidelines for fastening tiles were introduced in 2005 in the 4th edition (with amendments) of the Concrete and Clay Roof Tile Installation Manual. This manual is a collaboration between the Florida Roofing, Sheet Metal and Air Conditioning Contractors Association (FRSA) and The Tile Roofing Institute. The Tile Roofing Institute and the Western States Roofing Contractors Association have also partnered on a new manual for cold weather installation, Concrete and Clay Tile Roof Design Criteria Manual for Cold and Snow Regions.

## Underlayment

ASTM underlayment (also referred to as felt paper), goes over the roof deck, serving as a temporary roof covering before tile is applied. It provides a secondary water shedding membrane under the tile roof. Factors impacting underlayment choices include local codes, roof slope, elevation and climate.

Single-layer underlayment can be installed on roof slopes 4:12 and above. For slopes below 4:12 upgraded underlayment might be required as designated by local building codes. To assure that the underlayment will endure follow the specifications outlined in the appropriate code document.

## Fasteners

Tile is attached directly to the underlayment or to a batten system. Attachment is by one or a combination of the following code approved means:

- Mechanical — nails, screws or clips
- Mortar
- Foam adhesive

Securement methods vary according to the roof slope and type of roof tile, as well as such conditions as wind, seismic factors and building codes. Whatever method is selected, fasteners should be non-corrosive, in order to be effective during the roof's design life. Nails are the most common fasteners and should be long enough to penetrate  $\frac{3}{4}$ -inch into the deck or batten, whichever is less. The number of fasteners required depends on the wind zone and the slope of the roof.

One attachment method that is gaining acceptance is a code-approved foam adhesive that locks the tiles in place. Manufacturers claim that, with the exception of steep slopes, the product can be used without nails or screws, thereby minimizing punctures to the underlayment and roof deck. The major advantage is that the adhesive offers significantly greater wind resistance than either nails or screws. Currently these products are available in both one component and two-component, code-approved systems.

## Roof Layout

For optimum performance and appearance, the roof area should be divided into equal course sections between the eave and ridge. Layout within these sections will be based on tile length. An head lap of at least three inches should be maintained throughout the rows.

## Batten and Counter batten Systems

Concrete roof tiles can be either nailed directly to the roof deck or installed on battens, thin strips of wood, parallel to the eaves. Most tile manufacturers permit direct nailing, except on roofs with a slope greater than 7:12 or in very cold climates subject to ice dams. If used, battens should be 1-inch by 2-inch boards, and are required on higher sloped roofs (exceeding 7:12). Battens are nailed to the deck at 24 inches on center and should provide a  $\frac{1}{2}$ -inch break every four feet. Some roofs use battens in both directions, known as a counterbatten system, which is essentially a grid of wood strips nailed onto each section of the roof designed to hold the tiles and raise them off the roof to allow water to drain underneath. The counterbatten or shim under the batten enables condensation or moisture to exit off the roof via the eave.

Some installers insist on counterbatten systems to ensure moisture drainage. Because battens are elevated off the roof, water from wind-driven rain is blown under the tiles where it migrates to the eaves and leaves the roof. The number of nail penetrations of the underlayment is far less with a counterbatten system which has been the standard for low-slope tile roofs and tile roofs in cold weather climates.

Counterbatten systems have other advantages as well. The air space between roof deck and tile creates a thermal barrier that cools the structure in hot climates and minimizes ice dams in regions with severe winter weather — this is optimized in a counterbatten system, adding significantly to a reduction of ceiling level heat over a typical tile roof installation. Counterbattens are not recommended in high wind areas.

In cold weather climates there is always the risk of an ice dam, which is a ridge of ice that forms at the roof's edge, preventing snow from draining off the roof. This has serious implications as the backed up water can leak into the structure, causing significant damage. Ice dams can form because the heat lost through the structure's roof melts the snow on the surface, causing it to flow down the roof but freeze at the eaves. Even if there is heat rising from the attic, the counterbatten system has created the sufficient air space beneath the tile to dispel the heat before it can melt the snow.

The slope of the roof will often determine whether a batten system is used. On steeper pitches a batten system is required by code. Designing a lower sloped roof can be more cost effective due to reduced labor and materials requirements.

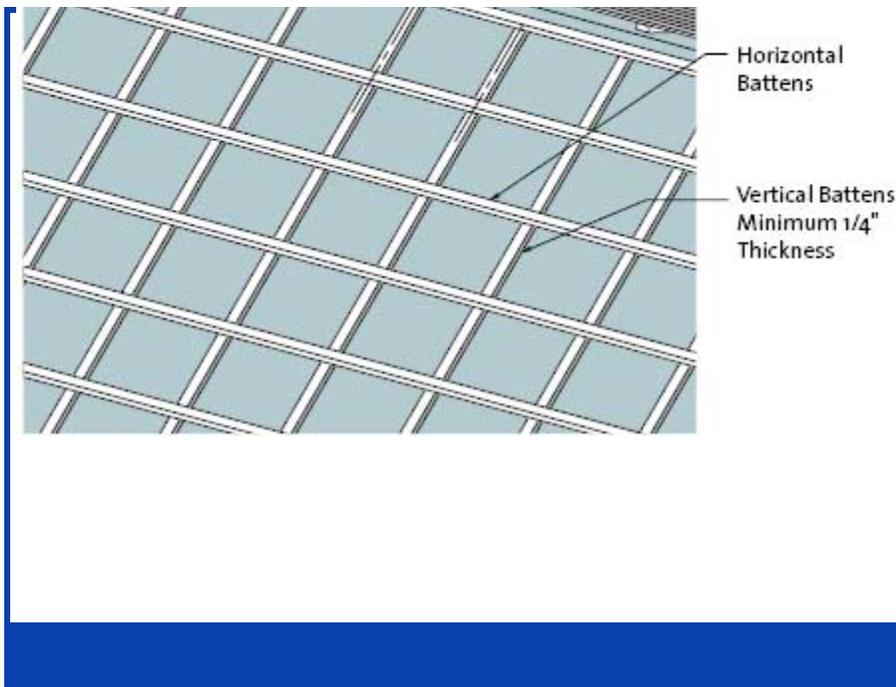
## Flashings

Every roof penetration such as vent pipes, dormers, chimneys, and skylights requires two flashings. The first flashing is installed with the underlayment and the second is integrated with the tile. Tiles should be cut close to the pipe, with a space open below the pipe to prevent debris accumulation. Vent pipe sealing options include adhesive, mastic or a pipe collar; flashings may be painted to match the tile.

### Counterbatten Installation System

**Note:**

Consideration should be given to climate and roof orientation to determine if it is beneficial to specify/use vertical battens over underlayment, with horizontal battens secured over the vertical battens.



## Blended Installation

Multiple shades of tile in either random or set patterns are referred to as "blended" tiles. They create distinctive roof designs especially in the custom home market and are becoming increasingly more popular. Either two or more solid colors can be selected and blended on site; another option is to purchase factory blended tiles where multiple colors are delivered to the job site on a single pallet.

Both methods require the contractor and architect to examine closely the tile distribution on the roof so that the effect is aesthetically pleasing. Poor layout can cause "hot spots," where tiles of the same shade are clumped together — an unpleasing patch of color that can result in additional labor to correct. Proper roof tile loading and application are essential for successful blend applications and meeting the expectations of the architect and owner.

## Conclusion

Sustainable and aesthetically pleasing, a concrete tile roof can be an attractive, cost-effective addition to any building. A known manufacturer with a strong warranty, a climate-appropriate product and a qualified roofer specializing in concrete tile roofs are essential to a trouble-free, long-lasting experience for architects, builders and owners.