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## EVALUATION REPORT

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ER-2656

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**Filing Category: ROOF COVERING AND ROOF DECK CONSTRUCTION—Roof Covering (202)**

### EXTRUDED CONCRETE INTERLOCKING ROOF TILES

**MONIER LIFETILE LLC**  
7575 IRVINE CENTER DRIVE  
IRVINE, CALIFORNIA 92618-2930

#### 1.0 SUBJECT

Extruded Concrete Interlocking Roof Tiles: Roma, Classic "100," Homestead, Mission "S," Shake, Slate, Split Shake, Split Slate, Country Shake, Country Slate, Country Split Shake, Country Split Slate, Cedarlite, Espana, Espana Tejas, Capri, Villa, Sentry Classic and Traditions.

#### 2.0 DESCRIPTION

##### 2.1 Materials:

###### 2.1.1 Regular-weight Tiles:

The extruded concrete roof tiles are interlocking elements having the dimensions and configurations shown in the accompanying table and figures. Accessory tile units are available for ridge, hip and gable areas. The regular-weight tiles are composed of portland cement and selected sand aggregates. The mix proportions are accurately maintained to ensure tile production in accordance with the specifications. Anchor lugs, located on the underside of all tiles except Cedarlite, overlap wood battens, purlins or spaced sheathing for anchorage in the plane of the roof. Holes are provided in each tile for fastening where required by the installation. Interlocking ribs are provided on the longitudinal edges of the tiles to restrict lateral movement and provide a water stop. In addition, transverse bars are provided on the underside to serve as weather checks. Mineral coloring oxides are either applied to the exposed surface in a cementitious material or mixed integrally with the tile mix to produce a through-colored product. The tiles are cured to reach required strength before shipment. See Table 1 for product designations, dimensions and installed weights. See Figure 1 for tile profiles.

**2.1.2 Lightweight Tiles:** Duralite tiles are manufactured in the same manner and size, and with the same profiles, as regular-weight tiles, but the tiles are comprised of portland cement, lightweight aggregate and proprietary ingredients. See Table 1 for product dimensions and installed weights.

**2.1.3 Cedarlite:** Cedarlite tiles are manufactured in the same manner as regular-weight tiles, except they are comprised of portland cement, lightweight aggregates and proprietary ingredients, and have a wood shake appearance and flat backside.

##### 2.2 Installation—New Construction:

**2.2.1 General:** Installation shall be in accordance with Tables 15-D-1 and 15-D-2 of the code, except as noted in this report. Care must be taken to ensure both horizontal and vertical alignment on the roof. Foreign particles must be cleaned from all interlocking areas, to ensure correct fit and prevent

water damming. Cracked or broken tiles must not be installed or allowed to remain on the roof.

**2.2.2 Sheathing:** Sheathing must be structurally adequate to support the loads involved. At a minimum, spaced sheathing boards must be nominal 1-by-6 lumber spanning a maximum of 24 inches (610 mm). Solid and spaced sheathing must be fastened in accordance with the code.

**2.2.3 Underlayment:** Tiles installed on roofs with slopes less than 2<sup>1</sup>/<sub>2</sub>:12 (21% slope) are considered decorative only, and must be applied over an approved roof covering, subject to local building official approval.

On roofs with slopes of 2<sup>1</sup>/<sub>2</sub>:12 (21% slope) to less than 3:12 (25% slope), an approved built-up roof applied in accordance with Table 15-D-1 of the code or an approved single-ply roof membrane assembly must be installed prior to installation of the tiles.

On solidly sheathed roofs with slopes of 3:12 (25% slope) to less than 4:12 (33% slope), underlayment may be as described in this section for roof slopes of 2<sup>1</sup>/<sub>2</sub>:12 (21% slope) to less than 3:12 (25% slope), or may be a single layer of Type 90, granular-surfaced, asphalt roll roofing, or two layers of Type 30 felt installed shingle fashion, or other approved single-ply systems installed in accordance with the code or an ICBO ES evaluation report.

Over solid sheathing, on roofs with slopes of 4:12 (33% slope) or greater, underlayment must be one layer of minimum Type 30 felt either complying with ASTM D 226 or recognized in an ICBO ES evaluation report, and must completely cover the decking.

When the tiles are installed over spaced sheathing, the underlayment must comply with the ICBO ES Acceptance Criteria for Concrete Tile Underlayment on Spaced Sheathing (AC08). The underlayment must be draped over the rafters, with a 4-inch (152 mm) headlap and a 6-inch (152 mm) side-lap.

Underlayment must be lapped over hips and ridges, and lapped or laced through the valleys. Hip and ridge nailers must also be covered.

See Section 2.2.9 for application of underlayment in areas subject to roof ice buildup.

##### 2.2.4 Battens:

**2.2.4.1 Cedarlite Tiles:** Battens installed for Cedarlite tiles must be nominal 1-by-3 wood. The battens must be fastened as described in Section 2.2.4.3, and spaced at 10 inches (254 mm) on center. The top edge of the Cedarlite tile must be aligned with the top of the batten.

**2.2.4.2 All Other Tiles:** Battens are required on solidly sheathed roofs with slopes below 3:12 (25% slope) in order to minimize membrane penetration, and above 7:12 (58.3% slope) to provide positive tile anchorage. Battens must be fastened either with corrosion-resistant 8d common or box nails

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or approved equal, spaced at 24 inches (610 mm) on center; or with 1 $\frac{1}{2}$ -inch-long (38 mm),  $\frac{7}{16}$ -inch-crown (11.1 mm), No. 16 gage, corrosion-resistant staples spaced a maximum of 12 inches (305 mm) on center.

On roofs with slopes of 2 $\frac{1}{2}$ :12 (21% slope) to less than 3:12 (25% slope), nominal  $\frac{3}{8}$ -inch (9.5 mm), decay-resistant wood lath strips are attached vertically to framing over the underlayment, from eave to ridge, at 24 inches (610 mm) on center. Battens must be structurally adequate to support expected loads, but not smaller than nominal 1-by-2 boards, and must be fastened through the vertical lath with minimum 8d corrosion-resistant box nails or approved equal.

When used on roofs with slopes of 3:12 to 21:12 (25% slope to 175% slope), battens must be fastened to the roof deck at a maximum of 24 inches (610 mm) on center. Battens must have provisions for drainage either by providing a  $\frac{1}{2}$ -inch (12.7 mm) separation at the batten ends every 4 feet (1219 mm), or by shimming with decay-resistant wood or strips of material such as asphalt cap sheet or shingles spaced no more than 12 inches (305 mm) on center. Battens must be spaced to maintain a minimum 3-inch (76 mm) headlap when tiles are installed.

See Section 2.2.9 for installation of battens in severe climate areas.

**2.2.5 Eaves:** An eave closure strip or other approved special accessory must be installed to ensure that the eave course of tiles lies in the same plane as the remainder of the field. In areas determined by local building officials to be subject to blowing dust or snow, eave closure strips are required with Espana and Mission "S" tiles. Where solid fascia material is attached to rafter ends and extends above the plane of the deck to act as a first-course riser, an anti-ponding device must be used to support the underlayment.

### 2.2.6 Fastening:

**2.2.6.1 Field Tile:** Tiles shall be fastened in accordance with Tables 15-D-1 and 15-D-2 of the code. Tile nails shall be minimum No. 11 gage corrosion-resistant steel nails having a minimum  $\frac{5}{16}$ -inch (7.9 mm) head diameter, and sufficient length to penetrate  $\frac{3}{4}$  inch (19 mm) into framing or battens or through the thickness of the sheathing, whichever is less. When battens are not used, every tile shall be nailed.

Cedarlite tiles must be fastened to the sheathing with two nails per tile in accordance with Table 15-D-1 of the code. As an alternative, on minimum  $\frac{7}{16}$ -inch-thick (11.1 mm) oriented strand board or minimum  $\frac{15}{32}$ -inch-thick (11.9 mm) plywood, a single buglehead wood screw, in the center fastener hole, may be used. The screw must be of sufficient length to penetrate through the deck approximately  $\frac{1}{4}$  inch (6.4 mm) minimum. The screw head is driven to a point that allows the face end of the tile to lift  $\frac{1}{4}$  to  $\frac{1}{2}$  inch (6.4 to 12.7 mm) above the tile below. The buglehead screw must have a head diameter of 0.328 inch (8.3 mm) and a shank diameter, between threads, of 0.132 inch (3.35 mm).

**2.2.6.2 Trim Tile:** Nailers boards of sufficient height to adequately support hip or ridge tiles either must be fastened to framing with two 10d nails at 24 inches (610 mm) on center or two 20d nails at 48 inches (1219 mm) on center, or are secured using galvanized steel strapping or special galvanized steel attachment devices at 48 inches (1219 mm) on center. Each hip and ridge tile is attached to the nailer board with one No. 11 gage, corrosion-resistant nail of sufficient length to penetrate  $\frac{3}{4}$  inch (19.1 mm) into or through the thickness of the supporting member. Nose ends must be set in a bead of roofer's mastic or an adhesive complying with ASTM C 920-87 that also covers the nail head. All rake tiles must be fastened with two nails. The junction of the field tile and the hip and/or ridge must be weatherproofed with a dry ridge/hip system, a bed of mortar or other approved bedding material in accordance with the manufacturer's instructions.

**2.2.7 Flashing:** Valley flashing must be in accordance with Section 1508 of the code. All other flashing must comply with

Section 1509 of the code. Openings through the tile for penetrations such as vents must be flashed in accordance with the code and supported by additional blocking or roof framing as required. Flashing around pipes, vents and flues shall consist of a sub-flashing at the deck and a top flashing fitted in with the tile application. Flashing for profile tile must be made of lead or other approved flexible material and must be formed to the contours of the tile.

A weatherblock is required at headwalls, hips and ridges when installing Espana or Mission "S" tiles. Weatherblock is optional for all other profiles. Weatherblock materials include mortar, foil-backed pressure-sensitive adhesive, flexible metal formed to fit the tile, preformed plastic, neoprene or metal formed to fit the tile, and coated rigid foam.

**2.2.8 Broken Tile Replacement:** The broken tile is first removed. If battens were used originally, existing nails, if any, are cut and new tile inserted. If no battens were used, the old fastener is removed and the hole in the underlayment repaired with roofing cement. A 6-inch-by-6-inch-by- $\frac{1}{2}$ -inch (152 mm by 152 mm by 12.7 mm) plywood piece is nailed to the deck to act as a batten. The new tile is then inserted.

**2.2.9 Severe Climate Considerations:** In areas designated by local building departments as subject to rooftop accumulation of sand, snow or rain driven by high winds, openings at hips, ridges and walls must be closed with metal or mortar, or approved sealant material. In areas subject to severe ice build-up at the eaves, tiles must not be installed on roof slopes below 4:12 (33% slope). Roof ventilation described in Section 1505.3 of the code must be provided.

Horizontal battens must be installed on top of nominal 1-by-4 vertical battens, to allow air flow between the roof deck and the installed tile. Vertical battens must be installed at 12 or 16 inches (305 or 406 mm) on center, or at up to 24 inches (610 mm) on center if fastened into rafters. Horizontal battens must be minimum 1-by-4 wood, fastened through the vertical battens. All tiles are nailed through horizontal battens. In areas where basic wind speeds exceeding 80 mph (129 km/h) exist, directions in Table 15-D-2 of the code must be followed. Underlayment application must comply with Tables 15-D-1 and 15-D-2 of the UBC.

## 2.3 Installation—Reroofing Applications:

**2.3.1 General:** Reroofing shall comply with Chapter 15 and Appendix Chapter 15 of the UBC. Care must be taken to ensure both horizontal and vertical alignment of tiles and battens on the roof. Foreign matter shall be cleaned from all interlocking areas. Cracked or broken tiles shall not remain on the roof. Damaged or rusted flashings should be replaced. Existing framing must be adequate for the additional load. The existing roof must be inspected in accordance with Appendix Chapter 15, Section 1515, of the code. When installed over existing spaced sheathing boards, with or without battens, either plywood, or an underlayment complying with the code or an underlayment specifically recognized for this type of use in an ICBO ES evaluation report may be used. When installed over solid sheathing, one layer of Type 30 felt or approved equivalent underlayment shall be installed on the roof prior to application of the tile. In lieu of this underlayment, the building official may determine that the existing roof covering provides the equivalent underlayment protection.

The minimum allowable roof slope is 3:12 (25% slope). Details not covered under this section are identical to those described in Section 2.2. Fasteners shall be of sufficient length to penetrate through the roof sheathing or a minimum of  $\frac{3}{4}$  inch (19.1 mm) into the structural framing, whichever is less. Battens shall be installed in accordance with Section 2.2.4.

### 2.3.2 Deck Preparation:

**2.3.2.1 Asphalt Shingles:** Wood batten strips shall be provided for roofs with slopes over 7:12 (58.3% slope).

**2.3.2.2 Rock or Gravel Roofs:** The existing roof deck shall be swept clean of all loose rock and gravel. One layer of minimum Type 40 coated base sheet shall be applied to the deck

prior to installation of battens in accordance with Section 2.2.4.

**2.3.3 Eave Preparation:** Existing roof material shall be cut back to allow installation of a raised fascia board or eave closure material, flush with the end of the roof sheathing in accordance with Section 2.2.5.

**2.3.4 Flashing:** New pipe flashing and minimum 24-inch-wide (610 mm) metal valley flashing shall be installed over existing flashing. Existing chimney and wall-counter flashing shall be used only if they are in good condition and sufficient height exists to insert new tile flashing. Flexible flashing shall be used with profiled tiles.

**2.3.5 Wood Shakes and Shingles:** Existing wood shakes and shingles shall be removed and tiles installed as for new construction.

#### 2.4 Roof Classification:

When installed in accordance with Section 2.2 of this report, the roof tiles are noncombustible roof coverings in accordance with Section 1504.1 of the UBC. When installed over minimum  $1\frac{5}{32}$ -inch-thick (11.9 mm) plywood, in accordance with Section 2.2 and in the reroofing applications described in Sections 2.3.1 through 2.3.4 of this report, the tiles are Class A roof coverings, in accordance with Section 1504.2 of the code.

#### 2.5 Identification:

The underside of each field tile is imprinted with the Monier Lifetile LLC logo or the name Monier, Lifetile or Boral Lifetile. Pallets bear a tag with the Monier Lifetile LLC name and address, the evaluation report number (ICBO ES ER-2656) and the installed weight of the product. Cedarlite tiles also have an "M" imprinted on the top side of the tile.

#### 3.0 EVIDENCE SUBMITTED

Reports of tests conducted in accordance with the ICBO ES Acceptance Criteria for Special Roofing Systems (AC07), dated April 1999, and installation and quality control details.

#### 4.0 FINDINGS

**That the extruded concrete interlocking roof tiles described in this report comply with the 1997 *Uniform Building Code*<sup>TM</sup>, subject to the following conditions:**

- 4.1 They are manufactured, identified and installed in accordance with this report and the manufacturer's instructions.
- 4.2 They are manufactured at plants located in Phoenix, Arizona; French Camp, California; Gilroy, California; Lathrop, California; Rialto, California; San Bernardino, California; Kapolei, Hawaii; Henderson, Nevada; Katy, Texas; and Tacoma, Washington.

This report is subject to re-examination in one year.

TABLE 1—TILE DIMENSIONS AND WEIGHTS

TILE DESIGNATION	INSTALLED WEIGHT <sup>1</sup> (psf)	LENGTH (inches)	WIDTH (inches)	HEIGHT (inches)
Espana	9.0	17	12 <sup>3</sup> / <sub>8</sub>	3
- Regular weight	5.5	17	12 <sup>3</sup> / <sub>8</sub>	3
- Duralite				
Espana, Tejas	9.0	16 <sup>1</sup> / <sub>2</sub>	13 <sup>1</sup> / <sub>8</sub>	2 <sup>3</sup> / <sub>4</sub>
Mission "S"				
- Monier 2000	9.5	16 <sup>1</sup> / <sub>2</sub>	13	2 <sup>1</sup> / <sub>2</sub>
Capri				
- Regular weight	9.5	17	12 <sup>3</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>8</sub>
- Duralite	5.5	17	12 <sup>3</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>8</sub>
Sentry Classic	9.5	16 <sup>1</sup> / <sub>2</sub>	13	2 <sup>1</sup> / <sub>4</sub>
Villa				
- Monier 2000	9.3	16 <sup>1</sup> / <sub>2</sub>	13	2 <sup>1</sup> / <sub>8</sub>
- Duralite	5.8	16 <sup>1</sup> / <sub>2</sub>	13	2 <sup>1</sup> / <sub>8</sub>
Roma	9.3	16 <sup>1</sup> / <sub>2</sub>	13	2
Classic "100"	9.5	16 <sup>1</sup> / <sub>2</sub>	13	1 <sup>3</sup> / <sub>4</sub>
Shake, Country Slate, Country Shake, Colonial Slate, and Split Shake				
- Regular weight	10.3	17	12 <sup>3</sup> / <sub>8</sub>	1 <sup>1</sup> / <sub>4</sub>
Shake, Sentry Slate, Country Shake, Country Slate, Country Split Shingle and Country Split Slate (Split Slate—Texas plant only)				
- Regular weight	10.3	16 <sup>1</sup> / <sub>2</sub>	13	1 <sup>1</sup> / <sub>4</sub>
Homestead	9.5	16 <sup>1</sup> / <sub>2</sub>	13	1 <sup>1</sup> / <sub>4</sub>
Split Shake and Slate Flat				
- Tradition	10.3	16 <sup>1</sup> / <sub>2</sub>	13	1 <sup>11</sup> / <sub>16</sub>
- Premium Duralite	7.4	16 <sup>1</sup> / <sub>2</sub>	13	1 <sup>11</sup> / <sub>16</sub>
Cedarlite	5.6	13 <sup>1</sup> / <sub>2</sub>	13	3/4
Monier 2000 Split Shake and Monier 2000 Slate	9.5	16 <sup>1</sup> / <sub>2</sub>	13	1
Duralite Split Shake and Duralite Slate	5.7	16 <sup>1</sup> / <sub>2</sub>	13	1

For SI: 1 inch = 25.4 mm, 1 psf = 0.0479 kPa.

<sup>1</sup>Installed weight was determined with a 3-inch headlap.

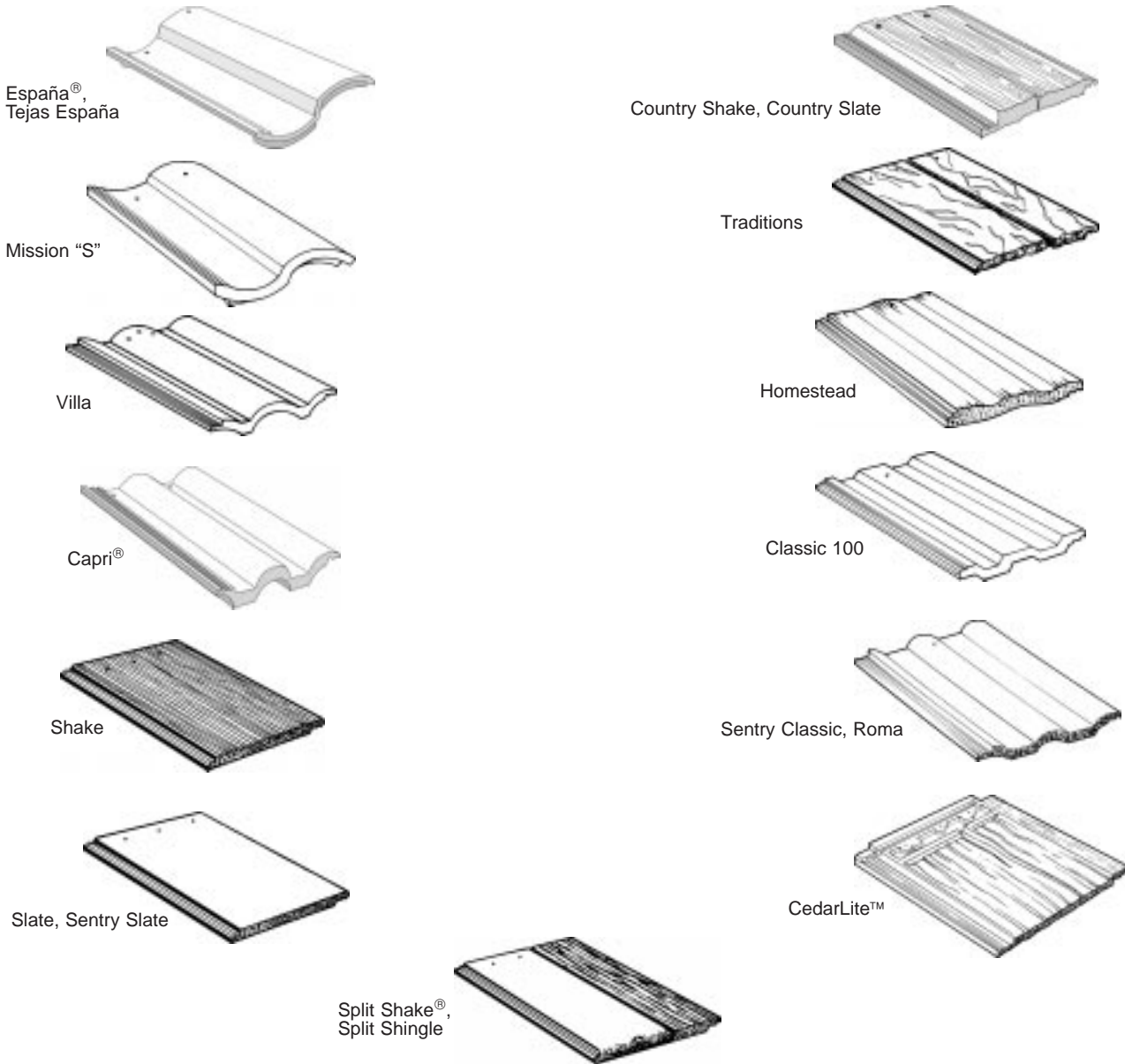
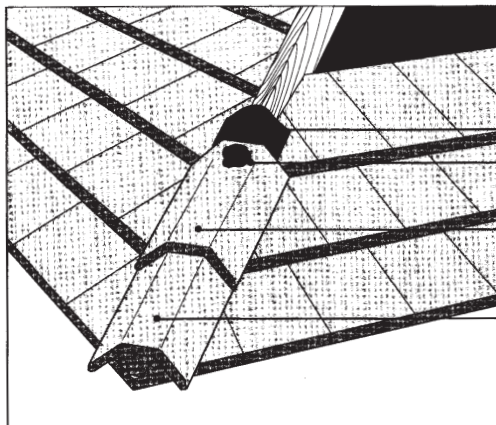


FIGURE 1—TILE PROFILES

**HIP TRIM DETAILS**

It should be noted that the installation of hip trim tiles, whether flat or profile, is similar. The options for hip trim tiles lie in the various treatments of end condition detailing.



Field tiles should be cut to within an average of 1/2" of nailer board.  
 Nail each trim with a corrosion-resistant nail of sufficient length to penetrate nailer board a minimum 3/4".  
 Cut tiles without nail holes may be drilled, notched and nailed or affixed with tile adhesive, wire and/or cut tile clips.  
 Roofer's mastic or tile adhesive must be applied at headlap to cover nail hole.  
 Provide a minimum 2" headlap.  
 Hold back hip nailer 6" from eave edge.  
 Suggested nailer sizes for Mission are 2" x 6". All others require 2" x 4". When counterbattens are used, the nailer board must be increased accordingly. Steep pitches may require reduction in nailer board size.  
**Note: Mission must be sealed in all regions.**  
 2" x 8" nailers may be necessary when using high barrel trim.

FIGURE 2—TYPICAL INSTALLATION DETAILS

It should be noted that the installation of rake trim tiles, whether flat or profile, is similar. The options for rake trim tiles lie in the various treatments of end condition detailing.

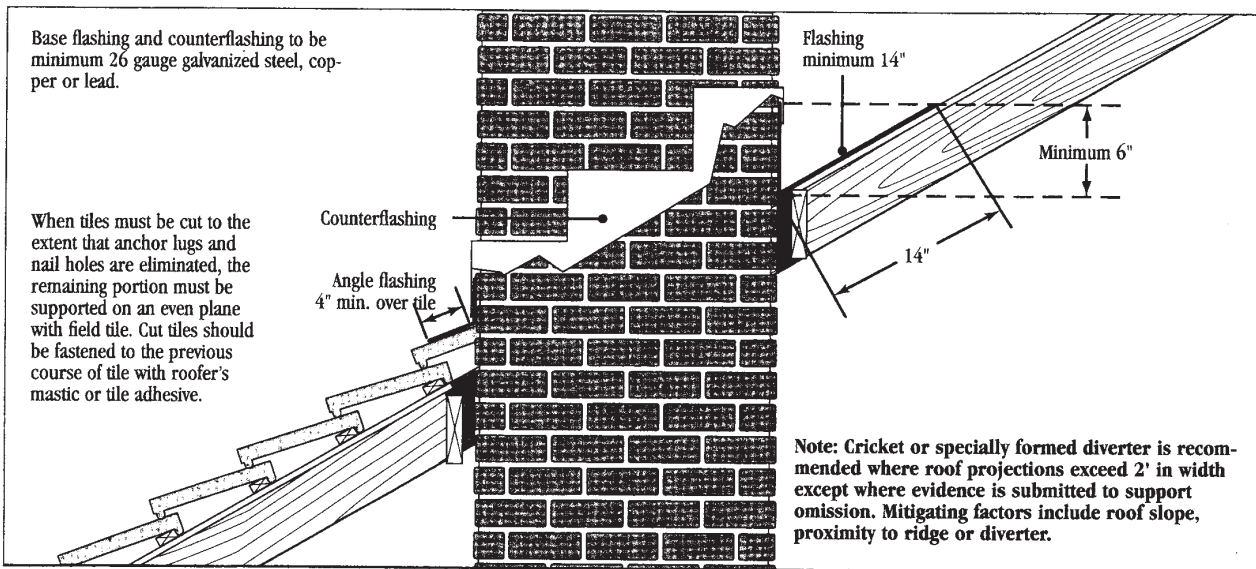
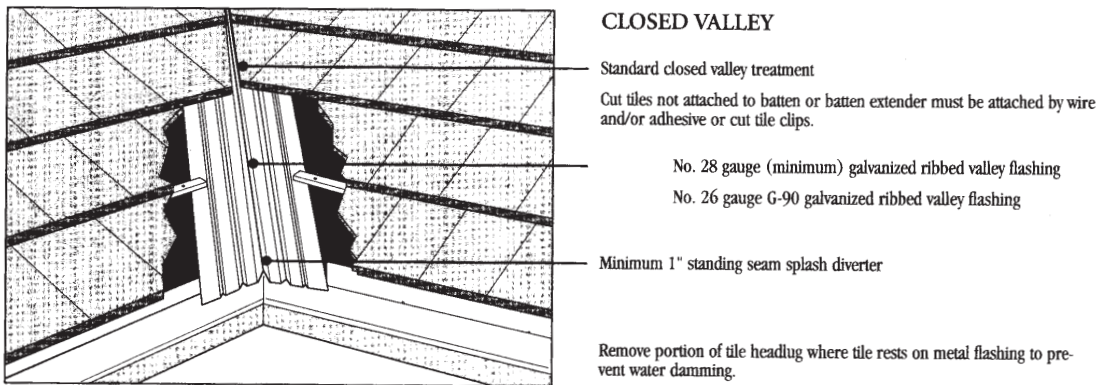
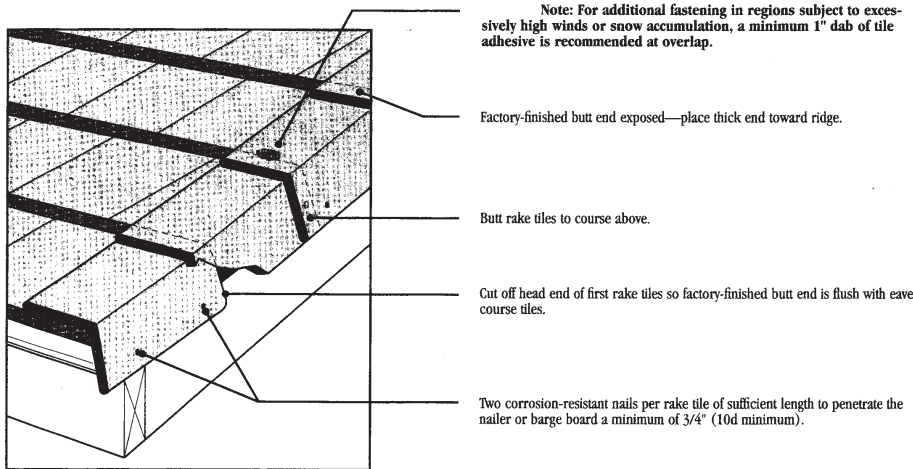
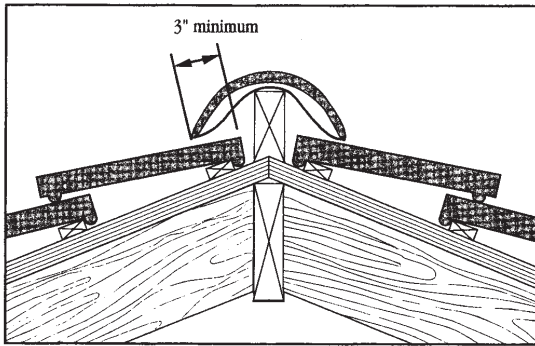


FIGURE 2—TYPICAL INSTALLATION DETAILS—(Continued)



**Typical Ridge Condition**

Trim is to be fastened with one corrosion-resistant nail of sufficient length to penetrate nailer board a minimum of 3/4"–10d minimum.

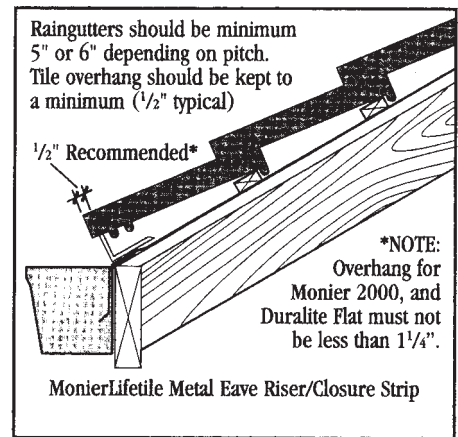
Trim tile covers field tile minimum 3".

Underlayment carried over or carried under ridge nailer.

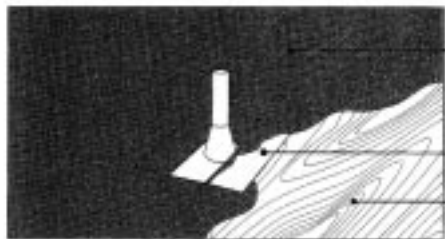
Optional second layer of felt over nailer board as weatherblock.

Place last batten 1 1/2" from center of ridge nailer.

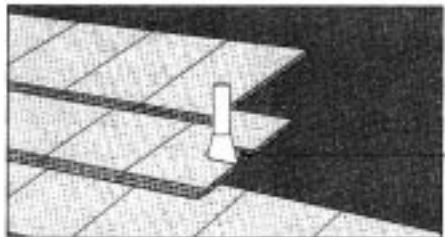
In severe climate areas, the ridge must be sealed with metal, mortar, mastic or pressure sensitive adhesive where tile meets ridge board. Roofer's mastic or tile adhesive must be applied at headlap to cover nail hole.



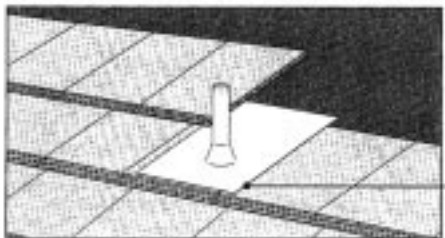
**SOIL PIPE AND VENT FLASHING**



**STEP 1**  
Underlayment  
Base flashing must extend 6" from core or be completely sealed to the underlayment.  
Decking



**STEP 2**  
Notch tile to accept flashing



**STEP 3 – Standard Galvanized or Lead Flashing**  
Aprons must extend a minimum 6" from the core for flat tile and 9" on profile tile.  
On short core flashings, pipe collar or sealant is required. Stamped flashings must be tucked into pipe or rapped.  
Side Gaskets are optional in all regions

For profile tiles, use lead or other flexible-type flashing, minimum 18" skirt around roof projection—attach to tile with approved roofer's mastic.



FIGURE 2—TYPICAL INSTALLATION DETAILS—(Continued)