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Business/Regional Office ■ 5360 Workman Mill Road, Whittier, California 90601 ■ (562) 699-0543
Regional Office ■ 900 Montclair Road, Suite A, Birmingham, Alabama 35213 ■ (205) 599-9800
Regional Office ■ 4051 West Flossmoor Road, Country Club Hills, Illinois 60478 ■ (708) 799-2305

Legacy report on the 1997 Uniform Building Code™, the 2000 International Building Code®, the 2000 International Residential Code®, and the 1999 Standard Building Code®

DIVISION: 07—THERMAL AND MOISTURE PROTECTION
Section: 07320—Roof Tiles

CLAY ROOF TILES

MARUHACHI CERAMICS OF AMERICA, INC.
1985 SAMPSON AVENUE
CORONA, CALIFORNIA 92879

1.0 SUBJECT

One-piece Mission, 10-inch Straight Barrel Mission, 8-inch Straight Barrel Mission, Corona Tapered Mission, Classic Tapered Mission, MF108 Interlocking Flat Tile, Improved-S and Oriental Clay Roof Tiles.

2.0 DESCRIPTION

2.1 General:

The clay roofing tiles described and installed in accordance with this report are roof coverings in accordance with Chapter 15 of the 1997 Uniform Building Code™ (UBC), the 2000 International Building Code® (IBC), the 2000 International Residential Code® (IRC) and the 1999 Standard Building Code® (SBC).

The roof tiles are machine-formed from natural clay and fired to various degrees to obtain the required strength. The tiles have a natural, glazed or spray-flash finish. The surface of the glazed tiles is furnished with an acrylic glaze prior to vitrification. The spray-flash consists of a sprayed-on mixture of manganese oxide, frit and other natural clay materials, which is then baked on the surface of the tile. Accessory tiles such as ridge, gable, hip, birdstop and turret tiles are also available. See Figure 4.

2.2 Materials:

2.2.1 One-piece Mission Tiles: The One-piece Mission tiles are S-shaped, 19 inches (483 mm) long, 14 1/2 inches (368 mm) wide and an average of 1/2 inch (12.7 mm) thick. The tiles weigh approximately 7.8 pounds per square foot (38.0 kg/m²) installed with a 3-inch (76 mm) headlap and 2 3/4-inch (70 mm) sidelap. The tiles have two nail holes in the pan and one nail hole in the cover side. The tiles are Type I, Grade 1, in accordance with ASTM C 1167-96. See Figure 1.

2.2.2 10-inch Straight Barrel Mission: The 10-inch Straight Barrel Mission tile consists of a pan and cover unit. The tiles are 19 inches (483 mm) long, 10 inches (254 mm) wide, and have a thickness of 1/2 inch (12.7 mm) at the center

tapering to 7/16 inch (11.1 mm) at the sides. The tiles weigh approximately 10.2 pounds per square foot (49.8 kg/m²) installed with a 3-inch (76 mm) headlap and 13 1/2-inch (343 mm) center-to-center side spacing of pan units. One nail hole is provided at the top of each tile. The tiles are Type I, Grade 1, in accordance with ASTM C 1167-96. See Figure 1.

2.2.3 8-inch Straight Barrel Mission: The 8-inch Straight Barrel Mission tile consists of a pan and cover unit. The tiles are 19 inches (483 mm) long, 8 inches (203 mm) wide and approximately 1/2 inch (12.7 mm) thick. The tiles weigh approximately 10.7 pounds per square foot (52.2 kg/m²) installed with a 3-inch (76 mm) headlap and 11-inch (279 mm) center-to-center side spacing of pan units. One nail hole is provided at the top of each tile. The tiles are Type I, Grade 1, in accordance with ASTM C 1167-96. See Figure 1.

2.2.4 Corona Tapered Mission: The tile consists of a pan and cover unit measuring 8 1/2 inches (216 mm) at the nose and 6 inches (152 mm) at the head of each tile. The tiles are 19 inches (483 mm) long and approximately 1/2 inch (12.7 mm) thick. The tiles weigh approximately 10.7 pounds per square foot (52.2 kg/m²) installed with a 3-inch (76 mm) headlap and 12-inch (305 mm) center-to-center side spacing of pan units. One nail hole is provided at the top of each tile. The tiles are Type I, Grade 1, in accordance with ASTM C 1167-96. See Figure 1.

2.2.5 Classic Tapered Mission: The tile consists of a pan and cover unit measuring 7 1/4 inches (184 mm) at the nose and 6 1/4 inches (159 mm) at the head of the tile. The tiles are 19 inches (483 mm) long and approximately 1/2 inch (12.7 mm) thick. The tiles weigh approximately 10.4 pounds per square foot (50.8 kg/m²) installed with a 3-inch (76 mm) headlap and 10-inch (254 mm) center-to-center side spacing of pan units. One nail hole is provided at the top of each tile. The tiles are Type I, Grade 1, in accordance with ASTM C 1167-96. See Figure 1.

2.2.6 MF108 Interlocking Flat Tile: The tiles are interlocking flat tiles that are 13.59 inches (345 mm) long, 13.70 inches (348 mm) wide and 1.47 inches (37 mm) thick. The tiles weigh 8.9 pounds per square foot (43.5 kg/m²) when installed with a 2 1/4-inch (57 mm) head lap and a 1 5/8-inch (41 mm) side lap. Two nail holes are provided at the top of each tile. The tiles are Type III, Grade 1, in accordance with ASTM C 1167-96. See Figure 1.

2.2.7 Improved-S: Improved-S is a Spanish-style interlocking tile, 12 3/8 inches (314 mm) long and 12 3/8 inches

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(314 mm) wide, and having an approximate thickness of $\frac{5}{8}$ inch (15.9 mm). The tiles weigh 10.8 pounds per square foot (52.7 kg/m²) installed with a 2-inch (51 mm) headlap. Two nail holes are provided in the pan portion of the tile and two lugs are provided on the back. See Figure 1. The minimum roof slope for Improved-S tiles is 4:12 (33.3 percent). The tiles are Type II, Grade 1, in accordance with ASTM C 1167-96.

2.2.8 Oriental Tile: Oriental tiles are 12 inches (305 mm) long and 12 inches (305 mm) wide, and have an approximate thickness of $\frac{3}{8}$ inch (19.1 mm). The tiles weigh 8.4 pounds per square foot (41.0 kg/m²) installed with a $2\frac{3}{8}$ -inch (60 mm) headlap. A nail hole is provided in the pan portion and two lugs are provided on the back. See Figure 1. The minimum roof slope for the Oriental tile is 4:12 (33.3 percent). The tiles are Type II, Grade 1, in accordance with ASTM C 1167-96.

2.3 Installation Under the UBC:

2.3.1 General: Installation shall be in accordance with this report and Table 15-D-2 of the UBC for the Improved-S and Oriental tiles, and Table 15-D-1 of the UBC for the One Piece Mission, 10-inch Straight Barrel Mission, 8-inch Straight Barrel Mission, Corona Tapered Mission, Classic Tapered Mission and Roman tiles. The MF108 Interlocking Flat tile is installed in accordance with this report and Table 15-D-1 of the UBC, except as noted in Section 2.3.5.1 of this report. The deck surfaces must be clean and dry prior to installation of underlayment. Foreign particles must be cleaned from all interlocking areas to ensure proper seating and to prevent water damming. Cracked or broken tiles must be replaced. Where mortar is used, it must comply as a Type O mortar under Chapter 21 of the UBC. Tiles in contact with mortar must be immersed in water for at least two minutes prior to placement. The Improved-S and Oriental tiles on roof slopes less than 4:12 (33.3 percent) are considered decorative material and must be applied on solid sheathing over a complying roof covering subject to approval by the building official. For the Roman, 8-inch Straight Barrel Mission, Corona Tapered Mission and MF1000 Interlocking tiles installed on roof slopes exceeding 60 degrees from the horizontal, the bottom edge of each tile must be secured with an approved clip or nail in addition to the fasteners required by UBC Tables 15-D-1 and 15-D-2.

2.3.2 Sheathing: Sheathing must be structurally adequate to support the loads involved. It must be nominal $\frac{1}{2}$ -inch or thicker solid sheathing installed in accordance with the code. Fascia boards or cant strips must be installed to properly elevate the first tile course.

2.3.3 Underlayment: A minimum of one layer of Type 30 asphalt-saturated organic felt, lapped 2 inches (51 mm) horizontally and 6 inches (152 mm) vertically, must be used in all applications. In areas subject to ice buildup, installation must comply with Tables 15-D-1 and 15-D-2 of the *Uniform Building Code*.

2.3.4 Battens: Battens shall be not less than 1-by-2 nominal lumber, spaced as required, and nailed with corrosion-resistant 8d nails at 24 inches (610 mm) on center, maximum. The end joints should be separated 1 inch (25 mm) every 4 feet (1219 mm) to provide for drainage. Minimum $\frac{1}{4}$ -inch-thick (6.4 mm) spacers, cut from asphalt shingles placed between the battens and the decking and spaced at 24 inches (610 mm) on center, may be used in lieu of providing the 1-inch (25 mm) space between the battens.

2.3.5 Tile Fastening: Tiles must be fastened in accordance with UBC Tables 15-D-1 and 15-D-2. Fasteners are minimum No. 11 gage, $\frac{5}{16}$ -inch-diameter-head (7.9 mm), corrosion-resistant nails having sufficient length to penetrate the sheathing or battens at least $\frac{3}{4}$ inch (19.1 mm) or to extend

through the sheathing, whichever is less. In lieu of nails, an approved tile tie system may be used.

In areas designated by the building official as being subject to repeated wind velocities in excess of 80 miles per hour (129 km/h), or where the roof height exceeds 40 feet (12 192 mm) above grade, tile attachment must comply with Footnote 2 in Table 15-D-2 of the UBC for the interlocking tiles, or Table 15-D-1 for the other tiles.

MF108 Interlocking Flat tile shall be fastened with a minimum of one nail per tile and installed at a minimum roof slope of 4:12 (33.3%).

2.3.6 Flashing:

2.3.6.1 Valley Flashing: The roof valley flashing shall be not less than 0.016-inch (No. 28 galvanized sheet gage) (0.41 mm) corrosion-resistant metal, which shall extend at least 11 inches (279 mm) from the center line each way and which shall have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of 3:12 (25 percent) and over, the metal valley flashing shall have a 36-inch-wide (914 mm) underlayment directly under it, consisting of one layer of Type 30 felt running the full length of the valley, in addition to the underlayment specified in UBC Tables 15-D-1 and 15-D-2.

In severe climates, the metal valley flashing underlayment shall be solidly cemented to the roofing underlayment for slopes under 7:12 (58.3 percent).

2.3.6.2 Other Flashing: At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided per roofing manufacturer's instructions, and when the flashing and counterflashing are of metal, they shall be not less than 0.019-inch (No. 26 galvanized sheet gage) (0.48 mm) corrosion-resistant metal.

2.3.7 Hips, Ridges and Rakes: Hip and ridge tiles are installed with ridge boards. Each ridge and hip tile is nailed with a No. 11 gage, corrosion-resistant nail driven into the ridge and hip framing members. Type M or O cement mortar, complying with Chapter 21 of the UBC, shall be provided at all ridges and hips to completely seal the area under the ridge and hip tiles; or follow the manufacturer's approved hip and ridge instructions for closure. Each rake tile shall be nailed to the supporting member with a minimum of two corrosion-resistant, minimum No. 11 gage, $\frac{5}{16}$ -inch-head (7.9 mm) nails. The nails must be long enough to penetrate the supporting member a minimum of $\frac{3}{4}$ inch (19.1 mm). Approved mastic, sealant or wind locks should be used under the butt end of tiles to inhibit wind damage.

2.3.8 Roofing Classification:

When installed in accordance with this report, the roof tiles described in this report are Class A roof coverings in accordance with Section 1504.2 of the UBC and are noncombustible roof coverings in accordance with Section 1504.1 of the UBC.

2.4 Installation Under the IBC, IRC and the SBC:

2.4.1 General: The tiles are installed on solid sheathing or spaced structural sheathing boards at a minimum roof slope of $2\frac{1}{2}$:12 (21%). Except as noted in this section, installation must comply with IBC Section 1507.3, IRC Section R905.3 or SBC Sections 1503.2, 1506.5 and 1507.4, as applicable. In addition to the requirements of the applicable code, hips, ridges and rakes must also be installed as described in Section 2.3.7 of this report. Other details of installation not covered in this section are as described in Section 2.3 of this report.

2.4.2 Fire Classification: The clay roofing tiles described in Section 2.2 of this report are Class A roof coverings in accordance with IBC Section 1505.2, IRC Section R902.1 and SBC Section 1505.1.

2.4.3 Wind Resistance: When installed in accordance with IBC Table 1507.3.7, the clay roofing tiles are limited to installation on buildings exposed to maximum 100 mph (161 km/h) basic (3-second gust) wind speeds, at a maximum mean roof height of 60 feet (18 288 mm). When installed in accordance with IRC Section R905.3.7, the clay roofing tiles are limited to installation on buildings exposed to maximum 100 mph (161 km/h) basic (3-second gust) wind speeds, at a maximum mean roof height of 40 feet (12 192 mm). When installed in accordance with SBC Table 1507.4.7, the clay roofing tiles are limited to installation on buildings exposed to maximum 80 mph (129 km/h) basic (fastest mile) wind speeds, at a maximum mean roof height of 60 feet (18 288 mm). For installation in areas with greater exposure, installation of the roofing tiles shall be in accordance with evaluation report ER-5595.

2.5 Identification:

A tag containing the manufacturer's name (Maruhachi Ceramics of America, Inc.), the evaluation report number (ER-4202) and the installed weight is attached to each shipping pallet. Each Improved-S and Oriental tile is marked with "KTH" or "MTK"; each MF108 tiles is marked with the letter

"D"; and all other tiles manufactured at the Corona facility are marked with "MCA."

3.0 EVIDENCE SUBMITTED

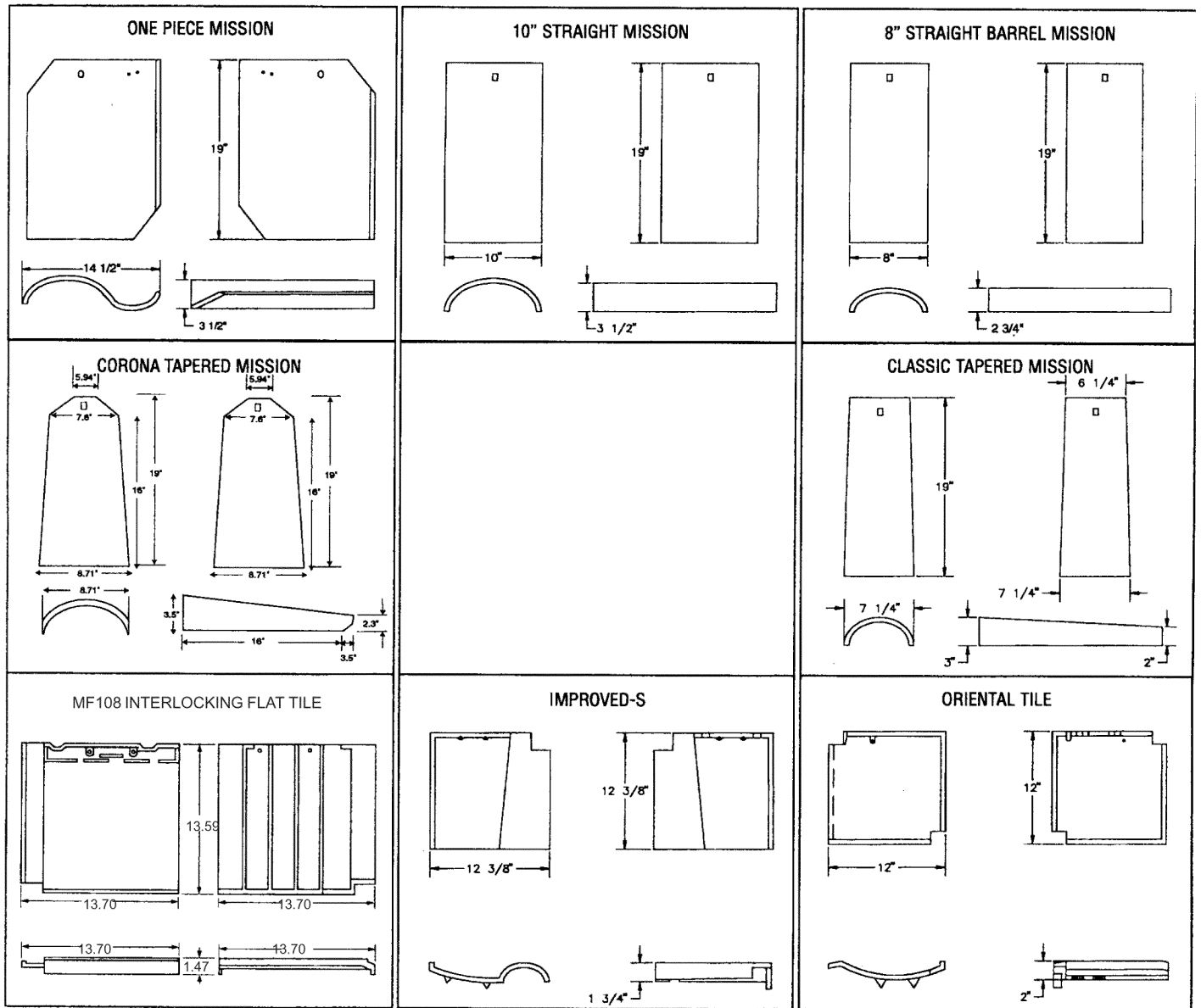
Data in accordance with the Acceptance Criteria for Clay and Concrete Roof Tiles (AC180), dated September 2001; reports of tests in accordance with ASTM C 1167-96; descriptive information and a quality control manual.

4.0 FINDINGS

That the clay roofing tiles described in this report comply with the 1997 *Uniform Building Code*[™], the 2000 *International Building Code*[®], the 2000 *International Residential Code*[®], and the 1999 *Standard Building Code*[®], subject to the following conditions:

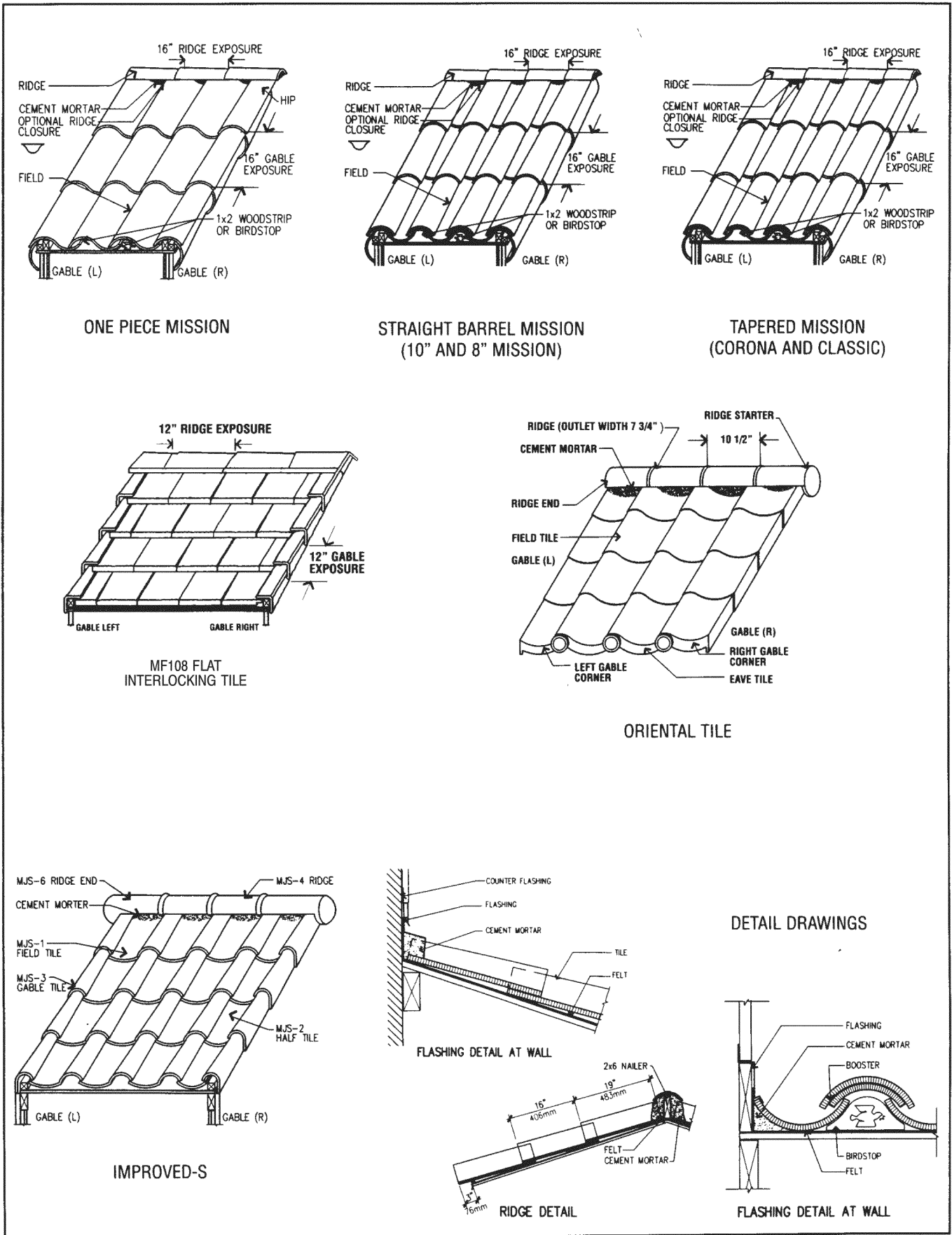
- 4.1 The tiles are manufactured, identified and installed in compliance with this report and the manufacturer's instructions.**
- 4.2 The tiles are manufactured in Corona, California, with the exception of the Improved-S and Oriental tiles which are manufactured in Handa City, Aichi, Japan, and the MF108 Interlocking Flat tile, which is manufactured in Nandan-Cho, Japan.**

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



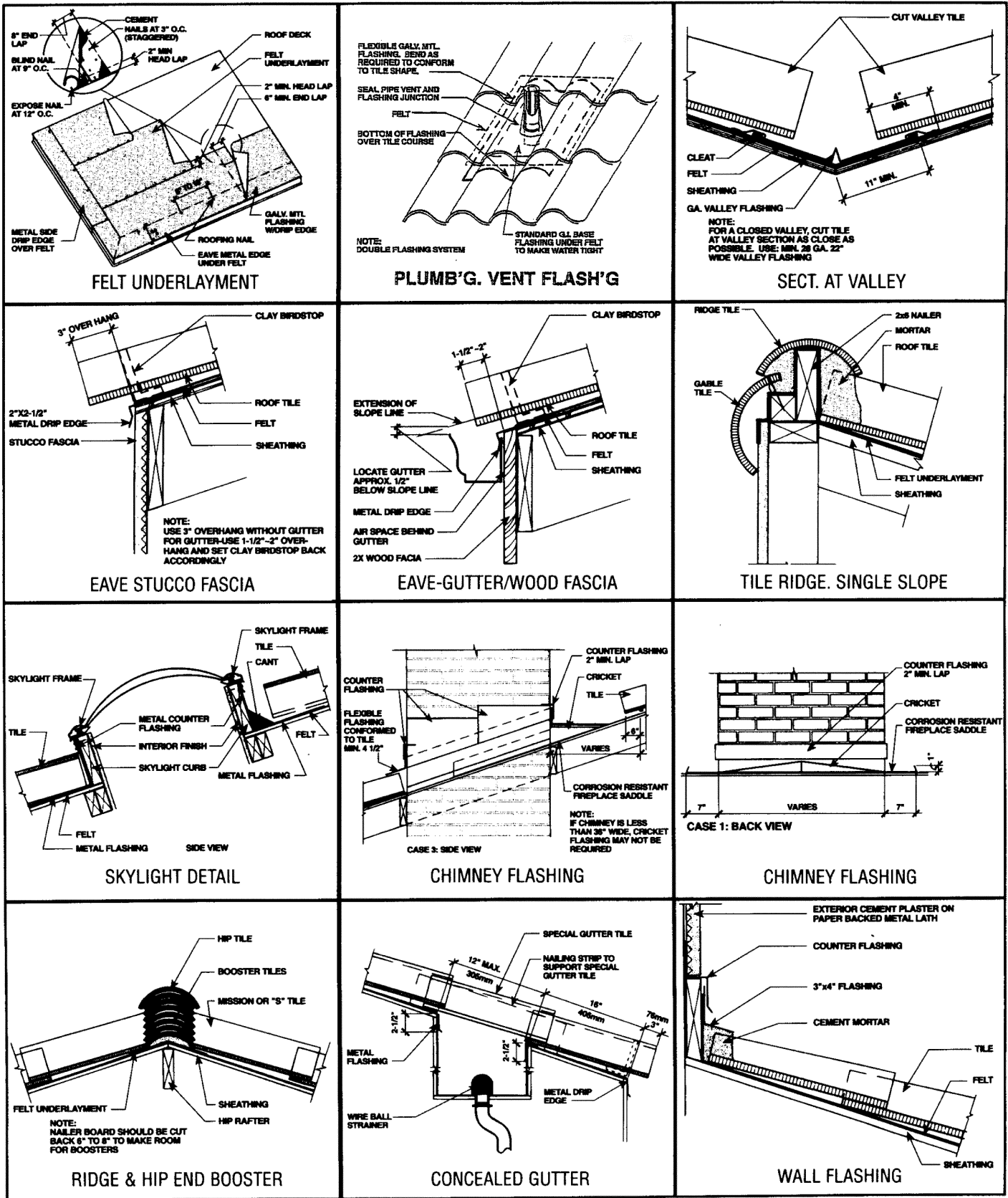
For SI: 1 inch = 25.4 mm.

FIGURE 1—TILE PROFILES



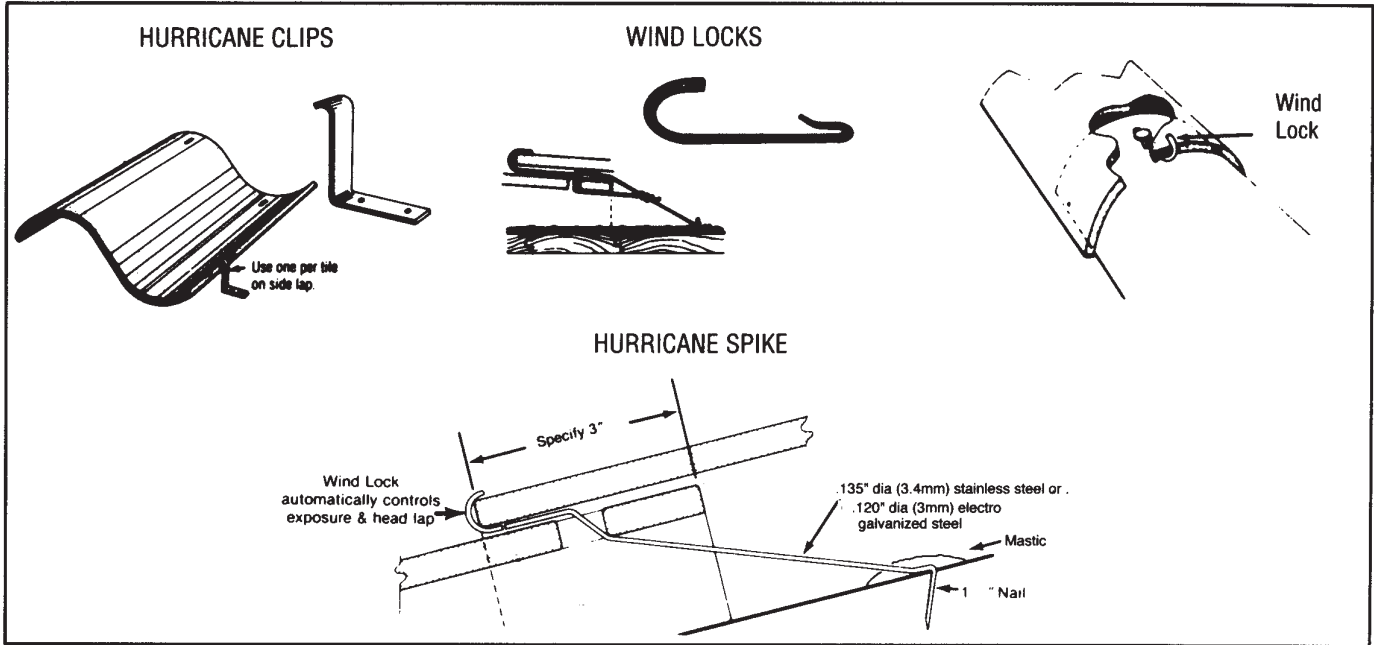
For SI: 1 inch = 25.4 mm.

FIGURE 2—TYPICAL INSTALLATION DETAILS



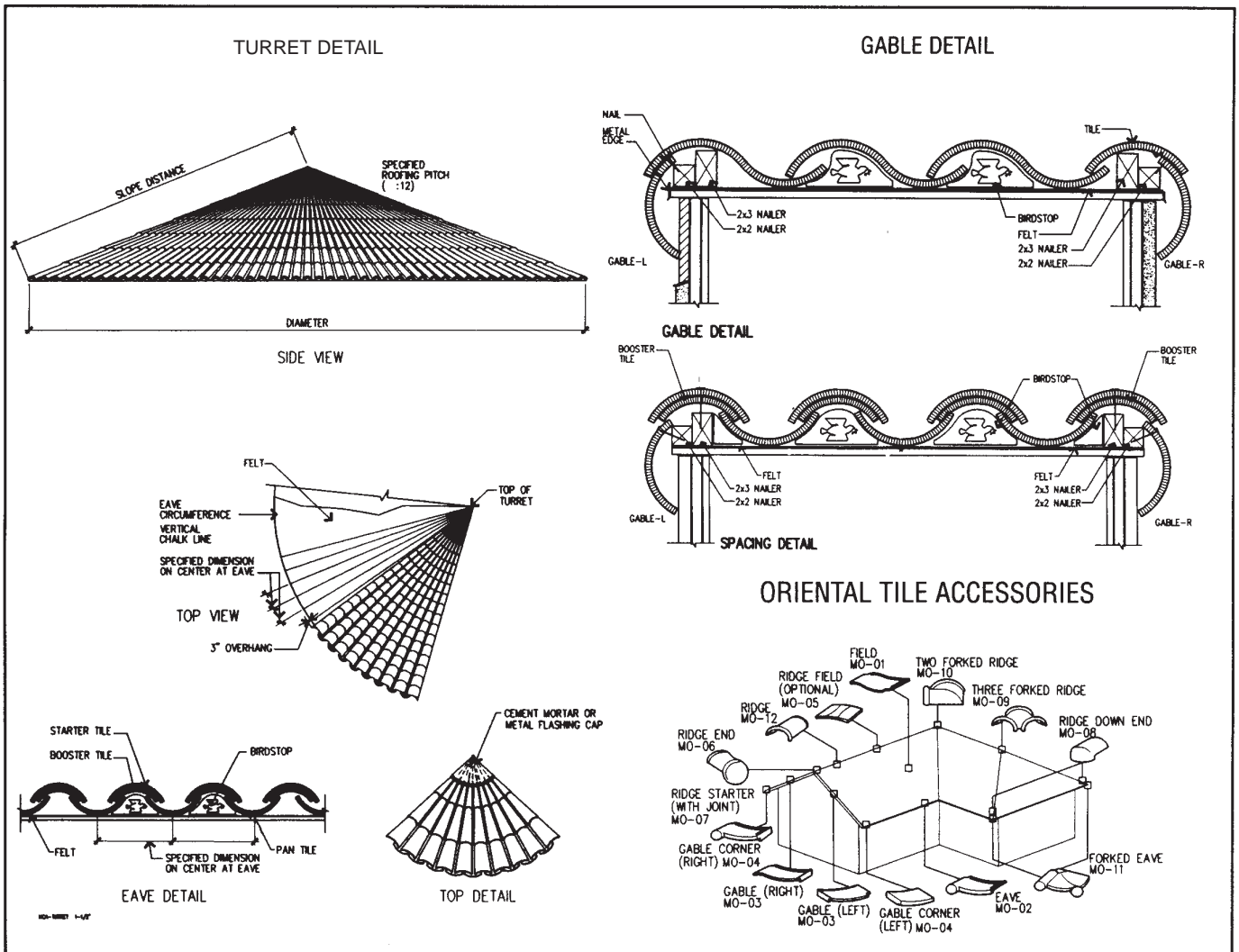
For SI: 1 inch = 25.4 mm.

FIGURE 2—TYPICAL INSTALLATION DETAILS—(Continued)



For SI: 1 inch = 25.4 mm.

FIGURE 3—ADDITIONAL TILE FASTENERS



For SI: 1 inch = 25.4 mm.

FIGURE 4—ACCESSORY TILE