
USACE / NAVFAC / AFCEA UFGS-07320N (September 1999)

Preparing Activity: NAVFAC Replacing without revision
NFGS of same number and date

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 23 June 2005

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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07320N

ROOF TILES

09/99

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ROOF TILES 09/99

NOTE: This guide specification covers the requirements for clay and concrete roofing tiles and underlayments.

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

NOTE: "The NRCA Steep Roofing Manual," National Roofing Contractors Association, 6250 River Road, Rosemont, IL 60018, may be consulted by the designer for a more detailed description of the tile roofing installation.

NOTE: On the drawings, show:

1. Pitch of substrate/tile roofing.
2. Roof edge, rake, ridge, valley, and intersections with vertical surfaces.

PART 1 GENERAL

1.1 REFERENCES

NOTE: Issue (date) of references included in
project specifications need not be more current than
provided by the latest guide specification. Use of
SpecsIntact automated reference checking is
recommended for projects based on older guide
specifications.

The publications listed below form a part of this specification to the
extent referenced. The publications are referred to within the text by the
basic designation only.

AMERICAN WOOD-PRESERVERS' ASSOCIATION (AWPA)

AWPA C1 (2000) All Timber Products - Preservative
Treatment by Pressure Processes

ASTM INTERNATIONAL (ASTM)

ASTM C 1177/C 1177M (2004e1) Glass Mat Gypsum Substrate for
Use as Sheathing

ASTM C 270 (2004a) Mortar for Unit Masonry

ASTM C 67 (2003a) Sampling and Testing Brick and
Structural Clay Tile

ASTM D 2178 (2004) Asphalt Glass Felt Used in Roofing
and Waterproofing

ASTM D 412 (1998a; R 2002e1) Vulcanized Rubber and
Thermoplastic Elastomers - Tension

ASTM D 4586 (2000) Asphalt Roof Cement, Asbestos-Free

ASTM E 108 (2004) Fire Tests of Roof Coverings

ASTM E 84 (2004) Surface Burning Characteristics of
Building Materials

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA SRM (2004, 5th Ed) Steep-Slope Roofing Manual

1.2 SUBMITTALS

NOTE: Submittals must be limited to those necessary
for adequate quality control. The importance of an
item in the project should be one of the primary
factors in determining if a submittal for the item
should be required.

A "G" following a submittal item indicates that the

submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" if the submittal is sufficiently important or complex in context of the project.

For submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy projects.

Submittal items not designated with a "G" are considered as being for information only for Army projects and for Contractor Quality Control approval for Navy projects.

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are [for Contractor Quality Control approval.] [for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

[Clay tile] [Concrete tile]

Self-adhering membrane underlayment

Glass mesh mortar units

Fiberglass-faced gypsum roof board

Submit data including tile properties , styles, and configurations.

SD-04 Samples

Manufacturer's color charts for [Clay tile] [Concrete tile]; G

[Clay tile] [Concrete tile]; G

Submit an appropriate number of tiles to illustrate the full range of colors and surface finish.

SD-06 Test Reports

Self-adhering membrane underlayment

Glass mesh mortar units

Fiberglass-faced gypsum roof board

Preservative-Treated lumber

SD-08 Manufacturer's Instructions

Installation

1.3 DELIVERY AND STORAGE

Deliver materials in the manufacturer's unopened bundles and containers bearing the manufacturer's brand name. Keep materials dry, completely covered, and protected from the weather. Store according to manufacturer's written instructions.

1.4 WARRANTIES

1.4.1 Contractor's Warranty

The Contractor shall warrant for 5 years that the tile roofing system, as installed, is free from defects in workmanship. When repairs due to defective workmanship are required during the Contractor's warranty period, the Contractor shall make such repairs within 72 hours of notification. When repairs are not performed within the specified time, emergency repairs performed by others will not void the warranty.

1.5 COORDINATION

Coordinate with the installation of flashing and gutters provided under Section 07600 FLASHING AND SHEET METAL to ensure proper sequencing. Do not install roofing materials until vent stacks and other penetrations through roof deck have been installed.

1.6 EXTRA STOCK

Provide an extra two percent of each type and color of tile used in clean marked containers. In the extra stock provided, include hip, ridge, and other special shapes in the same proportion as used on the project.

PART 2 PRODUCTS

2.1 MATERIALS

NOTE: Roofing systems specified in this section
have a life expectancy in excess of 50 years.
Flashing materials should be selected with similar
life expectancy.

[2.1.1 Clay Tile

ASTM C 67, Machine formed natural clay tiles, [One Piece "S" Mission] [Two Piece Spanish Mission consisting of a cover and pan tile] [Flat Bar Tile with interlocking edges], kiln-fired to vitrification and free from surface imperfections. Provide specially shaped, color-matched units as indicated

or required, including hip and ridge covers, rake covers and [birdstops]. Provide with fastening holes preformed at factory prior to firing.

] 2.1.2 Concrete Tile

NOTE: Use only concrete roof tiles with integral color in areas where freeze/thaw cycles exceed 30 per year.

ASTM C 67, ASTM E 108, Extruded, interlocking concrete roofing tile units, shapes as indicated, with [integral color] [color slurry coat on exposed surfaces]. Include specially shaped, color-matched units as indicated or required for ridges, rakes and hips. Provide with cast-in anchor lugs, transverse weather checks and fastening holes.

] 2.2 UNDERLAYMENT

2.2.1 Felt Underlayment

ASTM D 2178, Type VI.

2.2.2 Flexible Hip and Ridge Flashing

SBS modified rubberized asphalt adhesive on a lineal, low density polyethylene membrane with a 1.52 mm 60 mil total thickness.

2.2.3 Self-Adhering Membrane Underlayment

ASTM D 412, Polyethylene-sheet-backed, rubberized asphalt membrane, 1.02 mm 40 mil thickness.

2.2.4 Primer for Self-Adhering Membrane Underlayment

VOC compliant primer as recommended by membrane manufacturer for application on concrete substrates.

2.3 SUBSTRATE PANELS (FOR APPLICATION OVER STRUCTURAL METAL DECK)

NOTE: Choose one of the following substrate panels.

2.3.1 Glass Mesh Mortar Units

ASTM E 84, exterior type panels consisting of portland cement, light weight aggregate, with vinyl-coated woven glass fiber mesh imbedded in both surfaces, 11 mm 7/16 inch thickness by 900 mm 36 inch width by 1200, 1500, 1800, or 2400 mm 48, 60, 72 or 96 inch lengths.

2.3.2 Fiberglass-Faced Gypsum Roof Board

ASTM C 1177/C 1177M, non-structural, fiberglass faced, silicone treated core gypsum panels, 1200 by 2400 by 13 mm 48 by 96 by 1/2 inch thickness.

2.4 FASTENERS

2.4.1 Nails For Applying Felt Underlayment

Hot dip galvanized steel, 2.9 mm thick 11 gage, sharp pointed, conventional roofing nails with barbed shanks, minimum 9.5 mm 3/8 inch diameter head, and of sufficient length to penetrate [19 mm 3/4 inch into nailable concrete deck] [through plywood sheathing] [through substrate panels]. Verify that nails are compatible with flashing materials to prevent galvanic action.

2.4.2 Nails for Installation of Tile

Copper ring shank nails, 3.3 mm 10 gage, with minimum 11 mm 7/16 inch diameter head or 3.3 mm 10 gage stainless steel ring shank nails with minimum 9.5 mm 3/8 inch head and of sufficient length to penetrate 19 mm 3/4 inch into [wood ridge and hip boards] [battens]. Verify that chemicals used in pressure treatment of ridge and hip boards are compatible with copper nails.

2.4.3 Twisted-Wire Tie System

NOTE: This paragraph is applicable for the
installation of clay tile on roofs with slopes in
excess of 12:12.

Continuously twisted 3.3 mm 10 gage [copper] [brass] [2.5 mm 12 gage galvanized steel] wire with loops formed at 150 mm 6 inches on center and with tie wires of 1.8 mm 14 gage [copper] [brass] [1.5 mm 16 gage galvanized steel] [9.4 mm dia. 0.037 inch dia. stainless steel] wire. Provide clips for anchorage of twisted-wire tie system to substrate as recommended by manufacturer.

2.4.4 Single-Line Wire Tie System

NOTE: This paragraph is applicable for the
installation of clay tile on roofs with slopes from
2:12 to 12:12.

[3.3 mm 10 gage copper] [3.3 mm 10 gage brass] [2.5 mm 12 gage galvanized steel] [2.13 mm 0.084 inch stainless steel] pre-formed wire ties with a hook on one end and a loop on the other end. Lengths as required for manufacturer's recommended exposure.

2.4.5 Wind Locks

NOTE: This paragraph is applicable for the
installation of clay tiles for all slopes in high
wind areas as designated by local codes.

[3.3 mm 10 gage copper] [3.3 mm 10 gage brass] [2.5 mm 12 gage galvanized steel] [2.13 mm dia. 0.084 inch dia. stainless steel] formed wire clips. Select material type as recommended by manufacturer for specific locations.

2.4.6 Hurricane Clips

NOTE: The following paragraph is applicable for the
installation of clay or concrete tiles for all
slopes in high wind areas as designated by local
codes.

Tile edge clips fabricated from [1.2 mm18 gage brass] [1.05 mm19 gage
galvanized steel] [1.07 mm0.042 inch, type 302 stainless steel] strips, 13
mm 1/2 inch wide. Provide with two nail holes in horizontal leg for
anchorage to deck [substrate]. Select material type as recommended by
manufacturer for specific locations.

2.4.7 Preservative-Treated Lumber

AWPA C1, provide treated ridge and hip boards, [eave starter strips and
battens].

[2.4.8 Sheet Metal Birdstop for Concrete Tile

Formed 0.5 mm 26 gage galvanized steel "L" section with 75 mm 3 inch wide
horizontal leg and vertical leg cut to conform with bottom profile of tile.
Provide pre-finished to match tile color with drain holes punched in
vertical leg prior to application of finish.

]2.4.9 Mortar

ASTM C 270, Proportion specification for Type M mortar mix.

2.4.10 Asphalt Plastic Cement

ASTM D 4586, Type I.

PART 3 EXECUTION

3.1 EXAMINATION

Examine structural roof deck for compliance with requirements of selected
system. Verify that roof penetrations and openings are installed in their
proper location.

3.2 PREPARATION

3.2.1 Cleaning

Clean structural deck surfaces to receive substrate panels or underlayment.

3.3 INSTALLATION

Comply with manufacturer's installation instructions and recommendations,
but not less than recommended by NRCA SRM. Comply with local building code
requirements for special fastening requirements such as wind locks and
hurricane clips in high wind areas.

3.3.1 Substrate Panels

Install [glass mesh mortar units] [fiberglass-faced gypsum roof boards]

over corrugated metal structural deck as recommended by panel manufacturer.

3.3.2 Felt Underlayment

NOTE: This paragraph is applicable for tile roof installations over concrete and wood roof decks with a slope of 4:12 or greater.

Apply one layer of felt underlayment horizontally over entire surface to receive roofing tile, lapping succeeding courses a minimum of 50 mm 2 inches, end laps a minimum of 150 mm 6 inches, and hips and valleys a minimum of 300 mm 12 inches. Fasten felt with sufficient number of roofing nails to hold underlayment in place until roofing tile installation. [Provide additional layer of felt underlayment when recommended by roof tile manufacturer].

3.3.3 Self-Adhering Membrane Underlayment

NOTE: This paragraph is applicable for tile roof installations over all substrates with slopes up to 4:12 or for any slope where high wind or freeze/thaw conditions exist.

Apply self-adhering membrane over [wood deck] [concrete deck] [substrate panels] in accordance with manufacturers recommendations. Provide manufacturer recommended primer for application on concrete surfaces.

3.3.4 Clay Roofing Tile Installation

Beginning at eaves, install roofing tiles as indicated and in accordance with recommendations of the tile manufacturer and fastening system manufacturer. Sawcut tiles at hips valleys and ridges. Cut tile at valleys to form a straight border. Taper valleys from a 50 mm 2 inch exposure on each side of valley at top and increase exposure 25 mm one inch, each side, per 2400 mm 8 feet of valley length. [Set ridge and hip tile in a full bed of mortar and strike mortar flush with face of cover tiles.] [Apply flexible hip and ridge flashing over ridge and hip boards and top edge of tile. Apply asphalt plastic cement at lap between tiles at hip and ridge.] Nail hip and ridge tiles to hip and ridge boards.

3.3.5 Batten Installation for Concrete Roofing Tile

Install 19 by 38 mm one by 2 inches treated wood battens with 13 mm 1/2 inch drain slots at 1200 mm 4 feet o.c. horizontally. At eave provide 38 by 38 mm 2 by 2 inches treated wood starter strip. [Provide sheet metal birdstops at eave for "S" Type mission tile.] At metal structural decks, attach battens with self-tapping screws through substrate panels into metal deck.

3.3.6 Concrete Roofing Tile Installation

Beginning at eaves, install roofing tiles as indicated and in accordance with manufacturers recommendations. Hook mounting lugs over wood battens and nail through each tile into batten. Sawcut tiles at valleys to form a straight border. Taper valleys from a 50 mm 2 inch exposure on each side of valley at the top and increase exposure by 25 mm one inch, each side, per

2400 mm 8 feet of valley length. [Set ridge and hip tile in a full bed of mortar and strike mortar flush with face of cover tile.] [Apply flexible hip and ridge flashing over ridge and hip boards and top edge of tile. Apply asphalt plastic cement between tiles at hip and ridge.] Nail hip and ridge tiles to hip and ridge boards.

3.3.7 CLEANING

Remove mortar and asphalt plastic cement spatter from exposed surfaces of tiles. Upon completion of work, remove excess materials and all refuse generated by the work of this section.

3.4 SCHEDULE

Some metric measurements in this section are based on mathematical conversion of English unit measurement, and not on metric measurement commonly agreed to by the manufacturers or other parties. The English and metric units for the measurements shown are as follows:

<u>Products</u>	<u>English Units</u>	<u>Metric Units</u>
Nails - diameter	11 gage	2.9 mm
	head diameter	3/8 inch
Nails - diameter	10 gage	3.3 mm
	head diameter	7/16 inch
Wire	10 gage	3.3 mm
	12 gage	2.5 mm
	14 gage	1.8 mm
	0.037 inch	9.4 mm
	0.084 inch	2.13 mm
Edge Clips	18 gage	1.2 mm
	19 gage	1.05 mm
	0.042 inch	1.07 mm
	1/2 inch	13 mm
Birdstop	26 gage	0.5 mm

-- End of Section --