Preparing Activity: NAVFAC Replacing without change
UFGS-07320 (June 2005)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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04/06

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USACE / NAVFAC / AFCEC / NASA **UFGS-07 32 13 (April 2006)**

Preparing Activity: NAVFAC **Replacing without change UFGS-07320 (June 2005)**

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SECTION 07 32 13

ROOF TILES
04/06

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

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

****

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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.

****

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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: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

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 PROTECTION ASSOCIATION (AWPA)

AWPA C1	(2003) All Timber Products - Preservative Treatment by Pressure Processes

ASTM INTERNATIONAL (ASTM)

ASTM C67/C67M	(2023) Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile
ASTM C270	(2019a; E 2019) Standard Specification for Mortar for Unit Masonry
ASTM C1167	(2022) Standard Specification for Clay Roof Tiles
ASTM C1177/C1177M	(2017) Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
ASTM D226/D226M	(2017) Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
ASTM D412	(2016; R 2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D2178/D2178M	(2015a; R 2021) Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing

ASTM D4586/D4586M	(2007; R 2018) Asphalt Roof Cement, Asbestos-Free
ASTM E84	(2023) Standard Test Method for Surface Burning Characteristics of Building Materials
ASTM E108	(2020a) Standard Test Methods for Fire Tests of Roof Coverings

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA 0437	(2017) The NRCA Roofing Manual: Steep-slope Roof Systems

1.2 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

****

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that

will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Clay Tile Roofing System

SD-03 Product Data

[Clay Tile

][Concrete Tile

] Underlayment Membrane

Flexible Hip and Ridge Flashing

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; G[, [_____]]

][Manufacturer's color charts for Concrete Tile; G[, [_____]]

][Clay Tile; G[, [_____]]

][Concrete Tile; G[, [_____]]

] Submit an appropriate number of tiles for each type 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-07 Certificates

Qualifications of roofing personnel

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 07 60 00 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.

1.7 QUALITY ASSURANCE

1.7.1 Qualifications of Roofing Personnel

Submit documentation showing qualifications of personnel proposed to perform the roofing work and a listing identifying prior installations completed by the Contractor.

1.7.2 Clay Tile Roofing System Drawings

Submit drawings showing clay tile roofing installation and details for appearance, flashing and fastening of tiles.

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 C1167, Grade 1, 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][in accordance with Section 09 06 00 SCHEDULES FOR FINISHES] 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 C67/C67M, ASTM E108, 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 MEMBRANE

****
NOTE: If a felt membrane is desired solely or in combination with the elastomeric self-adhering membrane, please select either the asphalt glass felt or asphalt-saturated felt component.
****

Provide underlayment membrane on surfaces that will be covered with tile. Membrane shall consist of [asphalt glass felt][asphalt-saturated felt] [and] [high strength composite self-adhering membrane].

[2.2.1 Asphalt Glass Felt

ASTM D2178/D2178M, Type VI.

][2.2.2 Asphalt-Saturated Felt

Provide Type II, No. 30 asphalt felt in accordance with ASTM D226/D226M.

]2.2.3 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.

2.2.4 Self-Adhering Membrane Underlayment

ASTM D412, high strength polyethylene-sheet-backed, rubberized asphalt membrane, 1.02 mm 40 mil thickness.

2.2.5 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 E84, 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 C1177/C1177M, non-structural, fiberglass faced, silicone treated core gypsum panels, 1200 by 2400 by 13 mm 48 by 96 by 1/2 inchthickness.

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 0.037 inch diameter 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 0.084 inch diameter 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 mm 18 gage brass] [1.05 mm 19 gage galvanized steel] [1.07 mm 0.042 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.

2.5 PRESERVATIVE-TREATED LUMBER

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

[2.6 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.

]2.7 MORTAR

ASTM C270, Proportion specification for Type M mortar mix.

2.8 ASPHALT PLASTIC CEMENT

ASTM D4586/D4586M, 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 0437. 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:

Products	English Units	Metric Units
Nails - diameter	11 gage	2.9 mm
head diameter	3/8 inch	9.5 mm
Nails - diameter	10 gage	3.3 mm
head diameter	7/16 inch	11 mm
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 --