SECTION 07320
ROOFING TILE

PART 1 - GENERAL

1.1 SUMMARY:

A. Section Includes:
   1. Vitrified clay roofing tiles.
   2. Tile accessories.
   3. Felt underlayment.
   5. Snow guards.

B. Related Sections:
   1. Section 03740 – Structural Analysis/Vibration Criteria
   2. Section 05300 – Metal Decking
   4. Section 07230 – Perimeter and Underslab Insulation
   5. Section 07600 – Flashings and Sheet Metal.

1.2 DEFINITIONS:


1.3 SUBMITTALS:

A. Product Data: For each product listed below, submit product data from the manufacturer. Include data substantiating compliance with the requirements.

   1. Clay roofing tile.
   2. Tile accessories.
   3. Felt and/or synthetic underlayment.
   4. Self-adhering underlayment.
   5. Tile fasteners.

B. Samples for New Construction and Major Additions: Submit 2 sets of samples not less than 4 units each, of roofing tile showing color and maximum color range. Supply material within approved color range.
C. Samples for Repair of Existing Roofs and Nearby Adjacent Additions: Submit samples of each custom color and size of roofing tile. Include samples showing range of color to be expected for each color required.

D. Installation Instructions: Submit clay roofing tile manufacturer's current installation instructions.

E. Fastening Requirements: Submit evidence substantiating that attachment of the clay roofing tiles meet current building code requirements for the design wind speed and Exposure, signed by a Colorado registered engineer.

F. Maintenance Data: For clay tile roofing to include in maintenance manuals.

G. Warranties: Submit sample copies of clay roofing tile manufacturer's warranty and contractor's warranty.

1.4 QUALITY ASSURANCE:

A. Manufacturer Qualifications: Furnish products manufactured by a firm having not less than 5 years successful experience in the production of the type of roofing tiles required. Obtain clay tiles and clay tile accessories through one source from a single manufacturer.

B. Installer Qualifications:
   1. Installer: Company specializing in tile roofs with five years continuous experience.
   2. Pre-bid approval shall be obtained from the University of Colorado prior to bidding tile roof installation.
   3. Bidding Contractors shall submit a minimum of two similar jobs successfully completed within the last four years with Owner and Architect references.

C. Fire-Test-Response Characteristics: Exterior Fire-Test Exposure: Class A.

D. Conform to details and installation requirements of NRCA Roofing and Waterproofing Manual, Steep Roofing, Tile Roofing sections except as otherwise indicated, and the roofing tile manufacturer's installation instructions, whichever is more stringent.

E. All installation procedures must be approved by the Owner prior to commencing work.

F. Mockups:
   1. Prior to ordering tile, install a 4' x 8' mock-up at ground level at location directed by Architect for verification, showing full range of color, color distribution and trim pieces. Modify blends and colors as required. Order tile based on approved mock-up.
2. Install 16' x 16' mock-up in-place on roof structure, showing full range of color, color distribution and trim pieces. Obtain Architect's acceptance before proceeding with remainder of roof installation and revise mock-up until accepted. All or part of mock-up which is acceptable may be retained as part of permanent installation.

G. Pre-installation Meeting: Pre-installation for clay tile roofing is required prior to the commencement of roofing work.

1.5 PERFORMANCE REQUIREMENTS:

A. Exterior Fire-Test Exposure: Class A.

B. Design Wind Speed/Exposure:
   1. New Construction: As determined by the Architect of Record for the location of the building.
   2. Roof Repair/Replacement: 110 mph/Exposure C.

1.6 PROJECT CONDITIONS:

A. Proceed with roofing work only after substrate construction and penetration work have been completed.

B. Proceed with roofing work only when weather conditions are in compliance with manufacturer's recommended limitations, and when conditions will permit the work to proceed in accordance with requirements and the manufacturer's recommendations.
   1. Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended by manufacturer.

1.7 MAINTENANCE:

A. Extra Materials:
   1. Mission Tile: Provide 1 square of extra stock for pan and cover tile. Verify color blend of extra stock with the Owner prior to submission.
   2. One-piece Tile: Provide 1 square of extra stock.

1.8 WARRANTY:

A. Clay Roof Tile Manufacturer's Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace tile that fails in materials within specified warranty period. Material failures include manufacturing defects that result in leaks.
1. Warranty Period: 75 years from date of Substantial Completion.

B. Roofing Installer's Warranty: Roofing Installer's warranty, in which roofing Installer agrees to repair or replace components of clay tile roofing that fail in materials or workmanship within the following warranty period:

1. Warranty Period: 2 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER:

A. Ludowici-Celadon.

B. Any proposed substitution must be tested for strength, vitrification, and color fastness comparable with Ludowici-Celadon for consideration.

2.2 CLAY TILES:

A. Straight Barrel Mission Clay Tile: ASTM C1167, Grade 1, smooth, unglazed units, as manufactured by Ludowici-Celadon, kiln fired to vitrification, and free of surface imperfections. Provide with fastening holes pre-punched at factory before firing.

1. New Construction:

a. Furnish Straight Barrel Mission tile with matching ridge, eave, rake, hip, hip starter, top fixture, eave closure, and other fittings.

b. Field Tile: 16" length tile.

c. Eave Starter: 14-1/4" length tile with two holes.

d. Hip, Ridge, Rake, and 2nd Eave Course: 18" length tile with two holes.

e. Provide top fixture and eave closures for all open tiles and head walls and eaves.

f. Colors: Furnish clay tile color for new construction and major addition projects to UCB Staff for review. The following is the preferred color blend:

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<td><strong>Pans:</strong></td>
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<td>Red Range</td>
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<td>Burgundy</td>
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<td>Black Slip</td>
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<td><strong>Total Covers</strong></td>
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Note: Black and yellow/buff percentages are small and can be varied or deleted with campus architect's permission - architect of record to recommend blend.

2. **Repair, Replacement, and Major Building Additions:**
   
   a. Furnish clay roofing tiles to match existing size, shape, finish, and color blend.
   
   b. Furnish tile with matching ridge, eave, rake, hip, hip starter, top fixture, eave closure, and other fittings.
   
   c. Field Tile: Match existing.
   
   d. Eave Starter for Mission tile: 14-1/4" length tile with two holes.
   
   e. Hip, Ridge, Rake, and 2nd Eave Course: 18" length tile with two holes.
   
   f. Provide top fixture and eave closures for all open tiles and head walls and eaves.
   
   g. Colors: For repair of existing roofs and nearby adjacent additions, match existing colors and blends. Match the actual color of the tile, not the name as named colors have changed but the names have remained the same. Remove existing tiles and re-blend with new as required to achieve a uniform appearance. Verify actual blend with UCB Staff. Furnish clay tile matching the following existing colors:

   **Pans:**
   - FMS Red Range: 100%

   **Covers:**
   - Weathered red dark: 20%
   - Weathered red medium: 20%
   - Weathered brown black: 20%
   - Weathered X61 light brown: 7%
   - Total Covers: 100%

   B. **One-Piece Spanish Clay Tile:** ASTM C1167, Grade 1, smooth, unglazed units, as manufactured by Ludowici-Celadon, kiln fired to vitrification, and free of surface imperfections. Provide with fastening holes pre-punched at factory before firing.

   1. **Note:** Use of one-piece barrel clay tile must be approved by the Campus Architect prior to the start of design.

   2. **New Construction:**
      
      a. Furnish one-piece barrel tile with matching ridge, eave, rake, hip, hip starter, top fixture, eave closure, and other fittings.
      
      b. Field Tile: 18-3/8" length tile.
      
      c. Rake End Band: 18-3/8" length tile with two holes.
      
e. Provide top fixture and eave closures for all open tiles and head walls and eaves.

C. Colors: Furnish clay tile color for new construction and major addition projects to UCB Staff for review.

2.3 MISCELLANEOUS MATERIALS:

A. Tile Adhesive: Premium grade adhesive manufactured specifically for repair and installation of clay roof tiles.
   1. OSI RT-600 or approved equal.

B. Asphalt Roofing Cement: ASTM D4586, Type II, asbestos free.

C. Elastomeric Sealant: ASTM C920, polyurethane-based joint sealant; of Type S, Grade NS.

D. Mortar: ASTM C 270, Type M, with ASTM C 979 mortar pigment. Mortar shall match the tile color.

E. Wood Stringers and Nailers: Fire retardant treated wood strips as specified in Section 06100. Wood strips can be preservative treated if roof assembly is not fire-rated.

2.4 FASTENERS:

A. Roofing Nails: ASTM F1667, 11 ga. minimum copper or stainless steel nails with 0.285" to 0.312" minimum head diameter. Length as recommended by the clay roofing tile manufacturer.

B. Screws: Stainless steel, #8 or #9 with 0.285" to 0.312" minimum head diameter. Length as recommended by the clay roofing tile manufacturer.

C. Underlayment Nails: Stainless steel, or hot-dip galvanized steel wire with low-profile capped heads or disc caps, 1 inch minimum diameter.

D. Wood Batten Nails: ASTM F 1667, common or box, steel wire, flat head, and smooth shank.

E. Wire Ties: 16 ga. Copper wire.

2.5 UNDERLAYMENT MATERIALS:

A. Roof Felt Underlayment: ASTM D 2626, No 43 asphalt-saturated and -coated organic felt, dusted with fine mineral surfacing on both sides, unperforated.
B. Synthetic Felt Underlayment: ASTM D226, synthetic, scrim-reinforced underlayment designed for use under sloped roof coverings. Class A fire-rated. 30 year min. product warranty.


2.6 SNOW GUARDS:

A. Snow Guards: Stainless steel, supplied by CU Roofing Shop. Indicate size, type, pattern, quantity, and location on the drawings.

2.7 SHEET METAL FLASHING AND TRIM:

A. Sheet Metal Flashing and Trim: Comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."

1. Sheet Metal: Copper.

B. Fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item.

PART 3 - EXECUTION

3.1 INSPECTION OF SUBSTRATE:

A. Verify that valley and other metal flashing required under tile have been properly installed to provide watertight installation.

B. Care must be taken not to damage work of other trades. Repair underlayment where felts or self-adhering underlayment is damaged prior to installation of stringers.

C. Examine substrates, areas, and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provision has been made for flashings and penetrations through roof.

2. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 UNDERLAYMENT INSTALLATION:

A. General: Install underlayments according to tile manufacturer's written recommendations and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

1. Cover hip and ridge wood nailers with underlayment strips.
2. Install a minimum of two layers of protection felt over self-adhering underlayment.

B. Self-Adhering Underlayment: Install self-adhering sheet underlayment, wrinkle free, directly to roof substrate. Comply with manufacturer's low-temperature installation restrictions, if applicable. Lap sides not less than 3-1/2 inches in direction to shed water. Lap ends not less than 6 inches, staggered 24 inches between succeeding courses. Roll laps with roller. Cover self-adhering underlayment within 30 days with felt or synthetic underlayment.

1. As a minimum, apply self-adhering underlayment to a point 72" inside the interior side of all exterior walls and all hips and valleys.
2. Architect of Record to determine if full application of self-adhering underlayment is required.

C. Roof Felt Underlayment: Install asphalt felt or synthetic felt in a two-layer application perpendicular to roof slope in parallel courses. Lap sides a minimum of 3 inches over underlying course. Lap ends a minimum of 4 inches. Stagger end laps between succeeding courses at least 72 inches. Fasten with felt underlayment nails.

1. Install felt underlayment over entire roof deck. Extend to fully cover all areas of self-adhering underlayment.
2. If tile installation will not start within 30 days of asphalt felt underlayment installation, install one layer of synthetic felt underlayment over asphalt felt underlayment.

3.3 WOOD STRINGERS AND NAILERS:

A. Install wood nailers of proper height to support tile at ridges, hips, rakes, and eaves where shown on the drawings and securely fasten to roof deck.

B. For two-piece mission style tile, install 2x4 vertical stringers along roof slope at spacing required by the roof tile manufacturer to support each row of cover tile. Toe-nail stringers with 16d nails staggered at 18" o.c. each side of stringer.

1. At eaves, install stringer continuous to roof edge. Provide 1'x4" notch at bottom edge to receive eave closure.
3.4 METAL FLASHING INSTALLATION:

A. General: Install metal flashings and other sheet metal to comply with requirements in Division 7 Section "Sheet Metal Flashing and Trim."

1. Install metal flashings according to tile manufacturer's written recommendations and recommendations in NRCA's "The NRCA Roofing and Waterproofing Manual."

B. Apron Flashings: Extend lower flange over and beyond each side of downslope tile roofing and up the vertical surface.

C. Step Flashings: Install with a 3-inch headlap extending over the underlying tile and up the vertical surface. Install with lower edge of flashing just upslope of, and concealed by, butt of overlying tile. Fasten to roof deck only.

D. Cricket Flashings: Install against roof-penetrating elements, extending concealed flange beneath upslope tile roofing and beyond each side.

E. Open-Valley Flashings: Install centrally in valleys, lapping ends at least 8 inches in direction to shed water. Fasten upper end of each length to roof deck beneath overlap.

1. Secure hemmed flange edges into metal cleats spaced 12 inches apart and fastened to roof deck.

F. Channel Flashings: Install over underlayment and fasten to roof deck.

G. Rake Pan Flashings: Install over underlayment and fasten to roof deck.

H. Rake Drip Edges: Install over underlayment and fasten to roof deck.

I. Eave Drip Edges: Install beneath underlayment and fasten to roof deck.

J. Pipe Flashings: Under the clay tile, install new self-sealing flashing jack with galvanized steel base and EPDM rubber collar permanently attached; interlace base flange into felt underlayment. On top of clay tile, install new 4# lead jack; interlace flange into clay tiles. Sides of jack flange shall extend over the ridge of the adjacent tile.

3.5 TILE INSTALLATION:

A. General: Install roof tiles according to manufacturer's written instructions and recommendations in the NRCA's "The NRCA Roofing and Waterproofing Manual."

1. Except as otherwise indicated, install tiles to match Owner's existing roofs, accepted mock-up, and as recommended by the manufacturer.
2. Take special care in handling and working over installed tile to avoid cracking, chipping or breaking of the tiles. Replace any broken or chipped tile found during installation.

3. Provide accessory items as shown and as required to make a complete installation of roofing, including flashing integrated with the tile work.

B. Secure clay tile with fasteners with side and head lap as recommended by tile manufacturer for required roof slope, exposure, climate, and wind conditions. Include closers, ridge, edge and hip units as indicated or required. Caulk all exposed fasteners heads by setting them in roof tile sealant. Ensure nails penetrate substrate 3/4" minimum.

C. Install tile closures at all open tile ends at the eave and headwall.

D. At first rake course and ridge cover tile, install two-hole tile. Overlap of adjacent tile shall be set in tile adhesive. Exposed hole shall be secured with a screw and neoprene washer, sealed with tile sealant.

E. At eave courses with two-hole tile, exposed hole shall be secured with a screw and neoprene washer, sealed with tile sealant.

F. Install roof tile using "tight" method. Maintain uniform exposure and coursing of tiles throughout roof.

G. Install a minimum of four staggered rows, as size of roof permits, of snow guards at all sloped roofs where indicated on the roof plan. Show location of snow guards on drawings.

H. All clay tile pieces shall be fastened, including pan and cover tile. No exceptions.

I. Valleys shall have 6” min. wide opening to allow water to drain. Width of valley shall increase 1” every eight feet of valley run towards the eave.

J. Install concrete mortar to cover end of cut tile in all valleys.

K. Tile shall be installed to withstand campus loading criteria in Section 03740 and the most recent version of the International Building Code, Chapter 16.

L. All curbs heights shall be 12” above finished roof.

M. Fall Protection: Install permanent tie-off anchors on all new roofs for access to all areas of tile roofs.

N. Extend tiles 2 inches over eave fasciae.

O. Nail Fastening: Drive nails to clear the tile so the tile hangs from the nail and is not drawn up.

P. Install wire through nail holes of cut tiles that cannot be nailed directly to roof deck, and fasten to nails driven into deck.