

**SECTION 074229**

**TERRACOTTA RAINSCREEN PANELS**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies terracotta rainscreen panel systems as shown.

**1.2 RELATED WORK**

- A. Sustainable design requirements and procedures including submittal requirements: Section 018111, SUSTAINABLE DESIGN REQUIREMENTS.
- B. Procedures and requirements for managing and disposing construction and demolition waste: Section 017419, CONSTRUCTION WASTE MANAGEMENT.
- C. Blast mitigation shielding: Section 055400, COLD-FORMED METAL FRAMING.
- D. Sealant: Section 079200, JOINT SEALANTS.
- E. Air barrier/waterproofing membrane: Section 072713, MODIFIED BITUMINOUS SHEET AIR BARRIERS.
- F. Sealant: Section 079200, JOINT SEALANTS.
- G. Color and texture of finish: Section 090600, SCHEDULE FOR FINISHES.

**1.3 SYSTEM DESCRIPTION**

- A. A complete, pre-engineered aluminum or stainless steel clip and sub-girt system, with aluminum stud framing, insulation where indicated, closure pieces, trim and flashing. The system is to be composed of double-leaf clay (terracotta) tiles, which can only be removed on purpose by using a special tool, tiles hung on aluminum or stainless steel clips, at head grooves and base channels, connected to vertical aluminum sub-frame. The sub-frame is attached to horizontal aluminum "L" or "Z" profile which are attached with aluminum or stainless steel clip angles to the structural.
- B. Design system to allow for all movements within structure, and to support loads transferred from the adjacent construction and to fit within the space allotted without projections into the finished space as shown on the Drawings.
- C. Insulation air barrier/waterproofing membrane should not be visible when viewing the terracotta tile assembly.

**1.4 MANUFACTURER'S QUALIFICATIONS**

- A. Terracotta rainscreen panels shall be products of a manufacturer regularly engaged in the fabrication of the type and design shown and specified.

**1.5 SUBMITTALS**

- A. Submit in accordance with Section 013323, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

- B. Samples: Terracotta panels, minimum 300 mm x 300 mm (12 inch by 12 inch) showing finish, each color and texture.
- C. Delegated-Design Submittal: For terracotta rainscreen system indicated to comply with performance requirements and design criteria, including analysis data (structural calculations) signed and sealed by the qualified professional engineer licensed in the State of California responsible for their preparation.
- D. Shop Drawings: Wall panels, showing details of construction and installation. Support framing thickness and kind of material, closures, flashing, fastenings and related components and accessories.
  - 1. Include building elevations and floor plans showing terracotta panels specifically identified.
  - 2. Include large scale drawings and details of terracotta panels and support framing system showing terracotta panel dimensions and dimensioned relationship to other building components; location and sizes of support framing members, fasteners, and other components.
  - 3. Include detail drawings showing interface with adjacent building components such as window and door openings, flashing, waterproofing, and other perimeter details.
- E. Manufacturer's Literature and Data: Wall panels
- F. LEED Submittals: Submit in accordance with Section 018111.
  - 1. LEED submittals are in addition to other submittals. If submitted item is identical to that submitted to comply with other requirements, submit duplicate copies as a separate submittal to verify compliance with indicated LEED requirements.
  - 2. LEED Product Data Submittal Form: Submit completed product data form provided by the Contracting Officer's Representative; certified by vendor, installer, subcontractor, and/or manufacturer as appropriate.

#### **1.6 PRECONSTRUCTION TESTING OF TERRACOTTA TILES**

- A. Absorption: Test according to ASTM C 67 using 24 hour submersion and 5 hours boiling (separate sets of specimens, minimum 5 specimens each). Absorption by submersion shall not exceed 5 percent average, 7 percent individual specimen. Absorption by boiling shall not exceed: 7 percent average, 9 percent individual specimen.
- B. Freezing and Thawing: Test according to ASTM C 67 for 100 cycles requiring minimum of 50 days (minimum 5 specimens). No specimen shall lose more than 3 percent of its original dry weight. No specimen shall crack, crumble or fracture. Specimens shall conform to approved color range samples before and after testing.
- C. Breaking Load: Test according to modified ASTM C 67 (minimum 5 specimens). Supports shall be actual hardware used for this project. Apply load at mid-span between supports. Report shall include breaking load, calculated section modules at mid-span, and calculated breaking stress.

- D. Accelerated Weathering: Test according to modified ASTM E773-01 high humidity test for 42 days, accelerated weather cycle test for 252 cycles, frost point and due point do not apply (minimum 5 specimens). No specimen shall lose more than 3 percent of its original dry weight. No specimen shall crack, crumble or fracture. Specimens shall conform to approved color range sample before and after testing.
- E. Separate sets of specimens are required to be tested for each combination of color and texture. For a given color and texture combination, the most common size tile for the project shall be tested, except for breaking load, where tile size corresponding to maximum span shall be tested. If multiple widths occur to maximum span, test width shall be selected by Architect.

#### **1.7 VISUAL MOCK-UP**

- A. Within 30 calendar days from approval of samples, build a mockup to demonstrate aesthetic effects and set quality standards for terracotta rainscreen panels as directed by the Resident Engineer. As a minimum, visual mockup shall be 3.00 m by 3.00 m (10 feet by 10 feet) showing terracotta panel finish, color, pattern, and joinery, with at least one corner return.
- B. The Resident Engineer's review and approval of visual mockup shall occur prior to any production of materials to be installed in the project.
- C. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Resident Engineer specifically approves such deviations in writing.
- D. Mockup shall remain in place for the duration of the project to establish the standard of quality for terracotta finish, color, and joinery.
- E. For determination of acceptability and meeting of the specified criteria, the viewing distance for the visual mockup shall be 3.00 m (10 feet) for exterior surfaces where the observer can be within 3.00 m (10 feet) of the surface, and 15.00 m (50 feet) for the remaining surfaces.
- F. Finish and texture approved by Resident Engineer will be used as a standard of quality for remainder of work.

#### **1.8 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Design terracotta rainscreen panel systems and support framing, including complete engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Loads:
  - 1. Wind Loads: Per the 2012 International Building Code and ASCE 7-10.
    - a. Basic Wind Speed: (Ultimate): 51 m/s (115 mph)
    - b. Exposure Category: C
    - c. Design for positive and negative pressure in accordance with IBC Chapter 16 and ASCE 7.

- d. Deflection of Framing Members: Net deflection of framing support members shall be limited to 1/175 of span, but no more than 3.2 mm (0.125 inch). A span is defined as the distance between centerline of anchor to building fastening system. At cantilever spans, it is defined as two times the distance between the last anchor to the building fastening center line and the cantilever end.
  - e. At connection points of support framing members to anchors, combined movement of anchor relative to building, and framing members relative to anchor, shall not exceed 1.6 mm (0.063 inch) in any direction.
  - f. At 1.5 times design pressure loads for support framing members, net permanent deflection (set) shall not exceed 1/1000. There shall be no failure or gross permanent distortion to anchors, combined movement of anchor relative to the building, and framing member relative to anchor shall not exceed 3.2 mm (0.125 inch) set after load is removed.
2. Seismic Performance: Withstand the effects of earthquake motions determined according to ASCE 7-10.
    - a. Component Importance Factor is: 1.5
- C. Thermal Movements: Allow for thermal movements resulting from the following ambient and surface temperature changes.
1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- D. Anchorage Design: The terracotta rainscreen panel system connections shall be designed, fabricated, and installed to resist the following:
1. Reaction Forces: Connections between panel framing members shall be engineered for the maximum capacity of framing members. Connections and anchorages to the structure shall be engineered for the maximum capacity of the panel framing members to ensure that connections and anchorages are never the weak link of the system. The maximum capacity of each framing member shall be calculated to account for the actual provided member section and material properties. The maximum capacity corresponds to the ultimate uniform load for the given panel section, material, and stud spacing.
  2. Design anchorages and connections to fully develop the calculated reaction forces following the procedures outlined in the latest versions of AISC Allowable Stress Design (ASD) or Load and Resistance Factor Design (LRFD) manuals for metal-to-metal connections/ attachments and the latest version of ACI-318 for anchorage to concrete. When using LRFD-based ACI-318 apply a load factor of 1.0 to the blast-induced panel frame reactions obtained from dynamic analyses. When using the ASD manual to design connections/attachments for blast, allowable stresses can be increased by a factor of 1.7.

## 1.9 WARRANTY

- A. Terracotta rainscreen panel system Work subject to the terms of the Article "Warranty of Construction", FAR clause 52.246-21, except extend the warranty period to ten years.

### 1.10 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - 1. C67-02c Sampling and Testing Brick and Structural Clay Tile
  - 2. C126-098 Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units

## PART 2 - PRODUCTS

### 2.1 TERRACOTTA PANELS

- A. Hollow chamber cross section double leaf construction; thickness as shown on the Drawings.
  - 1. Heights and lengths as shown.
  - 2. Thickness: Minimum ~~18 mm (0.709 inches)~~ 30 mm (1.18 inches) <sup>(ADD#01)</sup>.
- B. Color: As specified in Section 090600. Match color and tonal variation of basis of design product indicated in Section 090600. Final tonal variation (darkest to lightest) shall be as approved by the Government from samples submitted.
- C. Placement of Terracotta Panels: Randomly mix tonal variations of panels on the façade.
- D. Properties:
  - 1. Linear Coefficient of Thermal Expansion: 0.04.
  - 2. Freeze and Thaw Test (ASTM C67): 50/100 cycles, passed.
  - 3. Hardness Resistance Mohs Scale: 7 to 9.
  - 4. Efflorescence (ASTM C67): No efflorescence.
  - 5. Chemical Resistance (ASTM C126): No change in color or texture.
  - 6. Provide terracotta panels with deep penetration sealer to prevent dirt pickup and retention.
  - 7. Provide terracotta panels with inherent color throughout tile body.
- E. Dimensional Tolerances:
  - 1. Width up to 1800 mm (70 inches) (center in hole direction): +/- 1.0 mm (0.04 inch) for cut length.
  - 2. Height (opposite to hole direction):
    - a. +/- 2.0 mm up to 3.00 m. (0.078 inch up to 10 feet)
    - b. +/- 2.5 mm up to 4.50 m. (0.100 inch up to 15 feet)
    - c. +/- 3.0 mm up to 6.00 m. (0.120 inch up to 20 feet)
  - 3. Thickness (cross section): +/- 1.5 mm (0.060 inch)
  - 4. Straightness (in hole direction): +/- 0.25% of length, not to exceed 3.0 mm (0.120 inch)
  - 5. Diagonal Flatness: +/- 0.25% of diagonal, not to exceed 3.0 mm (0.120 inch)

6. Vertical Flatness: +/- 1.0% of height

7. Torsion: +/- 0.2% of diagonal.

F. Special Shapes and Sizes:

1. Provide special shapes and sizes of terracotta panels as shown for solid corner tiles and shown, color to match field panels.

**2.2 SUPPORT FRAMING**

A. Manufacturer's proprietary support framing system engineered to meet structural performance criteria specified and designed to drain water away from the wall cavity.

B. Rainscreen Trim: PDVF coated aluminum continuous enclosure including, but not limited to the following:

1. Transition between materials at sills, jambs, and heads of openings to provide water tight system.
2. At bottom of lowest course.
3. At top of highest course.

**2.3 FASTENERS**

A. Stainless steel fasteners of size, type and holding strength as recommended by manufacturer.

**2.4 ACCESSORIES**

A. Spacers: Manufacturer's standard resilient vertical joint spacers.

**2.5 FINISH**

A. Color and texture shall be as specified in Section 090600, SCHEDULE FOR FINISHES.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

A. General: Install terracotta rainscreen panels in accordance with the manufacturer's approved erection instructions and diagrams, except as specified otherwise. Panels shall be in full and firm contact with supports. Provide special shapes and sizes where indicated and whenever panels terminate with open ends.

B. Terracotta Panels: Apply panels with the configuration as shown. Flash and seal walls around windows, door frames, framed louvers, and other similar openings. Provide open joints as required for back ventilation of cavity behind wall panels.

C. Flashing: All flashing and related trim, closures, and accessories in connection with the terracotta rainscreen panels shall be provided as indicated and as necessary to provide a watertight installation. Details of installation, which are not indicated, shall be in accordance with the panel manufacturer's printed instruction and details, or the approved shop drawings. Installation shall allow for expansion and contraction of flashing.

D. Spacers: Use manufacturer's standard resilient spacers at vertical joints between terracotta panels and at panel ends abutting changes in plane, openings, and related trim.

- E. Fasteners: Fastener spacings shall be in accordance with the manufacturer's recommendations, and as necessary to withstand the design loads indicated.

**3.2 PROTECTION AND CLEANING**

- A. Protect panels and other components from damage during and after erection, and until project is accepted by the Government.
- B. After completion of work, all exposed finished surfaces of panels shall be cleaned of soil, discoloration and disfiguration. Touch-up abraded surfaces of panels.

**3.3 CONSTRUCTION WASTE MANAGEMENT**

- A. General: Comply with Contractor's Waste Management Plan and Section 017419, CONSTRUCTION WASTE MANAGEMENT.
- B. To the greatest extent possible, separate reusable and recyclable products from contaminated waste and debris in accordance with the Contractor's Waste Management Plan. Place recyclable and reusable products in designated containers and protect from moisture and contamination.

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