**SECTION 07450**

**TERRA COTTA RAINSCREEN PANEL SYSTEM**

**PART 1 - GENERAL**

**1.1 SUMMARY OF WORK**

 A. Section includes: Exterior wall cladding system consisting of flat exterior grade extruded terra cotta panels installed on an aluminum attachment substructure. System shall be designed utilizing The Five Principles of Rainscreen Cladding Design, which includes incorporating moisture control at the outer face of the cladding system, structural design of the cladding and aluminum sub-framing system, design of the rainscreen cavity (for ventilation, thermal and acoustic performance) and design of the weather membrane system for inner moisture control.

 B. Related sections: [list appropriate spec sections and numbers]

1. Section 05080 - Cold Formed Metal Framing (if applicable)
2. Section 06100 - Rough Carpentry (if applicable).
3. Section 06165 - Air Barrier over exterior sheathing
4. Section 07210 - Building Insulation: [Batt] [Rigid board] thermal insulation installed behind the extruded terra cotta cladding system.
5. Section 07270 - Air Barriers: Sheet air infiltration barrier installed in cavity behind extruded terra cotta cladding panels.
6. Section 07600 - Flashing and Sheet Metal: Sheet metal air cavity flashings, wall transitions, [sills,] [trim,] [parapet cap,] and other sheet metal components.
7. [Section 06100 - Rough Carpentry] [Section 09250 - Gypsum Board] [Section 09255 - Cementitious Backing Board]: Sheathing to receive air barrier installed behind cladding

**1.2 REFERENCES**

 A. TEST Standards:

1. Water Absorption based on BS EN ISO 10545-3
2. Breaking Strength based on BS EN ISO 10545-3
3. Fire Behavior (Non-combustibility) per BS 476, Part 12
4. Resistance to Acids and Alkalis per BS EN 10545-13
5. Thermal Conductivity per ASTM C518
6. Linear Thermal Expansion based on BS 6431 Part 15
7. Resistance to Thermal Shock based on BS EN 10454-9
8. Poissions Ratio per ISO 17561
9. Elastic Modulus per ISO 17561
10. Frost Resistance per JC/T 1080-2008
11. Modulus of Rupture per JC/T 1080-2008
12. Earthquake Resistant Performance per GB5011
13. IBC 1403.2 Reference Standard for selection of Weather Resistive Barriers
14. ASTM E330-02 – Test method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference (Transverse Load Test)
15. ASTM E331-00 – Test method for Water Penetration of Exterior Windows, Skylights, Doors and Curtainwall by Uniform Static Air Pressure Difference
16. AAMA 509 Test Protocal for Drained and Back Ventilated Rainscreeens

**1.3 DEFINITIONS**

 A. Architectural grade extruded terra cotta panels, extruded aluminum or stainless steel support rails and fixing components designed with adequate durability.

**1.4 DESIGN REQUIREMENTS**

 A. Design and install terra cotta cladding and attachment system to:

 1. Provide in conjunction with wall substrate and air barrier a weather tight wall assembly utilizing the “rain screen principle”.

1. System design shall be single-source responsibility by the cladding supplier. All design criteria shall be project specific in accordance with the requirements of terra cotta cladding and support system supplier (**CLADDING CORP**) – Phone: (888) 826-8453. Products provided must conform to the design intent shown.
	1. PANEL SYSTEM: Drained and Back Ventilated Rainscreen Design. System shall drain water and condensation to exterior. A complete pre-engineered system including but not limited to terra cotta cladding panels, aluminum metal support structure by CLADDING CORP, closure pieces, trim and flashing. Wall panels shall be removable. The panels shall be secured to an aluminum metal support structure, which secures to cold-formed metal framing. Spacing of cold-formed metal framing indicated on structural drawings shall not be greater than 16 inch OC. Aluminum metal support structure shall also be of multiple components, with one component attaching to structure over the air barrier (using an F1/F2/F3 bracket) and one component fastening to bracket horizontally to allow for attachment of terra cotta panels. System must incorporate independent non-continuous wall brackets for attachment to substrate in order to meet continuous insulation (ci) requirements when exterior insulation is incorporated into cladding cavity design. Membrane should be visually inspected for breaches (and repaired as recommended by membrane manufacturer) prior to installation of support system.
	2. JOINTS: Shall be dry and un-caulked
	3. METAL FLASHING: Provide metal flashing for a proper water managed assembly, to direct condensation and water infiltration within the wall to weeping points. Coordinate details and installation with Air and Water Barrier provided with Section 07270.
		1. Drainage flashing is the primary component of a water managed system which diverts water that has penetrated the exterior cladding away from the cladding compartment or condensation that occurs at the interior face of cladding surface.
		2. Provide metal drainage flashing at locations listed below prior to installation of membrane to assure proper water drainage. Membrane shall assure proper lap over flashing:
			1. At bottom of system
			2. At penetrations: windows, doors, louvers, etc.
			3. At floor line or other locations which accommodate vertical movement
		3. End Dams: provide shop-formed end dams where drainage flashing terminates at openings.
			1. Configuration shall be triangular shaped, full width of horizontal flashing leg x 1 inch high
			2. Attachment – sauder joints and miters for an air and water tight condition
	4. System shall provide minimum 1 inch “clear” airspace behind cladding for proper ventilation.
	5. Design Modifications – shall be provided only as necessary to satisfy as-built conditions and to meet performance requirements. Significant system and aesthetic design shall be requested in writing to architect 10 days prior to bid date.

 3. Material supplier shall be responsible for engineering system per architectural design criteria and performance requirements.

**1.5 PERFORMANCE REQUIREMENTS**

 A. Design and install terra cotta cladding and attachment system to:

1. Material performance requirements for terra cotta tiles:
	1. Fabrication tolerances:
		1. Width: Deviation of the tile length from nominal dimensions shall not exceed +/- 1.0mm.
		2. Height: Deviation of the tile height up to 300mm shall not exceed +/- 2.0mm.
		3. Thickness: Deviation of tile thickness shall not exceed +/- 10%
		4. Diagonal flatness: Deviation of the tile flatness shall not exceed +/- 0.5%.
		5. Straightness: Deviation shall not exceed +/- 0.3%.
	2. Water Absorption: Test according to ISO 10545-3. Water absorption shall be 3% to 8% depending upon color.
	3. Breaking Strength: Test according to ISO 10545-3. Specimen shall exhibit average values of 19.3 MPa depending upon color selected.
	4. Fire Behaviour per BS 476, Part 12 – shall be classified “non-combustible”
	5. Resistance to Acids and Alkalis per EN 10545-13 (tested against effects to sodium hypochlorite solution, hydrochloric acid solution, citric acid solution, potassium hydroxide solution and ammonium chloride solution) – no visual defects noticed
	6. Thermal Conductivity: Test according to ASTM C518 with thermal conductivity (K) of 2.62296 Btu in/hr ft2 0F and Total R Value of 0.445 hr ft2 F/Btu.
	7. Thermal Shock: Test according to ISO 10545-9. Specimen shall be unalterable according to test up to 145 °C.
	8. Coefficient of Linear Thermal Expansion per BS 6431, part 15. Average value of 4.95x10-6
	9. Moisture Expansion: Test according to GB/T4100-2006. Mean value <0.1mm/m, maximum value <0.1mm/m.
	10. Frost Resistance per JC/T 1080-2008. Specimen shall be unalterable according to test (100 cycles +30 °C and –30 °C).

 2. Withstand design loads, as required by applicable codes for project location, as follows:

 a. Maximum panel deflection: 1/360 of span or less of span when tested in accordance with positive and negative pressures and as required to prevent cracking or damage to panel facing.

 3. Comply with applicable seismic requirements for project location in Seismic Zone [0] [1] [2A] [2B] [3] [4] **[select appropriate and define windload]** as defined by International Code Conference (ICC).

 4. Adequately resist wind forces and uplift for project location with minimum of [\_\_\_\_\_] [PSF] [kilopascals] [\_\_\_\_\_] for wall surface and [[\_\_\_\_\_] [PSF] [kilopascals] for parapet and corner panels tested in accordance with ASTM E330.

 5. Accommodate movement of cladding components without undue stress on fasteners or other detrimental effects, when subjected to seasonal temperature range of:

 a. Ambient: [120 degrees F] [67 degrees C].

 b. Cladding surface: [180 degrees F] [100 degrees C].

 6. Accommodate tolerances of support structure.

7. Condensation: System shall accommodate positive drainage for

 moisture entering or condensation occurring within panel system.

* 1. Design drainage system for 100 year rain cycle
1. Flatness: System shall be flat with no noticeable warping, buckling, deflections or other surface irregularities.

**1.6 CONTINUOUS INSULATION (CI).** System shall comply with ASHRAE 90.1-2010 thermal performance requirements. System shall:

1. Be manufactured from AL6063-T6 extruded aluminum components
2. Shall be designed with independent non-continuous wall brackets to ensure optimal thermal and moisture performance when required to provide outboard insulation (CI) within cladding cavity. Systems using continuous zee/hat shapes in lieu of brackets must incorporate a “energy-loss design factor” (up to 50%) based on spacing and thickness of profiles.
3. System shall incorporate thermal isolators behind wall brackets to reduce thermal drops/gains thru system components.
4. System shall use stainless steel wall anchors
5. Provide an energy model to show final R-value of cladding assembly to accommodate ASHRAE 90.1-2010 performance requirements.

**1.7 SUBMITTALS**

 A. Provide in accordance with Section 01330 - Submittal Procedures:

 1. Product data describing materials and fabrication for extruded terra cotta panels.

 2. Product data describing materials and fabrication for aluminum attachment system and components.

 3. Shop drawings showing:

 a. Layout, profiles and dimensions for panels, product components, edge conditions, special shapes, and trim pieces.

 b. Installation details: attachment methods, fasteners, joints, corners, openings, intersections with adjacent materials, flashings, closures, trim, and other critical conditions.

 c. Layout of terra cotta panels on wall and locations of special pieces and trim.

 4. Structural calculations.

 5. Copies of certificates, reports, and other data showing compliance with design and performance requirements specified in Paragraph [1.4].

 6. Copy of written approval by fastener supplier of the use of selected screws confirming use in a drained and back-ventilated (D&BV) rainscreen wall assembly.

 7. Samples:

 a. 2 inch by 2 inch [51mm by 51 mm] minimum terra cotta color samples for selection by Architect.

 b. One 3 inch x 5 inch terra cotta panel in selected color and surface finish.

 c. 3 inches [76 mm] minimum length of attachment profile.

 d. Typical SYSTEM5 Support brackets and anchors

 e. Typical exposed fasteners

 8. Manufacturer's installation and maintenance instructions.

 9. Copy of warranty required by Paragraph [1.11] for review by Architect.

**1.8 QUALITY ASSURANCE**

 A. System Manufacturer’s Qualifications: Provide exterior wall system manufactured by a firm experienced in manufacturing systems that are similar to those indicated for this project and have a record of successful in-service performance.

 B. Installer qualifications: Company experienced in installing exterior wall cladding systems and acceptable to extruded terra cotta panel and aluminum support system suppliers.

**\*\*\*\*\* Depending on the scope of the project, it may be advisable for supplier's field representative to observe the terra cotta panel cladding installation. \*\*\*\*\***

**1.9 DELIVERY, STORAGE, AND HANDLING**

 A. Prior to shipping, pack and crate terra cotta panel system components to prevent damage during transit and storage. During transport, handle the panels with special care taken not to damage the edges of the panels.

 B. Inspect terra cotta panels and aluminum attachment components immediately upon delivery at site. Notify manufacturer of damage.

 C. Follow manufacturer’s instructions for storage of terra cotta panels. Keep pieces in original packing material until ready to install. Remove transport protection films from both sides of the panels at the same time.

**1.10 WARRANTY**

 A. Provide Manufacturer’s standard 10-year warranty for terra cotta panels.

**1.11 EXTRA MATERIALS**

 A. ATTIC STOCK: Provide in accordance with Section 01780 - Closeout Submittals: [Quantity as defined by Architect/Owner]. (Architect please select if required for project).

 B. Extra panels shall be from same manufacturing lot as installed panels.

**PART 2 - PRODUCTS**

**2.1 ACCEPTABLE SUPPLIERS**

 A. **TERRA5 Terracotta by** **Cladding Corp** **(**[**www.claddingcorp.com**](http://www.claddingcorp.com)**)** Phone: (888) 826-8453

 Represented locally by:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 B. **Cladding** Panel Type – **TC18** or **TC30** (Architect please define and/or call Cladding Corp for assistance).

 C. **Sunscreen** Type – [**Various Shapes**]. (Architect please define and/or call Cladding Corp for proper panel selection).

 C. Panel **Thickness** – **TC18** = 18mm (0.71in) or **TC 30**= 30mm (1.18in)

(Architect please define and/or call Cladding Corp for assistance).

 D. **Color** as selected by Architect in manufacturer’s standard color range (Architect please define and/or call Cladding Corp for proper color selection).

E. Cladding **Module Size** (to centerline of joints):

**TC18** Format

**HGT:** 200mm | 250mm | X **LENGTH**: 600mm | 900mm | 1200mm (these heights are not available in 1515mm length)

**HGT:** 300mm | 350mm | 400mm | 450mm | 500mm | 600mm x **LENGTH**: 600mm | 900mm | 1200mm | 1515mm

**TC30** Format

**HGT:** 200mm | 250mm | X **LENGTH**: 600mm | 900mm | 1200mm (these heights are not available in 1515mm length)

**HGT:** 300mm | 350mm | 400mm | 450mm | 500mm | 600mm x **LENGTH**: 600mm | 900mm | 1200mm | 1515mm

 (Architect please define and/or call Cladding Corp for proper module size).

1. **SUNSCREEN MODULE SIZE**

**BAGUETTE** Format**: 50mm X 50mm or 60mm X 60mm x up to 5t in length**

**LOUVER** Format**: [put in selected size here] x up to 5ft in length**

 (Architect please define and/or call Cladding Corp for proper shape selection).

 F. Requests to use equivalent products of other manufacturers shall be submitted in writing 10 days prior to bid in accordance with Section 01630 - Product Substitution Procedures. Architect reserves right to reject substitution request based on available sizes, color, or surface finish even though fabrication, materials, and performance are equivalent.

**2.2 PANEL SUBFRAMING SYSTEM**

 A. **SYSTEM5** Subframing System Supplied by **Cladding Corp Systems**. ([www.claddingcorp.com](http://www.claddingcorp.com))

 Phone: (888) 826-8453

 Represented locally by:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 [architect to select one of system listed below]:

1. **TC18 SYSTEM5** **F1.45** horizontal rail system with self-shimming vertical rails to accommodate out-of-plumb conditions of metal stud wall installed (please call Cladding Corp for proper system selection).
2. **TC30 SYSTEM5 F2.22** vertical hat and clip attachment system with self-shimming horizontal rails to accommodate out-of-plumb conditions of metal stud wall installed (please call Cladding Corp for proper system selection).
3. SUNSCREENS – **SYSTEM5 F3.XX System** (please call Cladding Corp for proper system selection).

 B. Substrate: [Cast-in-place concrete] [Precast concrete] [Concrete unit masonry] [Metal] [Wood] stud with [cementitious board] [plywood] [gypsum] sheathing] wall. **\*\*\*\*\*\*\*(architect to select)**

 C. Panel support rails to be installed [directly to wall substrate.] [indirectly over furring, thermal insulation, and sheathing.] **\*\*\*\*\*\*\*(architect to select)**

**2.3 SUPPORT COMPONENTS AND ACCESSORIES**

 A. Metal Support Structure:

1. Shall be made of extruded aluminum or stainless steel support rails and fasteners designed with adequate durability for use with a drained and back-ventilated (D&BV) wall assembly. System shall also be designed to allow independent hydric and thermal movement of the system components. The design of a drained and back-ventilated (D&BV) system requires the use of an air water barrier (AWB) to prevent water entry through the entire wall system. The system shall be designed to manage and drain any water entering the cavity behind the cladding and shall be sufficiently vented to allow the cavity to dry and if water vapor diffuses from the building interior through the AWB into the D&BV system cavity, it shall be permitted to be vented and/or drained to the exterior.
2. Support Bracket – F1/F2/F3 Bracket – Non-continuous bracket assembly that anchors directly to wall substrate allowing for continuous insulation (ci) within cladding cavity and supports L/T/Tube Profile Rail.
3. L/T/Tube Profile – shelf shimming extrusions that fastens into open end of F1/F2/F3 bracket and supports Rail Profile
4. Continuous aluminum rail profile (BERSAL/Baguettes), aluminum hangars and clips anchors
5. Fasteners: Corrosion resistant fasteners and anchors of type, size, and spacing required for type of substrate and Project conditions, to meet performance requirements specified in Paragraph [1.4], and as indicated in design calculations and shop drawings. Fastener Manufacturer to supply written approval of the use of selected screws confirming use in a drained and back-ventilated (D&BV) rainscreen wall assembly.
6. Joints Closures (if required) – roll formed/brake shape aluminum closure pieces painted black and insert into open joint condition to protect against direct rain penetration into cavity and protection of membrane from UV exposure.

 B. Mastic: Single-component, non-sag, low-modulus, urethane adhesive mastic as recommended by cladding supplier. Other membranes as applicable for rainscreen systems as determined by architect.

 C. Sheet metal: Provide sheet metal flashings and trim as required for cladding system in accordance with Section 07600 - Flashing and Sheet Metal.

 1. Shop form components to profiles, dimensions, and thicknesses indicated on Drawings. Items to be provided include:

 a. Cavity drainage flashings: [Galvanized steel] [Aluminum] [Copper fabric] flashing at bottom of air cavities and pressurized compartments to gravity drain water from cavity.

 b. [Window sills] [parapet caps] [transition pieces to adjacent materials] and other exposed trim: [Galvanized steel] [Aluminum] [Galvalume] [\_\_\_\_\_] fabrications with [mill aluminum] [anodized aluminum] [fluorocarbon Kynar coating] [electrostatically applied powder paint coating] [bare galvalume] [\_\_\_\_\_] finish. Attach with clips or other means to avoid exposed fasteners.

 2. Form sheet metal fabrications in longest possible lengths. Turn back all exposed edges to form hem. Fabricate vertical faces with bottom edge formed outward and hemmed to provide drip.

**PART 3 - EXECUTION**

**3.1 INSPECTION**

 A. Examine walls to receive cladding system. Ensure substrate is structurally sound, clean, and free of contaminants, which could inhibit bond of air barrier.

 1. Maximum substrate/studwall deflection: L/360 or as recommended by code and architect per the guidelines of our manufacturer’s maximum system deflection.

 2. Maximum substrate surface variation: [1/8 inch in 10 feet] [3 mm in 3 m].

**\*\*\*\*\* Select appropriate requirements from the following paragraphs to reflect type of substrate. Edit as required to coordinate with installation details on Drawings. \*\*\*\*\***

 3. Concrete: Verify cast-in-place concrete walls have cured 30 days minimum. [Ensure inserts for attachment of cladding system are accurately positioned and properly embedded.]

 4. Concrete unit masonry: Verify that joints are flush and masonry walls have cured 30 days minimum.

 5. Stud construction with [gypsum sheathing] [cementitious backer board] [exterior grade plywood]: Verify stud framing is adequately braced without deflection and sheathing is properly secured with edges over firm bearing. Ensure proper framing and supports are provided and located for secure attachment of support rails.

 B. Do not proceed with cladding installation until deficiencies have been addressed.

**3.2 PREPARATION**

 A. Install assembly of thermal insulation, furring, and sheathing as specified in Section 07210 - Building Insulation and detailed on Drawings and approved shop drawings.

 B. Air barrier: Install air barrier to [wall substrate] [wall sheathing] as specified in Section 07270 - Air Barriers and detailed on Drawings and approved shop drawings. Install horizontally starting at bottom of wall. Do not leave air barrier membrane exposed for lengthy period of time. Exercise care not to puncture or tear barrier with subsequent cladding operations.

 C. Flashings: Install sheet metal flashings, pressure compartment dividers, and trim as specified in Section 07600 - Flashing and Sheet Metal and as positioned and detailed on Drawings and approved shop drawings. Ensure flashings at bottom of wall and pressure compartments properly drain water from air cavity to exterior through weep holes. Turn up flashings [4 inches] [102 mm] minimum and seal to substrate. Lap flashing end joints [6 inches] [152 mm] and seal watertight.

**3.3 CLADDING INSTALLATION**

 A. Install cladding in accordance with manufacturer's instructions and approved shop drawings.

 B. Establish level lines for panel coursing and positioning of SYSTEM5 Brackets/support rails.

 C. F1 / F2 / F3 Brackets/Support rails: Attach Brackets/rails with engineered fasteners and anchors to accomplish performance requirements specified in Paragraph [1.4].

 1. Attach brackets/rails to substrate at a distance recommended by CLADDING CORP in accordance with lateral loads and system dead load requirements or as shown on drawings.

 2. Provide 1 to 2 inches [25 to 51 mm] space between ends of adjacent rails.

 D. Extruded Terra Cotta Panels: Starting at bottom of wall, attach panels to horizontal/ vertical aluminum profile and install sequentially up the wall.

 1. Layout work so as to avoid or minimize cuts. Site cut tiles using power saw with appropriate blade type to prevent broken corners, edges, and chips.

 2. Install terra cotta panels with appropriate joint layout and configuration. Vertical and horizontal joints shall be open approximately 3/16 inch [5 mm] wide.

 3. Tolerances: Shim and align terra cotta panels to provide these tolerances:

 a. Deviations from level or plumb alignment: 1/4 inch in 20 feet [6 mm in 6 m] maximum, non accumulative.

**3.4 CLEANING AND PROTECTION**

 A. Remove and replace broken, chipped, stained, or otherwise damaged panels.

 B. Immediately after installing, wipe down work. Do not use wire brushes, metallic tools, or abrasives for cleaning.

 C. Protect cladding from roof run-off, splashed water, mud, sealants, bitumen, and other contaminants from remaining construction activities.

 D. Without damaging completed work, provide protective boards at exposed external corners, which may be damaged by construction activities.

 **END OF SECTION 7450**