SECTION 07 4229 – TERRACOTTA CLAY TILE IN PRECAST

SPECIFICTION FOR TERRART – SOLID

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Terracotta Precast Facade Assembly consisting of single-leaf, through body color terracotta clay tiles.

C. Engineering design and performance requirements for terracotta precast assemblies.

1.2 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-In-Place Concrete: Structural concrete.

B. Section 04 2200 - Concrete Unit Masonry: Single-width CMU.

1.3 REFERENCE STANDARDS

A. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2013a.

B. ASTM C484 - Standard Test Method for Thermal Shock Resistance of Glazed Ceramic Tile; 1999(2009). Applicable for glazed tiles only

C. ASTM C 126 Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick and Solid Masonry Units. Applicable for glazed tiles only

1.4 ADMINISTRATIVE REQUIREMENTS

A. Pre-installation Meeting: Convene one week before starting work of this section.
   1. Conduct pre-installation meeting at site attended by Owner, Architect, Manufacturer's Technical Representative, and other trade contractors.
   2. Coordinate building framing in relation to terracotta precast assembly.
   3. Coordinate window, door and louver, and other openings and penetrations of terracotta precast assembly.
   4. Coordinate terracotta precast assembly with rain drainage work, flashing, trim, and construction of other adjoining work to provide a leak proof, and secure installation.
   5. Coordinate construction of mock-up, sequence of construction, coordination with substrate preparation, materials approved for use, compatibility of materials, coordination with installation of adjacent and covering materials, and details of construction.
   6. Coordinate shop drawings, construction and installation such that manufacturing can proceed without impact to the general schedule and not be contingent upon field dimensions.

1.5 ACTION SUBMITTALS

A. Product Data: For each terracotta precast assembly component indicated, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. LEED Submittals:

1. Product Data for Credit MR 4.1 and Credit MR 4.2: For clay products having recycled content, documentation indicating percentages by weight of postconsumer and pre-consumer recycled content. Include statement indicating cost for each product having recycled content.
2. Product Data for Credit MR 5: For products clay products that have been extracted, harvested or recovered, as well an manufactured within 500 miles of the project site for a minimum of 10% or 20%, based on cost.

C. Shop Drawings: Submit drawings for a complete terracotta precast assembly

1. Include plans, elevations, sections, and attachment details. Show and include adjacent Work and interface between terracotta precast assembly and adjacent Work including termination and transitions of weather barrier, exterior glazed aluminum curtain walls, and flashings required. Include all adjacent Work by others.
    a. Distinguish among factory, shop, and field assembled work.
    b. Identify special shapes required and indicate their locations on the building.
3. Indicate adjacent structure locations by actual field dimensions.
3. Indicate terracotta precast assembly dimensions, including joints and allowable tolerances.
4. Include details of each vertical and horizontal intersection of each terracotta precast assembly with other systems and materials, showing the following:
    a. Anchorage to building structure.
    b. Expansion provisions and maximum allowable movement.
    c. Building movement, deflection, and creep provisions and maximum allowable movement.
    d. Terracotta clay tile cladding.
    e. Flashing and drainage.

D. Professional Engineer's Analysis: Submit complete structural analysis and calculations performed by a Professional Engineer licensed in the State of the Project location.

E. Delegated-Design Submittal: For terracotta precast assembly indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by a qualified professional engineer responsible for their preparation.

1. Provide calculations for loadings and stresses of framing, fastening and attachments.

F. Samples:

1. Samples for Initial Selection: For each type of terracotta tile indicated.
    a. Provide samples of tiles, trim, and accessories for the purpose of color selection.
2. Samples for Verification: For each type of component indicted provide three samples.
    a. Terracotta Clay Tiles: 4 x 8 inches minimum of a standard color.
3. Samples for color development: For each custom color indicated.
    a. provide three laboratory samples in a size of 3"x3@

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit coordination drawings on which the following items are shown and coordinated with the terracotta tiles and precast system, drawn to scale, using input from installers of the items involved:

1. Wall-mounted items including doors, glazed assemblies, louvers and lighting fixtures.
2. Penetrations of assembly by pipes and utilities.

B. Design Test Reports: Submit copies of test reports performed in accordance to part 1.3 of this section and supporting the requirements of part 2.4 of this section.
   1. Test reports shall be performed by independent, accredited testing laboratories, and shall bear the seal of a registered professional engineer.

C. Warranties: Provide unexecuted specimen warranty documents for each warranty as required in specification article 1.13.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For terracotta precast assembly to include in maintenance manuals.

1.8 QUALITY ASSURANCE

A. Material Source Limitations: Obtain terracotta clay tiles and related accessories from a single source manufacturer.

B. Manufacturer's Qualifications: Terracotta clay tile manufacturers who have been in business for a minimum of ten (10) years and are experienced in the design and manufacturing of terracotta precast assemblies. A reference of a minimum of ten (10) successful executed terracotta tiles in precast elements is required.

C. Installer Qualifications: Engage an experienced contractor (erector) to install the terracotta precast who has experience specializing in the installation of precast.
   1. Contractor must be approved by manufacturer specified as supplier of the terracotta precast and obtain written certification from manufacturer that installer is approved for installation of the specified system.
   2. Successful contractor must obtain all components of terracotta from a single manufacturer. Any secondary products that are required which cannot be supplied by the specified manufacturer must be recommended by primary manufacturer.
   3. Fabricator/Installer shall submit work experience and evidence of adequate financial responsibility. Architect reserves the right to inspect fabrication facilities in determining qualifications.

D. Professional Engineer Qualifications: Licensed structural engineer in the state where the project is located and experienced in design of complete terracotta precast assembly of the types specified in this section with minimum five (5) years' experience and minimum three (3) completed projects of similar scale and scope as this Project within the past five (5) years.

1.9 MOCK-UP

A. Mockup: Build mockup in size and location directed by Architect. Show details of terracotta precast assembly. Demonstrate methods and details of installation. Show details of horizontal and vertical joints, penetrations, doors, windows, louvers, pipe openings, inside and outside corners, top and bottom of wall.

B. Approval of mockup does not relieve Contractor of responsibility to comply with all requirements of contract documents.

C. Approved mock-up may remain as part of the completed Work.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, terracotta tiles, and other manufactured items so as not to be damaged or deformed. Package terracotta tiles for protection during transportation and handling.

B. Unload, store, and erect aluminum framing system and terracotta tiles in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack terracotta tiles on platforms or pallets, covered with suitable weather-tight and ventilated covering. Store tiles to ensure dryness and with positive slope for drainage of water. Do not store tiles in contact with other materials that might cause staining, cracking, or other surface damage.

1.11 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit work to be performed according to manufacturer's written instructions and warranty requirements.

B. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer’s absolute limits.

1.12 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit installation to be performed according to manufacturer's written instructions and warranty requirements.

B. Field Measurements: Verify locations of structural members and wall opening dimensions before terracotta precast installation.

1.13 WARRANTY

A. Manufacturer’s Warranty: Provide manufacturer’s standard material warranty in which the manufacturer warrants that the precast and terracotta clay tiles shall be free from defects for a period of (5) five years due to faulty workmanship.

B. Installer’s Warranty: Installer's 3 year warranty covering precast assembly installation.

C. Warranties shall commence on date of substantial completion.

1.14 ATTIC STOCK

A. Manufacturer to provide minimum 1% attic stock material of each type in projects maximum length.

B. Manufacturer to provide minimum 1% extra material for installation process.

PART 2 PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Terracotta Precast Assembly - Completely integrated exterior wall assembly comprising of:

1. Base Wall System – Structural Steel or Cast-In- Place Concrete (provided by others). Building components must be designed to accommodate imposed loads, so their deflection under imposed loading will not cause deflection of precast assembly exceeding specified tolerances.
2. Terracotta Clay Tile Elements: Single -leaf, solid dove tail backside, through body color terracotta clay tile elements, with ship lap joint system.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer licensed in the state where the project is located to provide complete structural analysis and calculations.

B. General Performance: Terracotta precast assemblies shall comply with performance requirements without failure due to defective manufacture, fabrication, installation, or other defects in construction.
   1. Terracotta precast assemblies shall withstand movements of supporting structure including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
   2. Failures include the following:
      a. Thermal stresses transferring to building structure.
      b. Terracotta tile element breakage.
      c. Noise or vibration created by wind and thermal and structural movements.
      d. Loosening or weakening of, anchor attachments, and other components.

C. Design Criteria.

   1. The system shall have a design load of positive and negative pressure to meet local building codes.
   2. At 1.5 times design pressure loads, there shall be no failure or gross permanent distortion of framing members, anchors, or connections. At connection points of framing members to anchors, combined movement of anchor relative to the building, and framing member relative to anchor shall not exceed 0.125 inch set after load is removed.

D. Movement.
   1. Design, fabricate, and install system to withstand building, seismic, and thermal movements including deflections, temperature change without buckling, distortion, joint failure, or undue stress on system components, anchors, or permanent deformation of any kind.
      a. Provide for a thermal movement over and ambient temperature range of 120 degrees F, and a surface temperature of 180 degrees F.

2.3 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the following:
   1. NBK TERRART-SOLID Tile as manufactured by NBK, represented by NBK North America: www.nbkusa.com.
      a. Local Representative: *[Add local representative name and contact information]*
   2. Alternate manufacturers are subject to full compliance with specification requirements, and shall be submitted for approval as follows.
      a. Manufacturers not listed above must submit for approval ten (10) days prior to bid date.
      b. Submittals must show evidence of compliance with this specification and the drawings.

         Submittals must include full size tiles in color and shape of each profile shown in architectural drawings.
      c. Submittals must provide proof of manufacture and successful performance of terracotta precast of similar size and complexity.
      d. Manufacturer shall provide a reference list of at least 6 projects located in the USA, including names, addresses, and phone numbers where tiles have been used.
      e. No substitutions will be permitted after the bid date of this project.

2.4 TERRACOTTA CLAY TILE ELEMENTS

A. TERRART-SOLID: Single -leaf with dove tail – back-side, extruded through body color terracotta clay tile elements with horizontal ship lap joints.
   1. Length: [Insert required length] The length of the element can be adjusted to a maximum of 5’-0” (1524 mm).
   2. Height: [Insert required height] The height of the element can be adjusted to a maximum of 2’-0” (600 mm).
   3. Thickness: 13/16”, 1”, 1 3/16” (20mm, 25mm, 30mm), approximately.
   4. Weight: approximately 9-13.5 lb./sq.ft.
   5. Profile(s): Provide the following profiles as indicated on the drawings:
      a. [Insert selected profile(s)].
   6. Color(s): Provide the following colors as indicated on the drawings:
      a. Color:
   7. Orientation: *[Vertical or Horizontal]*

B. Finishes:
   1. Provide tiles in natural finish manufactured from high quality clays to prevent the formation of pores (more than 1.0 mm in diameter) in the clay body for preventing problems in connection with freeze and thaw.
   2. Finish:

C. Terracotta Clay Tile Tolerances:
   1. Width: Deviation of the tile length from nominal dimensions (cuts) shall not exceed +/- 1.0 mm.
   2. Height: Deviation of the tile height up to 200mm shall not exceed 2.0mm, 400 mm shall not exceed +/- 2.5 mm, and up to 600 mm +/- 3.0 mm.
   3. Thickness: Deviation of tile thickness shall not exceed +/- 1.5 mm.
   4. Diagonal Flatness: Deviation of the tile flatness shall not exceed 0.25% of diagonal measurement.
   5. Straightness: Deviation shall not exceed 0.25% of total module size.

D. Terracotta Clay Tile Testing:

Provide material test report to demonstrate performance of clay products.

1. Water Absorption: Test according to ASTM C 67 using 24-hour submersion and 5 hours boiling (separate sets of specimens, minimum 5 specimens each).
   a. Absorption by submersion shall not exceed 5 percent average, 6 percent individual specimen.
   b. Absorption by boiling shall not exceed: 7 percent average, 8 percent individual specimen.
2. Freezing and Thawing: Test according to ASTM C 67 (minimum 5 specimens). No specimen shall lose more than 0.5 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.
3. Breaking Load: Test according to ASTM C 67 (minimum 5 specimens). Supports shall be actual hardware used for this project. Apply load at mid-point between supports. Report shall include breaking load, calculated section modulus at mid-span and calculated breaking stress. Modulus of Rupture in average shall not be lower than 2500lb/in^2. [Minimum 5 specimens]
4. Thermal Shock Resistance: Test according to ASTM C 484 for glazed tiles. [Minimum of 5 specimens] Specimens shall pass two cycles. Applicable only for glazed tiles.
5. Efflorescence: Test according to ASTM C 67. [Minimum 10 specimens] Specimens to be rated “Not Effervesced”.

2.5 TERRACOTTA PRECAST SYSTEM / FABRICATION

A. General: Terracotta clay tiles and precast concrete panels.
   1. System designed to accommodate thermal movement.
   2. System designed for terracotta clay tile elements to be placed face down into precast formwork with dovetail face up. Teflon or plastic spacer bars to be placed between tiles to maintain tile joint alignment. Tape horizontal joints back-side and add sealant between tile edges and formwork to prevent concrete from spilling over onto the tile face. Add reinforcing steel and anchors as required and pour concrete into formwork. Leave in form until cured and remove by standards as outlined in precast industry. After cure and release from formwork, remove any excess cement or slurry from terracotta face via a light acid wash. Watering terracotta before and after acid wash with plentiful of clean water.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, and other conditions affecting performance of work.
   1. Examine wall framing to verify that structural support members and anchorage have been installed within alignment tolerances as specified.
   2. Examine rough-ins for components and systems penetrating terracotta clay tiles to verify actual locations of penetrations relative to seam locations of tiles before installation.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install terracotta precast panels in accordance with manufacturer’s instructions and approved shop drawings, within specified erection tolerances.

B. Establish level lines for tile coursing.

C. Coordinate flashing and sheet metal work to provide weather tight conditions at wall terminations.

D. Provide for temperature expansion/contraction movement of terracotta clay tile elements at wall penetrations and wall mounted equipment in accordance with system manufacturer's product data and design calculations.

E. Install components so that in their final location and position they are not twisted, out of plane, or exceed manufacturer’s specified tolerances. . Provide manufactures standard procedure as part of the submittal package.

F. Remove damaged work and replace with new, undamaged components.

3.3 ERECTION TOLERANCES

A. Installation Tolerances: Align terracotta precast panels within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m) at location lines as indicated and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a manufacturer-authorized service representative to inspect terracotta precast panel installation. Report results in writing.

B. Remove and replace clay tiles where inspections indicate that they do not comply with specified requirements.

C. Additional inspections, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.5 CLEANING

A. On completion of terracotta clay precast panel installation, clean finished surfaces as recommended by manufacturer. Maintain in a clean condition during construction.

B. Protect components and terracotta clay tile elements from damage for the duration of construction.

C. Replace any components that have been damaged.

END OF SECTION