

SPECIFICATIONS FOR ARCHITECTURAL TERRA COTTA

STANDARD SPECIFICATION

for the Manufacture, furnishing and setting of Architectural Terra Cotta and Veneer

SECTION 04210 Architectural Terra Cotta

PART I GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Provide new Terra Cotta as indicated on Drawings.
 - 2. Detail, furnish, and install support, anchorage, and connection devices and coordinate size and configuration with other elements of the work.
- B. Related Sections:
 - 1. Section 01300 – Submittals
 - 2. Section 04150 – Terra Cotta Repair
 - 3. Section 04212 – Structural Anchoring
 - 4. Section 04510 – Masonry Cleaning

1.02 REFERENCES

- A. ASTM C212 – Standard Specification for Structural Clay Facing Tile.
- B. ASTM C126 – Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
- C. ASTM C67 – Standard Methods of Sampling and Testing Brick and Structural Clay Tile.

1.03 QUALITY ASSURANCE

- A. Contractor Qualifications:

All work shall be performed by mechanics experienced in the handling and setting of the material having not less than five (5) years satisfactory experience in comparable installation of new Terra Cotta including work on at least two (2) projects similar in scope and scale to this Project. Submit references with name of contact person and telephone number for the two (2) submitted similar projects.
- B. Manufacturer's Qualifications:
 - 1. All Terra Cotta work shall be by a manufacturing firm normally in business of producing work of the type indicated and shall be capable of submitting proof to the Architect/Engineer as follows:
 - a. Length of Time in this Kind of Manufacturing: Five (5) years.
 - b. Photographs and Job Description: At least three (3) previous jobs.
- C. Installer's Qualifications:
 - 1. All Terra Cotta work shall be installed by a firm normally in business of installing work of the type indicated and shall be capable of submitting proof to the Architect/Engineer as follows:
 - a. Length of Time in this Kind of Installation: Ten (10) years.
 - b. Photographs and Job Description: At least two (2) previous jobs.

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1.04 SUBMITTALS

- A. Submit under provision of Section 01300.
- B. Shop and Setting Drawings:
 - 1. The Contractor or Architect shall furnish the Terra Cotta manufacturer with all drawings, details and information necessary for the manufacture of Terra Cotta units, including drawings of all classes of work with which the Terra Cotta engages, proposed method of installation and elevations showing location of the units to be replaced.
 - 2. Submit shop, fabrication and setting drawings to the Customer for approval by both the Architect and the Contractor prior to production of any material. Contractor shall be responsible for all field dimension verification.
 - 3. Shop drawings shall show sections, dimensions and connection with other work. These drawings must conform as nearly as practicable to the architect's drawing, but shall be in accordance with good Terra Cotta structural practice.
 - 4. Anchorage: Terra Cotta unit anchorage shall be coordinated with the Terra Cotta manufacturer and designed by Contractor's structural engineer and submitted to the Architect/Engineer for approval.

The attachment design will withstand loads from wind, earthquake, gravity, building movement, and thermally induce movement according to the requirements of the governing Building Code and good engineering practice.
 - 5. The Terra Cotta manufacturer shall provide [] copies of the complete set of scale shop drawings to be used for setting and showing the piece numbering of the Terra Cotta. The size of the joints to be used for setting the various portions of the work shall be clearly indicated. These drawings shall be designated as the setting drawings.
- C. Samples:
 - 1. Whenever Terra Cotta is required to match existing terra cotta in contour, color finish and surface treatment, as for example in connection with alterations to existing work, the Terra Cotta manufacturer shall be furnished with the required profiles and samples of the original work and other needed information.
 - 2. If a restoration, the customer shall provide a cleaned, full size, Terra Cotta unit control sample representing required color, texture and finish.
 - 3. Preliminary Color Sample Approval: Submit two 6" x 6" x 5/8" samples showing typical color range and finish for preliminary acceptance.
 - 4. Final Approval: After approval of the preliminary color sample, submit two (2) final samples at minimum 12" x 12" x 3/4" which when inspected and approved become the standard for quality, color range, texture and color finish. All materials shall conform to the approved samples within the range, subject to normal ceramic variation.

Submit manufacturer's specifications and other product data for each manufactured product including instructions for storage, handling and use.
- D. Contractor to submit details and procedures for incremental protection of completed work. At a minimum, install protection after installation of each eight feet height of completed Terra Cotta wall.

Manufacturer reserves the right to change, drop, or alter product lines and specifications.

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E. Material Testing:

1. Test in accordance with ASTM C67 to determine compressive strength and absorption. Use a certified lab for testing. Manufacturer to supply current test data.

F. Field Sample for New Construction:

1. After acceptance of sample submittal, but prior to commencement of work under this Section, prepare a working field sample if required of new Terra Cotta unit installation. Demonstrate all methods, materials and workmanship required for the Project. Approved field sample will serve as a standard for the balance of Terra Cotta unit installation procedures. If approved, field sample may or may not remain as part of the finished work.

1.05 PRODUCT DELIVER, STORAGE AND HANDLING

- A.** Packing and crating of the architectural Terra Cotta shall be done by the manufacturer to prevent damage to the units in transit by normal handling methods. Delivery shall be made to correspond to priority sequencing as directed by the customer. All crates will be delivered f.o.b. job site, unless otherwise requested.
- B.** The Contractor becomes responsible for the product at the time it is received.
- C.** The contractor has a 72-hour window for inspecting the delivery. Any non-conformity must be communicated to the Manufacturer immediately and in writing, within that time frame.
- D.** If any pieces of Terra Cotta are damaged in transit, the manufacturer shall be immediately notified in writing by the setting contractor and proceed with the remaking of the pieces. The responsibility for the cost of such replacements shall be determined by the point of delivery outlined the contract. The Customer shall assume responsibility for the necessary proof of damage.
- E.** Storage at Job Site or Production Facility:
 - 1. Units shall stay in their original packing material until ready for use. Crates shall not be stacked and shall remain in an upright position. Store units on firm, level and smooth surface. The units shall be protected from weather before setting, to prevent staining.
 - 2. The manufacturer is responsible for providing the architectural Terra Cotta only. All other materials, products, and equipment necessary to setting and installation the units to the architectural drawing and specification, and the labor to do so, must be provided by the Customer.

1.06 JOB CONDITIONS

- A.** Cold Weather: Perform work in accordance with ACI 530.1 current edition.
- B.** Hot Weather: Perform work in accordance with ACI 530.1 current edition.
- C.** At end of the working day, or during rainy weather, cover masonry work exposed to weather with waterproof coverage and securely anchor as necessary.
- D.** Protection: Adequately protect and do not damage existing construction to remain.

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PART 2 – PRODUCTS

2.01 TERRA COTTA AND ACCESSORIES

- A. Terra Cotta units shall be outlined on Architectural Drawing with respect to exterior appearance and profile
1. Manufacture all pieces for particular installation conditions to minimize any cutting in the field. Contractor to adjust individual pieces to accommodate setting sequence.
(In concrete or steel frame building, the veneer or facing material should be fully and continuously supported, at each floor level on shelf supports, of adequate strength and stiffness, rigidly connected to the structural frame, steel shelf angles or supports, in all cases, should be located in mortar joints. The strength of the Terra Cotta should not be unnecessarily reduced by cutting the webs to receive the steel.)
 2. Adjust Terra Cotta to accommodate relieving angles, vents, weeps, expansion joints, etc.
 - a. Proper provision should be made for expansion joints, at shelf supports, over column cases, etc., to prevent the development of disruptive stresses cause by deflection, wind pressure, temperature changes, settlement and like forces.
 - b. Properly constructed flashing should be provided.
 - c. Reglets shall be provided to receive gutter linings and flashing when the joints cannot be used for the purpose. Reglets shall be not less than 3/4' deep, unless otherwise specified.
 - d. **The volume changes incident to the setting and hardening of concrete, and the variations in volume of concrete due to humidity and temperature conditions, require provisions to allow free movement of the supporting frame and make it undesirable to completely fill a facing applied to a concrete structure.**
- B. Install by anchored method as required by referenced standards and as described on approved shop drawings.
1. All anchors, hangers, bolts, clips, straps, rods and pins for securing Terra Cotta shall be of stainless steel or galvanized steel.
- C. Quality control:
1. Terra Cotta units shall conform to the physical requirements listed below as preformed in accordance with ASTM Specifications.
 - a. Compressive Strength – ASTM C67
 - b. Absorption (5hour boil) – ASTM C67
 - c. Saturation Coefficient – ASTM C67
 - d. Crazeing – ASTM C126
 2. Face Dimension Tolerances: The face dimensions (length and width) of sized/cut Terra Cotta units shall not vary more than 1/16 inch over or under the dimensions specified on the shop drawings.
Handmade Tolerance – Table II and III, C126: Exposed face shall not vary from shop drawing dimensions by more than 1/8 inch plus or minus per linear foot.
 3. Warpage Tolerances: The exposed face of hand made Terra Cotta shall not vary from a true plane more than the existing original material.
Warpage Tolerances – The exposed face of machine extruded ceramic veneer shall not vary from a true plane by more than 0.005 inch per inch of length.

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4. Finished faces that will be exposed when installed shall be free from chips, blisters or other imperfections detracting from the appearance of the finished wall when viewed from a normal viewing distance or of a minimum of 15 feet.

Terra Cotta Specifications

<u>Test Average (based on 10 Samples)</u>	<u>Method</u>	<u>Criteria</u>
Compressive Strength – 6000 psi	ASTM C67	ASTM C126
Absorption (5 hour boil) 11.5%	ASTM C67	
Absorption (24 hour soak) 7.5%	ASTM C67	
Saturation Coefficient - .69	ASTM C67	
Craze Resistance	ASTM C126	
Glaze absorption - .15%	ASTM C67	
Freeze/thaw resistance Cycles without degradation	ASTM C67	300

2.02 MORTAR AND GROUT MATERIALS

- A. Mortars shall comply with ASTM C270
- B. Grouts shall comply with ASTM C476
- C. Cementitious Materials:
 - Portland Cement: ASTM C150, Type I or II; low-alkali per ASTM C150, Table 2
 - Hydrated Lime: ASTM C207, Type S
- D. Aggregates:
 - 1. Sand:
Clean, washed natural or manufactured silica sand graded according to ASTM C144, shall contain no more than 50 parts per million of chloride ions, and shall be free of organic contaminants.
 - 2. Coarse Aggregates:
ASTM C404 with a maximum size of 3/8" diameter. Aggregate shall contain no more than 50 parts per million of chloride ions and shall be free of organic contaminants.
- E. Water:
Potable, clean and free from injurious amount of oil, alkali, organic matter or other deleterious material.

2.03 FABRICATION

- A. Walls shall not be less than one inch thick and partitions shall be of such thickness and so spaced as to perform their proper functions with regard to form and structure. Necessary anchor holes and hand holds shall be provided in accordance with shop drawings so formed as to properly engage the structure. Beds generally shall be not less than 4 inches deep.
- B. All joints shall be straight and true. All Terra Cotta shall be laid out at the factor to check for uniformity of joint widths and over-all dimensions. Where necessary to secure accurate dimensions and uniform joint widths, the material shall be sized straight and true.

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PART 3 EXECUTION

3.01 PREPARATION BY INSTALLER

- A. Establish lines, levels, and coursing. Protect from disturbance.
- B. Clean new unit prior to setting, leaving edges and surfaces free of dirt or foreign material. Do not use wire brushes or implements that mark or damage exposed surfaces.
 - 1. Soak units in a vat or box of clean water for one hour or more just prior to installation. Units shall be noticeably damp at the time of setting. Units shall be drained sufficiently to eliminate surface water.
 - 2. At the beginning of setting each day, soak all walls to be faced with clean water applied by a hose and spray nozzle. Soak again with water not more than one hour before setting of unit.

3.02 INSTALLATION: GENERAL

- 1. In connection with Structural Steel:
Beams, channels, angles, T's, plates and fabricated members for supporting Terra Cotta and which are not secured to the structural steel by fixed connections, as shown on the architect's drawings, together with all anchors, hangers, bolts, clips, straps, rods and pins for securing Terra Cotta, shall be furnished and installed by the Terra Cotta Installation Contractor.
- 2. In Connections with Structural Concrete:
The contractor for structural concrete shall furnish and install all supporting metal work imbedded in the concrete and all shelf angles and continuous supports. All such metal work shall conform to the requirements of the Terra Cotta structural support drawing and setting drawing prepared by the Terra Cotta manufacturer.
- 3. All other loose anchors, such as clamps, hangers, clips, straps, and pins shall be furnished and installed by the Terra Cotta Installation Contractor.
- 4. Proper care should be exercised to prevent the corrosion of all steel supports, ties, etc. Where such protection cannot be permanently secured through encasement with mortar or concrete, or through the use of corrosion resistant metallic coating, non-corrosive metals should be employed.
- 5. Exposed free-standing construction, subject to the absorption of water through mortar joints and liable to injury from subsequent freezing, or the expansion of improper filling material, should generally be left unfilled and should be ventilated by means of small, inconspicuously placed weep-holes indicated by W.H. on the shop drawings.
- 6. Maintain uniform joint widths to match existing.
- 7. Erection Tolerances:
 - a. Variation from Plumb: In accordance with ACI 530.1 current edition.
 - b. Variation from Level: In accordance with ACI 530.1 current edition
 - c. Variation from True Plane: In accordance with ACI 530.1 current edition

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3.03 MIXING, MORTAR AND GROUT

- A. Mix and proportion cementitious materials for site-made setting beds and grout:
1. Setting Mortar:
Use Type N mortar; in accordance with ASTM C270 with the following material mix proportion by volume:
Portland Cement: 1 part
Hydrated Lime: 1 part
Sand: 6 parts
 - a. Color of mortar shall match building's existing cleaned mortar.
 - b. Use colored sand to obtain desired mortar color.
 2. Pointing Mortar:
Use setting mortar for new construction. If new construction is adjacent to existing, match color of mortar. If new Terra Cotta is to replace existing, refer to Section 04150 Terra Cotta Repair.

Mortar for Terra Cotta Pointing

TYPE N: (Harder compression strength) **TYPE O: (Softer compression strength)**

Portland Cement: 1 part	Portland Cement: 1 part
Hydrated Lime: 1 part	Hydrated Lime: 2 part
Sand: 6 parts	Sand: 9 parts

Color of mortar shall match building's existing cleaned mortar.

Use colored sand to obtain desired mortar color.

3.04 SETTING FOR TERRA COTTA NON-CAVITY WALL

- A. Just prior to commencement of setting, brush a coat of neat Portland Cement and water onto a limited area of the wall and the entire back of the piece of soaked Terra Cotta unit to be set.
- B. Immediately thereafter spread half of the setting mortar coat on a limited area of the wall and the other half over the back of the Terra Cotta unit.
- C. Screed the setting mortar trowled on the back of Terra Cotta unit to a uniform thickness as measured from the face of the Terra Cotta. Screed the other half of the setting mortar applied to the wall surface to a true and plumb level.
- D. The total thickness of the setting mortar coat shall average $\frac{3}{4}$ inch, but use sufficient mortar to create a slight excess, which will be forced out at the joints at the edge of the unit when tapped into place.
- E. Firmly place the unit against the wall by repeated tapping with a rubber mallet to eliminate all voids in the setting bed.
- F. Completely fill all voids and joints with appropriate mortar grout and make watertight. Rake out the face joints of each unit $\frac{1}{2}$ inch to allow for pointing.
- G. Anchorage and reinforcement shall be located in bed joints and/or interior webs as indicated on approved shop drawings. Clean and degrease anchors prior to setting in epoxied holes. Follow manufacturer's instructions for proper cure of epoxy prior to setting.

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- H. Remove any Terra Cotta unit tipped away from the wall for readjustment or improperly set for any reason. Remove and clean away all mortar from units and wall surface, and reset in accordance with the above procedure.
- I. Support each Terra Cotta unit, in addition to the usual centers and Teflon or plastic wedges, with suitable bent vertical wooden shores exerting a constant upward pressure until the mortar coat is set for several days.
- J. After setting, but prior to pointing, clean all exposed surfaces with natural fiber brushes, non-ionic mild soap powder or detergent, and clean water.

3.05 POINT JOINTS

- A. Pointing
 1. Refer to ACI 530.1 current edition for Hot and Cold Weather Construction.
 2. Wet joint thoroughly and repeatedly prior to pointing and between pointing lifts. Allow water to soak in so that no freestanding water is visible.
 3. Point in two lifts: pack joints to within 3/8 inch of surface on first lift, allow first lift to set prior to pointing second lift.
 4. As soon as mortar has taken its initial set, tool joint surfaces to be slightly concave, or to match existing sound mortar joint surfaces. Do not allow mortar to extend over edges of Terra Cotta units.
 - a. After initial 24 hour set, moisten until cured. Allow mortar to cure completely prior to cleaning operations, minimum 30 days.
 - b. Clean up after pointing operations are complete. Remove mortar stains, excess mortar, etc., from all surrounding surfaces. Do not use acids; rinse thoroughly after clean up operations.

All joints in overhanging Terra Cotta, balustrades, parapets and free standing features shall have joints raked out 1/2 inch, backer rod, sealant and lead "T" installed.
- B. Re-pointing – See Section 04150.303.B – Terra Cotta Repair
 1. General:

Do not re-point in temperatures over 90° F. or under 40° F. Provide cover so that re-pointing may be accomplished without direct sunlight on the joints for up to eight (8) hours after re-pointing.
 2. Clean up after re-pointing operations are complete. Remove mortar stains, excess mortar, etc., from all surrounding surfaces. Do not use acids; rinse thoroughly after clean-up operations.

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3.06 CUTTING AND FITTING

- A. Obtain Architect/Engineer concurrence prior to job site cutting and fitting any item not indicated on drawing. Cutting and fitting of the Terra Cotta that may be required at the building, including all fitting around anchors, steel and ironwork and reinforced concrete, shall be done by the contractor for setting Terra Cotta. Do not impair appearance or strength of Terra Cotta.
- B. All necessary face cutting of Terra Cotta at the job site shall be done with a saw using a water-cooled diamond blade. Face cutting shall not disturb the glaze.

3.07 CLEANING

- A. Remove excess mortar from all surrounding surfaces upon completion of setting to prevent stains.
- B. Clean area of work as specified.

3.08 PROTECTION

- A. Protect and do not damage existing adjacent work to remain.
- B. Protect new work from damage or staining due to construction operations.
 - 1. All uncompleted walls including Terra Cotta and backing shall be protected by waterproof covering at night and at any time when liable to injury from storms or freezing.
- C. On completion of construction, remove all temporary protection.

3.09 ACCEPTANCE

- A. The completed installation shall have the acceptance of the Architect/Engineer /Owner. Remove and replace units that are chipped, cracked, or otherwise damaged which do not conform to the Specification Requirements.

3.10 CLEAN-UP

- A. Upon completion of Terra Cotta replacement operations, remove tools, equipment, and other unnecessary materials from site. Return adjacent area to the clean condition, which existed prior to the start of work.
- B. Remove and legally dispose off-site all debris, rubbish, and other materials resulting from Terra Cotta installation.