

SECTION 034500 – ARCHITECTURAL PRECAST CONCRETE

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Related Drawings

All drawings to include supplemental drawings, instructions and conditions of this Contract.

B. Related Specifications

- 1.) Division 01 “General Requirements” for specific contract practices and procedures.
- 2.) Division 03 “Cast in Place Concrete” for coordination and installation of connection anchors.
- 3.) Division 04 “Unit Masonry” for coordination and installation of connection anchors.
- 4.) Division 05 “Structural Steel” for coordination and installation of connection anchors.
- 5.) Division 07 “Joint Sealants” for coordination of joint locations and conditions.

1.2 SUMMARY

A. Scope

Include all labor, materials, design, supervision, tools and equipment required for the fabrication, delivery and installation of the Architectural Precast Concrete as shown and as specified, in accordance with the Contract Documents.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance

Provide Architectural Precast concrete units and connections capable of withstanding the design loads outlined by IBC and specific loads shown on the contract documents, within the limits and under all conditions indicated therein.

1.4 SUBMITTALS

A. Samples

Provide preliminary samples to match Architects control sample, a minimum in size of 3”x 3”x 1” for basic color and texture. Once selected, provide 3 - 12”x 12” x 1 ½” samples (minimum size for approval), representing selected color and finish texture for final approval.

B. Shop Drawings

1.) Detail fabrication and installation shop drawings for the Architectural Precast Concrete units, utilizing elevations, plan views and cross-sections of each Architectural Precast Concrete unit, indicating its location, dimensions, shapes, and the relationship of each unit type to the adjacent materials. Indicate joints, drips, chamfers, rustications or reveals, and the extent and location for each surface finish. Identify the separate face and backup mixture locations and thickness. Indicate locations, tolerances, and details of anchorage devices in or attached to structure or other construction. Utilize AWS standard symbols to show size, length, and type of each weld at all welded connections. Coordinate, locate and detail openings or inserts required by other trades.

2.) Provide comprehensive engineering design calculations, signed and sealed by qualified professional engineer responsible for its preparation, licensed in the state in which the project

is located. Show governing panel types, connections, concrete cover and reinforcement types, including special reinforcement. Indicate location, type, magnitude, and direction of loads imposed on the building structural frame by the Architectural Precast Concrete, within these calculations.

C. Product Data / Material Certificates

- 1.) Qualification data for fabricator
- 2.) Form Materials
- 3.) Mold release agent
- 4.) For each Mix design provide
 - a.) Cementitious materials
 - b.) Aggregates both coarse and fine
 - c.) Admixtures both for water reducer and air entrainment
 - d.) Coloring
 - e.) History for similar mix designs proving compressive strength and water absorption.
- 5.) For each type of reinforcing
- 6.) Structural connection steel shapes
- 7.) Bearing Pads
- 8.) MSDS
- 9.) Welding Certificates

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications

A fabricator having been regularly and continuously engaged in the manufacture of Architectural Precast Concrete units, similar to those required on the contract drawings, for a minimum of 5 years. Has sufficient production capacity to produce required units without delaying the work. Fabricator will assume responsibility for engineering Architectural Precast Concrete units to comply with performance requirements. This responsibility includes preparation of shop drawings and comprehensive engineering analysis by a qualified professional engineer. Fabricator will perform quality control inspections during manufacturing and finishing to ensure testing requirements, along with dimensional tolerances for all units compliant with contract documents.

B. Design Standards

Comply with ACI 318 and the design recommendations of PCI MNL 120, as they are applicable to the different types of units shown.

C. Quality Control Standard

The standard for manufacturing procedures, testing requirements, quality control recommendations and dimensional tolerances for the types of units required will comply with PCI MNL 117.

D. Testing Agency Qualifications

An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

E. Mock-up

After sample approval and before production, as indicated or directed by Architect, produce 2 actual units for review, one to remain at the project site and the other to be maintained by the fabricator for control. These units will demonstrate aesthetic effects, verify sample selections

made under sample submittals and be used to review quality standards for the balance of production. Upon substantial completion of production these mock up pieces can then be incorporated into completed project.

F. Installer Qualifications

Erector shall be an experienced installer, who has completed Architectural Precast Concrete installation for a period of 5 years, similar in material, design and to the extent indicated for this project. Erector shall provide a verifiable list of successfully completed projects. Erector at his expense shall contract an independent, certified weld inspector, acceptable to authorities having jurisdiction, to inspect all completed work and report conformance to contract documents.

F. Welding Standard

Qualify procedures and personnel according to AWS D1.1, AWS D1.4

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery

Deliver Architectural Precast Concrete units in such quantities and at such times to ensure compliance with the agreed upon project schedule and setting sequence as to limit double handling. Provide support for units during shipment on non-staining material.

B. Storage

Insure all stored units at fabrication facility have identification marks which are clearly visible and adequate blocking or bracing to prevent contact with soil, prevent staining, prevent cracking, distortion, warping, or other physical damage.

D. Handling

Lift and support units only at designated points, handling and transporting units to avoid excessive stresses which could cause cracking or damage.

1.7 SEQUENCING

A. Furnish connection hardware and any anchors to be embedded in or attached to the structure without delaying the work.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Acceptable fabricators of Architectural Precast Concrete are still subject to compliance with all project requirements. Provide products by one of the following:

- 1.) Artisan Stone Company, Inc. – Omaha Ne.
- 2.) .
- 3.) .
- 4.)

2.2 FORM MATERIALS

- A.** Build forms of wood, steel, fiberglass, rubber, plastic, plaster or concrete. Forms must be stable, constructed of or coated with a non-absorptive material, which will allow continuous and true precast concrete surfaces. Form finish should not react with concrete and be suitable for producing required finishes without lines or blemishes.
 - 1.) Form release agent should be a commercially produced product that will not bond with, stain, or affect the curing process of precast concrete surfaces. Ensure release agent will become inert and not impair subsequent surface or joint treatments of precast concrete.

2.3 REINFORCING MATERIALS

- A.** Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed
- B.** Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed
- C.** Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, fabricated steel wire into flat sheets.
- D.** Support, suspend hold or tie reinforcement in place according to PCI MNL 117. Use wire ties, plastic chairs, clips or other devices for spacing, supporting, and fastening reinforcing and welded wire reinforcement in its proper place.

2.4 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type I or III

- 1.) For the exposed finish use gray or white portland cement to simulate Architects control sample. Utilize the same type, brand, and mill source of each type, throughout the completion of the Architectural Precast Concrete production.
- 2.) Standard gray portland cement may be used for any non-exposed finish.

B. Cement Supplements

- 1.) Fly Ash: ASTM C 618, Class C or F.
- 2.) Metakaolin: ASTM C 618, Class N.
- 3.) Silica Fume: ASTM C 1240.
- 4.) Ground Granulated Blast Furnace Slag: ASTM C 989, Grade 100 or 120.

C. Normal weight Aggregates

ASTM C 33, Provide a hard and durable coarse aggregate material from a single source (pit or quarry). Select fine aggregates, generally a natural sand or manufactured sand from a single source (pit or quarry). Ensure all selected aggregate is free of material that reacts with cement or causes staining; along with the compatibility of the coarse and fine aggregate to match Architects required finish types and meet required design strength.

E. Water

Potable, free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

F. Admixtures

- 1.) All chemical admixtures to be certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.
- 2.) Coloring; ASTM C 979, synthetic or natural mineral-oxide pigments, temperature stable, and non-fading.
- 3.) Air-Entraining, ASTM C 260
- 4.) Water-Reducing, ASTM C 494/C 494M, Type A.
- 5.) High-Range, Water-Reducing, ASTM C 494/C 494M, Type F.
- 6.) Super Plasticizer for Flowable Concrete: ASTM C 1017/C 1017M.

2.5 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A 36/A 36M.
- B. Carbon-Steel Headed Studs: ASTM A 108, Grades 1010 through 1020, cold finished, AWS D1.1/ D1.1 M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 117, Table 3.2.3.
- C. Carbon-Steel Plate: ASTM A 283/A 283M, Grade C.
- D. Malleable Iron Castings: ASTM A 47/A 47M, Grade 32510 or 35028.
- E. Carbon-Steel Castings: ASTM A 27/A 27M, Grade 60-30 (Grade 415-205).
- F. High-Strength, Low-Alloy Structural Steel: ASTM A 572/A 572M.
- G. Carbon-Steel Structural Tubing: ASTM A 500/A 500M, Grade B or C.
- H. Wrought Carbon-Steel Bars: ASTM A 675/A 675M, Grade 65 (Grade 450).
- I. Deformed-Steel Wire or Bar Anchors: ASTM A 496/A 496 M or ASTM A 706/A 706M.
- J. Carbon-Steel Bolts and Studs: ASTM A 307, Grade A or C (ASTM F 568M, Property Class 4.6) carbon-steel, hex-head bolts and studs; carbon-steel nuts (ASTM A 563/A 563M, Grade A); and flat, unhardened steel washers, ASTM F 844.
- K. High-Strength Bolts and Nuts: ASTM A 193/A 198M, Grade B5 or B7, ASTM A 325/A 325M, or ASTM A 490/A 490M, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts, (ASTM A 563/A 563M) and hardened carbon-steel washers (ASTM F 436/F 436M).
- L. Shop-Primed Finish: Prepare surfaces of steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3 and shop-apply rust-inhibitive primer according to SSPC-PA 1.
 - 1.) Apply rust-inhibitive primer repairs to all field welds on primed connection materials. Comply with manufacturer's requirements for surface preparation.

M. Hot dipped galvanized or Zinc-Coated Finish: For steel items exposed to the weather or soil or items specifically indicated for galvanizing, apply zinc coating by hot-dip process according to ASTM A 123/A 123M, after fabrication, ASTM A 153/A 153M, or ASTM F 2329 as applicable.

1.) For steel shapes, plates, and tubing to be galvanized, limit silicon content of steel to less than 0.03 percent or to between 0.15 and 0.25 percent or limit sum of silicon content and 2.5 times phosphorous content to 0.09 percent.

2.) Apply galvanizing repair paint at all welds, Zinc paint with dry film containing not less than 94 percent zinc dust by weight, and complying with DOD-P-21035B or SSPC-Paint 20. Comply with manufacturer's requirements for surface preparation.

2.6 ACCESSORIES

A. Bearing Pads

Provide one of the following bearing pads for architectural precast concrete units as recommended by precast concrete fabricator for application:

1.) **Elastomeric Pads:** AASHTO M 251, plain, vulcanized, 100 percent polychloroprene (neoprene) elastomer, molded to size or cut from a molded sheet, 50 to 70 Shore A durometer according to ASTM D 2240, minimum tensile strength 2250 psi (15.5 MPa) per ASTM D 412.

2.) **Random-Oriented, Fiber-Reinforced Elastomeric Pads:** Preformed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer according to ASTM D 2240. Capable of supporting a compressive stress of 3000 psi (20.7 MPa) with no cracking, splitting, or delaminating in the internal portions of the pad. Test one specimen for each 200 pads used in Project.

3.) **Cotton-Duck-Fabric-Reinforced Elastomeric Pads:** Preformed, horizontally layered cotton-duck fabric bonded to an elastomer. Surface hardness of 80 to 100 Shore A durometer according to ASTM D 2240. Conforming to Division II, Section 18.10.2 of AASHTO LRFD Bridge Design Specifications, or Military Specification, MIL-C-882E.

4.) **Frictionless Pads:** Tetrafluoroethylene (Teflon), glass-fiber reinforced, bonded to stainless or mild-steel plates, or random-oriented, fiber-reinforced elastomeric pads, of type required for in-service stress.

5.) **High-Density Plastic:** Multimonomer, nonleaching, plastic strip capable of supporting loads with no visible overall expansion.

B. Welding Electrodes: Comply with AWS standards for steel type and/or alloy being welded.

2.7 GROUT MATERIALS

A. Sand-Cement Grout

Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144 or ASTM C 404. Mix at ratio of 1 part cement to 2^{1/2} to 3 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Nonshrink Grout

Premixed, prepackaged non-ferrous aggregate, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing admixtures, complying with ASTM C 1107, Grade A for drypack and Grades B and

C for flowable grout and of consistency suitable for application within a 30-minute working time.

C. Epoxy-Resin Grout

Two-component, mineral-filled epoxy-resin: ASTM C 881/C 881M of type, grade, and class to suit requirements.

PART 3 – MANUFACTURING

3.1 MOLDS

- A.** Build molds mortar tight, of sufficient strength to withstand pressures due to concrete placement and vibration operations, true to dimension and within fabrication tolerances indicated. Accurately place drips, chamfers, rustications or reveals, block-outs and edge treatments. Coat contact surfaces of molds with release agent before reinforcement is placed.

3.2 FABRICATION

A. Panel Anchors

Cast-in anchors, inserts, plates, angles, and other anchorage hardware, fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware and secure in place during casting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

- 1.) Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4.

B. Structure Anchors

Furnish cast in structure and loose items including steel plates, clip angles, seat angles, anchors, dowels, hangers, and other shapes for securing architectural precast concrete units, to their respective installer.

C. Other Trades

Coordinate and cast in reglets, slots, holes or other accessories required by other trades, in Architectural Precast Concrete units as indicated on Contract Drawings.

D. Reinforcement

Reinforce architectural precast concrete units to resist handling, transportation and erection stresses along with specified in-place loads. Reinforcement to comply with recommendations of PCI MNL 117 for fabrication, placing, and supporting reinforcement.

- 1.) Ensure reinforcement is clean free of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
- 2.) Accurately position, support, and securely tie bars and bar supports to hold reinforcement against displacement during concrete placement and consolidation operations. Direct wire tie ends away from finished, exposed concrete surfaces. Completely conceal plastic tipped or corrosion resistant metal or plastic chair support devices to prevent exposure on finished surfaces.

- 3.) Place reinforcing steel to maintain an absolute minimum of at least 3/4 in. (19 mm) concrete cover. Increase cover requirements for reinforcing steel to 1 1/2 in. (38 mm) when units are exposed to corrosive environment or severe exposure conditions.
- 4.) Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh spacing and wire tie laps, where required by design. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.3 CONCRETE MIXTURES

A. Mix Designs

Prepare normal weight concrete face and backup design mixtures by trial batch or field experience methods, to match Architect's sample for each type of precast concrete required. Limit the use of fly ash or ground granulated blast furnace slag to 20 percent replacement of portland cement by weight. Limit the use of metakaolin or silica fume to 10 percent of portland cement by weight. Proportion mixtures with materials to be used on project, to provide normal weight concrete with the following properties:

- 1.) Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.
- 2.) Maximum Water-Cementitious Materials Ratio: 0.42.
- 3.) Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642.

B. Admixtures

Add all admixtures per manufacturer's prescribed rate to result in concrete at point of placement having an air, slump and color dispersal conforming with the requirements of PCI MNL 117 along with the requirements of contract documents.

C. Mixing

Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

D. Placing

Place face mixture to a minimum thickness after consolidation of the greater of 1 in. (25 mm) or 1.5 times the nominal maximum aggregate size, but not less than the minimum reinforcing cover as indicated on Contract Drawings. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.

E. Vibration

Thoroughly consolidate placed concrete by internal and or external vibration without dislocating or damaging reinforcement and built-in items, to minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 117.

F. Weather

Comply with PCI MNL 117 procedures for hot- and cold-weather concrete placement.

G. Identification

Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on individual shop tickets. Imprint or permanently mark casting date on each Architectural Precast Concrete unit on a surface that will not show in finished structure.

H. Curing

Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by radiant heat and moisture. Cure units until the compressive strength is high enough to ensure that stripping does not have an effect on the performance or appearance of final product.

I. Repair

Repair damaged architectural precast concrete units to meet acceptability requirements in PCI MNL 117 and Architect's approval. Discard/reject any units which do not meet structural, manufacturing or appearance tolerances.

3.4 FABRICATION TOLERANCES

- A.** Fabricate Architectural Precast Concrete units straight and true to size and shaped with exposed finishes indicated, so each finished unit conforms to the tolerances set forth in PCI MNL 117, as well as position tolerances for cast-in items.

3.5 FINISHES

- A.** Exposed panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform and straight. Finish exposed-face surfaces of each unit to match approved sample and mockup, free of excessive air voids, sand streaks or honeycomb.
- B.** Finish unexposed finishes of units with a float finish.

3.6 QUALITY CONTROL

- A.** Quality-Control Testing: Test and inspect all units according to PCI MNL 117 requirements.
- B.** Strength of any unit will be considered deficient if unit fails to comply with ACI 318 (ACI 318M) concrete strength requirements.
- C.** If there is evidence that strength of any units may be deficient or may not comply with ACI 318 (ACI 318M) requirements, Architectural Precast Concrete fabricator will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete units to determine compressive strength according to ASTM C 42/C 42M and ACI 318/ACI 318M.
 - 1.)** A minimum of three representative cores will be taken from units of suspect strength, from locations directed by Architect.
 - 2.)** Cores will be tested in an air-dry condition.
 - 3.)** Strength of concrete for each series of three cores will be considered satisfactory if the average compressive strength is equal to at least 85 percent of the 28-day design compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.

- 4.) Test results will be reported in writing on the same day that tests are performed, with copies to Architect, contractor, and fabricator. Test reports will include the following:
- a. Project identification name and number.
 - b. Date when tests were performed.
 - c. Name of Architectural Precast Concrete fabricator.
 - d. Name of concrete testing agency.
 - e. Identification letter, name, and type of precast concrete unit(s) represented by core tests; design compressive strength; type of break; compressive strength at breaks, corrected for length-diameter ratio; and direction of applied load to core in relation to horizontal plane of concrete as placed.
- D. If all test core results are satisfactory and all units comply with project requirements, Architect / Owner or Contractor shall issue a change order to reimburse Architectural Precast Concrete fabricator for all additional tests and subsequent repairs.
- 1.) **Patching:** If core test results are satisfactory and all units comply with requirements, clean and dampen core holes and solidly fill with precast concrete mixture and finish to match adjacent precast concrete surfaces.
- E. **Acceptability:** Architectural Precast Concrete units that do not fall within acceptable requirements as outlined in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range will be rejected. Replace unacceptable units with Architectural Precast Concrete units that comply with the requirements. Chipped, spalled or cracked units may be repaired based on review and acceptance from the Architect.

Part 4 – EXECUTION

4.1 PREPARATION

- A. Contractor or respective sub-contractor will install any precast anchorage devices to be embedded in or attached to building foundation or structural frame required to attach Architectural Precast Concrete. Architectural Precast Concrete fabricator will provide locations, setting diagrams, templates and instructions for proper installation of each anchorage device.

4.2 EXAMINATION

- A. Erector will examine supporting structural frame and foundation conditions for compliance with requirements for installation tolerances, trueness and level of bearing surface tolerances, and other conditions affecting precast concrete installation or performance.
- B. Proceed with precast concrete installation only after unsatisfactory conditions have been corrected.
- C. Contractor shall notify precast concrete erector that supporting cast-in-place concrete foundation and building structural framing has attained minimum allowable design compressive strength or supporting steel or other structure is structurally ready to receive loads from precast concrete units prior to proceeding with installation.

- D. Contractor / Erector will provide a sequence list of the precast for setting direction from starting point to completion.

4.3 ERECTION

- A. Install Architectural Precast Concrete units to include all loose clips, hangers, bearing pads, and other accessories required for connecting these units to supporting members and backup materials.
- B. Contractor / structural steel fabricator will supply and install any special supports, braces or seat stiffeners required by contract documents.
- C. Erect Architectural Precast Concrete units level, plumb, and square within the specified allowable erection tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment of units until permanent connections are completed.
 - 1.) Install temporary steel or plastic spacing shims as precast concrete units are being erected. Surface weld steel shims to each other to prevent shims from separating.
 - 2.) Remove projecting lifting devices and use sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast concrete surfaces when recess is exposed.
 - 3.) Unless otherwise indicated, provide for uniform joint widths of 3/4 in. (19 mm).
- D. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop (Erection) Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and/or grouting are completed.
 - 1.) Disruption of roof flashing continuity by connections is not permitted; concealment within roof insulation is acceptable.
- E. **Welding:** Comply with applicable AWS D1.1/D1.1M, AWS D1.4/D1.4M and D1.6/D1.6M requirements for welding, welding electrodes, appearance of welds, quality of welds, and methods used in correcting welding work.
 - 1.) Protect Architectural Precast Concrete units and bearing pads from damage during field welding or cutting operations and provide noncombustible shields as required.
 - 2.) Welds not specified shall be continuous fillet welds, using not less than the minimum fillet as specified by AWS D 1.1/D 1.1M, D 1.4/D 1.4M or D1.6/D1.6M.
 - 3.) Clean weld- affected metal surfaces with chipping hammer followed by brushing or power tool cleaning and then repair damaged painted surfaces in accordance with paint manufacturer's recommendations.
 - 4.) For galvanized metal, clean weld-affected metal surfaces with chipping hammer followed by brushing or power tooling cleaning and then apply a minimum 0.004-in.-thick (4 mil) coat of galvanized repair paint to galvanized surfaces in conformance with ASTM A 780/A 780M.
 - 5.) Remove, grind out and re-weld or repair all defective welds, outlined to be corrected, by AWS-certified welding inspector.
- F. At bolted connections, use upset threads, thread locking compound or other approved means to prevent loosening of nuts after final adjustment.

- 1.) Where slotted connections are used, verify bolt position and tightness at installation. For sliding connections, properly secure bolt but allow bolt to move within connection slot.
 - 2.) For slip critical connections, one of the following methods shall be used to assure proper bolt pretension:
 - a. Turn-of-Nut – in accordance with AISC.
 - b. Calibrated Wrench – in accordance with AISC.
 - c. Twist-off Tension Control Bolt – meeting ASTM F 1852.
 - d. Direct-Tension Control Bolt – meeting ASTM F 1852.
 - 3.) For slip critical connections, the method to be used and the inspection procedure to be used shall be approved by the Architect and coordinated with the inspection agency.
- G. Grouting or Dry-Packing Connections and Joints:** Indicate joints to be grouted and any critical grouting sequences on Shop (Erection) Drawings. Grout connections where required or indicated on Shop (Erection) Drawings. Retain flowable grout in place until it gains sufficient strength to support itself. Alternatively pack spaces with stiff dry pack grout material, tamping until voids are completely filled. Place grout and finish smooth, level, and plumb with adjacent concrete surfaces. Promptly remove grout material from exposed surfaces before it affects finishes or hardens. Keep grouted joints damp for at least 24 hours after initial set.

4.4 ERECTION TOLERANCES

- A.** Erect Architectural Precast Concrete units level, plumb, square, and in alignment without exceeding the non-cumulative erection tolerances of PCI MNL 117, Appendix I.

4.5 FIELD QUALITY CONTROL

- A.** Erectors AWS-certified weld inspector will visually inspect all welds critical to precast concrete connections. Provide inspection reports to ensure all welds are properly completed and checked along with any corrections for remedial work.
- B. Testing:** Owner will engage accredited independent testing and inspecting agency to perform field tests and inspections and prepare reports.
- 1.) Field welds will be subject to visual inspections and dye penetrant or magnetic particle testing in accordance with ASTM E165 or ASTM E 1444 and ASTM E 709. Testing agency shall be qualified in accordance with ASTM E543.
 - 2.) Testing agency will report test results promptly and in writing to Contractor and Architect.
- C.** Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements. Additional testing and inspecting, at Erector's expense, will be performed to determine compliance of corrected work with specified requirements.

4.5 REPAIRS

- A.** Repairs will be permitted provided structural adequacy of units and appearance are not impaired. Repair damaged units to meet acceptability requirements of PCI MNL 117 and the Architects review.

- B.** Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet (6 m).
- C.** Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780/A 780M.
- D.** Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- E.** Remove and replace damaged Architectural Precast Concrete units when repairs do not comply with specified requirements.

4.6 CLEANING

- A.** Clean all surfaces of Architectural Precast Concrete to be exposed to view, as necessary, prior to shipping.
- B.** Contractor / respective sub-contractor will clean mortar, plaster, fireproofing, weld slag, and any other deleterious material from concrete surfaces and adjacent materials immediately.
- C.** Contractor / cleaning contractor will clean exposed surfaces of Architectural Precast Concrete units after erection and completion of joint treatment to remove weld marks, dirt, stains and other markings from construction. Perform cleaning procedures according to Architectural Precast Concrete fabricator's recommendations. Protect adjacent work from staining or damage due to cleaning operations. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034500