

SECTION 13207 - PRECAST CONCRETE POTABLE WATER STORAGE TANKS

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes one (1) precast concrete tank suitable for the storage of potable water.
- B. Related Sections include but are not limited to the following:
 - 1. Division 1 – General Requirements
 - 2. Division 2 – Site Work
 - 3. Division 3 - Concrete
 - 4. Division 5 - Metals
 - 5. Division 7 – Thermal and Moisture Protection
 - 6. Division 8 – Doors and Windows
 - 7. Division 9 - Finishes
 - 8. Division 13 – Special Construction
 - 9. Division 15 – Mechanical
 - 10. Division 16 – Electrical
 - 11. Geotechnical Report

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide precast structural concrete units and connections capable of withstanding the following design loads within limits and under conditions indicated:
 - 1. Dead Loads: As required.
 - 2. Live Loads: 10,000 pound axle load plus 30 psf snow load.
 - 3. Hydrostatic Loads: Internal pressures resulting from any combination of full or empty compartments.
 - 4. Earth Loads: In accordance with the Geotechnical Evaluation Report.
 - 5. Wall panels: 120 pcf granular backfill, two (2) foot surcharge with coefficient of earth pressure at rest equal 0.50.
- B. Process Performance: Provide a precast concrete potable water storage tank to include the following:
 - 1. Form, function and volume shall be as shown in the Contract Documents.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixes: For each concrete mix.
- C. Shop Drawings: Detail fabrication and installation of precast structural concrete units. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, openings, and types of reinforcement, including special reinforcement.
 - 1. Indicate locations and details of anchorage devices to be embedded in other construction.
- D. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:
 - 1. Concrete materials.
 - 2. Reinforcing materials.
 - 3. Admixtures.
 - 4. Bearing pads.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed at least ten (10) precast structural concrete units similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Fabricator Qualifications: A firm that complies with the following requirements and is experienced in manufacturing precast structural concrete units similar to these indicated for this Project and with a record of successful in-service performance.
 - 1. Assumes responsibility for engineering precast structural concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
 - 2. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for

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installations of precast structural concrete that are similar to those indicated for this Project in material, design and extent.

- C. Testing Agency Qualifications: An independent testing agency acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.
- D. Design Standards: Comply with ACI 318-99.
- E. Quality-Control Standard: For manufacturing procedures and testing requirements, quality-control recommendations, and camber and dimensional tolerances for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products."
- F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver precast structural concrete units to Project site in such quantities and at such times to ensure continuity of installation.
- B. Lift and support units only at designated lifting and supporting points as shown on Shop Drawings.

1.7 SEQUENCING

- A. Furnish anchorage items to be embedded in other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2- PRODUCTS

2.1 MANUFACTURERS

- A. HTI, Inc., Phone 231-995-7630

2.2 MOLD MATERIALS

- A. Molds: Provide molds of metal, plastic, wood, or another material that is nonreactive with concrete and dimensionally stable to produce continuous and true precast concrete surfaces within fabrication tolerances and suitable for required finishes.

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2.3 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Steel Bar Mats: ASTM A 184/A 184M 615, Grade 60, deformed bars.
- C. Plain-Steel Wire: ASTM A 82, as drawn.
- D. Deformed-Steel Wire: ASTM A 496.
- E. Plain-Steel Welded Wire Fabric: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- F. Deformed-Steel Welded Wire Fabric: ASTM A 497, flat sheet.
- G. Supports: Manufacturer's bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place according to CRSI's "Manual of Standard Practice," PCI MNL 116, and as follows:
 - 1. For uncoated reinforcement, use CRSI Class 1 plastic-protected bar supports.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150 Type I or Type III, of same type, brand, and source.
- B. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C 33, with coarse aggregates complying with Class 5S.
- C. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PIC MNL 116.
- D. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
- E. Water-Reducing Admixture: ASTM C 494, Type A.
- F. Water-Reducing Admixture: ASTM C 494, Type B.
- G. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
- H. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.

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- I. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494, Type G.
- J. Plasticizing Admixture: ASTM C 1017.

2.5.1 JOINTS AND INTERIOR COATING

- A. Joint Materials
 - 1. Interior and Exterior Vertical Joint Covering Materials
 - a. Bituthane 3100 and Bituthane EM-3000 (or LM 3000) by WR Grace
 - b. Sikadur Combiflex by the Sika Corporation
 - c. CIM 1000 Trowel Grade by CIM Industries, Inc.
 - 2. Exterior and Horizontal Joint Materials. Provides manufacturer's standard chemical curing, fluid-applied, elastomeric sealants that comply with ASTM C 920 and other requirements shown on each Elastomeric Joint Sealant Data Sheet
 - a. Base Polymer Urethane
 - b. Type M or S
 - c. Grade NS
 - d. Class 25
 - e. Additional Movement Capability plus 35 percent, minus 50 percent
 - f. Uses Related to Exposure NT
 - g. Uses Related to Joint Substrate M
 - h. Subject to compliance with requirements, incorporated sealants used in this work may include, but are not limited to:
 - Vulkem 203; MAMECO International, Cleveland, OH
 - Sikaflex 2cNS; SIKA Corporation
 - Tremco THC900; Tremco Sealants
- B. Interior Tank Coating of Vertical Walls. Provide uniform coating of a polyurethane membrane approved for ANSI/NSF standard 61 Drinking Water System. Application shall be in accordance with manufacturer's recommendations. Application procedures shall be included with submittal data.
 - 1. Approved Manufacturers
 - a. CIM 1061; CIM Industries, Inc.

2.6 BEARING PADS

- A. Provide bearing pads for precast structural concrete units as follows:
 - 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, minimum tensile strength 2250 psi per ASTM D 412.

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2. Random-Oriented, Fiber-Reinforced Elastomeric Pads: Performed, randomly oriented synthetic fibers set in elastomer. Surface hardness of 70 to 90 Shore A durometer.
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.
4. High-Density Plastic: Multimer, nonleaching, plastic strip.

2.7 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C 150, Type 1, and clean, natural sand, ASTM C 144. Mix at ratio of 1 part cement to 1 1/2 parts sand, by volume, with minimum water required for placement and hydration.
- B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, Portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application.

2.8 CONCRETE MIXES

- A. Prepare design mixes for each type of concrete required.
 1. Limit use of fly ash to not exceed, in aggregate, 25 percent of Portland cement by weight.
- B. Design mixes may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318.
- D. Normal-Weight Concrete: Proportion mixes by either laboratory trial batch or field test date methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 1. Compressive Strength (28 Days): As required by the Manufacturer's design.
 2. Maximum Water-Cementitious Materials Ratio: 0.40.
 3. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows, with a tolerance of plus or minus 1/2 percent:
 - i. Air Content: 6-1/2 percent.

- E. Other Admixtures: Use water-reducing, high range water reducing, water-reducing and accelerating, or water-reducing and regarding admixtures according to manufacturer's written instructions.
- F. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.9 FABRICATION

- A. Formwork: Accurately construct forms, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes. Maintain formwork to provide completed precast concrete units of shapes, lines, and dimensions, indicated, within fabrication tolerances.
 - 1. Coat surfaces of forms with bond-breaking compound before reinforcement is placed. Provide commercial-formula, form-coating compounds that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces requiring bond or adhesion. Apply in compliance with manufacturer's written instructions.
- B. Built-in Anchorages: Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or concrete placement.
- C. Cast-in openings according to Shop Drawings.
- D. Reinforcement: Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
 - 1. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy the bond with concrete.
 - 2. Accurately position, support, and secure reinforcement against displacement by formwork, construction, or concrete-placement operations. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.
 - 3. Place reinforcement to obtain at least the minimum coverage for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position while placing concrete. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
 - 4. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire.

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Offset laps of adjoining widths to prevent continuous laps in either direction.

- E. Mix concrete according to PCI MNL 116 and requirements in this Section. After concrete batching, no additional water may be added.
- F. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units. Comply with requirements in PCI MNL 116 for measuring, mixing, transporting, and placing concrete.
- G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with PIC MNL 116.
- H. Comply with ACI 306.1 procedures for cold-weather concrete placement.
- I. Comply with ACI 305R recommendations for hot-weather concrete placement.
- J. Identify pickup points of precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings.
- K. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture.
- L. Product Tolerances: Fabricate precast structural concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished unit complies with PCI MNL 116 product tolerances.
- M. Finish formed surfaces of precast structural concrete as indicated for each type of unit, and as follows:
 - 1. Standards Finish: Normal plant-run finish produced in forms that impart a smooth finish to concrete. Small surface holes caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls will be tolerated. Major or unsightly imperfections, honeycombs, or structural defects are not permitted.
- N. Screed finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections.
 - 1. Apply scratch finish to precast concrete units that will receive concrete topping after installation. After initial strike off, transversely scarify surface to provide ridges approximately 1/4 inch deep.

2.10 STRUCTURAL FRAMING UNITS

- A. Type: Precast, structural concrete framing units.
- B. Furnish units free of voids and honeycombs.
- C. Provide standard finish to precast concrete units.
- D. Reinforce units to resist transportation and erection stresses.
- E. Include cast-in weld plates where required.
- F. Coordinate with other trades for installation of cast-in items.

2.11 SOURCE QUALITY CONTROL

- A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 116 requirements.
- B. Strength of precast concrete units will be considered deficient if units fail to comply with PCIC MNL 116 requirements, including the following:
 - 1. Units fail to comply with compressive-strength test requirements.
 - 2. Reinforcement of units do not comply with fabrication requirements.
 - 3. Concrete curing and protection of units against extremes in temperature fail to comply with requirements.
 - 4. Units are damaged during handling and erecting.
- C. Dimensional Tolerances: Units with dimensions smaller or larger than required and not complying with tolerance limits may be subject to additional testing.
 - 1. Precast concrete units with dimensions larger than required will be rejected if the appearance or function of the structure is adversely affected or if larger dimensions interfere with other construction. Repair or remove and replace rejected units, as required, to comply with construction conditions.
- D. Defective Work: Precast concrete units that do not comply with requirements, including strength, manufacturing tolerances, and finishes, are unacceptable. Replace with precast concrete units that comply with requirements.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Bearing Pads: Install bearing pads as precast concrete units are being erected. Set pads on true, level, and uniform bearing surfaces and maintain in correct position until precast concrete units are placed.
- B. Install precast structural concrete. Shore and brace precast concrete units to maintain location, stability, and alignment until permanent connections are installed.
- C. Welding: Perform welding in compliance with AWS D1.1 and AWS D1.4, with qualified welders.
 - 1. Protect precast concrete units and bearing pads from damage by field welding or cutting operations and provide noncombustible shields as required.
- D. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.
- E. Erection Tolerances: Install precast concrete unit level, plumb, square, and true, without exceeding the recommended erection tolerances in PCI MNL 127, “Recommended Practice for Erection of Precast Concrete.”
- F. Grouting Connections and Joints: After precast concrete units have been placed and secured, grout open spaces at keyways, connections, and joints as follows:
 - 1. Provide forms or other approved method to retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

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3.3 FIELD QUALITY CONTROL

- A. Remove and replace work that does not comply with specified requirements.
- B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.4 WATER LEAKAGE TESTING

- A. Test each cell of tank independently prior to backfilling of tank.
- B. Clean with water all interior surfaces of tank, and drain. Owner will provide water for initial filling.
- C. Completely fill tank with water and allow to stand for a period of not less than 24 hours.
- D. Measure drop in liquid level after 24hours.
- E. No allowable drop in water level for a 24-hour period shall occur in each of the compartments tested.
- F. If leakage exceed maximum allowable, refill and retest tank.
- G. Repair all leaks.
- H. Contractor will pay for all water used for retesting.

END OF SECTION