

SECTION 331613 – POTABLE WATER STORAGE TANK, BOLTED STEEL CONSTRUCTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This section includes furnishing and erecting the bolted steel reservoir and necessary piping and appurtenances, per AWWA D103-19 specifications, (latest revision).

1.03 BUY AMERICAN REQUIREMENTS

- A. Provide certificates to show that all products meet the following requirements.
 - 1. American Iron and Steel (AIS)
 - 2. Build America, Buy America
- B. See Supplementary Conditions for details.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.05 DEFINITIONS

- A. Water Tank: Exterior standalone bolted steel potable water storage tank, prefabricated and assembled onsite.

1.06 INFORMATIONAL SUBMITTALS

- A. Qualifications of Tank Supplier:
 - 1. The Engineer's selection of a factory applied epoxy-coated bolt together tank is predicated on a thorough examination of design criteria, construction methods, and optimum coating for resistance to internal and external tank corrosion. Deviations from the specified design, construction or coating details will not be permitted.
 - 2. The bidder shall offer a new tank reservoir as supplied from a manufacturer specializing in the design, fabrication and erection of bolted water storage tanks.
 - 3. The tank shown on the contract drawings and specified herein shall be fabricated by CST Industries, One Clarion or approved equal.
 - 4. Tank design shall be stamped by a licensed engineer in the State of Alaska.
 - 5. The tank vendor's engineer is responsible for verifying that the provided foundation design is adequate to support the final tank loads and reactions. The contractor shall include in their budget an allowance for up to 15% additional concrete and reinforcing steel beyond the quantities shown in the drawings, to accommodate any modifications required based on the final tank reactions.
 - 6. Erection of the tank is to be by the tank manufacturer or approved contractor. The installer shall be fully responsible for the entire installation including tank erection, and

the ultimate water tightness of the complete installation. The tank manufacturer shall monitor and inspect work performed by the approved contractor.

7. Strict adherence to the standards of design, fabrication, erection, product, quality, and long-term performance, established in this Specification will be required by the Owner and Engineer.

B. Submittal Drawings and Specifications:

1. Construction shall be governed by the Owner's drawings and specifications showing general dimensions and construction details. Drawings shall include ~~insulation system and~~ penetration details. There shall be no deviation from the drawings and specifications, except upon written order from the Engineer.
2. The bidder is required to furnish, for the approval of the Engineer and at no increase in contract price, five (5) sets of complete specifications and construction drawings for all work not shown in complete detail on the bidding drawings. A complete set of structural calculations shall be provided for the tank structure. ~~The tank foundation will be designed and constructed by others.~~
3. When approved, two sets of such prints and submittal information will be returned to the bidder marked "APPROVED FOR CONSTRUCTION" and these drawings will then govern the work detailed thereon. The approval by the Engineer of the tank supplier's drawings shall be an approval relating only to their general conformity with the bidding drawings and specifications and shall not guarantee detail dimensions and quantities, which remains the bidder's responsibility.
3. ~~Cathodic protection plan to support 50 year life of tank~~

C. Coating schedule: Contractor shall submit a coating schedule describing application in accordance with AWWA D103 and this specification including the following information: minimum dry film thickness for each coat, application temperature, curing time and temperature, humidity limits, and a description of the finish coat.

1. The coating schedule shall include a description of the marking, protection and holiday testing in accordance with AWWA D103, and shall be approved, in writing, by the Engineer prior to application.
2. Schedule shall include dates of work. The Owner's Representative, at his/her discretion, may inspect the coated surfaces prior to packaging and shipping.
3. All coating work shall be performed in accordance with the approved schedule.

D. NSF 61 Certification for tank coating and all components in contact with potable water.

~~C.E.~~ Field Quality-Control Test Reports:

1. Hydrostatic pressure test results.
2. Disinfection and biological test results.

1.07 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: Operational instructions for water valves and meters to include in emergency, operation, and maintenance manuals.

1.08 QUALITY ASSURANCE

- A. Steel, piping, and appurtenance materials shall bear label, stamp, or other markings of specified testing agency.
- B. NSF/ANSI Compliance: Comply with NSF/ANSI 61 for materials for water piping for domestic water.
- C. AWWA Compliance: Comply with AWWA Standard D103-19.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare prefabricated steel tank components to preclude from damage incurred during transport.
- B. Protect stored steel framing, plate, and piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- C. Protect flanges, fittings, and specialties from moisture and dirt.

1.10 COORDINATION

- A. Coordinate tank construction laydown requirements and schedule with the General Contractor responsible for construction of the Pump house Site.

1.11 TANK CAPACITY AND ELEVATION

- A. Tank working capacity shall be 500,000 U.S. gallons (nominal). See drawings for operating points as well as nominal height and diameter.
- B. Freeboard space at the top of tank shall be 6.5 feet.

1.12 TANK DESIGN REQUIREMENTS

- A. Design Standards: The materials, design, fabrication and erection of the bolted tank shall conform to:
 - 1. AWWA Standard D103-19, (latest edition).
 - 2. ANSI/NSF Standard No. 61
- B. Tank Foundation: The tank vendor's engineer is responsible for verifying that the provided foundation design is adequate to support the final tank loads and reactions. The contractor shall include in their budget an allowance for up to 15% additional concrete and reinforcing steel beyond the quantities shown in the drawings, to accommodate any modifications required based on the final tank reactions.
 - 1. Tank floor shall slope up inwardly at 0.01 ft/ft (minimum).
- C. Reservoir shall be furnished with piping and appurtenances as shown on the plans and as follows:
 - 1. Inlet pipe.
 - 2. Overflow pipe.
 - 3. Outlet pipe.

4. Drain pipe.
5. 30-inch square, hinged, lockable roof hatch.
6. Two shell manholes with hinged covers.
7. Outside ladder with ladder gate and lock, without fall protection.
8. Screened roof vent.
9. Level indicator.
10. Identification nameplate.
11. Tank mixer.
12. Power appurtenances.
13. Communications appurtenances.

~~D.~~ ~~Cathodic Protection: Active system required to To be designed by tank manufacturer.~~

~~E.~~D. Corrosion Allowance: No corrosion allowance (additional plate thickness) is required on any plate steel.

~~F.~~E. Structural Requirements: All tank structural components to be designed per the requirements of AWWA D103-19 and API Spec 12B.

1. Seismic Design Criteria at Tank Site:

S_s	= 1.63
S_1	= 0.76
I_e	= 1.5
Site Class	= D
2. Roof Design Criteria:

Balanced roof snow load	= 188 pounds per square foot (PSF)
P_g	= 186
I_s	= 1.2
C_e	= 1.0
C_t	= 1.2
3. Wind Design Criteria:
 - a. Wind Speed = 161 mph, pressures to be the maximum of ASCE 07-16 and AWWA D103-19.
4. Foundation: Shallow frost-protected mat foundation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. All materials shall meet "Buy American" meeting Federal Acquisition Regulations (FAR).

2.02 TANK MATERIALS

- A. All tank materials shall be in accordance with all applicable standards of AWWA D103-19, Section 4.

2.03 VALVE APPLICATIONS

- A. Tank Application: Use flanged-end valves for all aboveground tank piping.

2.04 COATINGS

- A. The coating system for the tank shall be as specified in these specifications and on the construction Drawings. An inspector may be present during the coating process and may randomly test panels. Any deficiencies identified during the inspection shall be corrected at the manufacturer's expense.
- B. A thermally cured epoxy paint system shall be supplied. The protective paint system shall meet the following procedural and materials qualifications.
1. Preparation of Surfaces for Painting: All steel, including plates, members, and appurtenances, shall be blast cleaned in accordance with Steel Structure Painting Council - Surface Preparation Specification No. 10 (SSPC-SP10). The surface anchor pattern shall be not less than 1.0 mil or greater than 3.0 mils. No shaping, bending, punching, flanging, or grinding may be done on the steel after blast cleaning and before painting.
 2. Interior Painting: All interior steel surfaces, members, and parts shall be painted with a two-part, two-coat, thermally cured epoxy paint system in strict accordance with manufacturer's recommendations. The minimum recommended dry film thickness shall be 5 to 7 mils. The paint used must be acceptable to the Environmental Protection Agency (EPA) and certified that no health hazard is expected to occur when in contact with potable water. Finished interior paint color shall be white. The Contractor shall provide paint chips for color approval by the Owner.
 3. Exterior Painting: All exterior steel surfaces, members, and parts shall receive one (1) coat of thermally cured epoxy ester primer having maximum dry film thickness of 3 mils, and one (1) thermally cured acrylic finish coat. The finish dry film thickness shall be a minimum of 4 mils. Finished exterior paint color shall be selected by the owner from the manufacture standard color palette. The Contractor shall provide paint chips for color approval by the Owner.
 4. Application of Paint: The Contractor shall submit to the Owner, for their approval, the tank manufacturer's proposed painting schedule. At minimum, this shall include the spreading rate in square feet per gallon for each coat, minimum dry film thickness for each coat, application temperature, curing time and temperature, humidity limits, and paint and paint thinner to be used for the final coat. The painting schedule shall be in accordance with the paint manufacturer's recommendation, and shall be approved, in writing, by the Owner prior to application.
 5. If paint is diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. Deficiencies in film thickness shall be corrected by the application of an additional coat(s) of paint.
 6. Inspection and Testing: Inspection shall include a mil thickness test on both the interior and exterior surfaces of not less than 30% of the tank panels.

A. Interior Coating System:

1. All coatings that are in contact with potable water must be certified on the current approved list of the National Sanitation Foundation to meet ANSI/NSF Standard No. 61, as well as AWWA D103-19.
2. Coating system, including coating manufacturer brand name to be as specified in bid documents.

- ~~3. Interior coating process shall conform to AWWA D102-17 ICS-6 and shall include:~~
 - ~~a. Shop epoxy prime.~~
 - ~~b. Field spot epoxy prime.~~
 - ~~c. Apply epoxy finish.~~
- ~~B. Exterior Coating System:~~
 - ~~1. Exterior coating system, including coating manufacturer brand name, and average dry film thickness/mils (DFT) to be as specified in bid documents.~~
 - ~~2. All exposed edges will be coated with primer. Underside of floor will remain uncoated to be factory coated.~~
 - ~~3. Exterior coating process shall include:~~
 - ~~a. Shop epoxy prime.~~
 - ~~b. Field spot epoxy prime.~~
 - ~~c. Apply epoxy intermediate coating.~~
 - ~~d. Apply epoxy finish coat.~~

2.05 TANK FABRICATION

- A. All reservoir sub-assemblies and accessories, including shell manholes, ladders, and overflow pipes, shall be fabricated in accordance with AWWA D103-19, Sec. 7 Accessories for Tanks.
- B. All exterior ladders, guard rails, brackets, hatch covers, pins and fasteners shall be steel that is hot dipped galvanized per ASTM A123/153 after fabrication.
- C. Welded steel deck assembly per AWWA D103-19.
- D. Roof construction per AWWA D103-19.

2.06 APPURTENANCES

- A. Pipe Connections:
 - 1. Overflow piping shall be 6-inch nominal diameter Schedule 80 carbon steel coated externally.
 - 2. Inlet and outlet connections shall conform to the sizes and locations specified on the plan sheets.
 - 3. Provide and install all internal tank piping as flanged spool pieces that facilitate free passage through roof opening and assembly inside tank.
- B. Expansion Joint:
 - 1. Expansion joint shall provide 1-in lateral deflection and 0.06-in horizontal deflection, concurrently. Concurrent movement shall be verified with the manufacturer. Basis of design as specified on the drawings or an approved equal.
 - 2. Expansion joint shall be NSF 61 certified.
 - 3. Expansion joint shall be installed per manufacturer's specifications.
 - ~~3.4.~~ Expansion joint shall be rated for minimum of 140 PSIG and have 150 lb flanged ends in accordance with ANSI B16.42.

B.C. Insulation Blanket

- 1. Provide and install removable insulation blankets at all valves and expansion joints.

2. Provide and install removable insulation blanket covers for exterior drain and overflow piping.
3. Blankets shall be made with 4 inches of mineral-wool or fiberglass blanket insulation, sewn in grey siliconized fabric, with stainless steel lacing anchors, fabricated to be well-fitting and to close easily around equipment without air gaps or exposed surfaces. Use stainless steel tie wire for securing blankets.
 - a. Insulation shall be mineral-wool or fiberglass insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

~~C~~D. Outside Tank Ladders:

1. An outside tank ladder shall be furnished and installed as shown on the Drawings.
2. Safety cage and step-off platforms shall be fabricated of galvanized steel. Ladders shall be equipped with hinged lockable entry devices.

~~D~~E. Access Doors:

1. Two hinged manways shall be provided as shown on the contract drawings in accordance with AWWA D103-19.
2. The manhole opening shall be a minimum of 30 inches in diameter. The access door (shell manway) and the tank shell reinforcing shall comply with AWWA D103-19.

~~E~~F. Roof Vent:

1. A properly sized vent assembly in accordance with AWWA D103-19 shall be furnished and installed above the maximum water level of sufficient capacity as shown on the drawings.
2. The overflow pipe shall not be considered to be a tank vent.
3. Provide tank vent stick-up elevation from tank roof as shown on the Drawings.
4. The vent shall be so designed in construction as to prevent the entrance of birds and/or animals by including a 4 mesh (1/4-inch opening size) galvanized screen. If required by the contract drawings, a 16 mesh (1/16-inch opening size) galvanized screen will be installed to prevent the entrance of insects.

~~F~~G. Roof Hatch: The manufacturer shall furnish a roof opening which shall be placed in line between the outside tank ladder and tank vent and which shall be provided with a hinged cover and a hasp for locking. The opening shall have a clear dimension of at least 30 inches square. The opening shall have a curb, at least 4 inches high and the cover shall have a downward overlap of at least 2 inches.

1. Roof hatch shall be sized to allow tank mixer to freely pass through the opening.

~~G~~H. Roof Perimeter Guardrail: Perimeter guardrail and toe board around the perimeter of the deck shall be provided and installed as shown on the Drawings.

~~H~~I. Liquid Level Indicator: A liquid level indicator with stainless steel float, numbered board and high visibility target shall be provided and installed as detailed on the project drawings.

I.J. Identification Plate: Manufacturer's nameplate shall list the tank serial number, tank diameter and height, and maximum design capacity. The nameplate shall be affixed to the tank exterior sidewall location approximately 5 feet from the grade elevation.

~~1. Nameplate mounting steel shall allow 5 inches clear space from shell to accommodate insulation panels.~~

J.K. Electrical Appurtenances: Provide supporting struts and brackets, conduit entry boots, cable entry fittings, and other fittings, complete with corrosion resistant straps, fasteners and other hardware, as required, for supporting electrical equipment, and support and entry of electrical cable and conduit, as indicated in the plans.

1. All electrical materials and installations, installed in the tank interior, shall meet the applicable requirements of Articles 2.04 and 2.06 of this specification section.
2. Struts and brackets shall be components of a mounting system, with compatible conduit straps and other required attachments, of a common manufacturer, suitable for mounting electrical raceway and equipment.
3. Struts and brackets shall be mounted to the tank with welded studs, or with mounting flanges directly welded to the tank interior and exterior, prior to applying final interior coatings ~~and exterior insulation system.~~
4. Attach struts for support of conduit and cable, at specific locations and spacing, in accordance with Article 300 of the NEC.
5. Supporting struts mounted to the exterior of the tank, shall extend a minimum of one-foot outside of the tank ~~insulation system~~ to stand-off and support electrical raceway and exterior mounted equipment.
6. Apply coatings to supporting struts, brackets, conduit straps and other associated fittings and attachments, mounted in the tank interior, in accordance with applicable requirements of Article 2.04 of this specification section.
7. Provide a cord-grip fitting, at each cable entry into top of tank, with annulus of rubber grommet sized to match outside cable diameter.
8. Provide weathertight, weatherproof, flexible conduit entry boot fitting, for the entrance of each conduit entry through the top of the tank.
 - a. Body of entry boot fitting shall be a one-piece rubber extrusion, that includes sealing flange that mates to tank surface, and flexible boot that forms an annulus seal, or gland, around the conduit.
 - b. Entry boot shall be provided as a kit, complete with corrosion resistant metallic tank mating flange, clamp(s), and attachment hardware.
 - c. Entry boots shall be flexible, permitting angled conduit entries up to 15 degrees off of perpendicular centerline, in any direction, without leaking or subjecting the conduit or conduit seal to excessive stress.
 - d. Installed entry boot, with installed conduit, shall withstand a minimum of 6 feet of water head pressure, at maximum conduit entry angle, without leakage.

K.L. All ladder mounts, nozzles, and manway flanges shall be positioned to provide adequate distance from the shell to allow for stud removal and maintenance ~~without conflict with tank insulation system.~~

L.M. Personal Fall Arrest System: Provide and install a fixed ladder fall arrest anchor and self-retracting lifeline. CAI Safety Systems SRL Fall Arrest Anchor or approved equal.

M.N. Tank Mixer: Provide and install tank mixer where indicated in the Drawings per manufacturer's recommendations. Tank mixer shall be PAX PMW150 or approved equal.

2.07 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water piping to the Pump House. Install fittings and valves shown in drawings.
- C. Install pre-insulated pipe and fittings per manufacturer's specifications.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. All excavation, structural fill, and structural backfill in connection with foundation preparation and construction shall be completed by others according to the requirements of the drawings and of contract documents. A finished foundation will be provided for constructing the tank, in advance of the tank manufacturer's planned starting date.
- B. All trench excavation, pipe laying, and pipe bedding and backfill shall be done according to the requirements of the drawings and specifications.

3.02 CONCRETE

- A. All concrete work for the reservoir foundation shall be provided based on Specifications in Section 033000 – Cast-in-Place Concrete.

3.03 FIELD QUALITY CONTROL

- A. Tank fabricator shall field verify the foundation elevation and the tolerances of the in-place foundation. Any deviations shall be reported to the Engineer for correction before proceeding with any work. All tank piping must be in place prior to the commencement of tank erection.

3.04 TANK ERECTION

- A. The CONTRACTOR shall furnish all labor, tools, scaffolding, and other equipment necessary to properly erect the tank complete and ready for use.
- B. Erection shall be completed in compliance with Section 10 of AWWA D103-19 for bolted steel tanks.

3.05 COATING REPAIR

- A. Prior to placing water in the tank, a "holiday" inspection of the entire tank, corners included, will be provided and performed by the manufacturer in the presence of the owner.
- B. Touch-up coatings as required to restore materials to their original finish in strict compliance with the manufacturer's recommendations where needed and as directed to achieve 100% holiday-free surface

~~3.05~~ 3.06 FIELD QUALITY CONTROL TESTING

- A. After the erection of the reservoir is completed, it shall be tested for leaks. Any leaks that are disclosed in the shell bottom, roof, manhole, or piping shall be repaired.

- B. Inspection and testing shall be in accordance with Section 11 of AWWA D103-19, (latest revision).
- C. Make available all radiographs and other testing information to the Owner's Representative during construction.
- D. After completion of the work, the Contractor shall submit a written report and certification that all work has been inspected and tested and is in accordance with all applicable provisions of AWWA D103-19, (latest revision).
- E. All costs associated with testing shall be paid by the Contractor.
- F. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks ~~or field foam insulation~~ have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
 - 1. Hydrostatic Tests: Test pipe at not less than 150 psig for two hours.
 - 2. Prepare reports of testing activities and submit to Engineer of Record.

3.063.07 STANDARDS

- A. The tank structure shall be disinfected at the time of testing in accordance with AWWA Standard C652-02 "Disinfection of Water Storage Facilities" using chlorination method No. 2. Disinfection shall be performed by a competent water treatment contractor.

3.073.08 TANK MANUFACTURER'S WARRANTY

- A. The tank manufacturer shall include a warranty on tank materials and workmanship for a specified period. As a minimum, the warranty shall provide assurance against defects in material, coatings and workmanship for a period of one (1) year.
- B. Upon completion of the 1-year warranty period provide an inspection of the tank coating. The City's preference is for a submersible camera with a video that they can observe. Provide two copies of the video; one to the City and one to the RESPEC Engineers.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. Construction of the Potable Water Storage Tank and associated items by the Contractor shall include furnishing all necessary material, personnel, equipment, transportation, up to final grade, and supplies to perform the work as shown and specified.
- B. Payment for the Potable Water Storage Tank, pipe and fittings will not be paid until all testing are finished and the work is complete in place.
- C. Payment for the Potable Water Storage Tank shall include work shown on civil, structural, mechanical, and electrical sheets.

<u>Pay Item No.</u>	<u>Pay Item</u>	<u>Pay Unit</u>
331613-1	500K Gallon Water Storage Tank	Lump Sum