SECTION 33 16 13.12

BOLTED STEEL STORAGE TANK
04/06

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN IRON AND STEEL INSTITUTE (AISI)

AISI 1010

ASTM INTERNATIONAL (ASTM)

ASTM A 325	(2007a) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A 36/A 36M	(2008) Standard Specification for Carbon Structural Steel
ASTM A 607	(2008) Standard Specification for Carbon Structural Steel
ASTM A 1011/A 1011M	(2008) Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA D103	(1997) Factory-Coated Bolted Steel Tanks for Water Storage

1.2 DESIGN REQUIREMENTS

a. General: Contractor shall be responsible for design of the bolted steel storage tanks and anchorage system to the concrete foundation.

b. Tank Size: Factory coated glass-fused-to-steel, bolted together tank shall have the following dimensions: Reclaim Tank: 24 feet diameter and 24 feet sidewall height, Backwash Tank: 24 feet diameter and 24 feet sidewall height.

c. Tank Capacity: Nominal, 66,000 U.S. gallons.

d. Floor Elevation: Finished floor set at elevation.

e. Tank Design Standards:

1. Design, materials, and fabrication of bolted steel tank in accordance with AWWA D103.

2. Tank coating system in accordance with AWWA D103, Section 10.4.

3. Tank certified and listed by NSF International.

f. Design Loads:

1. Specific gravity of minimum design shall be 1.

2. Wind velocity in accordance with AWWA D103.

3. Shape factor 0.6.

4. Allowable soil bearing psf.

5. Roof live load 20 psf.

6. Seismic design criteria, in accordance with AWWA D103.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

a. Action Submittals:

1. Manufacturer's catalog data including accessories, components, exterior coating and interior coating systems.

2. Drawings showing steel tank, plan and elevation details, details of tank bottom, foundations, roof, shell plates, interior tank coating system, openings, connections for fittings and appurtenances.

3. Structural calculations for tank structure and anchorage system stamped and signed by a registered Civil or Structural Engineer currently licensed in the State of California.

4. Layout drawing of pipe connections.

b. Informational Submittals:

1. NSF certification.

2. Manufacturer's Certificate of Proper Installation.

3. Manufacturer's:

a. Installation instructions.

b. Proposed disinfection plan.

4. Operation and Maintenance Manual: Submit operation and

maintenance data in accordance with Section 01 78 23, OPERATION AND MAINTENANCE DATA.

5. Statements of Qualification:

a. Tank manufacturer.

b. Tank installer.

c. Registered Civil or Structural Engineer currently licensed in the State of California.

d. Tank manufacturer's Site representative.

6. Written test reports of inspections for steelplates and sheets as specified in Article Fabrication.

1.4 QUALIFICATIONS

a. Tank Manufacturer: At least five tanks presently in potable water service, of similar size and character required for this Project, and minimum of 5 years' satisfactory operation.

b. Tank Installer: Certified by tank manufacturer that installer is qualified to do the Work.

c. Registered Professional Engineer: Licensed in the state of Project.

d. Tank Manufacturer's Site Representative: Certified by tank manufacturer that the representative is qualified and experienced in type of Work to be performed.

1.5 PACKING AND SHIPPING

a. Protect sheets from damage prior to packing for shipment.

b. Place heavy paper or plastic foam sheets between each panel to eliminate sheet-to-sheet abrasion during shipment.

c. Wrap individual stacks of panels in heavy mil black plastic and steel banded to wood pallets built to the roll-radius of the tank panels. This procedure eliminates contact or movement of finished panels during shipment.

1.5 SPECIAL GUARANTEE

Provide tank manufacturer's and installer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the Owner, removal and replacement of glass-fused-to-steel sheet found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work as specified in the General Conditions.

PART 2 PRODUCTS

2.1 MATERIALS

a. Plates and Sheets:

1. Plates and sheets for tank shell, tank floor, and tank roof in accordance with AWWA D103, Section 2.4.

2. Mild strength steel in accordance with ASTM A 1011/A 1011M, Grade 30 with a maximum allowable tensile stress of 14,566 psi.

3. High strength steel in accordance with ASTM A 607, Grade 50 with a maximum allowable tensile stress of 26,000 psi.

4. Annealing effect created from glass coated firing process shall be considered in determining ultimate steel strength. In no event shall a yield strength greater than 50,000 psi be utilized for calculations in AWWA D103, Sections 3.4 and 3.5.

b. Rolled Structural Shapes: In accordance with ASTM A 36/A 36M and AISI 1010.

c. Horizontal Wind Stiffeners:

1. Intermediate horizontal wind stiffeners "web truss" design.

2. Steel web truss stiffeners with hot-dipped galvanized coating.

3. Do not furnish rolled steel angles for intermediate stiffeners.

d. Bolt Fasteners:

1. 1/2 inch diameter 13 UNC 2A rolled thread bolts for tank lap joints in accordance with AWWA D103, Section 2.2.

2. SAE Grade 2:

a. Tensile strength 74,000 psi minimum.

b. Proof load 55,000 psi minimum.

c. Allowable shear stress 18,164 psi.

3. SAE Grade 8 in accordance with ASTM A 325 heat treated to:

a. Tensile strength 150,000 psi minimum.

b. Proof load 120,000 psi minimum.

c. Allowable shear stress 36,818 psi.

4. Bolt Finish:

a. Mechanically galvanized zinc plate.

b. 0.002 inch thick minimum under bolt head and on shank and threads.

5. Bolt Head Encapsulation:

a. High impact polypropylene co-polymer encapsulation of bolt head up to the splines on the shank.

b. Natural resin only.

e. Lap Joint Sealant:

1. One component, moisture cured, and polyurethane compound in accordance AWWA D103.

2. Sealant capable of curing to a rubber-like consistency, have excellent adhesion to glass coating, have low shrinkage, and shall be suitable for interior and exterior exposure.

3. Sealant curing rate at 73 degrees F and 50 percent RH:

a. Tack-free time 6 to 8 hours.

b. Final cure time 10 to 12 days.

4. Do not furnish neoprene gaskets and tape sealer.

5. Seal tanks other than cobalt blue with a color compatible Sika 1A sealer.

6. Manufacturer and Product: Harvestore Products, Inc.; System Sealer No. 79, Private Label.

f. Outside Tank Ladder:

1. Fabricated of aluminum and utilize grooved, skid-resistant rungs.

2. Safety cage and step-off platforms shall be fabricated of galvanized steel.

3. Stainless steel fasteners, Type 304.

g. Cathodic Protection and Tank Grounding.

1. Passive Cathodic Protection and tank grounding systems shall be designed and supplied by the tank manufacturer. Passive Cathodic Protection system shall be provided in accordance with AWWA D104. Tank grounding lugs shall be provided at locations shown on the drawings.

h. Access Doors:

1. Bottom access door in accordance with AWWA D103.

2. Door shall be a minimum of 24 inches in diameter with an ob-round reinforcing plate, cover plate, and davit. Hinged cover not acceptable.

i. Identification Plate: Furnish nameplate listing tank serial number, tank diameter and height, and maximum design capacity.

2.2 FABRICATION

a. Plates and Sheets:

1. Surface Preparation:

a) Following decoiling and shearing process, grit-blast steel sheets on both sides to equivalent of SSPC SP10. Do not sandblast or chemically pickle steel sheets.

b) Surface anchor pattern no less than 1 mil.

c) Evenly oil sheets on both sides for protection from corrosion during fabrication.

2. Cleaning:

a) After fabrication and prior to application of coating system, clean sheets thoroughly with caustic wash and hot rinse process followed immediately by hot air drying.

b) Inspect sheets for traces of foreign matter or rust, and recleaned or grit-blast to remove foreign matter and rust.

3. Coating:

a) Apply one coat of precoat glass to both sides of sheets and then air dried.

b) Apply final coat of cobalt blue glass frit to both sides of sheets.

c) Fire sheets at a minimum temperature of 1,500 degrees F in accordance with manufacturer's quality process control procedures (e.g., firing time, furnace humidity, and temperature control).

d) Minimum dry coating thickness 6 mils. Inside finish color cobalt blue. Outside finish color may be other than cobalt blue, but fire color over a cobalt blue base.

4. Inspection:

a) Inspect coated sheets for mil thickness (e.g., Mikrotest).

b) Check coated sheets for color uniformity by an electronic colorimeter.

c) Perform an electrical leak detection test on inside surface after fabrication of sheet. Reject sheets with excessive electrical leakers to minimize field touchup.

PART 3 EXECUTION

3.1 GENERAL

Identification Plate: Attach nameplate to tank exterior sidewall at

location approximately 5 feet from grade elevation in a position of unobstructed view.

3.2 ERECTION

a. Tank Floor:

1. Glass-Coated Bolted Steel:

a) Standard floor design is glass-coated, bolted steel. Place bolted steel panels either over a 3 inch compacted sand base contained by a concrete ring wall.

b) Provide polyethylene copolymer caps and sealant to cover bolts, nuts, and washers exposed on inside of floor.

2. Concrete Floors:

a) Floor design is of reinforced concrete with an embedded glass-coated steel starter sheet in accordance with manufacturer's design.

b) Level starter ring and maximum differential elevation within the ring not to exceed 1/8 inch, nor exceed 1/16 inch within 10 feet of length.

c) Leveling of plate assembly consist of two 18 inch anchor rods of 3/4 diameter and a slotted plate 3 1/2 inches by 11 inches by 3/8 inches thick, provide to secure starter ring prior to encasement in concrete. Install starter ring on concrete blocks or bricks, do not use shims for adjustment.

d) Place two water stop seals made of butyl rubber elastomer on inside surface of starter ring below concrete floor line. Place one bentonite impregnated water seal below butyl rubber seal. Install materials in accordance with tank manufacturer's instructions.

b. Sidewall Structure:

1. Provide erection jacks and building equipment developed and manufactured by tank manufacturer for erection of tanks.

2. Take particular care in handling and bolting of tank panels and members to avoid abrasion of coating system.

c. Roof:

1. Tanks with diameters between 14 and 31 feet, provide radially sectioned roof fabricated from glass-coated and bolted steel panels.

2. Assembled roof similar to sidewall panels utilizing same sealant and bolting techniques to assure water and airtight assembly.

3. Roof shall be clear-span and self-supporting. Both live and dead loads carried by tank walls.

4. Roof Opening:

a) Install roof opening near outside tank ladder with a hinged cover and hasp for locking.

b) Clear opening shall be 24 by 15 inches.

c) Install curb 4 inches in height.

d) Cover shall overlap 2 inches or provide a gasketed weathertight cover in lieu of 4 inch curb and 2 inch overlap.

e) Provide hatch open switch mounting bracelet to accommodate a Square D type 9007/FT limit switch.

5. Roof Vent:

a) Size vent assembly in accordance with AWWA D103 and installed above the maximum water level of sufficient capacity for maximum possible rate of water fill or withdrawal, the resulting interior pressure or vacuum shall not exceed 0.5 inch water column.

b) Do not consider overflow pipe as a tank vent.

c) Install vent with 1/2 inch bird screen. Provide insect screen of 23 to 25 mesh.

d) Pipe Connections:

1. Field locate and saw cut pipe connections passing through tank panels and utilize an interior and exterior flange assembly. Do not acetylene torch or weld cut. Apply sealer on cut panel edges and bolt connections.

2. Overflow piping inches diameter Schedule 80 PVC, seamless aluminum tubing, or FRP.

e. Install tank shell bolts with head portion located inside tank.

f. Install lap joint bolts so threaded portions shall not be exposed in shear plane between tank sheets. Size bolt lengths to achieve a neat and uniform appearance. Excessive threads extending beyond nut after torquing not permitted.

g. Include with lap joint bolts a minimum of four splines on underside of bolt head at shank in order to resist rotation during torquing.

h. Provide sealant to seal lap joints, bolt connections, and sheet edges.

i. Multiple vertical bolt line sheets and plates, the effective net area shall not be taken as greater than 85 percent of the gross area.

3.3 TESTS AND INSPECTIONS

a. Leak Test:

1. Prior to liquid testing, Engineer will visually inspect

surface areas.

2. Conduct an electrical leak test using a 9 volt leak detection device.

3. Repair electrical leak points found on inside surface in accordance with manufacturer's instructions.

b. Hydrostatic:

1. Following completion of erection and cleaning of tank, test structure for liquid tightness by filling tank to overflow elevation.

2. Leaks disclosed shall be corrected in accordance with tank manufacturer's instructions.

3.4 DISINFECTION

a. Disinfect tank structure by chlorination in accordance with AWWA C652.

b. Do not perform disinfection until tank sealant is fully cured.

c. Do not use calcium hypochlorite (HTH).

3.5 SUPPLEMENTS

a. The supplements listed below are part of this specification, and are located in Volume XX, Standard Details and Supplements.

1. Reclaim Tank.

2. Backwash Tank.

-- End of Section --