

Multi-Column Water Tank Construction Specifications

Tank Contractor: Phoenix Fabricators and Erectors, LLC

MULTI-COLUMN ELEVATED WATER STORAGE TANK

PART 1.0 – GENERAL SCOPE

1.1 DESCRIPTION OF WORK

- A. The work to be performed under this section consists of the furnishing of all materials, tools, equipment, labor and incidentals necessary for the design, manufacture, delivery, erection, painting, disinfection and testing of a multi-column elevated storage tank. The tank is to be complete with all accessories specified herein, and is to be erected on foundations to be designed and constructed by the Tank Contractor. The tank shall meet all requirements of AWWA D100-11 Standard for Welded Carbon Steel Tanks for Water Storage.
- B. The contracting company shall own their fabrication facilities. Divided responsibilities between erection and fabrication will not be allowed.
- C. A qualified supervisor employed by the Contractor shall be on site at all times during construction of the steel support structure and water tank.
- D. The Contractor shall have completed the design, construction, and commissioning of at least ten (10) multi-column elevated tanks with an equal style and design that have been completed within the last five years.

1.2 SUBMITTALS

- A. Each bidder shall submit with their proposal a design sketch of the tank and foundation they propose to furnish. The general plan of the structure must show all major dimensions including the tank diameter, the height to low and high water levels, the sizes of all principal and secondary members, thickness of all plates, arrangement of members, and size of the tank foundation, including approximate quantities of concrete and rebar.
- B. The successful bidder must submit shop drawings for all proposed work to include the tank foundation, concrete mix design, tank structure showing plate thicknesses, members, details of all connections, special details and member loads, piping, valves, painting and other pertinent information as required per the project plans and specifications. These drawings shall be sealed by a registered Professional Engineer in the State of _____.

PART 2.0 – FOUNDATIONS

2.1 FOUNDATION DESIGN

- A. Foundation design shall be based on the recommendations provided in the Geotechnical Report. The Owner shall retain the services of a testing firm to confirm that the design conditions are in conformance with design recommendations. The design of the foundation shall be in accordance with the requirements of ACI 301, ACI 318, and the Geotechnical Report. Minimum concrete compressive strength shall be 3,000 psi at 28 days.

2.2 TANK FOUNDATIONS

- A. The Tank Contractor shall furnish and install all materials, labor, and equipment necessary to complete the tank foundation, complete with anchor bolts, reinforcing steel, and concrete.
- B. The Tank Contractor shall design and prepare construction plans and details for the foundations in accordance with the requirements of the specifications. The foundation construction drawings shall be sealed by a registered Professional Engineer in the State of _____ and submitted to the Engineer for review and final approval.
- C. All testing of materials concerning the foundations shall be performed by an independent testing laboratory satisfactory to the Engineer.

PART 3.0 – TANK DESIGN AND MATERIALS

3.1 GOVERNING SPECIFICATIONS

- A. Material, design, welding, shop fabrication, erection, testing, and inspection of the proposed elevated water storage tank shall be in compliance with the latest revision of AWWA D100 for “Welded Carbon Steel Tanks for Water Storage” and ACI 318.
- B. The multi-column elevated tank shall consist of the following components: foundation, welded steel support tower, and a welded steel water tank. The elevated tank shall be in accordance with the shape, dimensions, and details required by these specifications.

- C. The following design parameters shall apply, and the structure shall safely withstand the following loads acting separately or in combination:
1. Weight of the structure.
 2. Weight of the water in the tank.
 3. The structure shall be designed to withstand wind velocities in accordance with AWWA D100-11.
 4. Seismic design in accordance with AWWA D100-11.
 5. Snow load in accordance with AWWA D100-11.
 6. Minimum thickness of plates in contact with water: 1/4 inch.
- D. All steel in the structure shall be manufactured, rolled, or shaped in accordance with AWWA D100-11.

3.2 ELEVATED STORAGE TANK

- A. Preference shall be given to designs of good appearance, with operating characteristics which give a constant pressure on the mains, as is consistent with the manufacturer's standards and economics of design.
1. The tank shall have a capacity of _____ gallons.
 2. The tank shall have an operating head range of ____ feet between low and high water levels, ± 2.5 feet.
 3. The high water level (HWL) shall be _____ with an elevation of ____ feet.

3.3 ACCESSORIES

- A. Steel Riser (AWWA D100-11, Sec. 4.4.1): The center riser for the elevated tank shall be water-bearing and not less than _____ inches in diameter.
- B. Riser Manway (AWWA D100-11, Sec. 5.4.4): The riser shall have a hinged manway not less than 24 inches in diameter. The manway shall be located approximately 36 inches above the riser baseplate.
- C. Riser Safety Grate (AWWA D100-11, Sec. 5.1.1): The top of the riser shall be equipped with a safety grate unless a riser handrail is specified.
- D. Shell Manway (AWWA D100-11, Sec. 5.4.3.2): The tank shell shall have a manway not less than 24 inches in diameter. The manway lid shall be supported with a hinged davit arm that is welded to the tank shell. The manway shall be located approximately 30 inches above the balcony floor.

- E. Roof Hatch (AWWA D100-11, Sec. 5.4.3): Provide one 24 inch diameter weatherproof steel roof hatch, above the HWL, for egress into the tank. The hatch shall have a minimum 4 inch curb height and the lid shall overlap the curb 2 inches. The lid shall be watertight and lockable.
- F. Balcony (AWWA D100-11, Sec. 4.4.4 & 4.4.4.2): The tank shall be provided with a balcony at least 24 inches in width and with a handrail of no less than 42 inches in height. The floor plate shall be at least 1/4 inch steel, perforated for drainage.
- G. Tank Vent (AWWA D100-11, Sec. 5.5): The tank vent should be sized for needed venting capacity for maximum inflow or outflow considering a main break at the base of the tank. The overflow pipe shall not be considered a tank vent. The vent will be designed to prevent the ingress of birds, insects, or animals, and minimize condensation on the underside of the roof. There should be provisions in the vent design to release differential pressures caused by clogging of the ___ mesh non-corrodible vent screen.

The vent shall be designed to allow the attachment of an exhaust fan for ventilation during painting.

- H. Ladders (AWWA D100-11, Sec. 5.4.2): Ladders shall have side rails not less than 2 inches x 3/8 inch, with a spacing between the side rails of not less than 16 inches and rungs not less than 3/4 inch round or square, spaced 12 inches on center. Ladders shall not, in any place, have a backward slope.

All ladders and safety devices shall comply with OSHA Standards. Two climbing belts and clamp assemblies approved by OSHA will be provided.

The tank shall be provided with steel ladders at the following locations:

1. A ladder shall be provided on one column of the tower, extending from approximately 10 feet above the foundation and terminating at the balcony railing (or the tank ladder, if no balcony is provided).
 2. A ladder shall be provided from the balcony (or tank ladder, if no balcony is provided) to the roof manway and near other roof accessories.
 3. A ladder shall be provided at the roof manway, extending to the bottom of the tank.
 4. A ladder shall be provided at the shell manway, extending to the bottom of the tank.
 5. A ladder shall be provided on the interior of the riser, starting 36 inches above the base of the riser and extending to the top of the riser.
- I. Inlet/Outlet Piping (AWWA D100-11, Sec. 5.2.2): Provide a _____ diameter combined inlet/outlet pipe made of carbon steel (Sch. STD) that extends from

the top flange of the base elbow and terminates 12 to 18 inches above the base of the riser. The inlet/outlet pipe shall be equipped with a protective cap to prevent entry of foreign materials dropping from above.

- J. Overflow Pipe (AWWA D100-11, Sec. 5.3): The carbon steel overflow pipe (Sch. 20) shall be designed for a maximum fill rate of _____ GPM, with a maximum water level of not more than 6 inches above the weir. The overflow shall originate at the top in a weir box and terminate near grade, discharging onto a splash block to direct water away from the foundation. The discharge point of the overflow shall have a removable #12 mesh stainless steel screen.
- K. A bronze tank identification plate shall be mounted above the riser manway. The identification plate shall contain the following information:
 - 1. Tank contractor's name
 - 2. Year erected
 - 3. Tank capacity in U.S. gallons
 - 4. Tank head range
 - 5. Tank style
 - 6. Contractor's serial number or project number
 - 7. Tank contractor's erection foreman

PART 4.0 – TANK AND SUPPORT STRUCTURE CONSTRUCTION

4.1 ERECTION OF TANK

- A. All parts forming the structure shall be built in accordance with approved drawings. Welding procedures and general welding requirements shall be in accordance with AWWA D100-11, Sections 8 and 10. Welding shall only be performed by ASME qualified welders. Records of these qualification tests shall be available to the Engineer. The work at all times shall be open to the Engineer or their representative.
- B. Roof Lap Joints: All interior roof lap joints and roof penetrations shall be sealed by means of continuous caulking.
- C. Upon completion of the tank erection, the Tank Contractor will remove or dispose of all rubbish and other unsightly material caused by its operation, and will leave the premises in good appearance.

4.2 TESTING

- A. After tank construction has been completed and the tank painted, the tank shall be hydrostatically tested by filling it with water to be furnished by the Owner. Any leaks shall be repaired and the structure made watertight. No

repair work will be done on any point unless the water level in the tank is at least two feet below the joint being repaired.

- B. In addition, the Tank Contractor shall test the weld joints by means of radiographic testing. All testing shall be done in accordance with AWWA D100-11, Section 11. The radiographic film test results will become the property of the Owner.

PART 5.0 – TEST AND DISINFECTION

- A. The structure will be tested by filling the tank with water and any leaks or defects which may appear will be repaired. Prior to acceptance, Contractor shall disinfect the tank in accordance with AWWA C-652 Method 3.
- B. After disinfecting the tank and returning the chlorine residual to normal, two bacteriological tests shall be taken 24 hours apart. Both tests must come back non-detectable.

PART 6.0 – SAFETY

- A. The Contractor shall strictly comply with all applicable statutes, regulations, orders, rules, requirements and standards of all governmental authorities having jurisdiction with respect to the project, including without limitation, federal, state, and local OSHA and health regulations as well as the latest professional practices.
- B. The Contractor shall, at its own expense, protect its employees and other persons from risk of injury, bodily harm, or death arising out of or in any way connected with work preformed.
- C. Prior to commencing work, all personnel on the jobsite will have a minimum ten (10) hours of OSHA safety training or equivalent training within the previous year.

PART 7.0 – GUARANTEE

- A. The Contractor shall guarantee the structure against any defects in coating application, material, or workmanship for a period of three (3) years from the date of substantial completion. If any defect is discovered and reported to the Contractor during the guarantee period, the Contractor shall make the necessary repairs without charge to the Owner.