

**Fluted Column Tank Construction Specifications**  
**Tank Contractor: Phoenix Fabricators and Erectors, LLC**

# FLUTED 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 fluted 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 five (5) fluted column elevated tanks.

### **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 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 fluted column elevated tank shall consist of the following components: foundation, welded fluted column support structure, 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. Access Tube (AWWA D100-11, Sec. 5.4.2.3): An access tube having a minimum diameter of 42 inches shall be provided for egress from the bottom of the tank to the roof.
- B. Painter's Railing & Painter's Hatch: Continuous bar railing shall be provided on the exterior of the tank near the top of the fluted column and at the top of the access tube. This railing shall be permanent to facilitate future tank maintenance. A hatch with a minimum diameter of 24 inches shall be located near the top of the fluted column to provide access to the exterior railing. This hatch shall be accessible from the upper platform.
- C. Upper Platform: A minimum four foot wide upper platform shall be located at the top of the support column to provide access from the fluted column to the access tube ladder located on the interior of the access tube. Platforms shall be perforated to allow condensation to pass through.

- D. Condensate Ceiling: A fabric condensate ceiling shall be provided inside the fluted column. The condensate ceiling shall be equipped with a flexible drain pipe to the overflow. The condensate ceiling location and elevation shall be detailed on the project drawings.
- E. Roof Hatch (AWWA D100-11, Sec. 5.4.3): Provide two 30 inch diameter weatherproof steel roof hatches. One hatch shall be located on top of the access tube and provide access to the roof. The second hatch shall be located adjacent of the access tube, above HWL, and provide access to the interior of the tank. The hatches 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. 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 located adjacent to the access tube and designed to allow the attachment of an exhaust fan for ventilation during painting.
- G. Drain Valve: A 2 inch diameter freeze-proof drain valve shall be provided in the bottom the tank. The drain valve shall be installed to permit the maximum amount of water to drain from the tank, yet be fully operational as a freeze-proof valve. The drain valve shall be located such that it can be operated from the access tube ladder.
- H. Tank Manway: An 18 inch x 24 inch elliptical manway shall be provided in the bottom of the tank. The manway shall open inward and be accessible from the access tube ladder or a ladder extending from the upper platform directly to the tank manway.
- I. Personnel Door: Provide one 36 inch wide X 84 inch high access door. Door frames shall be 16-gauge with concealed reinforcement at hardware locations. Door frame shall be sufficiently anchored to rigidly secure the frame. Doors shall be 1-3/4 inch thick insulated, reinforced, full, flush type with 18-gauge face sheets and concealed reinforcement at hardware locations. All edges shall be finished flush with watertight seams. Shop applied finish for the frame and door shall be baked on rust inhibitive primer. Field finish shall be compatible with the tank exterior. Standard hardware shall be stainless steel and include three 4-1/2 inch hinges, industrial duty

closer and lockset. Location of personnel door shall be shown on the drawings.

- J. Overhead Vehicle Door: Provide one 10 foot wide X 10 foot high vehicular door. Door installation shall be on the interior face of the support wall. The door frame shall be of steel plate construction, suitably detailed, fastened and reinforced to accept the door. Operation of the door shall be manual by chain hoist. The curtain shall be formed of 22-gauge steel interlocking slats with end locks and wind locks designed for a wind loading of 20 PSF. Torsion springs shall be mounted on a solid torsion rod, which is attached to an exterior mounted spring tension adjustment wheel. A 24-gauge steel hood shall be provided with a weather seal to protect the assembly. Steel brackets shall be installed to the interior face of the wall with expansion anchors which enclose and support the counterbalance assembly with sealed bearings. Steel curtain guides are mounted to the brackets. The curtain, bottom bar, brackets, guides, hood, pipe, and chain shall be galvanized. A locking device shall be provided. Location of vehicular door shall be shown on the drawings.
  
- K. Slab on Grade: A 6 inch thick concrete slab on grade shall be provided for the interior base of the tank column. The concrete shall be reinforced with welded wire mesh and isolation material shall be provided at all junctions with walls and penetrations.
  
- L. 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.

Ladders shall be provided from the floor inside the base of the fluted column to the upper platform located below the tank floor. A tank floor manhole shall be provided with ladder access from the upper platform. A ladder shall extend from the upper platform, through the access tube interior, to the roof. Ladder shall be designed in accordance with OSHA standards. Ladders that terminate at platforms or landings shall extend a minimum of 48 inches beyond the platform elevations.

- M. 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 at or below the low water line. The inlet/outlet pipe shall be equipped with a protective cap to prevent entry of foreign materials dropping from above and an expansion joint to accommodate differential movement due to settlement or thermal cycling.

- N. 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 extend down through the tank, shaft, and base cone. The overflow pipe shall penetrate the base cone approximately 18 inches above 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.
- O. 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 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 2.
- 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.