

**SECTION 22 12 16**  
**FACILITY ELEVATED, POTABLE-WATER STORAGE TANKS**

SPEC WRITER NOTES:

1. Delete between //-----// if not applicable to project. Also delete any other item or paragraph not applicable in section and renumber the paragraphs.
2. Specify cathodic protection for underground water piping only if severe corrosion problems exist in the area. Discuss with local Water Authority and the VAMC, and specify cathodic protection, if warranted.
3. The "Safe Drinking Water Act" (SDWA) was originally passed into law in 1974. It was amended several times. The "Reduction of Lead in Drinking Water Act" was passed in January 2011 and amends the SDWA to the new lead free standard to include NSF 61 and NSF 372.

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. An elevated steel water storage tank and tower, completed, including risers, piping, drains, materials, labor, equipment, painting, sterilization and all accessories as required for a complete working system.
- B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.
- B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- C. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- //D. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.//
- E. Section 09 06 00, SCHEDULE FOR FINISHES.
- //F. Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS: Seismic Restraint.//
- G. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.
- //H. SECTION 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//
- I. Section 26 41 00, FACILITY LIGHTNING PROTECTION: Lightning Protection.  

SPEC WRITE NOTE: Provide obstruction lighting only, if required by the FAA.
- //J. Section 26 56 00, EXTERIOR LIGHTING: Obstruction lighting.//



- D100-2011.....Welded Carbon Steel Tanks for Water Storage
- D102-2014.....Coating Steel Water-Storage Tanks
- G. American Welding Society (AWS):
  - D1.1/D1.1M-2010.....Structural Welding Code-Steel
  - D1.3/D1.3M-2008.....Structural Welding Code-Sheet Steel
  - D1.4/D1.4M-2011.....Structural Welding Code-Reinforcing Steel
- H. International Code Council (ICC)
  - IBC-2012.....International Building Code
  - IPC-2012.....International Plumbing Code
- I. National Fire Protection Association (NFPA):
  - 22-2013 .....Standard for Water Tanks for Private Fire Protection
  - 25-2014.....Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
  - 70-2014.....National Electric Code
- J. NSF INTERNATIONAL (NSF):
  - 61-2014a.....Drinking Water System Components-Health Effects
  - 372-2011.....Drinking Water System Components-Lead Content
- K. Department of Labor:
  - 29 CFR PART 1910.....Occupational Safety and Health Standards
- L. Department of Veterans Affairs:
  - H-18-8-2013.....Seismic Design Handbook

**1.4 SUBMITTALS**

- A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 12 16, FACILITY ELEVATED, POTABLE-WATER STORAGE TANKS", with applicable paragraph identification.
- C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
  - 1. Piping.
  - 2. Valves.
  - 3. Floor Drain.
  - 4. Steel Tank and Accessories.

- 5. Alarm System.
- 6. OSHA approved climbing equipment for maintenance personnel.
- 7. Tank Heating Equipment.
- 8. Lightning Protection.
- 9. Paint.
- D. Calculations and completely detailed erection procedure with shop drawings.
- E. Foundation, footings and calculation, designed and stamped by a professional Structural Engineer.
- F. Power, signal and control wiring.
- G. Plans, sections, details, elevations and attachment to other work.
- //H. Completed System Readiness Checklist provided by the CxA and completed by the contractor, signed by a qualified technician and dated on the date of completion, in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//
- //I. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.//

#### **1.5 QUALITY ASSURANCE**

- A. Criteria:
  - 1. Manufacturer regularly and presently manufactures the item submitted as one of their principal products.
  - 2. Installer, or supplier of a service, has technical qualifications, experience, trained personnel, and facilities to perform the specified work.
  - 3. Submit a list of five completed projects of similar type and size with references with current position, address, telephone number, and e-mail.
- B. System Requirements: AWWA D100 for steel tanks plus the following:
  - 1. Steel Tower Supporting Elevated Water Tank Design Loads:
    - a. Weight of Tank and Water.
    - b. Wind Load.
    - c. Seismic Load.
    - d. Combined Loads: Design for the worst case:
      - 1) Gravity and wind.
      - 2) Gravity and seismic.
    - e. //Snow Load.//
    - f. Design Code: AISC 360.

- 2. IBC and local building codes.
- C. Tank welding qualification procedures and personnel shall be in accordance with AWS D1.1, AWS D1.3 and AWS D1.4.
- D. Pipe welding qualification procedures and personnel shall be in accordance with ASME BPVC Section IX.
- E. Electrical components, devices and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit <http://www.biopreferred.gov>.

#### 1.6 AS-BUILT DOCUMENTATION

SPEC WRITER NOTE: Coordinate O&M Manual requirements with Section 01 00 00, GENERAL REQUIREMENTS. O&M manuals shall be submitted for content review as part of the close-out documents.

- A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.
- B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be // in electronic version on compact disc or DVD // inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.
- C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set

at the time of final systems certification testing. As-built drawings are to be provided, and a copy of them in Auto-CADD version //\_\_\_\_// provided on compact disk or DVD. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

- D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. Material or equipment containing a weighted average of greater than 0.25 percent lead is prohibited in any potable water system intended for human consumption, and shall be certified in accordance with NSF 61 or NSF 372.

### **2.2 TANK**

SPEC WRITER NOTE: Select the type of tank required and provide a detailed drawing showing the tank height, capacity, high and low water levels, VAMC logo and other pertinent data for a complete installation. Due to its aesthetics the pedestal tank is preferred.

- A. Shall be in accordance with NFPA 22, AWWA D100 and ASTM A36/A36M.
- B. //The tank shall be of the double ellipsoidal type and supported by columns // Double ellipsoidal // Pedestal Sphere or Spheroid //.
- C. The tank shall be constructed of 1/4 inch minimum thick steel plus .01 inch for corrosion allowance. Tank shall be welded throughout.
- D. The wind loading shall be // // kg/m<sup>2</sup> (// // lb/ft<sup>2</sup>) on the vertical surfaces, // // kg/m<sup>2</sup> (// // lb/ft<sup>2</sup>) on the projected areas of cylindrical surfaces and // // kg/m<sup>2</sup> (// // lb/ft<sup>2</sup>) on projected area of conical and double-curved plate surfaces. The entire structure shall withstand a // // km/hr (// // mph) winds.
- E. Design the tank to withstand // earthquake zone // // as defined by the Veterans Affairs Handbook H-18-8 // IBC requirement //.

- F. The balcony and ladder loading shall be as specified in AWWA D100, furnish OSHA approved climbing equipment.

### 2.3 FOUNDATION

SPEC WRITER NOTE: Provide at least one soil boring in the area of the proposed tank for the contractor reference.

- A. The elevated water tower contractor shall be responsible for the soil borings, design and installation of the foundation and footings.
- B. The soil borings shall be performed by an independent and established soils engineering firm.

### 2.4 ACCESSORIES

- A. Comply with // NFPA 22 // AWWA D100 //. Main riser and overflow shall be schedule 40 steel, ASTM A53/A53M with schedule 40, ASTM A234/A234M, butt welded fittings.
- B. The main tank riser shall be // // mm (// // inch).
- C. Overflow: Provide a // // mm (// // inch) steel pipe extended to grade with an overflow that is visible/conspicuous before spilling into a storm sewer inlet. The overflow shall be provided with an insect screen and splash block.

SPEC WRITER NOTE: Use paragraph D, E & F only for double ellipsoidal tanks.

- //D. Rigging Lugs for future maintenance: Provide 7 mm (1/4 inch) minimum diameter holes. Lugs shall be located to access all portions of the tank and shall be capable of sustaining a load of 450 kg (992 pounds).//
- //E. Protection Shields: Provide each column with a circular protection shield projecting at least 600 mm (24 inches) from column. Shield on ladder column shall be 7 mm (1/4 inch) steel plate and other shields shall be 3.2 mm (1/8 inch) steel plate. Hinged trap door in ladder column shield shall swing up and left. Trap door shall have a welded-on hasp and staple, and a pin tumbler type padlock with chain welded to shield. Key padlock in COR's set.//
- //F. Riser: Steel riser shall be // // mm (// // inch) diameter. Supply pipe shall be // // mm (// // inch) diameter. Riser manhole shall be 600 mm (24 inches) minimum.//
- G. Perimeter Safety Railing for Riser Opening in Tank: Provide a circular steel railing around perimeter of riser opening in bottom of tank. Railing shall be 1050 mm (42 inches) high and constructed of four 50 mm

by 50 mm by 10 mm (2 inch by 2 inch by 3/8 inch) angle uprights welded to riser compression ring or tank construction at bottom, one 50 mm by 50 mm by 10 mm (2 inch by 2 inch by 3/8 inch) circular angle top member, and two 40 mm by 7 mm (1-1/2 inch by 1/4 inch) circular bars with first bar located 200 mm (8 inches) above bottom of tank, and second bar at midpoint between first bar and top member of railing.

- H. Vent: Vent shall be welded to the cover plate of the center manhole on the roof. Vent shall be tank manufacturer's standard type mushroom vent with aluminum bird screen. The free area of the vent shall be sized 50 percent in excess of the // // L/second (gpm) pump-in rate and // // L/second (gpm) pump-out rate. Screening for vent shall conform to Section 5.7.2 of AWWA D100. //Ensure fail-safe operation in the event that screen frosts over and the bottom of the screen shall be sufficiently elevated for snow consideration in the area//.
- I. Ladders and Safety Devices: Ladders and safety devices shall be provided in accordance with Sections 7.4 and 7.5 of AWWA D100. Location of ladders shall be as shown on the drawings. Sections 7.4 and 7.5 of AWWA D100 represent the minimum requirement. In addition, safety cage, rest platforms, roof ladder handrails, and other safety devices shall be provided as required by federal or local laws or regulations.
- J. Balconies: Provide a balcony a minimum of 600 mm (24 inches) wide with a standard guard railing. Provide a structural steel railing with a top rail 1050 mm (42 inches) above balcony platform with an intermediate rail halfway between. Guard rail shall be capable of withstanding a force of 888 N (200 pounds) applied in any direction. Install a steel toe board with minimum height of 100 mm (4 inches). Bottom of toe board shall be a maximum 7 mm (1/4 inch) from platform top. Extend guard rail and toe board entire length of balcony except where access openings are required. For balcony floors use diamond plates a minimum of 7 mm (1/4 inch) thick, punched or drilled for drainage. //Equip access openings in guard rail with a gate which closes automatically.// Hatches through balcony floor shall be counterbalanced or otherwise arranged to open from below with padlock keyed by local VAMC lock shop.

**2.5 PIPING**

## A. Pipe:

## 1. Ductile Iron:

- a. Underground: AWWA C151, working pressure 1035 kPa (150 psig), exterior bituminous coating and interior cement lining. Bio-based materials shall be utilized when possible.
- b. In Pits: AWWA C115, flanged joints only, working pressure 1035 kPa (150 psig).

## 2. Steel (Above Ground Only): Galvanized, ASTM A53/A53M, standard weight, threaded flanges, ASME B16.1, class 125.

## B. Fittings: Ductile-iron, AWWA C110.

SPEC WRITER NOTE: Coordinate with the mechanical design engineer and modify the following paragraph as required to suit the design conditions.

**2.6 VALVES**

## A. Altitude: Differential type, hydraulically operated, diaphragm-actuated iron body, bronze mounted, self-contained unit. Valve shall close when water level in tank reaches a point 150 mm (6 inches) below tank overflow.

//1. Single Acting Valve: Shall remain closed against upstream pressure until water level in tank drops to a point 600 mm (2 feet) below tank overflow //.

//2. Double Acting Valve: Shall remain closed until upstream pressure drops below pressure available when water is 150 mm (6 inches) below tank overflow //.

## B. Check: Iron body, bronze trim swing type, vertical or horizontal installation, flange connection, 1380 kPa (200 psig) WOG, Underwriters Laboratories Inc. approved.

## C. Gate: Fed Spec WW-V-58, Type II, class 1, flanged, non-rising stem type. Valve shall turn counterclockwise to open. Furnish hand wheel for operation. Ends of valves shall suit, or be adapted to pipe furnished.

**2.7 VALVE CHAMBER**

## A. Valve chamber shall be sufficiently large to house all control valves and fittings; and allow for unobstructed maintenance and replacement. Pipes, valves, and fittings shall be supported on concrete blocks where necessary. The valve chamber shall be constructed to provide not less than // // mm (// // inch) of cover over the pipes. The valves and fittings shall extend from the //standpipe//reservoir//riser pipe//

connection to a point one length of pipe outside the valve chamber walls on the main or feed line to the //elevated tank//standpipe//. The drain line shall be carried to an outlet as indicated on the drawings. The access manhole shall be not less than 762 mm (30 inches) in diameter.

## 2.8 FLOOR DRAIN

- A. ASME A112.6.3, Cast iron with light duty grate.
- //B. Bottom outlet//.
- //C. Side outlet//.

## 2.9 HIGH AND LOW WATER LEVEL ALARM SYSTEMS

- A. Provide high and low level devices for alarm monitoring and an intermediate device for tank water level status.
  1. All three water levels shall be indicated by their respective pilot lights; green for high, amber for intermediate and red for low water levels, and a buzzer for low and high water levels.
  2. Buzzer and the respective pilot lights at high and low water levels shall be energized while the high or low water level pilot device is actuated.
  3. Depressing a silencing button shall silence the buzzer indicating the water level and shall remain in OFF condition. The pilot light shall remain energized.
  4. Resetting the pilot light shall de-energize the pilot light and release the buzzer from its sealed-off condition.
  5. Provide alarming contacts to a DDC (Direct Digital Controls) remotely to the BAS operator.

## 2.10 TANK HEATING

SPEC WRITE NOTE: Provide heating for tanks located where the lowest mean temperature for one day is less than -15 degrees C (5 degrees F). NFPA 22 defines many ways for heating the tank water including steam coils, hot water coils, solar panels, direct discharge of steam, etc.

- A. Provide tank heating to protect the tank from freezing in accordance with NFPA 22 Chapter 16 Water Tank Heating. Maintain water temperature at or above 5.6 degrees C (42 degrees F) at all times.
- //B. Electric Heat: Nickel chromium, electric-resistance elements, helix wound, factory-wired with time delay for element staging, and overcurrent and overheat protective devices. //

//C. Hot Water Pipe: Copper tubing.//

//D. Steam Water Heater:

1. Shall consist of cast-iron or steel shell where water circulates around steam tubes or coils of brass or copper.
2. Steam water heater shall be connected to a reliable steam supply with a pressure not less than 0.7 bar (10 psig) and not over 3.4 bar (50 psig). //

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- A. Install tank and tower in accordance with NFPA 22.
- B. Install safety ladders in accordance with NFPA 22 and OSHA 29 CFR PART 1910 requirements.

**3.2 TANK INSPECTION**

- A. Comply with AWWA and NFPA 25 requirements.

**3.3 LEAKAGE TEST**

- A. Comply with AWWA, NFPA 22 and NFPA 25 requirements.

**3.4 LIGHTNING PROTECTION**

- A. Comply with NFPA 22.

SPEC WRITER NOTE: Select either painting or metallic coatings.

**//3.5 FIELD PAINTING**

- A. After construction, all weld seams, unprimed margins, field bolts, lugs and any area where the factory primer has been damaged shall be blast cleaned and re-primed with the same factory primer. Apply paint in accordance with NFPA 22 and AWWA D102. The exterior paint color and the VAMC logo shall be as directed by the VAMC //.

**//3.6 METALLIC COATINGS**

- A. Tower members, protection shield, ladders, ladder safety cages, rigging lugs, overflow pipe and riser shall be zinc-coated (galvanized) by the hot-dip method, ASTM A123/A123M. Bolts and similar fasteners shall be zinc-coated by the hot-dip method, ASTM A153/A153M. Hot-dip galvanized surfaces abraded or burned off by welding operations shall be repaired with zinc repair compound in stick or powder form, applied in accordance with the manufacturer's printed instructions.
- B. All interior surfaces and all interior components of the tank shall be zinc metallized, and all exterior surfaces of the tank and any additional surfaces not previously designated shall be aluminum metallized after construction and testing. Application of metallized

coatings shall be as specified in Section 09 06 00, SCHEDULE FOR FINISHES. //

//C. Option: In lieu of hot-dip galvanizing members, all such members may be aluminum metallized as specified in Section 09 06 00, SCHEDULE FOR FINISHES.//

**3.7 FLUSHING**

A. After tests and // painting // metallizing //, flush tank and connecting pipelines.

**3.8 DISINFECTION/ STERILIZATION**

A. After flushing, thoroughly disinfect and sterilize the tank and connecting piping with a chlorine and hypochlorite solution as required by AWWA C652. Following a contact period of 24 hours, flush the system with clean water until the residual chlorine content is not greater than that of the water supply. All valves in water line being disinfected shall be opened and closed several times during the 24 hour period. Hypochlorite material shall comply with Fed Spec O-C-114 or Fed Spec O-S-602, grade B.

B. Hypochlorite material shall comply with AWWA B300.

C. COR shall witness flush and disinfection/sterilization. Contractor shall coordinate schedules with the COR and CxA. Contractor shall submit request to COR a minimum of 10 working days prior to flushing, disinfection/sterilization, startup, and testing.

**//3.9 COMMISSIONING**

A. Provide commissioning documentation in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS.

B. Components provided under this section of the specification will be tested as part of a larger system.//

**3.10 DEMONSTRATION AND TRAINING**

A. Provide services of manufacturer's technical representative for //four// // // hours to instruct VA Personnel in operation and maintenance of the system.

//B. Submit training plans and instructor qualifications in accordance with the requirements of Section 22 08 00, COMMISSIONING OF PLUMBING SYSTEMS//.

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