

SECTION 33 16 00
UNDERGROUND NON-POTABLE WATER STORAGE AND PUMPING

PART 1 GENERAL

1.1 DESCRIPTION

- A. This section specifies materials and procedures for construction of underground non-potable water storage tank, including manholes, pumps systems and level control.
- B. A complete listing of common acronyms and abbreviations are included in Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT AND STEAM GENERATION.

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 57 19, TEMPORARY ENVIRONMENTAL CONTROLS: Erosion and Sediment Controls.
- D. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
- E. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.
- F. Section 01 91 00, GENERAL COMMISSIONING REQUIREMENTS.
- G. Section 03 30 00, CAST-IN-PLACE CONCRETE: Concrete Work, Reinforcing, Placement and Finishing.
- H. Section 05 50 00, METAL FABRICATIONS: Steel for trench and tunnel pipe supports.
- I. Section 09 91 00, PAINTING, Painting exposed steel and other surfaces.
- J. Section 23 05 10, COMMON WORK RESULTS FOR BOILER PLANT AND STEAM GENERATION.
- K. Section 25 10 10, ADVANCED UTILITY METERING SYSTEM: Metering.
- L. Section 26 42 00, CATHODIC PROTECTION: Cathodic Protection of DDT Pre-Engineered Direct-Buried Systems.
- M. Section 31 20 00, EARTHWORK: Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing.
- N. Section 33 08 00, COMMISSIONING OF SITE UTILITY SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.
- B. American Concrete Institute (ACI) standard ACI 318, Building Code Requirements for Structural Concrete.

- C. ANSI/AWWA D120 - Thermosetting Fiberglass-Reinforced Plastic Tanks.
- D. IAPMO/ANSI Z1000 - Prefabricated Septic Tanks.
- E. IAPMO/ANSI Z1001 - Prefabricated Gravity Grease Interceptors.
- F. NFPA 22: Standard for Water Tanks for Private Fire Protection.
- G. NFPA 1142: Standard for Water Supplies for Suburban and Rural Fire Fighting.
- H. NSF/ANSI Standard 61: Drinking Water System Components - Health Effects.

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 33 16 00 UNDERGROUND NON-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.
- D. Underground Tanks:
 - 1. Drawings of tanks, anchoring devices, heating coils (if required), tank manholes, tank manhole enclosures, access doors for the tank manhole enclosures and all accessories. Include overall dimensions and dimensional locations and sizes of all anchoring devices, pipe connections, and access openings.
 - 2. Manufacturer's installation instructions describing recommended foundation, bedding and backfill material, support and anchoring devices, and method of installation.
 - 3. Weight of entire tank assemblies, empty and flooded.
 - 4. Certification of compliance with specified standards.
 - 5. Certification that steel tank manufacturer participates in the Steel Tank Institute (STI) Quality Assurance Program.
 - 6. Data certifying that tanks are designed for surcharge loads of backfill, traffic and other construction.
 - 7. Design and construction of tanks, secondary containment, pipe connections, manholes, anchoring devices, access doors for tank manhole enclosures.
- E. Submersible Pumps.

1. 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.
 - a. Pump:
 - 1) Manufacturer and model.
 - 2) Operating speed.
 - 3) Capacity.
 - 4) Characteristic performance curves.
 - b. Motor:
 - 1) Manufacturer, frame and type.
 - 2) Speed.
 - 3) Current Characteristics and W (HP).
 - 4) Efficiency.
 - c. Controls and Disconnect Apparatus:
 - 1) Starting switch.
 - 2) Automatic control and level alarm.
 - 3) Alternating relay.
 - 4) Circuiting of control panel.
 - 5) Sensors.
 - d. Removal/Disconnect System.
2. Certified copies of all the factory and construction site test data sheets and reports.
3. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, and information for ordering replaceable parts, and troubleshooting guide:
 - a. Include complete list indicating all components of the systems.
 - b. Include complete diagrams of the internal wiring for each item of equipment.
 - c. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
4. 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.

1.5 QUALITY ASSURANCE

- A. Approval by Contracting Officer is required of products or services of proposed manufacturers, suppliers and installers, and will be based on Contractor's certification that:
1. Manufacturers regularly and currently manufacture tanks, tank and piping accessories, tank fluid level monitoring and leak detection systems, and fuel quality management systems.
 2. Manufacturers of steel tanks participate in the Quality Assurance Program of the Steel Tank Institute (STI).
 3. The design and size of each item of equipment provided for this project is of current production and has been in satisfactory operation on at least three installations for approximately three years. Current models of fluid level and leak detection systems with less than three years' service experience are acceptable if similar previous models from the same manufacturer have at least three years' service experience.
- B. Apply and install materials, equipment and specialties in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract drawings and specifications shall be referred to the COR for resolution. Provide copies of installation instructions to the COR two weeks prior to commencing installation of any item.
- C. All equipment shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components or overall assembly.
- D. Tanks, Secondary Containment Systems for Piping, Plastic Piping and Containment Systems, Tank Level Monitoring Systems, Leak Detection Systems, Fuel Quality Management Systems, Cathodic Protection Systems: Authorized manufacturer's representatives shall provide onsite training of installers and supervision of the installation and testing of the equipment and systems to assure conformance to written instructions of manufacturers.
- E. Tank and piping installation contractor shall be certified as acceptable by local and state pollution control authorities.
- F. Entire installation shall conform to requirements of local and state pollution control authorities.
- G. Pipe Welding: Conform to requirements of ASME B31.1. Welders shall show evidence of qualification. Welders shall utilize a stamp to identify their work. Unqualified personnel will be rejected.

- H. Assembly of Glass Fiber Reinforced Plastic Piping: Installation personnel shall have been trained, tested and certified under a procedure approved by the manufacturer of the piping. Proof of certification, in writing, shall be provided to the COR.
- I. Where specified codes or standards conflict, consult the COR.
- J. Label of Conformance (definition): Labels of accredited testing laboratories showing conformance to the standards specified.
- K. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a safe, complete and fully operational system which conforms to contract requirements and in which no item is subject to conditions beyond its design capabilities.

1.6 AS-BUILT DOCUMENTATION

- 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, VA approved substitutions and construction revisions shall be inserted into a three-ring binder. All aspects of system operation and maintenance procedures, including applicable 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 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. 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. Provide record drawings as follows:
 - 1. Red-lined, hand-marked drawings are to be provided, with one paper copy and a scanned PDF version of the hand-marked drawings provided on CD or DVD.

- D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.
- E. Certification documentation shall be provided to COR 21 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 provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.7 PERMITS

- A. Contractor shall obtain and complete all tank permit and registration forms required by governmental authorities.

1.8 WARRANTY

- A. Warranty: Provide manufacturer's standard limited warranty.

PART 2 PRODUCTS

2.1 UNDERGROUND WATER TANKS

- A. Tank Design - Fiberglass reinforced plastic (FRP) tanks:
 - 1. The tank size, fittings and accessories shall be as shown on the drawings.
 - 2. Tank shall be manufactured with structural ribs which are fabricated as an integral part of the tank wall.
 - 3. Tank shall be manufactured with a laminate consisting of resin and glass fiber reinforcement only. No sand/silica fillers or resin extenders shall be used.
 - 4. Tank shall be vented to atmospheric pressure.
 - 5. Tank shall be capable of handling liquids with specific gravity up to 1.1
 - 6. Tank shall be compatible with liquids identified in the manufacturer's standard limited warranty.

- B. Loading Conditions - Tank shall meet the following design criteria:
1. Internal Load Tank shall be designed to withstand a 5-psig (35 kPa) air-pressure test with a 5:1 safety factor.
 2. Surface Loads Tank shall be designed to withstand surface H-20 and HS-20 axle loads when properly installed according to manufacturer's current Installation Manual and Operating Guidelines.
 3. External Hydrostatic Pressure Tank shall be designed for 7 feet (2.1 m) of overburden over the top of the tank, the hole fully flooded, and a safety factor of 5:1 against general buckling.
- C. Emergency Standby Water Storage Applications:
1. Governing Standards, as applicable:
 - a. ANSI/AWWA D120 - Thermosetting Fiberglass-Reinforced Plastic Tanks.
 - b. American Concrete Institute (ACI) standard ACI 318, Building Code Requirements for Structural Concrete.
 - c. NFPA 22: Standard for Water Tanks for Private Fire Protection.
 - d. NFPA 1142: Standard for Water Supplies for Suburban and Rural Fire Fighting.
 - e. Tank manufacturer shall be recognized by Underwriters Laboratories (UL) as a manufacturer of tanks listed to the UL 1316 standard.
 - f. National Fire Code of Canada.
 - g. Tank manufacturer shall be recognized by Underwriters Laboratories of Canada as a manufacturer of tanks listed to the ULC S615 standard.
 2. Tank Design: Single-Wall vessel as specified and shown on the drawings.
 3. Tank Accessories - Fire Protection Standby Water Storage Applications:
 - a. Tank Anchoring
 - 1) Anchor straps shall be as supplied by tank manufacturer and designed for a maximum load of 25,000 lbs (11340 kg).
 - 2) Galvanized turnbuckles shall be supplied by the tank manufacturer.
 - 3) Prefabricated concrete anchors shall be supplied by the tank manufacturer, designed to the ACI 318 standard, manufactured with 4,000 psi concrete and shall have

- adjustable anchor points.
- b. Access Openings:
 - 1) All access openings shall have a diameter of 24 inches or 30 inches, complete with riser, lid and necessary hardware.
 - c. Attached Access Risers:
 - 1) Attached access risers shall be PVC or FRP as supplied by tank manufacturer.
 - 2) Attached access risers shall be 24-inch or 30-inch-diameter
 - 3) Access risers shall be attached to access openings during installation utilizing adhesive or FRP bonding kits as supplied by the tank manufacturer.
 - d. Piping and Fittings:
 - 1) Tank shall be equipped with factory-installed threaded fittings, or pipe stubs.
 - 2) PVC piping shall at a minimum meet the requirements of ANSI Schedule 40.
 - 3) All flanged nozzles shall be flanged and flat-faced, and conform to Class 150 bolting patterns as specified in ANSI/ASME/ B16.5.
 - 4) Carbon steel and stainless steel NPT fittings shall withstand a minimum of 150 foot-pounds (203 NM) of torque and 1,000 foot-pounds (1356 NM) of bending, both with a 2:1 safety factor.
 - e. Manway Openings:
 - 1) The standard manway shall be flanged, 22 inches (559 mm) I.D. and complete with gaskets, bolts and cover.
 - 2) Manway openings shall be designed to withstand 5-psig (35 kPa) test pressure with a 5:1 safety factor.
 - f. Ladders:
 - 1) Ladders shall be the standard FRP ladder as supplied by tank manufacturer.
 - g. Pump Platforms:
 - 1) FRP pump platforms shall be supplied by tank manufacturer.
 - h. Internal Piping
 - 1) All internal piping shall be supplied by tank manufacturer.
 - 2) All FRP nozzles for fire pump supply shall have an anti-vortex plate factory installed.
 - i. Suction/Fill tubes:

- 1) Vertical draft/fill tubes shall be a minimum of PVC SCH 40 or FRP.
- 2) Vertical draft /fill tubes shall be factory installed.
- 3) Vertical draft /fill tubes shall terminate 4 inches (102 mm) above the bottom of tank.
- 4) Vertical draft tubes shall have anti-vortex plate factory installed.

2.2 In-Tank Pumping System (Addendum 3, 01-16-2025)

- A. Duplex centrifugal type designed for 60 degrees C (140 degrees F) maximum water service. Driver shall be electric motor. Support shall be rigid type. Systems to include one pump in each tank.
- B. Pump housing: Stainless steel.
- C. Impeller: Stainless steel.
- D. Shaft: Stainless steel.
- E. Bearings: As per manufacturer's recommendations to hold shaft alignment, anti friction type for thrust and permanently lubricated.
- F. Motor: Maximum 40 degrees C (72 degrees F) ambient temperature rise, drip-proof, voltage and phase as shown in schedule on electrical drawings conforming to NEMA 6P. Size the motor capacity to operate pump without overloading the motor at any point on the pump curve. Refer to Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
- G. Starting Switch: Manually-operated, tumbler type, as specified in Section 26 29 11, MOTOR CONTROLLERS.
- H. Provide a union, and check and shut-off valve in the discharge from each pump.

2.3 TANK FLUID LEVEL MONITOR, PUMPING AND ALARM SYSTEMS

- A. Digital systems for central monitoring of water levels and pump control in the two water storage tanks in the project. High and low level visual and audible alarms. Volumetric tank-tightness testing. Complete with all transducing, transmitting, and receiving devices.
- B. Automatic Control and Level Alarm: Provide control panel in a NEMA 1 enclosure for indoors.
 1. Provide two separate power supplies to the control panel, one for the control/alarm circuitry and one for power to the pump motors. Each power supply is to be fed from its own breaker. If a pump overload trips a breaker, the alarm system shall still function. Each power supply will be wired in its own conduit. Wiring from the tank to the control panel shall have separate conduits for the pump

power and for the sensor switches. All conduits are to be sealed at the sump basin and at the control panel to prevent the intrusion of moisture.

2. Only one pump shall operate from either tank via a HOA switch at the panel.
3. The controls shall be suitable for operation with the electrical characteristics listed on the electrical drawings.
4. The control panel shall have a level control system with monitors the water level and to activate a high-water alarm.
5. The level control system shall include sensors in the tank that detect the level of the liquid.
6. The high-water alarm shall have a red beacon light at the control panel and a buzzer or bell.
7. The alarm shall have a silencing switch.
8. The circuitry of the control panel shall include:
 - a. Power switch to turn on/off the automatic control mechanism.
 - b. HOA switches to manually operate each pumps. Only one pump shall be allowed to run.
 - c. Run lights to indicate which pumps are powered up.
 - d. Level status lights to indicate when water in sump has reached the predetermined on/off and alarm levels.
 - e. Magnetic motor contactors.
 - f. Disconnect/breaker for each pump.
 - g. Automatic motor overload protection.
 - h. Provide auxiliary contacts for remote alarming to the BAS and BACnet compatible open-protocol type interface to DDC Controls System.
- C. Provide a manual switch to alternate duties of each pump at the end of each pumping cycle. Pumps shall be manually selected to start/stop.
- D. Fluid Level Monitor:
 1. Digital continuous readout, water levels in gallons, smallest reading one gallon. Provide identification of product measured, measuring units, and the tank number.
- E. High and Low Fluid Level Alarm System:
 1. Automatic continuous on-line monitoring of all tanks.
 2. Visual and audible indicators combined with fluid level monitor. Identify the tank that is in alarm condition.
 3. Manual alarm test and silencing controls.

4. Low level alarm actuation adjustable 0-25 percent of tank capacity.
High level alarm actuation adjustable 75-100 percent of tank capacity.
- F. Locate all indicators, selector switches, alarms on face of wall-mounted NEMA 250 panel.
- G. BacNet communication to DDC computer workstation to indicate tank water level and alarm conditions.
- H. Sensors:
 1. Provide sensor types such as magnetostrictive, capacitance, float, hydrostatic and other types as necessary for the applications.
 2. Apply in accordance with manufacturer's instructions with provisions for easy future replacement without need for excavation.
 3. Float-type units shall be designed for installation and removal through a 100 mm (4 inch) diameter vertical pipe mounted in the top of the tank.
 4. Sensors that detect the level of water in the tank shall be arranged as to allow the accumulation of enough volume of liquid so that the pump will run for a minimum cycle time of two minutes.
- I. Control Sequence for Pumping
 1. The system shall monitor water level in tanks
 2. The system pumps shall normally be commanded off.
 3. The operator shall command the selected pump to start and run by switching the HOA switch to the automatic position.
 - a. The pump in the selected tank shall start and run. Water will circulate the industrial water supply to the boiler plant condensate tank emergency make up water line.
 - b. The backpressure valve shall be set by the test and balance contractor to recirculate water to the industrial water storage tanks in the event the condensate tank emergency make up water valve is closed.
- J. Underground Wiring and Piping: Enclose in water-tight corrosion-resistant conduit system sized and arranged as recommended by system manufacturer and conforming to Section 26 05 41, UNDERGROUND ELECTRICAL CONSTRUCTION.

PART 3 EXECUTION

3.1 TESTING

- A. Tanks shall be field tested for leakage immediately prior to installation.
- B. Notify the owner 14 days in advance of testing. Tests shall be witnessed by Owner.
- C. Testing Procedure:
 - 1. Tighten and soap all tank fittings and all parts of the tank which, in the opinion of Engineer, appear to have been damaged during transportation and handling.
 - 2. Pressurize the tank with air to 5 psig and visually inspect for leaks.
 - a. Retighten all leaking fittings until such leakage is stopped.
 - b. All damaged areas on the tank which are found to be leaking shall be brought to the attention of the manufacturer's installation representative. The manufacturer's representative shall submit the proposed repair method to Engineer for review and acceptance.
 - c. Test shall not be considered complete until pressure has been maintained for one hour during which no leaks are detected.
 - 3. Tanks which have been repaired and those which have been dropped or impacted after initial test shall be retested. Tanks shall continue to be retested until a successful leakage test is obtained.

3.2 STARTUP AND TESTING OF PUMPS

- A. Perform tests as recommended by product manufacturers and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.
- B. The tests shall include system capacity, control function, and alarm functions.
- C. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.
- D. The CxA will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the COR and CxA. Provide a minimum notice of 10 working days prior to startup and testing.

3.3 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.

3.4 DEMONSTRATION AND TRAINING

- A. Provide services of manufacturer's technical representative for 4 hours to instruct VA personnel responsible 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.

- - END - - -