

SECTION 43 40 01
POLYETHYLENE STORAGE TANK

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Mechanical Engineers (ASME): B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
2. ASTM International (ASTM):
 - a. C177, Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
 - b. D638, Test Method for Tensile Properties of Plastics.
 - c. D648, Test Method for Deflection Temperature of Plastics Under Flexural Load.
 - d. D746, Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
 - e. D790, Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
 - f. D833, Standard Definitions of Terms Relating to Plastics.
 - g. D1505, Test Method for Density of Plastics by the Density-Gradient Technique.
 - h. D1525, Test Method for Vicat Softening Temperature of Plastics.
 - i. D1621, Test Method for Compressive Properties of Rigid Cellular Plastics.
 - j. D1622, Test Method for Apparent Density of Rigid Cellular Plastics.
 - k. D1623, Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.
 - l. D1693, Test Method for Environmental Stress-Cracking of Ethylene Plastics.
 - m. D1940, Method of Test for Porosity of Rigid Cellular Plastics.
 - n. D1998, Specification for Polyethylene Upright Storage Tanks.
 - o. E84, Test Method for Surface Burning Characteristics of Building Materials.

1.02 DEFINITIONS

A. XLHDPE: Cross-linked high-density polyethylene.

1.03 SYSTEM DESCRIPTION

- A. Provide polyethylene tank for membrane equipment system backpulse tank.

1.04 DESIGN REQUIREMENTS

- A. Manufacturer shall design bulk chemical storage tank suited for sodium hydroxide, including wall thickness and methods and locations of support and anchorage. Design shall be prepared and sealed by designer meeting requirements of Article Quality Assurance.
- B. Tank manufacturer must be capable of providing UL Listing for Nonmetallic Aboveground Tanks for Chemicals.
- C. Membrane Equipment System Supplier shall design the tank size, backpulse tank inlet, outlet, and overflow opening locations and fitting requirements. Manufacturer shall design wall thickness and methods and locations of support and anchorage.

1.05 SUBMITTALS

- A. Action Submittals:
 - 1. Shop Drawings:
 - a. Fabricator's catalog information, descriptive literature, specifications, and identification of materials of construction. Provide catalog cuts for all off-the-shelf items.
 - b. Detailed fabrication drawings shall be scale drawings showing the relative size, configuration, location, materials of construction, and details of all equipment and materials to be furnished including the tanks, fittings, access ladders, supports, and tank holddown and support systems. Both plan and elevation views shall be provided. All piping terminal points shall be clearly shown and fully dimensioned.
 - c. Resin used for each tank and all supporting specifications for resins.
 - d. Foundation and Anchor Bolt Drawings: Drawings shall be provided that show all data and details required for design of the tank foundations including locations and dimensions for knockouts and embedded items, and the size, type, location, embedment and projection of anchor bolts.
 - e. Complete design calculations for tanks, supports and appropriate accessories.
 - f. Tank data indicating pressure rating, diameter, straight shell lengths, overall lengths, wall thickness, and details of nozzle designs.

- g. Tank capacity chart indicating gallons for each inch of depth and cumulative total from bottom.
 - h. Certified test data on representative samples of standard materials which demonstrate compliance with the physical properties specified herein.
 - i. Certified copy of all factory test results including gel tests, impact tests, and hydrostatic tests. Provide a listing of procedures used in testing.
 - j. Installation instructions shall be completed, detailed, and sequenced instructions for original installation. Recommended methods for assembly and adjustment including all bolt torques shall be provided along with special precautions and the sequence of work. Rigging and lifting details shall also be included for all factory-fabricated assemblies and individual components weighing over 100 pounds.
 - k. All exceptions and any proposed revisions to the requirements of the Specifications shall be included with the Submittals.
2. Samples: Representative Samples of the high density cross-linked polyethylene with anti-oxidant resistant linear low density polyethylene liner tank shall be provided.

B. Informational Submittals:

- 1. Fabricator's Certificate of Compliance with fabrication requirements.
- 2. Quality Assurance Inspection:
 - a. Initial QA Inspection Report.
 - b. Certification of Factory Testing.
- 3. Special shipping, storage and protection, and handling instructions.
- 4. Fabricator's written/printed installation and tank support instructions.
- 5. Manufacturer's Certificate of Proper Installation.
- 6. Operation and Maintenance Data: As specified in Section 01 78 23, Operation and Maintenance Data.

1.06 QUALITY ASSURANCE

- A. Fabricator's Quality Assurance Supervisor: Minimum of 5 years' experience in the fabrication of polyethylene storage tanks of similar size and usage.
- B. Tanks shall be manufactured by a firm with a nationally accepted quality standard (such as, ISO 9001).

1.07 DELIVERY, STORAGE, AND HANDLING

- A. All materials fabricated to this specification must be packaged, crated, or protected in such manner so as to prevent damage in handling and while in transit. Details of these procedures shall be the responsibility of manufacturer.

B. In addition, prepare and protect tanks for shipment as follows:

1. Mount tanks on padded cradles if shipped horizontally or on a suitable skid if shipped vertically.
2. Protect all flanged nozzles with wooden blinds bolted to the flange and having a diameter of 2 inches greater than the outside diameter of the flange.
3. Provide either rigid plugs inside the ends to prevent deflection or wooden boxes for all unflanged components. Brace the open ends of tanks with a suitable stiffening member to prevent deflection.
4. Do not ship components or other pieces loose inside the tanks.
5. Load tanks with at least 2 inches clearance between the tank (including fittings) and the bulkheads or bed of the vehicle.
6. Regardless of the mode of transportation, firmly fasten and pad all components to prevent shifting of the load or flexing of components while in transit.
7. Nozzles or other fittings shall not be used for lifting.

1.08 SPECIAL GUARANTEE

- A. Tanks shall have a minimum 2-year guarantee from the tank manufacturer, covering the complete cost of repair and replacement of the tanks (not including any costs associated with altering, removing, or demolishing the existing facility structure for such removal which shall be borne by Contractor) during the first 2 years of service, should leakage occur through the tank or the tank fittings, or should the tank or tank fittings show signs of fatigue or failure as determined by Contracting Officer.

PART 2 PRODUCTS

2.01 GENERAL

- A. All equipment specified herein shall be factory fabricated and assembled to the maximum extent possible requiring a minimum of field assembly. Field installation shall be limited to anchoring the tanks and making external piping connections.
- B. All equipment specified herein shall be suitable for contact with the stored chemicals.
- C. Like items of materials and equipment shall be the end products of one manufacturer in order to provide standardization for appearance operation, maintenance spare parts, and manufacturer's service.

2.02 SERVICE CONDITIONS

- A. Location: Indoors.
- B. Ambient Air Temperature Range: 50 degrees F to 100 degrees F.
- C. Relative Humidity: Up to 100 percent.
- D. Operating Pressure: Atmospheric.
- E. Stored Materials:

Stored Materials		
Equipment	Chemical	Specific Gravity
Membrane Backpulse Tank	Membrane permeate	1.0

2.03 TANK DESIGN

- A. Physical Characteristics:
 - 1. Membrane Backpulse Tank Design:
 - a. Working Volume: 775 gallons (approx. 6,500 pounds).
 - b. Tank Diameter: 48 inches.
 - c. Tank Height: 123 inches.
 - d. Special Loads: Design tanks for dead loads from all attached piping.
 - e. Hydrostatic Load: For specific gravities of stored materials specified herein. Tanks shall be designed to withstand the hydrostatic pressure resulting from a full tank.
 - 2. Fittings:
 - a. Tank fittings and openings shall be provided as listed in the Fitting/Opening Schedule and located as shown on the Drawings.

Fitting/Opening Schedule		
Service	Type/Location	Diameter
Fill/Discharge	Flanged/Top	8 inch
Vent	Flanged/Top	8 inch
Overflow	Flanged/6" below tank top	10 inch

- b. Provide fill pipe drop leg inside tank connecting to fill connection. Pipe drop leg shall extend down into tank interior and shall have a 45-degree elbow installed on its end to discharge to interior sidewall of tank. Drop leg shall be supported internally by a pipe support. Pipe support shall be a bolted fitting at tank sidewall.

- c. Fittings shall be CPVC compressive type, with long shank, deep cut threaded with dual wide nut assembly. End type of fittings for connection to facility piping shall be as shown in the Fitting/Opening Schedule.
- d. All flanged fittings shall be gasketed with materials compatible with the chemical service.
- e. Flanged fittings where stresses could be applied to flanged outlet shall include elastomer bellows.
- f. Bolted fittings shall use bolts made of corrosion resistant alloy with polyethylene-encapsulated heads and CPVC external flanges.
- g. All materials used in tank fitting assemblies shall be resistant to the stored chemicals. No wetted fittings or appurtenances shall be of metallic construction.

B. Functional Characteristics: None.

C. Performance Characteristics:

1. Tank Construction:

- a. Tanks specified herein shall be cross linked high-density polyethylene construction with interior anti-oxidant resistant linear HDPE liner and integrally mounted flanged outlet (IMFO) and shall meet or exceed all requirements of ASTM D1998.
- b. Tanks shall be vertical, flat bottom, dome top construction with translucent materials to allow observation of liquid level.
- c. Tank manufacturer must be capable of issuing gel test results with 1/8-inch inner wall reading no less than 65 percent and outer wall no less than 90 percent gel. Entire thickness must be at least 80 percent gelled.
- d. The XLHDPE tanks shall be constructed using the rotational molding process.
- e. Tanks shall be fabricated to the dimensions shown on the Drawings and as listed in the Tank Schedule:

Tank Schedule			
Equipment No.	Minimum Capacity	Maximum Diameter*	Sidewall Height*
Membrane Backpulse Tank	775 gal	4'-0"	10'-3"
*Tank sizes are nominal sizes.			

- f. Materials shall meet or exceed the following properties:

Parameter	ASTM Test	Requirement
Density	D1505	0.944 - 0.946 gm/cc
Environmental Stress, Cracking Resistance (F50)	D1693	1,000 hrs
Tensile Strength, Ultimate (2" min.)	D638	2,600 - 3,000 psi
Elongation at Break (2" min.)	D638	400%
Vicat Softening Point	D1525	240 degrees F
Flexural Modulus	D790	100,000 psi
Brittleness Temperature	D746	-130 degrees F
Heat Distortion Temp	D648	67 degrees C
Polyethylene Notch Test (PENT)	F1473	>1,000 hours

2. Tank Support and Restraint System:
- Each tank and its associated attachments shall be structurally adequate for all tank design criteria specified herein.
 - Provide a minimum of four Type 316 stainless steel holddown lugs, complete with plate, anchor bolts, nuts, and washers for proper anchoring of the tank. Actual number of holddown lugs shall be calculated with the tank full.
 - All exposed metal surfaces not constructed of stainless steel shall be painted in accordance with and as specified in Section 09 90 00, Painting and Coating.

2.04 ACCESSORIES AND APPURTENANCES

A. Physical Characteristics:

- Gaskets:
 - Material compatible with chemical service, low torque, full face, ASME B16.1 dimensions, two concentric, convex, molded rings between center hole and bolt hole circle.
 - Type: 1/4-inch thick, low torque, full face, ASME B16.1 dimensions.
- Pipe Supports:
 - Provide pipe supports for the fill pipe, overflow pipe, and discharge pipe attached to the tank.
 - Spacing of pipe supports shall be as recommended by the fabricator, but shall not be greater than 5 feet on center.

- c. Pipe supports shall allow removal of supported pipes.
 - d. Complete with Hastelloy C bolts, nuts, washers, and other necessary hardware for easy field assembly.
 - 3. Lifting Lugs: Provide suitably attached for all tanks weighing over 100 pounds. Lifting lugs shall be bolted fittings in sidewall of tank. Bolted fittings shall be as specified herein.
 - 4. Anchor Bolts: Type 316, stainless steel bolts, sized by fabricator and at least 3/4-inch diameter, or as shown and as specified in Section 05 50 00, Metal Fabrications.
- B. Functional Characteristics: None.
- C. Performance Characteristics:
- 1. All tank accessories and appurtenances shall be chemically compatible with the stored materials and shall be designed to withstand the hydrostatic pressure resulting from a full tank.
 - 2. Calibration Tape: Calibration tape shall be self-adhesive, translucent tape calibrated in multiples of 50 gallons or less. Strips shall use black numerals and tick marks to denote gallonage.

2.05 SOURCE QUALITY CONTROL

- A. General: The tank fabricators shall have a quality control procedure adequate to ensure that all fabrication complies with these Specifications.
- B. Factory Tests:
- 1. Impact Tests: A representative sample from each tank shall undergo a factory impact test. Impact test must meet the requirements of ASTM D1998.
 - 2. Gel Tests: A representative sample from each tank provided shall undergo a factory gel test, as prescribed by ASTM D1998.
 - 3. Hydrostatic Leak Tests:
 - a. Perform on each tank.
 - b. Fill to overflow nozzle; allow to stand for 24 hours with no visible leakage.
 - 4. Wall Thickness: Each tank shall have an actual wall thickness measurement taken at every 90 degrees, at each one foot elevation, up to three feet from the bottom of the tank.
 - 5. Reports: Certify, by signature, the results of the factory testing.

PART 3 EXECUTION

3.01 INSTALLATION

- A. In accordance with the manufacturer's written instructions.
- B. Contractor shall provide all supervision, labor, tools, construction equipment, incidental materials, and the necessary services required to complete the installation and testing of the equipment.
- C. Accurately place anchor bolts using templates furnished by the manufacturer or as otherwise recommended by manufacturer and as specified in Section 05 50 00, Metal Fabrications.
- D. Tanks shall be installed in such a manner that no stresses shall be applied to flanged outlet as per manufacturer's installation instructions.
- E. Uniform and level surface contact shall be made between all tank bottoms and the support foundations by means of grouting. Tanks shall be set in wet grout tapered from a point 1 inch higher at tank center to the foundation edges. Initially, grouting shall be finished to leave no voids. Tanks shall be settled down squeezing out excess grout in such a manner as to leave no voids in the tank bottom/foundation interface. The grout shall not be used to support any load, only to fill irregularities in the tank bottoms and foundations. The in-place tanks shall not be exposed to any loads until the grout has hardened.
- F. Bolt torques on gaskets shall be as recommended by the equipment manufacturer.

3.02 FIELD QUALITY CONTROL

- A. Field Tests:
 - 1. Hydrostatic Test: Storage tanks shall be filled with clean water to the overflow level after all connections have been made. There shall be no leakage, no signs of weeping, and no signs of capillary action over a period of 48 hours.
 - 2. Quality control shall include a final inspection by Contractor and a written record of this final inspection.
 - 3. After testing, the tanks shall be thoroughly cleaned and dried.

3.03 MANUFACTURER'S SERVICES

- A. A manufacturer's representative for the equipment specified herein shall be present at the Job Site and classroom designated by Government for the minimum person-days listed for the services hereunder, travel time excluded:
 - 1. 1 person-day for inspection and certification of the installation.
- B. Manufacturer shall certify in writing:
 - 1. Equipment has been provided in accordance with this specification.
 - 2. Equipment has been installed in accordance with the manufacturer's recommendations and inspected by a manufacturer's authorized representative.
 - 3. Proper mechanical connections have been made.
 - 4. Equipment is ready for startup and operation.

END OF SECTION