SECTION 11251

chemical storage tanks – single walled tanks

# GENERAL

## SCOPE OF WORK

### The CONTRACTOR shall provide a high density cross-linked polyethylene tank with an exterior Slope Bottom to Match existing Concrete on site and accessories per section 2.05, complete and in place, in accordance with the Contract Documents.

## related work specified elsewhere

### Section 01300 – Shop Drawings and Submittals

## references, codes and standards

### American Society of Testing Materials (ASTM).

#### D638 Tensile Properties of Plastics

#### D883 Standard Definitions of Terms Relating to Plastics

#### D1505 Density of Plastics by the Density-Gradient Technique

#### D1525 Test Method for Vicat Softening Temperature of Plastics

#### D1693 ESCR Specification Thickness 0.125" F50-10% Igepal

#### F412 Standard Terminology Relating to Plastic Piping Systems

### ANSI Standards: B-16.5, Pipe Flanges and Flanged Fittings

### Building Code: International Building Code - IBC 2009

### ARM: Low Temperature Impact Resistance (Falling Dart Test Procedure).

### NSF/ANSI Standard 61, AWWA – Drinking Water System Components

### ASTM D-1998, Standard Specification for Polyethylene Upright Storage Tanks

## submittals

### **Shop Drawings:** Shop drawings shall be approved by the engineer or contractor prior to the manufacturing of the tank. Submit the following as a single complete initial submittal. Sufficient data shall be included to show that the product conforms to Specification requirements. Provide the following additional information:

#### Single wall tank and Fitting Material

##### Resin Manufacturer Data Sheet

##### Fitting Material

##### Gasket style and material

##### Bolt material

#### Dimensioned Tank Drawings

##### Location and orientation of molded in fitting (IMFO®), openings, fittings, accessories, restraints and supports.

##### Details of inlet and molded outlet fitting (IMFO®), manways, flexible connections, and vents.

#### Calculations shall be stamped and signed by a registered, third party engineer in the State of California.

##### Wall thickness. Hoop stress shall be calculated using 600 psi @ 100 degrees F.

##### Tank restraint system. Show seismic and wind criteria.

##### Concrete pad and concrete secondary containment berm

### Manufacturer’s warranty

### Manufacturer's unloading procedure

### Manufacturer's installation instructions

### Supporting information of Quality Management System

### Supporting documentation of Manufacturer’s certification to supply Slope Bottom Tanks

### Manufacturer’s Qualifications: Submit to engineer a list of 5 installations in the same service as proof of manufacturer's qualifications.

### Factory Test Report

#### Material, specific gravity rating at 600 psi @ 100 degrees F. design hoop stress.

#### Wall thickness verification.

#### Visual inspection

#### Impact test

#### Gel test

#### Hydrostatic test

### A statement of chemical compatibility between material to be stored and all components and accessories of tank system.

## quality assurance

### Tanks shall be by a manufacturer with at least ten (10) years prior experience in construction of similar polyethylene tanks

### The CONTRACTOR shall provide an exterior sloped bottom vertical, high density cross-linked polyethylene tank with full drain capability and molded in flange.

### Tanks shall be manufactured from virgin materials.

### Tanks shall be manufactured from materials certified to NSF/ANSI Standard 61 for chemical storage and submit form from NSF supporting chemical certification. *(Remove if not required)*

### Warranty: The warranty shall be provided upon request for the specific service application and shall be a minimum 5 year, full replacement warranty.

# products

## general

### Tanks shall be rotationally-molded, slope bottom, high density cross-linked polyethylene, one-piece seamless construction, cylindrical in cross-section and vertical with flat / sloping bottoms in axis. Tanks shall be adequately vented. Where indicated, tanks shall be provided with ancillary mechanical fittings and accessories. Tanks shall be marked to identify the capacity to include graduated capacity indicator, manufacturer, date of manufacture and serial numbers must be permanently embossed into the tank.

## manufacturers

### Polyethylene tanks shall be manufactured or supplied by Snyder-Crown Industries, Ine.; Poly Processing Company; Rotational Molding Inc.; Nalgene; or equal.

### For aqueous ammonia applications Snyder-Crown Industries only.

## polyethylene storage tanks

### Service: Chemical storage tanks shall be suited for the operating conditions contained in this section.

### High Density Cross-linked Polyethylene resin used in the tank manufacture shall contain ultraviolet stabilizer as recommended by resin manufacturer. Where black tanks are indicated, the resin shall have a carbon black compounded into it. The tank material shall be rotationally molded and be a resin that is commercially available at the time of tank manufacture.

### Tank exterior slope will match existing elevated concrete sloped pads with no connection to the existing pads.

### Wall thickness for a given hoop stress is to be calculated in accordance with ASTM D 1998. Tanks shall be designed using a hoop stress no greater than 600 psi. In NO case shall the tank thickness be less than design requirements per ASTM D 1998.

### The wall thickness of any cylindrical portion at any fluid level shall be determined by the following equation:

### T = P x OD/2SD or 0.433 x SG x H x OD/2SD

### Where: T = wall thickness, in

### P = pressure, psi

### SG = specific gravity, gm/cc

### H = fluid head, ft

### OD = outside diameter, ft

### SD = hydrostatic design stress, 600 psi

#### The minimum wall thickness shall be sufficient to support its own weight in an upright position without external support but shall not be less than 0.187” thick.

### On closed top tanks the top head shall be integrally molded with the cylindrical wall. Its minimum thickness shall be equal to the thickness of the top of the straight sidewall. In most cases, flat areas shall be provided for attachment of large fittings on the dome of the tank.

### The bottom head shall be integrally molded with the cylindrical wall. Knuckle radius shall be:

|  |  |
| --- | --- |
| **Tank Diameter, ft** | **Min Knuckle Radius, in** |
| less than or equal to 6 | 1 |
| greater than 6 | 1-1/2 |

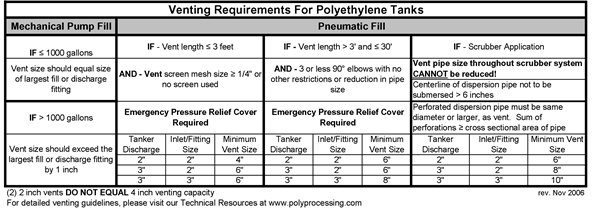
### Tanks with 3,000 gal capacity or larger shall have at least 3 lifting lugs. Lugs shall be designed for lifting the tank when empty.

### Unless otherwise indicated by Contract drawings, for indoor pneumatic fill, manways shall be 24-in diameter or greater and equipped with an emergency pressure relief device to prevent over-pressurization. Gaskets shall be closed cell, cross-linked polyethylene foam, Viton, or EPDM materials.

### Unless otherwise indicated by Contract drawings, for outdoor pneumatic fill, manways shall be 24-in diameter or greater. Manway must be capable of relieving a volume flow rate of up to 2,650 ACFM. Gaskets shall be closed cell, cross-linked polyethylene foam, Viton, or EPDM materials.

### Unless otherwise indicated, tanks less than 2,000 gallons in non-pneumatic applications shall have a manway cover 17-in or smaller. Gaskets shall be closed cell, cross-linked polyethylene foam, Viton or EPDM materials.

### Tanks must be vented to allow for performance at atmospheric pressure, in accordance with the following matrix:



### Tank colors shall be specified by the ENGINEER with written agreement by the tank manufacturer.

## tank accessories

### All accessories affixed to or near the tank shall be chemically compatible with the material to be stored in the tank. The Contractor shall submit a statement of chemical compatibility as a part of the accessory submittal.

### Ladder: (Populate if required)

#### [Painted carbon steel], [fiberglass], [galvanized carbon steel] or [stainless steel] access ladders shall be provided with the polyethylene chemical storage tanks at locations as shown. Safety cages shall be added to ladders as required, per OSHA.

#### Ladders must be secured to the tank and secured to the concrete to allow for tank expansion/ contraction due to temperature and loading changes. Use proper chemical resistant materials when anchoring to tank dome or sidewall.

#### Safety cages shall be added to ladders as required by OSHA. All ladders shall be designed to meet applicable OSHA standards. Reference: OSHA 2206; 1910.27; fixed ladders.

[\*Note to the Engineer: If the tank is located outside, a davit crane shall be supplied for fall protection.\*]

### Restrained System: (Populate if required)

#### Metal components to be [galvanized], [stainless steel], or [painted clips], edge softeners, and tension ring with [stainless steel], [galvanized] cables and clamps.

#### Tank restraint system shall be designed by a Structural Engineer registered in the State of California. Design shall conform to the most recent edition of the IBC/CBC code for seismic and wind load. Anchor bolts as required by the calculations shall be supplied by the tank manufacturer.

### Heat Tracing: (Populate if required)

#### (Heat tracing shall be included when weather conditions of the facility location permit.)

### Heat tracing system for temperature maintenance shall be SPX tank heating system by HTD Heat Trace Inc. designed to maintain a desired product temperature, not to exceed 100 degrees F. Each system shall include tank heating pads and a temperature controller. The quantity and type of SPX pads is determined by the size of the tank, the desired temperature maintenance and environmental conditions. Systems shall be available in 30, 60 or 100 degrees F. Power supply to be the only field installation required.

##### Pads to operate on 120 vac single phase with a maximum power density of 0.39 watts/square inch.

##### Temperature controller to be supplied with two electronic thermostats switching the heating system via one solid state relay. Primary thermostat to control desired product temperature and secondary thermostat to provide over temperature protection at 150 degrees F.

##### Heater pads to be completely water proof.

##### Wrapped-on electric resistance heat tape or banding is not acceptable.

##### Heat loss calculations shall be supplied for each specifically designed tank heating system.

### Insulation: (Populate if required)

#### All tank tops and sidewalls shall be insulated with polyurethane spray foam insulation. Insulation used shall be polyurethane foam with a density of 2.5 lb/ft3 with a minimum "R" value of 6.3/in, K Factor of 0.158, a minimum compression strength per ASTM D1621, and meet ASTM E-84 flammability. The foam shall be applied with a nominal thickness of 2 inches to all external tank surfaces except the tank bottom shelf.

#### Upon completion of application and curing of the insulation, 2 full coverage coats of latex mastic coating shall be applied to the surface of the insulation in such manner as to seal the insulation from the outside environment.

### Leak Detection:

#### Each tank shall be installed with a leak detection system to detect a leak in the interstitial space of the double wall tank (area between the inner and outer tanks). Leak detection controls are mounted in a NEMA 4X fiberglass enclosure. System to include: power light, leak detection alarm horn, alarm silence push button with light and control relays. Alarm horn to have a sound output of 68-80 dB at~~@~~ 2 feet. Pilot devices are NEMA 4X rated. The leak detection sensor shall be a 4-wire, 24VDC, single point optical sensor molded of PFA Teflon material. The sensor will have a NEMA rating of NEMA 6 (IP68), and a process temperature rating ~~of~~ from –40° F to 176°F.

[\*Note to the Engineer: Tank leak detection shall be tied to the District’s SCADA system. Incorporate language for SCADA into this specification. \*]

### Concrete Pad:

#### The tank shall sit on a minimum 18” raised concrete pad. The Contractor shall submit a concrete pad drawing submittal to be approved by the District prior to construction.

### Concrete Containment Berm:

#### The Contractor shall submit a submittal for a concrete secondary containment berm to be approved by the District.

#### The containment berm shall be sized to adequately capture the entire volume of the tank.

## Tanks

### **Tank Schedule:** (Populate tank and fittings schedule)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Tank tag number** | **Qty.** | **Product stored** | **Tank capacity** | **Diameter** | **Height** | **Manway size** |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |

**Note 1:** Approximate overall height is measured along the straight cylindrical portion of the tank and includes the dome top.

1. **Fittings Schedule:** *(Populate fittings schedule)*

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Tank tag number** | **Fill** | **Drain/outlet** | **Vent** | **Overflow** | **Level** | **Spare** | **Ladder** | **Restraints** |
|  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |

### **Fittings:** Threaded fittings shall use American Standard Pipe Threads. If tanks are insulated, fittings shall be installed at the factory prior to application of the insulation.

### Bolted flange fittings shall be constructed of one 150 lb. flange with ANSI bolt pattern, one flange gasket and stud bolts with gaskets. Stud bolts to have chemical resistant polyethylene injection molded heads and gaskets to provide a sealing surface between the bolt head and the interior tank wall. Stud bolt heads are to be color coded for visual ease of identifying the bolt material by onsite operators. Green- 316 Stainless Steel, Black- Titanium, Red- Alloy C-276, Blue- Monel. All materials shall be compatible with chemical service and as indicated in the fitting schedule above. For NSF/ANSI 61 certification, EPDM or Viton GF gaskets shall be supplied.

### For sodium hypochlorite and sulfuric acid storage, Bolted One-Piece Sure Seal (B.O.S.S.), double flange fittings constructed of virgin polyethylene shall be supplied. Bolts will be welded to a common backing ring and encapsulated with polyethylene preventing fluid contact with the metal material. Flange will have one full face gasket to provide a sealing surface against inside tank wall. All materials shall be compatible with chemical service and as indicated in the fitting schedule above. For NSF/ANSI 61 certification, EPDM or Viton GF gaskets shall be supplied.

### **Down Pipes and Fill Pipes:** Down pipes and fill pipes shall be supported at 6-ft max intervals. Down pipes and fill pipes shall be PVC or material compatible with the chemical stored.

### **U-Vents:** Each tank must be vented for the material and flow and withdrawal rates expected. Vents should comply with OSHA 1910.106(F) (iii)(2)(IV)(9). U-vents shall be sized by the tank manufacturer and be furnished complete with insect screen if required (Insect screen lessens the vent capacity by 1/3) in accordance with the venting schedule listed above.

### All fittings on the 1/3 lower sidewall of tanks with capacities > 1,000 gallons shall have 100% virgin PTFE Flexi-joint® expansion joint. Expansion joint to have a minimum of 3 convolutions, stainless steel limit cables and FRP composite flanges. All hardware shall be chemically compatible. Galvanized parts will not be accepted.

### Expansion joint to meet the following minimum performance requirements:

#### Axial Compression ≥ 0.67”

#### Axial Extension ≥ 0.67”

#### Lateral Deflection ≥ 0.51”

#### Angular Deflection ≥ 14º

#### Torsional Rotation ≥ 4º

## level indication *(populate if required)*

### **Float Indication:** The level indicator shall be assembled to the tank and shall consist of PVC float, indicator, polypropylene rope, perforated interior pipe, PVC roller guides, clear UV resistant PVC sight tube and necessary pipe supports. The level indicator shall act inversely to the tank contents and shall not allow entrance of tank contents into the sight tube at any time. Indicator shall be neon orange color for visual ease for onsite operators.

[\*Note to the Engineer: Coordinate with the District on whether float indication or magnetic indication is preferred for the specific application. Update section 2.06A accordingly.\*]

### **Visual Indication:** The level indicator shall be assembled to the tank and shall consist of clear UV resistant PVC sight tube and necessary pipe supports. Indicator shall be neon orange color for visual ease for onsite operators.

### **Ultrasonic Level Indicator:** The ultrasonic level indicator shall be a Flowline ultrasonic level transmitter, level controller with one 4-20 mA or 0-10 VDC continuous level input and NEMA 4X box to be supplied by tank manufacturer.

## factory testing

### Material Testing

#### Perform gel and low temperature impact tests in accordance with ASTM D 1998 on condition samples cut from each polyethylene chemical storage tank.

#### **Degree of Cross-linking.** Use Method C of ASTM D 1998- Section11.4 to determine the ortho-xylene insoluble fraction of cross-linked polyethylene gel test. Samples shall test at no less than 60 percent.

### Tank Testing

#### **Dimensions:** Take exterior dimensions with the tank empty, in the vertical position. Outside diameter tolerance, including out-of-roundness, shall be per ASTM D 1998-21. Fitting placement tolerance shall be +/- 1/2-in vertical and +/- 1 degree radial.

#### **Visual:** Inspect for foreign inclusions, air bubbles, pimples, crazing, cracking, and delamination.

#### **Hydrostatic test:** Following fabrication, the bottom tanks, including inlet and outlet fittings, shall be hydraulically tested with water by filling to the top sidewall for a minimum of 1 hour and inspected for leaks. Following successful testing, the tank shall be emptied and cleaned prior to shipment.

# execution

## delivery, storage and handling

### The tank shall be shipped upright or lying down on their sides with blocks and slings to keep them from moving. AVOID sharp objects on trailers.

### All fittings shall be installed and, if necessary, removed for shipping and shipped separately unless otherwise noted by the contractor.

### Upon arrival at the destination, inspect the tank(s) and accessories for damage in transit. If damage has occurred, manufacturer shall be notified immediately.

## installation

### Install the tanks in strict accordance with manufacturer’s Tank Installation Manual and shop drawings.

### Installation will be inspected by manufacturer to verify system flexible connections, venting and fittings are properly installed. In addition to on-sight inspection tank system(s) to be reviewed using tank manual check list as supplied by manufacture as listed below.

### Manufacturer to provide 1 hour training session to prepare operators to service and maintain the tank system. Included in training session will be (#) training manuals.

### Manufacturer’s trained technician to do an onsite inspection of installation. Inspection will verify chemical application, plumbing connections, venting, and applicable ancillary equipment such as ladders, restraints, etc. A verification of proper installation certificate will be supplied when equipment passes installation checklist.

### Tank manuals will consist of installation check lists, tank drawing(s) as built, fitting drawings referencing nozzle schedule on tank drawing, materials of construction, and recommended maintenance program.

## field testing

### All tanks shall be hydro-tested for 24 hours prior to commissioning

end of section