

Section 13202

POLYETHYLENE CHEMICAL STORAGE TANKS

PART 1 GENERAL

1.01 SUMMARY

This Section covers the furnishing, installation and testing of double wall polyethylene chemical storage tanks and appurtenances as indicated and in compliance with Contract Documents.

1.02 MEASUREMENT AND PAYMENT

Unless indicated in the Unit Price Schedule as a pay item, no separate measurement or payment for work performed under this Section. Include cost of same in Contract price bid for work of which this a component part.

1.03 REFERENCES

This specification references the following publications in their current editions. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

- A. ASME B16.5: Pipe Flanges and Flanged Fittings NPS ½ Through NPS 24 Metric/Inch Standard
- B. ASTM D638: Standard Test Method for Tensile Properties of Plastics
- C. ASTM D746: Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
- D. ASTM D790: Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
- E. ASTM D883: Standard Terminology Relating to Plastics
- F. ASTM D1505: Standard Test Method for Density of Plastics by the Density-Gradient Technique
- G. ASTM D1693: Standard Test Method for Environmental Stress-Cracking of Ethylene Plastics
- H. ASTM D1998: Standard Specification for Polyethylene Upright Storage Tanks
- I. Association of Rotational Molders International (ARM) Standard Low Temperature Impact Test
- J. NSF/ANSI 61: Drinking Water System Components – Health Effects

- K. NFPA 704: National Fire Rating System (NFR) – Standard System for the Identification of the Hazards of Materials for Emergency Response
 - L. OSHA 29 CFR Part 1910.27: Fixed Ladder
 - M. OSHA 29 CFR Part 1926.104: Safety Belts, Life Lines and Lanyards
 - N. OSHA 29 CFR Part 1926.500: Fall Protection – Scope, application, and definitions applicable to this subpart
 - O. OSHA 29 CFR Part 1926.501: Fall Protection – Duty to have fall protection
 - P. OSHA 29 CFR Part 1926.502: Fall Protection – Fall protection systems criteria and practices
 - Q. International Building Codes (IBC): Tank Restraints
 - R. ISO 9000 Series: Quality Management Systems
- 1.04 SUBMITTALS
- A. Submit the following in accordance with Section 01330 – "Submittal Procedures:"
 - 1. When the Contractor proposes tanks which require an arrangement differing from that indicated on the Plans or as specified, prepare and submit for review detailed structural, mechanical, and electrical drawings and equipment lists, utilities consumption schedule and operating instructions, showing all necessary changes and embodying all special features of the equipment they propose to furnish. Make changes, if accepted, at no additional cost to the Owner.
 - 2. Operating and maintenance instructions and parts lists
 - 3. Shop Drawings data for accessory items
 - 4. Templates or certified setting plans, with tolerances, for anchor bolts
 - 5. Number and identify components to correspond with terminology on Plans. Use these numbers on all submittal sheets and Shop Drawings.
 - 6. Recommendations for short and long term storage
 - 7. Sales bulletins or other general publications are not acceptable as submittals for review except where necessary to provide supplemental technical data.
 - 8. A listing of the materials recommended for each service specified and indicated.
 - 9. ISO 9000 series certification or other quality control manual demonstrating a complete system for quality management

10. Tank manufacturers must be capable of providing a list of customers using at least five (5) similar tanks for the same chemical applications for at least ten (10) years.
11. Material Certification:
 - a. Provide certification from the manufacturer that the materials of construction specified are recommended and suitable for the service conditions specified and indicated.
 - b. If materials other than those specified are proposed based on incompatibility with the service conditions, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated including an installation list of a minimum of five (5) installations in operation for a minimum of three (3) years. Provide proposed materials at no additional cost to the Owner.
 - c. Where materials are not specified, provide technical data and certification that the proposed materials are recommended and suitable for the service conditions specified and indicated.
12. Certified results of factory tests
13. Recommended baffle design
- B. Special Requirements:

Submit the following:

 1. Manufacturer's specification, catalog data and illustrations
 2. Tank heating calculations
- C. Submit a copy of the contract mechanical process, electrical and instrumentation drawings, with addenda that are applicable to the equipment specified in this Section, marked to show all changes necessary for the equipment proposed for this Section. If no changes are required, mark all drawings with "No changes required".
 1. Failure to include all drawings applicable to the equipment specified in this Section shall result in rejection of the entire submittal with no further review.
- D. Submit a copy of this Section with addenda and all referenced specification sections with addenda, with each paragraph check-marked to indicate compliance or marked to indicate requested deviations and clarifications from the specified requirements.
 1. If deviations and clarifications from the Section are indicated, therefore requested by the Contractor, provide a detailed written justification for each deviation and clarification.

2. Failure to include a copy of the marked-up Sections and or the detailed justifications for any requested deviation or clarification shall result in rejection of the entire submittal with no further review and consideration.

1.05 RELATED REQUIREMENTS

- A. Section 01330 - "Submittal Procedures"
- B. Section 01610 - "Basic Product Requirements"
- C. Section 02515 - "Hydrostatic Testing of Pipelines"
- D. Section 09902 - "Painting and Protective Coating"
- E. Section 13446 - "Primary Instrumentation Devices"
- F. Section 15100 - "Chemical Piping"
- G. Section 16473 - "Water Receiving Facilities (WRF) Programmable Logic Controllers (PLC), SCADA Interface Panels and Panel Mounted Equipment"

1.06 QUALITY ASSURANCE

- A. Contractor shall do work required by and in accordance with applicable State and local codes; arrange for permits, inspections and tests required by these codes; and provide complete systems ready for use.
- B. Manufacturer shall provide tanks and accessories that conform to applicable safety standards including those for safety of personnel.
- C. Manufacturer shall provide components to manufacturer's standard for service intended unless otherwise required.
- D. Manufacturer shall provide components and accessories of latest and proven design
- E. All tanks and appurtenances listed in this Section are to be from the single source responsibility of the supplier of the tanks.
- F. The Plans and specifications direct attention to certain required features of the tanks, but do not purport to cover details entering into its design, construction and installation; nevertheless, provide tanks so that systems shall be complete and ready for operation.
- G. Provide supervisory services for satisfactory installation, with factory-trained serviceman to assist in determining location and orientation.
- H. Coordinate the work schedule of other parts of the chemical systems manufacturer's service personnel during construction, testing, start-up, and acceptance, to coordinate with the tank manufacturer.

- I. Upon completion of the installation, provide services of above serviceman for field testing.
- J. Clean tanks internally prior to shipping
- K. Shop test and provide certificates as specified
- L. Turn on no form of energy to any part of system prior to receipt by Engineer of certified statement of approval of installation from Contractor containing his supplier's authorization to energize system unless done by the supplier's servicemen may do so for purposes of checkout.

1.07 SYSTEM DESCRIPTION (NOT USED)

1.08 DELIVERY, STORAGE AND HANDLING

Deliver, unload, and store products on site in manner that prevents damage. Use special care to prevent damage from temperature and condensation.

1.09 - 1.12 (NOT USED)

1.13 WARRANTY

Provide Owner with manufacturer's warranty guaranteeing tanks to be free from defects in workmanship and materials, under normal use and service, for five (5) years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURER(S)

A. Cross-link Polyethylene Tank Fabricators:

- 1. Assman Tanks
- 2. Poly Processing
- 3. Snyder Industries, Inc.
- 4. Belding Tank Technologies
- 5. Or Approved Equal

B. Ultrasonic Level Transducer

- 1. Siemens
- 2. Or Approved Equal

C. Level Controller

1. Siemens Milltronics
2. Or Approved Equal

2.02 MATERIALS AND/OR EQUIPMENT

A. General

1. Provide NSF/ANSI 61 approved double wall tanks as indicated on Plans, using elevation and data as indicated on Plans and in Contract Documents.
2. Tank data includes pressure; temperature; shell, head, and connection materials; and design and construction details along with nozzle information.
3. Provide tanks with lifting lugs for handling and a tie-down system for installation.
4. Provide tank nozzles with flange fittings constructed of 150 lb. flanges with ANSI bolt pattern, as indicated on Plans. Project nozzles shall be installed at least 4-inches (100 mm) in length from the tank surface.
5. Provide overflow pipe support brackets on side of tank, to support overflow pipe.
6. Provide tank configuration to allow for gravity feed of solution from tanks to metering pumps. Provide tank configurations as indicated.
7. Provide spare connections with the specified type of nuts, bolts, gaskets and blind flanges.
8. Provide manway on tank with gasketed cover.
9. Clean tanks internally prior to shipment to meet requirements of NSF/ANSI 61.
10. Ship tanks protected to prevent damage to tanks and their protective coatings.
11. Provide open nozzles with masonite or plywood covers.
12. Provide top of tank capable of supporting its equipment, walkway and maintenance personnel.
13. As shown on the Plans, provide an anchorage point at the top of the storage tank(s) to meet OSHA requirements for fall protection, in accordance with OSHA 29 CFR Part 1926.500, 1926.501 and 1926.502.
14. Provide tanks with anti-swirl baffles as specified

15. When tanks are specified to require vertical or clamp-on mixers on the Plans, provide necessary supports, and coordinate design of these supports between mixer and tank manufacturers with respect to loadings and other mounting details to ensure that mixer loads are transmitted to tank walls without undue stresses or undesirable instability or vibrations.
16. For tanks specified to have mixers, coordinate clearances required for mixer removal with tank design and location in building.
17. Where tanks specified require anti-swirl baffles, incorporate them within tank as recommended by the mixer manufacturer. Coordinate the recommendations of the mixer manufacturer and tank manufacturer with respect to whether or not baffles are required, and if so, location and size of baffles.

B. Tanks

1. Cross-Linked Polyethylene Tank(s):

- a. Provide Double Wall High Density Cross-Linked Polyethylene Vertical/Horizontal storage tank, with all accessories as specified.
- b. The HDXLPE Tanks shall be as manufactured in accordance with the definitions given in ASTM D1998 Type I. The tanks shall be manufactured by the rotational molding process.
- c. The tanks shall be designed for a 1.90 Specific Gravity using a hoop stress value of no greater than 600 psi at 100 degrees F, with a safety factor of no less than 2, using the Barlow Formula for calculating wall thickness. For applications in excess of 100 degrees F design conditions, lower values for the design hoop stress shall be used.
- d. All double wall tanks are to be designed with wall thicknesses equal to or greater than that required by ASTM D1998 standards.
- e. Tanks shall be sized to meet the storage and chemical storage requirements of each site. See the "ATTACHMENT" for recommended manufacturer, model, volume, dimensions, and quantity of tanks to be provided.
- f. Tanks to be suitable for continuous exposure to the following chemicals (See the "ATTACHMENT" for chemicals and % solution to be stored):
 - (1) Up to 17% aqueous solution of sodium hypochlorite (Bleach)
 - (2) Up to 25% aqueous solution of Sodium hydroxide (Caustic)
 - (3) Up to 40% aqueous solution of ammonium sulfate (LAS)

- (4) Up to 38% aqueous solution of sodium bisulfite
- g. Storage tanks are to be opaque or semi-translucent with mastic coatings or insulation to prevent ultraviolet degradation of the chemicals.
- h. The tank shall be molded from a virgin High Density Cross-Linked Polyethylene resin, with no fillers.
- i. All dome fittings shall be PVC self-aligning bulkhead type.
- j. Impact Test:

 Test shall be done in accordance with ASTM D746. The standard method shall be used in this test.
- k. The nominal value for the properties of the polyethylene plastic material shall be as follows, as supplied by the resin suppliers.

Test Procedure	Units	XLPE	HDPE
Density/ASTM D1505	g/cc	0.940 to 0.945	0.939
ESCR Cond. A, F50/ASTM D1693 10 Percent Igepal	Hrs.	>1000	1000
Tensile Strength/ASTM D638	psi	2,600	3,900
Flexural Modulus/ASTM D790	psi	1000,000 to 110,000	86,500
Heat Distortion Temperature At 66 psi	Degrees C	67 Degrees	-
Long Term Hydrostatic (LTHS) (Creep)	psi	900	-
FDA-grade resin	-	No	Yes
UV-stabilized	-	Yes	Yes

- l. All edges cut out for manway or other openings shall be trimmed to have smooth edges.
- m. All fittings which are below the liquid level shall be flange style. There shall be a single 150 lb. ANSI PVC flange and a 1/4-inch gasket attached to the inside tank wall. The flange shall be bolted to the tank from the inside with a minimum of four (4) 1/2-inch diameter all thread bolts with bolt heads encapsulated in black polyethylene. The encapsulation shall be a minimum of 1/4-inch of the threads closest to the bolt head. Each bolt shall have a 1/4-inch EPDM gasket with head on the inside of the tank. See "ATTACHMENT" for location of drawings and details covering the storage tank.

- (1) The outlet/drain fitting may have a siphon leg attachment.
- (2) A molded in fitting is required for tank fittings at the bottom (invert).

C. Tank Accessories

1. Lifting Lugs:

Provide three (3) Type 316 stainless steel or high-density cross-linked polyethylene (molded) lifting lugs on each tank, spaced as follows:

- a. Three lugs spaced 120° apart at top portion of straight shell.

2. Flexible Expansion Joints:

- a. As called out and specified on the Plans, provide one expansion joint per tank per connections.
- b. Expansion joints are to be provided as shown on the Plans to allow the tank to expand and contract when filling and draining.

3. Nozzles:

- a. All tank nozzles shall be constructed of 150 lb. flanges with ANSI bolt pattern, as indicated on Plans
- b. Provide all nozzle sizes and locations as identified in Plans.
- c. Project nozzles at least 4 inches in length from tank

4. Wind and Seismic Restraint System:

- a. Tank restraint systems are to be provided on each tank when called for and as shown on Plans.
- b. To be designed to the latest International Building Code
- c. Provide with foot pads and anchors for concrete
- d. Provide with cable and turnbuckle assemblies

5. Sight Gauge:

- a. Tank is to be provided with a sight gauge when shown on Plans. Sight gauge shall be a clear PVC sight gauge of a material resistant to U.V
- b. Tank is to be provided with two PVC/CPVC tank sight gauge isolation ball valves. Bottom valve is to have a drain for the sight gauge.

- c. In addition, a ruler inscribed in the sight glass to measure liquid level in feet measured from the tank floor shall be provided
6. Ladders:
 - a. Rigid ladders are to be provided on each tank when called for and as shown on Plans.
 - b. Ladders to be in accordance with OSHA 29 CFR Part 1910.27, Fixed Ladder
 - c. Provide with a ladder safety device conforming to OSHA 29 CFR Part 1910.27 for ladders above six feet in height.
 - d. Provide one personnel full body harness in conformance with OSHA 29 CFR Part 1926.104 and associated attachments for every two tanks provided.
 - e. Ladder safety device shall be provided in addition to any cage or landing required or shown.
 - f. Ladder rungs to be nonskid of fiberglass on one foot centers, two foot wide
7. Vents:
 - a. Each tank shall contain one vent. Diameter of vent is to be as shown on Plans or as recommended by tank manufacturer. Manufacturer is to provide written confirmation that vent is of adequate size for filling tank via pump-truck.
 - b. Provide non-metallic insect screen and rain cap for each vent.
 - c. Tank to be vented to exterior atmosphere
8. Ultrasonic level transducer/Level Controller
 - a. Provide ultrasonic level indicator per requirements of Section 13446 – "Primary Instrumentation Devices."
 - b. See "ATTACHMENT" for manufacturer and model of level instrument to be purchased.
 - c. Instrument shall be designed for use with the chemical being stored in the tank.
 - d. Transmitter/indicator shall be equipped to send, at a minimum, four 4-20 mA signals for "Liquid Level" calibrated for liquid volume in gallons, "Liquid Level" calibrated for liquid level in feet, "High Level"

alarm and "Low Level" alarms. See Paragraph 2.02.E for more details on communication requirements.

- e. Level transducer to be top mounted
- f. Level Controller to provide 5 closures (min.)
- g. Local LED display panel, compatible with the ultrasonic level transducer/level controller' shall be provided for mounting near the tank to indicate liquid level (feet) and volume of liquid (gallons) in the tank.

9. Top Hatches:

Hatch diameter to be as shown on the Plans at a minimum. Larger opening size can be provided as recommended by the Manufacturer or Contractor.

10. Containment Pad:

- a. Provide a containment pad/tank stand for each tank. Pad shall raise the tank above the surface a minimum of 2-inches and a maximum of 8-inches.
- b. As required, coat pad per Section 09902 – "Painting and Protective Coatings."

11. Conduit unistrut supports:

Provide fiberglass unistrut mounted on the tank to accommodate three (3) 1-inch conduits for instrumentation and field devices.

12. Fill System:

- a. Tanks shall be provided with a fill line located and sized per the Plans.
- b. Fill line is to be equipped with a shut-off valve and quick connect fitting at the fill location for ease in filling the tank.
- c. Fill line should be located to have a clear view of the sight gauge for the tank.
- d. Provide chemical resistant non-metallic drip pans to be placed under each fill line. At a minimum, pans to measure 6" deep, 18" x 18". Include removable chemical absorbent pads in bottom of drip pans (provide 10 replacement pads).

13. Leak Detection System

- a. Tank shall be supplied with an Interstitial Leak Detection System with audible and visual alarms for detecting leaks between the walls of the tank.

- b. Leak detection system shall be provided by tank manufacturer and compatible with the tank being provided.
 - c. Manufacturer shall provide personnel qualified in installing and calibrating leak detection system once tank is installed and before being placed in operation.
14. Tank shall be heat traced and insulated as called for on the Plans.
- D. Tank Signage:
- 1. National Fire Rating (NFR):
 - a. Provide signage for the National Fire Rating System (NFR) designation conforming to NFPA 704, for the chemicals contained in the tanks.
 - b. Provide two (2) signs per tank. Location of signs to be determined in the field by the Project Manager for proper visibility.
 - c. Signs to be vinyl, screen printed with UV resistant inks, and a minimum of 18 inches per side. No mechanical fasteners are allowed.
 - 2. Provide signage for identifying for the chemicals contained in the tanks.
 - a. Provide two (2) signs per tank. Location to be determined in the field by the Project Manager for proper visibility.
 - b. Letters to be 6-inches high, colors of letters and background to be submitted for acceptance. Signs to be vinyl and screen printed and UV resistant inks. No mechanical fasteners are allowed.
- E. Communication
- 1. The ultrasonic level indicator/transmitter shall be equipped to transmit 4-20 mA signals from the transmitter to the customer operated control panel and/or the Owner's Supervisory Control and Data Acquisition (SCADA) system.
 - 2. The transmitter shall send a "LIQUID LEVEL," "HIGH LEVEL" alarm, and "LOW LEVEL" alarm to the customer operated control panel or PLC and/or the Owner's SCADA system. See the "ATTACHMENT" for level settings for the "HIGH LEVEL" and "LOW LEVEL" alarms.
 - 3. See Section 16473 - "Water Receiving Facilities (WRF) Programmable Logic Controllers (PLC), SCADA Interface Panels and Panel Mounted Equipment" for more information on the interface between the tank level transmitter and the Owner's SCADA system, if applicable.

2.03-2.04 (NOT USED)

PART 3 EXECUTION

3.01 - 3.02 (NOT USED)

3.03 ERECTION / INSTALLATION / APPLICATION AND/OR CONSTRUCTION

- A. Install tanks in accordance with printed instructions of manufacturer/fabricators, as indicated and specified.
 - 1. Do not use fittings for handling
 - 2. Install on concrete pads.
 - 3. Provide pad as recommended by the tank supplier.
 - 4. Assure there is no stress on tank nozzles.
- B. Field Painting:

As specified in Section 09902 – "Protective Painting and Coatings."
- C. Install all piping, fittings, valves and appurtenances required to install and operate the tanks in accordance with Section 15100 - "Chemical Piping" and the Plans.

3.04 REPAIR/RESTORATION (NOT USED)

3.05 FIELD QUALITY CONTROL

- A. Hydrostatic Test
 - 1. After installing tanks, but before making piping connections, block outlets and hydrostatically test tank by filling it with water to the top of the straight shell portion. Water is to be held for a minimum of 24 hours with no visible signs of leaks or excessive wall deflection. Check thoroughly for leaks, and then drain completely.
 - 2. If any leaks are found, inform fabricator and the Project Manager in writing and repair per manufacturer's instructions.

3.06 – 3.07 (NOT USED)

3.08 DEMONSTRATION / TESTING AND INSPECTION

- A. Acceptance Testing
 - 1. The Owner shall provide all chemicals for testing.
 - 2. Contractor shall supply all pipe, hose, pumps, water, power and other equipment required to convey the test liquids and carry out the tests.

3. After installation, clean tanks of loose debris and dry prior to tests.
4. Test tanks for leaks or damage prior to use and provide certification per ASTM D1998.
5. Test tanks with water first and then with specified chemical
6. Do not test acid tanks with water; use air at pressure of 5 psig for one hour prior to test with acid.
7. Test tanks with each liquid for period of 24 hours during which no visible leakage is acceptable.
8. Where hydrostatic testing of tanks is specified, apply required hydrostatic test pressure to the tank.
9. Repair leaks or damage by tradesman skilled in that type of work at no cost to the Owner.

3.09-3.10 (NOT USED)

END OF SECTION

ATTACHMENT

[Design Engineer is to complete blanks per site requirements]

A. Storage Tanks

1. Number of Tanks: _____

2. Tank Manufacturer: _____

3. Tank Model: _____

4. Level Indicator Manufacturer: _____

5. Level Indicator Model: _____

6. Chemical Storage Requirements:

a. Chemical to be stored: _____

1. Concentration: _____

2. Density: _____

3. Pressure: Atmospheric

4. Temperature: _____

b. Dimensional Requirements

1. Nominal outside diameter: _____

2. Nominal Straight Shell Height: _____

3. Nominal Capacity: _____

4. Shape: Dished Top, flat bottom

5. Ladder: _____

6. Low Level Alarm (Feet): _____

7. High Level Alarm (feet): _____

B. Storage Tank Drawing(s): _____

C. Storage tank Detail(s): _____

END OF SECTION