

SECTION 13205 - POLYETHYLENE TANKS

City of San Diego, CWP Guidelines

PART 1 -- GENERAL

1.1 WORK OF THIS SECTION

- A. The WORK of this Section includes providing cross-linked, high density polyethylene tanks with anchoring systems, piping connections, [insulation,] [heat tracing,] and accessories for chemical storage.
- [B. The WORK also requires that one manufacturer accept responsibility for furnishing the WORK as indicated [except for the level indication] but without altering or modifying the CONTRACTOR'S responsibilities under the Contract Documents.
- C. The WORK additionally requires that the one manufacturer who accepts the indicated responsibilities shall manufacture the tank.]

1.2 CODES

- A. The WORK of this Section shall comply with the current editions of the following codes as adopted by the City of San Diego Municipal Code:
 - 1. Uniform Building Code

1.3 SPECIFICATIONS AND STANDARDS

- A. Except as otherwise indicated, the current editions of the following apply to the WORK of this Section:

[1. ASTM C177	Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus
2. ASTM C273	Method for Shear Test in Flatwise Plane of Flat Sandwich Constructions or Sandwich Cores]
3. ASTM D638	Test Method for Tensile Properties of Plastics
4. ASTM D746	Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
5. ASTM D790	Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
6. ASTM D1505	Test Methods for Density of Plastics by the Density-Gradient Technique
7. ASTM D1525	Test Method for Vicat Softening Temperature Plastics
8. ASTM D1998	Standard Specification for Polyethylene Upright Storage Tanks

- [9. ASTM D1621 Test Method for Compressive Properties of Rigid Cellular Plastics
- 10. ASTM D1622 Test Method for Apparent Density of Rigid Cellular Plastics
- 11. ASTM D1623 Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics]
- 12. ASTM D1693 Test Method for Environmental Stress-Cracking of Ethylene Plastics
- [13. ASTM D2126 Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging]
- [14. ASTM D2842 Test Method for Water Absorption of Rigid Cellular Plastics]
- 15. ASTM D2856 Test Method for Open Cell Content of Rigid Cellular Plastics by the Air Pycnometer
- [16. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials]
- [17. NEMA ICS 6 Enclosures for Industrial Control and Systems]

1.4 SHOP DRAWINGS AND SAMPLES

A. The following shall be submitted in compliance with Section 01300:

- 1. Tank manufacturer's data and dimensions showing locations of all openings, locations of level indicators, seismic support structure and anchoring system details, and location of tank accessories.
- 2. Details on inlet and outlet fittings, manways, flexible connections, vents and level indicators.
- 3. List of installations in compliance with manufacturer's experience requirements per paragraph 1.8.
- 4. Statement by the manufacturer indicating compliance with the materials requirements.
- 5. Tank pad requirements such as pads and blockouts.
- [6. Electrical heat tracing installation details, sizing calculations, wattage-amperage (120 volt) and thermostat details.]
- [7. Insulation data, name of insulation contractor, and insulation contractor qualifications.]
- 8. Information on at least one successfully performing installation of comparable size and complexity constructed in the recent past including contact name, address, and telephone number where tanks can be inspected.

1.5 OWNER'S MANUAL

- A. The following shall be included in the OWNER'S MANUAL in compliance with Section 01300:
1. Manufacturer's recommendations for installation.
 2. Fitting installation and adjustment procedures.
 3. Repair procedures for typical situations including small holes, pinholes, and minor cracks in the tank [and insulation].
 4. Certification signed by the manufacturer that the tanks have been factory tested and meet the requirements indicated.
 5. Seismic restraint plans and instructions as specified in paragraph 2.7.
 6. Calculations used to determine wall thickness. Hoop stress shall be indicated. Calculations shall be signed by a Registered Structural Engineer.

1.6 SERVICES OF THE MANUFACTURER

- A. A representative of the manufacturer shall certify in writing that the tank has been installed in accordance with the manufacturer's recommendations. Certification shall be submitted.

1.7 FACTORY TESTING

- A. **Material Testing:** Material taken from each tank shall be tested for the following:

<u>Parameter</u>	<u>Test Standard</u>	<u>Value</u>
Impact	ASTM D1998	120 ft-lb, min
Gel, minimum percent	ASTM D1998,	1/32-inch of inner wall: 65 outer wall: 90 total wall: 70

- B. Following fabrication, the tanks, including factory applied inlet and outlet fittings, shall be hydraulically tested with water. The factory test shall compensate for the difference in specific gravity between the test water and chemical stored to simulate actual maximum operating pressures. Test methods may include adding a [2.5 psi] air pad to a filled tank or filling the tank with standpipes, raising the maximum water surface approximately [5 feet] higher than the normal maximum tank level. The test duration shall be 24 hours. Following successful testing, the tank shall be emptied and dried prior to shipment.
- C. An affidavit signed by the tank manufacturer shall be furnished indicating that the factory tests have been performed and the indicated conditions have been met.

1.8 QUALIFICATIONS

NTS: In the paragraph below, define the terms "comparable size and complexity" for the equipment or system specified. Requiring experience of more than one successful project requires sound justification and prior written approval from the City Project Manager.

- A. The tank manufacturer shall have a record of at least one successfully performing installation of comparable size and complexity constructed in the recent past for the tank size indicated.

1.9 SPECIAL WARRANTY

- A. The tank shall be warranted for 5 years to be free of defects in material and workmanship. Warranty shall be prorated over the last 3 years.

PART 2 -- PRODUCTS

2.1 GENERAL

- A. Tanks shall be circular in cross-section, vertical, complete with piping inlets and outlets, drains, overflows, and anchoring system. Covered tanks shall be vented, and where indicated, tanks shall be provided with entrance manways, level indicators, [electrical heat tracing, spray-on urethane foam insulation, and exterior coating]. Tanks shall be marked to identify the manufacturer, date of manufacture, serial number, and capacity. Tanks shall meet the requirements of ASTM D1998 unless otherwise indicated.

2.2 TANKS

- A. **Materials:** Polyethylene shall be the cross-linked, high density type meeting or exceeding the following:

<u>Parameter</u>	<u>ASTM Test Method</u>	<u>Value</u>
Density, gm/cc	D1505	0.937 to 0.945
Tensile strength at yield, psi minimum	D638	2600
Elongation at break, min percent	D638	400
Stress-crack resistance, min hours for F ₅₀	D1693	1000
Vicat softening temperature, deg. F	D1525	230
Brittleness temperature, deg. F, maximum	D746	-180
Flexural modulus, psi	D790	100,000

Resin used in the tank shall be equal to Phillips Chemical Marlex CL-200 or CL-250, PAXON grade 7004 or 7204, or equal, and shall contain a minimum of 0.3 percent ultraviolet stabilizer

as recommended by the manufacturer. Where black tanks are indicated, the black resin shall contain 2 percent carbon black blended into the resin.

B. Operating Conditions:

1. Chemical storage tanks provided under this section shall be suitable for the following operating conditions:

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NTS: The Specifier shall add as many columns as needed, one for each set of tanks with identical characteristics and requirements.

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Equipment number	-	[02-T-01, 02-T-02]	[04-T-01]
Chemical stored	-	[]	[]
Concentration, percent	-	[]	[]
Unit weight, lb/gal	-	[]	[]
Design specific gravity	-	[]	[]
Solution pH	-	[]	[]
Solution viscosity, centipoise at [] deg. F	-	[]	[]
Maximum fluid temperature, deg. F	-	[]	[]
Minimum fluid temperature, deg. F	-	[]	[]
Minimum ambient air temperature, deg. F	-	[]	[]

- C. Construction:** Tanks shall be constructed using a rotationally molded fabrication process. Wall thickness of the tank shall be designed by the manufacturer with a hoop stress no greater than 600 psi using 1.5 times the specific gravity indicated. Stress shall be calculated using the Barlow formula.

Tanks shall have the following characteristics:

1. Equipment No.	-	[]	[]
2. Type (Note 1)	-	[]	[]
3. Nominal diameter, ft	-	[]	[]
4. Nominal height, ft	-	[]	[]
5. Nominal capacity, gallons	-	[]	[]

(Note 2)

6. Liquid depth, maximum, ft - [] []
7. Manway (Note 3)
- Mounting - [] []
- Diameter, inches - [] []
8. Exposure - [] []
9. Color - [] []

Note 1: CD = closed, domed top; CF = closed, flat top; OIF = open, internal flange; OEF = open, external flange; FLR = flat lid removable; FLH = flat lid hinged.

Note 2: Nominal height of domed top tanks is the dimension measured along the straight cylindrical portion of the tank and does not include the rounded end.

Note 3: TM = top mount; TSM = top and side mount
Unless otherwise indicated, manways shall be integrally molded with the tank.

2.3 TANK FITTINGS

- A. Tank fittings shall be according to the fitting schedule below. Gasket material shall be [closed cell, crosslinked polyethylene material equal to the tank material indicated] [Buna-N] [Viton] [EPDM] []. PVC fittings shall be compression type Schedule 80 long shank high-torque design with minimum of 85 percent threaded contact. Any screwed fittings shall use American Standard Pipe Threads. No metals shall be exposed to tank contents. If tanks are insulated, fittings shall be installed at the factory prior to application of the insulation.

<u>Item</u>	<u>Fitting Type</u> (Note 4)
1. Equipment No.	- [] []
2. Fill	- [] []
3. Overflow	- [] []
4. Tank drain	- [] []
5. U-vent	- [] []
6. Outlet to pump	- [] []
7. Level indication	- [] []
8. []	- [] []

Note 4: Refer to drawings for fitting size and location. Abbreviations for fittings are:

BF-H: Bolted flanged fitting with Hastelloy-C studs and polyethylene encapsulated heads.
BF-SS: Bolted flanged fitting with 316 SS studs and polyethylene encapsulated heads.

- IMFO: Integrally molded flanged outlet.
- DB-SD: Double bolt with siphon drain, 316 SS studs, and polyethylene encapsulated heads.
- PVC: Double-nut PVC fitting.

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NTS: Of the three listed manufacturers, only Poly Cal is willing to provide IMFO fittings.

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2.4 LEVEL INDICATION

- A. Level indication shall be provided where indicated. [Graduations shall be provided at every [200 gallon] interval with [1,000 gallon] intervals clearly labeled for bulk storage tanks. Unless otherwise indicated, graduations shall be marked on the tank exterior. The level indicator shall be completely assembled to the tank and shall consist of PVC float, indicator, polypropylene rope, perforated interior pipe, PVC roller guides, sunlight and chemical resistant 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.]

[Level indication shall be by [diaphragm level transmitter as indicated in Section []]
[ultrasonic level transmitter as indicated in Section []].]

[2.5 TANK INSULATION

- A. Tanks [] [] shall be provided with factory-applied spray-on foam insulation. Insulation shall be []-inch thick minimum polyurethane foam insulation applied to the exterior of the tank. Exterior surfaces of the insulation shall be coated with waterproof [acrylic] as indicated in Section []. The final foam surface shall be free from bumps, rings, pinholes, voids, and depressions. Mating surfaces of piping flange connections shall be kept clear of insulation. The applied insulation shall meet or exceed the following test properties:

<u>Parameter</u>	<u>ASTM Test</u>	<u>Test</u>
Density, lb/cu ft, min	D1622	2.5
Compressive strength, psi, min	D1621	25
Tensile strength, psi, min	D1623	40
Shear strength, psi, min	C273	30
Closed cell content, percent, min	D2856	95
Water absorption, lb/sq ft, max	D2842	0.10
Thermal conductivity, Btu/sq ft-hr degree F	C177	0.11-0.13
Flame spread	E84	<25
Dimensional stability at 150 degree	D2126	12]

F and 100 percent relative humidity,
28 days, percent

[2.6 HEAT TRACING

- A. Tanks [] [] shall be provided with heat tracing between the tank exterior and tank insulation.

Heat tracing shall be parallel circuit, constant watt density, heater cable, modified to provide the indicated features. Watt density shall not exceed 4 watts per foot and shall not be capable of heating the tank wall material greater than 150 degrees F in the event of a closed contact failure of the thermostat. Heat tracing shall maintain tank contents at or above minimum fluid temperature at minimum ambient air temperature as indicated in paragraph 1.4.

Heater cable shall be of sufficient width to ensure that the density of the watts output will not cause softening of the tank wall or damage the cable insulation. Cable insulation shall be made of Santoprene thermoplastic rubber to ensure flexibility, ease of installation, and resistance to moisture and chemicals.

Heater cable shall be capable of withstanding continuous exposure to 15 degrees F temperature and shall be wrapped in a spiral fashion incorporating short waves to allow for tank expansion. Cable shall be attached using 2-inch wide aluminum tape applied along the entire cable to ensure thermal conductance. The cable shall operate using 120 VAC, 1 phase, 60 Hz power. The cable shall be provided with a thermostat control. The thermostat shall be provided in an aluminum NEMA 4X watertight enclosure. The terminating end of the cable shall be provided with a signal light indicating when the cable is energized. The indicating light shall be visible following application of tank insulation and protective coating. The maximum mounting height of the thermostat and indicating light shall be 4 feet.

Electrical current requirement of the tank heat tracing shall not exceed 15 amps at 120 VAX power.]

2.7 SEISMIC [AND WIND] RESTRAINT SYSTEM

- A. The tanks shall be provided with seismic restraint systems manufactured in conformance with plans and instructions prepared and stamped by a registered structural engineer. The lateral restraint assembly shall be designed for seismic Zone 4 and shall conform to the Uniform Building Code.

[Wind restraint for outdoor tanks shall be designed to resist a wind velocity of [80] miles per hour. Wind restraint shall be designed to restrain an empty tank.]

2.8 SAFETY SIGNS

- A. Each tank inlet and tank outlet shall be clearly marked with hazardous material warning signs, 10 inches by 14 inches in size. Each sign shall have the word "DANGER" and the name of the chemical stored, printed in large block letters and mounted directly adjacent to the tank outlet and tank inlet. Each entry manway shall be provided with a sign ("DANGER--CONFINED SPACE--HAZARDOUS ATMOSPHERE"). Signs shall comply with Section 10400 and the requirements herein.

2.9 MANUFACTURERS

A. Products shall be manufactured by one of the following (or equal):

1. Poly Cal Plastics
2. Central California Container Mfg.
3. Nalgene

PART 3 -- EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer's recommendations.

3.2 FIELD TESTING

A. After installation of tank and all fittings, the tank shall be water tested by filling the entire tank with water and monitoring the tank as well as all fitting connections for at least 24 hours. Any leaks shall be corrected prior to acceptance. Following successful field tank testing, the tank shall be completely emptied and dried.

**** END OF SECTION ****