Snyder Industries, Inc.
Specification #199202 For
Polyethylene Upright Storage Tanks
Revision: G - 2/15/09

1. Scope

Contractor shall supply and install all materials, equipment, appurtenances, specialty items, and services required to provide an upright, single wall, flat bottom, closed top, polyethylene storage tank for storage of the chemical application(s) described in Table I. Each tank is to be molded in one-piece seamless construction according to ASTM D 1998 (laminated or fabricated tanks will not be accepted) and will be capable of storing the chemical application at atmospheric pressure.

2. General

2.1 This specification covers upright, cylindrical, flat bottom, single wall tanks molded in a one-piece seamless construction by the rotational molding process (laminated or fabricated tanks will not be accepted). The tanks are designed for above-ground, vertical installation and are capable of containing chemicals at atmospheric pressure. Included are requirements for materials, properties, design, construction, dimensions, tolerances, workmanship, and appearance. Tank capacities are from 400 gallon (1,453 L) up to 16,500 gallon (62,453 L).

2.2 This specification does not cover the design of vessels intended for use at pressures above or below atmospheric conditions. It is also not for vessels intended for use with liquids heated above their flash points, temperatures above 140 degrees Fahrenheit for Type I materials, or temperatures above 130 degrees Fahrenheit for Type II materials. (Note: See 9.1.2 for chemicals being stored above 100 degrees F)

3. Manufacturer

3.1 Tanks shall be manufactured by Snyder Industries Inc. or approved equal

4. Applicable Documents

4.1 ASTM (American Society for Testing and Materials) Standards:

D618 Conditioning Plastics and Electrical Insulating Materials for Testing
D638 Tensile Properties of Plastics
D790 Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
D883 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 Test Method for Environmental Stress-Cracking of Ethylene Plastics

D1998 Standard Specification for Polyethylene Upright Storage Tanks
D2765 Degree of Crosslinking in Crosslinked Ethylene Plastics as Determined by Solvent Extraction
D2837 Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
D3892 Practice for Packaging/Packing of Plastics
F412 Definitions of Terms Relating to Plastic Piping Systems

4.2 ARM (Association of Rotational Molders) Standards: Low Temperature Impact Resistance (Falling Dart Test Procedure)

4.3 ANSI Standards: B-16.5 Pipe Flanges and Flanged Fittings

4.4 OSHA Standards: 29 CFR 1910.106 Occupational Safety and Health Administration, Flammable and Combustible Liquids

4.5 UBC CODE: Uniform Building Code 2006 Edition

4.6 IBC CODE: International Building Code 2006 Edition

4.7 CBC Code: California Building Code 2007 Edition

4.8 NSF/ANSI Standard 61 – Drinking Water System Components (Type II resin)

5. Submittals

5.1 Drawings and Data: The manufacturer's shop drawings shall be approved by the engineer or contractor prior to the manufacturing of the tank(s). Data and specifications for the equipment shall include, but shall not be limited to the following.

5.2 Contractor shall submit for review sufficient literature, detailed specifications, and drawings to show dimensions, materials used, design features, internal construction, weights and any other information required by the ENGINEER for review of storage tanks and accessories.

5.3 Additional requirements for information to be included with submittals are specified below:

5.3.1 Shop drawings for the tanks shall include as a minimum the following:

a) Service Conditions: Chemical environment and temperature.

b) Statement that fabrication shall be in accordance with ASTM D 1998, where applicable.

c) Sizing and description of the fittings and accessories for each tank that are to be supplied by the tank manufacturer.

d) Layouts and assembly schedules for each tank identifying the location and elevation from the bottom of the tank for all inlet, outlet and other integrally molded connections and appurtenances supplied by the tank manufacturer.

5.3.2 Resin - A copy of the resin data sheet from the resin manufacturer for the tank is to be supplied and the tank manufacturer is to certify that it will be the resin used in the manufacture of the tank. Verification may be required if the resin is to be FDA or NSF 61 listed.

5.3.3 Wall thickness - Prior to the manufacture of the tank the designed wall thickness audit is to be supplied based upon 600 psi hoop stress (ASTM D 1998) @ 100 degrees F. (Note: See 9.1.2 for chemicals being stored above 100 degrees F)

5.3.4 Tank restraint – If supplied, the drawings and calculations for the system are to be supplied. Note: Wet stamped or site specific drawings and calculations may be required.

5.3.5 Supporting information on fittings and accessories to be supplied; heat system, insulation, mastic coating, etc.

5.4 Technical Manuals: The tank manufacturers Guideline for Use & Installation is to be submitted for review.

5.5 Manufacturer's warranty

5.6 Manufacturer Qualifications: The manufacturer is to have rotationally molded tanks based upon ASTM D 1998 utilizing Type I and Type II resins for the last 10 years.

5.7 Factory Test Report: Upon completion of the tank the manufacturer's inspection report is to be supplied for each tank.

a. Verification of wall thickness (See 10.5)
b. Impact test (See 10.3.1)
c. Gel test – (Type I resin only) (See 10.4)
d. Hydrostatic test (See 10.6)
e. Verification of fitting placement (See 10.2)
f. Visual inspection (See 10.7)
g. Verification of materials

6. Service Conditions

Note: The tank color will be based upon the chemical application and UV exposure of the installation. Tank color is to be natural, black or opaque white.

Table I – Service Conditions

Tank #	Chemical Stored	Concentration / Specific Gravity	Tank Location Inside / Outside	Operating Temperature	Fitting Material	Gasket Material	Bolt / Insert Material

7. Chemical Compatibility

7.1 Chemical compatibility shall be according to the following chemical resistance guides:

Pruett, Kenneth M., "Chemical Resistance Guide for Elastomers", Compass Publications.

Pruett, Kenneth M., "Compass Corrosion Guide II", Compass Publications.

7.2 These references shall be considered as general guidelines only. In many cases, combinations of these chemicals are used in such a way that only the customer (by testing molded product samples) can make a determination in regards to acceptability.

Note: Contact the manufacturer for applications that are not listed below.

Chemical	Concentration	Resin	Design Info	Fitting Material	Gasket Material	Bolt Material
Acetic Acid	60	HDLPE & XLPE	1.5/600	PP/PVC	EPDM	316SS/Hastelloy/Titan.
Acetic Acid	80	HDLPE	1.9/600	PP	EPDM	316SS/Hastelloy/Titan.
Acrylic Emulsions	50	XLPE	1.9/600	PVC	EPDM	316SS
Aluminum Sulfate	50	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Ammonium Sulfate	40	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Calcium Carbonate	Saturated	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Calcium Chloride	40	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS**/Hastelloy/Titan.
DEF (Diesel Exhaust Fluid)	32.5	HDLPE & XLPE	1.35/600	PP/PVC	EPDM	316SS
Deionized Water <5 Megohm		HDLPE & XLPE	1.5/600	PVC	EPDM	316SS
Deionized Water >5 Megohm		HDLPE & XLPE	1.5/600	PVC	EPDM	316SS
Ethyl Alcohol	100	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS
Ethylene Glycol	100	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Ferric Chloride	50	HDLPE & XLPE	1.9/600	PVC	EPDM	Hastelloy/Titan.
Ferric Sulfate	60	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Ferrous Chloride	Saturated	HDLPE & XLPE	1.9/600	PVC	EPDM	Hastelloy/Titan.
Ferrous Sulfate	20	HDLPE & XLPE	1.5/600	PVC	EPDM	Hastelloy
Hydrochloric Acid	37	HDLPE	1.9/600	PVC	Viton	Hastelloy
Hydrofluoric Acid	48	HDLPE	1.9/600	PP/PVC	Viton	Hastelloy
Hydrofluosilicic Acid	26	HDLPE/XLPE*	1.9/600	PP/PVC	Viton	Hastelloy
Hydrogen Peroxide	50	HDLPE	1.9/600	PVC	Viton	316SS/Hastelloy/Titan.
Isopropyl Alcohol	100	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS
Magnesium Chloride	30	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Methyl Alcohol	100	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS
Motor Oil	100	HDLPE & XLPE	1.9/600	316SS	Viton	316SS
Phosphoric Acid	85	HDLPE	1.9/600	PVC	Viton	316SS
Phosphoric Acid	50	HDLPE	1.9/600	PVC	Viton	316SS
Polymers (Deposition)		XLPE	1.5/600	PVC	EPDM	316SS
Potable Water		HDLPE	1.5/600	PVC	EPDM	316SS
Potassium Carbonate	50	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Potassium Hydroxide	Saturated	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Sodium Carbonate	30	HDLPE & XLPE	1.5/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Sodium Carbonate	Saturated	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS**/Hastelloy/Titan.
Sodium Hydroxide	50	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Sodium Hypochlorite-in(Non-UV)	<16.5	HDLPE	1.9/600	PVC	Viton	Titanium
Sodium Hypochlorite-out (UV)	<16.5	HDLPE #880059	1.9/600	PVC	Viton	Titanium
Sodium Hypochlorite-out (UV)	<16.5	HDLPE Insulated	1.9/600	PVC	Viton	Titanium
Sodium Thiosulfate	40	HDLPE & XLPE	1.9/600	PVC	EPDM	316SS
Sulfuric Acid	98	HDLPE #880046*	1.9/600	CPVC	Viton	Hastelloy
Sulfuric Acid	93	HDLPE #880046*	1.9/600	CPVC	Viton	Hastelloy
Surfactants		XLPE	1.5/600	PVC	EPDM	316SS
Urea Solution	50	HDLPE & XLPE	1.35/600	PP/PVC	EPDM	316SS
Water w/Ozone up to 10 PPM		HDLPE & XLPE	1.5/600	PVC	EPDM	316SS

Note: Ambient Temperature.
Chart applies to Industrial ASTM designed tanks.
*Chemical may cause tank material to discolor.
** 316SS may pit upon drying. Not recommended for SUMOs.
High purity chemical applications are limited to natural tank color or special hot compounded resins.

For chemicals or chemical blends not listed on the above chart, please contact Snyder Industries.

8. Materials – Resin Classification

8.1 Tanks are classified according to type as follows and it is the responsibility of the purchaser to specify Type I or Type II.

8.1.1 Type I – Tanks molded from cross-linkable polyethylene resin.

8.1.2 Type II - Tanks molded from linear polyethylene resin (not cross-linkable resin).

8.2 The material used shall be virgin polyethylene resin as compounded and certified by the manufacturer. Type I tanks shall be made from crosslinked polyethylene (XLPE) resin as manufactured by ExxonMobil Chemical, or resin of equal physical and chemical properties. Type II tanks shall be made from high density linear polyethylene (HDLPE) resin as manufactured by ExxonMobil Chemical, or resin of equal physical and chemical properties.

8.3 All polyethylene resin material shall contain a minimum of a U.V. 8 stabilizer as compounded by the resin manufacturer. Pigments may be added at the purchaser's request, but shall not exceed 0.25% (dry blended) of the total weight.

8.4 Mechanical Properties of Type I tank material: Cross-linked (XLPE)

PROPERTY	ASTM	VALUE
Density (Resin)	D1505	0.938-0.946 g/cc
Tensile (Yield Stress 2"/min)	D638	2830 PSI
Elongation at Break (2"/min.)	D638	700%
ESCR (100% Igepal, Cond. A, F50)	D1693	>1000 hours
ESCR (10% Igepal, Cond. A, F50)	D1693	>1000 hours
Vicat Softening Degrees F. Temperature	D1525	250
Flexural Modulus	D790	100,000 PSI

8.5 Mechanical Properties of Type II tank material: High density Linear (HDLPE)

PROPERTY	ASTM	VALUE
Density (Resin)	D1505	0.941-0.948 g/cc
Tensile (Yield Stress 2"/min)	D638	2950 PSI
Elongation at Break (2"/min.)	D638	>1000%
ESCR (100% Igepal, Cond. A, F50)	D1693	550 hours
ESCR (10% Igepal, Cond. A, F50)	D1693	48 hours
Vicat Softening Degrees F. Temperature	D1525	235
Flexural Modulus	D790	129,000 PSI

9. Design Requirements

Note: The designed specific gravity of the tank shall be based upon the actual chemical, its' concentration and temperature. From these factors it can be determined if polyethylene can be used and if so which family of polyethylene is to be used. There are chemical applications where both the (cross-linked - Type 1) XLPE and HDLPE (high-density linear - Type 2) resin will work. There are also applications where only one of these families of resin is recommended. If FDA or NSF 61 is required the Type II HDLPE resin will be required.

9.1 The minimum required wall thickness of the cylindrical shell at any fluid level shall be determined by the following equation, but shall not be less than 0.187 in. thick.

T = P x O.D./2 SD = 0.433 x S.G. x H x O.D./2 SD

T = wall thickness
SD = hydrostatic design stress, PSI
P = pressure (.433 x S.G. x H), PSI
H = fluid head, ft.
S.G. = specific gravity, g/cm^3
O.D. = outside diameter, in.

9.1.1 The hydrostatic design stress shall be determined by multiplying the hydrostatic design basis, determined by ASTM D2837 using rotationally molded samples, with a service factor selected for the application. The hydrostatic design stress is 600 PSI at 73 degrees Fahrenheit for Type I and Type II materials. In accordance with the formula in 9.1, the tank shall have a stratiform (tapered wall thickness) wall.

9.1.2 The hydrostatic design stress shall be derated for service above 100 degrees Fahrenheit and for mechanical loading of the tank.

9.1.3 The standard design specific gravity shall be 1.5 or 1.9.

9.2 The minimum required wall thickness for the cylinder straight shell must be sufficient to support its own weight in an upright position without any external support.

9.3 The top head must be integrally molded with the cylinder shell. The minimum thickness of the top head shall be equal to the top of the straight wall. The top head of tanks with 2000 or more gallons of capacity shall be designed to provide a minimum of 1300 square inches of flat area for fitting locations.

9.4 Tanks with 2000 or more gallons of capacity shall have a minimum of 3 lifting lugs integrally molded into the top head. The lifting lugs shall be designed to allow erection of an empty tank.

9.5 The tank shall be designed to provide a minimum of 4 tie-down lugs integrally molded into the top head. The tie-down lugs shall be designed to allow tank retention in wind and seismic loading. Refer to section 12.7 for tank tie-down accessories.

Table II – Tank Schedule

Tank Reference #				
Quantity				
Capacity - Side Wall				
Specific Gravity– designed				
Diameter (nominal)				

Height (feet) maximum				
Tank Resin				
Type I XLPE				
Type II HDLPE				
Color				
Manway Type				
Fitting Material				
Gasket Material				
Bolt Material				

Note: Useable Volume is the height between the drain outlet and the overflow. Specified tank volume is larger than the useable volume. Check useable volume for tanks designed to take full truck loads.

10. Quality Assurance & Testing

10.1 The tanks of the same material furnished under this Section shall be supplied by a manufacturer who has been regularly engaged in the design and manufacturing of rotationally molded chemical storage tanks using cross-linked and high density linear polyethylene tanks for over ten years.

10.2 Dimensions and Tolerances

10.2.1 All dimensions will be taken with the tank in the vertical position, unfilled. Tank dimensions will represent the exterior measurements.

10.2.3 The tolerance for the outside diameter, including out of roundness, shall be per ASTM D1998.

10.2.4 The tolerance for fitting placements shall be +/- 0.5 in. in elevation and 2 degrees radial at ambient temperature.

10.3 Test Methods

Test specimens shall be taken from fitting location areas.

10.3.1 Low Temperature Impact Test

10.3.2 Test specimens shall be conditioned at (- 40) degrees Fahrenheit for a minimum of 2 hours.

10.3.3. The test specimens shall be impacted in accordance with the standard testing methods as found in ASTM D1998. Test specimens < ½" thickness shall be tested at 100 ft.-lb. Test specimens > ½" thickness shall be tested at 200 ft.-lb.

10.4 Degree of Crosslinking Test (% Gel – Type I Resin Only)

10.4.1 The test method used is to be the o-xylene insoluble fraction (gel test) per ASTM D2765 Method C. This test method is for determination of the ortho-xlene insoluble fraction (gel) of crosslinked polyethylene.

10.4.2 The percent gel level for Type I tanks on the inside 1/8 in. of the wall shall be a minimum of 65%.

10.5 Ultrasonic Tank Thickness Test

10.5.1 All tanks 2000 gallons or larger shall be measured for tank wall thickness at 6", 1ft., 2ft. and 3ft. on the tank sidewall height at 0° and 180° around the tank circumference with 0° being the tank manway and going counter-clockwise per ANSI standard drafting specifications. A copy of this test report can be ordered when placing the original tank order. All tanks shall meet design thickness requirements and tolerances.

10.5.2 Tanks smaller than 2000 gallons are only periodically measured at the start of a production run or after any design changes. Customers can place an order for tank wall thickness measurements on smaller tank sizes when placing the original order. A copy of the test report will be provided if ordered.

10.6 Hydrostatic Water Test

10.6.1 The hydrostatic water test shall consist of filling the tank to brim full capacity for a minimum of four hours and conducting a visual inspection for leaks. A hydrostatic water test will be conducted if ordered by the customer.

10.7 Workmanship

10.7.1 The finished tank wall shall be free, as commercially practicable, of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking and delaminations that will impair the serviceability of the vessel. Fine bubbles are acceptable with Type II tanks to the degree in which they do not interfere with proper fusion of the resin melt.

10.7.2 All cut edges where openings are cut into the tanks shall be trimmed smooth.

Table III – Fitting and Accessory Schedule

Tank Number	TNK -	TNK -	TNK -	TNK -
Description	**Quantity / Size**	**Quantity / Size**	**Quantity / Size**	**Quantity / Size**
Inlet nozzle				
Outlet nozzle				
Molded full/maximum drain				
Drain				
Overflow				
Vent				
Surge Protection Lid				
Fill				
External fill pipe				
Internal fill pipe				
Manway				
Threaded/ vented				
Threaded				
Hinged				
Bolted / Sealed				
Ladder FRP / Coated Steel				
Lifting Lugs				

Tie-down Lugs				
Seismic/Wind Tie-down				
Level Indicator				
Ultrasonic				
Flexible tube				
Mechanical Reverse Float				
Heat System				
Maintenance Temperature				
Min. Ambient Temperature				
Insulation w/mastic coating				

11. Tank Fittings (Nozzles) & Attachments

11.1 Fittings - Threaded Bulkhead

11.1.1 Threaded bulkhead fittings are available for below liquid installation depending on the tank diameter and the placement of the fitting in the tank. Fittings must be placed away from the tank knuckle radius' and flange lines. Consult the manufacturer for placement questions. The maximum allowable size for bulkhead fittings placed on a curved sidewall section of tanks 48 in. to 142 in. in diameter is 2 inch size. Tank wall thickness must be considered for bulkhead fitting placement. The maximum wall thickness for each fitting size is shown below. The following chart is based upon PVC and CPVC fittings. Contact the manufacturer for other fitting materials

Fitting Size	Maximum Wall Thickness
1/2 in.	2 in.
3/4 in.	2 in.
1 in.	2 in.
1 1/4 in.	2 in.
1 1/2 in.	2 in.
2 in.	2 in.
3 in.	2.125 in. (Flat Surface Only)

11.1.2 The bulkhead fittings shall be constructed of PVC or other specified material. Gaskets shall be a minimum of 1/4" thickness and constructed of 40-50 durometer EPDM, 60-70 durometer Viton◆, or other specified material.

11.2 Fittings - Bolted Double 150 lb. Flange Fittings

11.2.1 Bolted double flange fittings are required for below liquid level installation for sizes above 2 in. depending on the tank diameter and the placement of the fitting in the tank. Fittings must be placed away from tank knuckle radius' and flange lines. Consult the manufacturer for placement questions. Bolted double flange fittings provide the best strength and sealing characteristics of any tank fitting available. Allowable fittings sizes based on tank diameter for curved surfaces are shown below.

Tank Diameter	Maximum Bolted Fitting Size Allowable
48 in. - 86 in.	3 in.
90 in. - 102 in.	6 in.
120 in. - 142 in.	8 in.

The bolted double flange fittings shall allow tank wall thickness up to 2 1/2 in.

11.2.2 The bolted double flange fitting shall be constructed with 2 ea. 150 lb. flanges, 2 ea. 150 lb. flange gaskets, and the correct number and size of all-thread bolts for the flange specified by the flange manufacturer. The flanges shall be constructed of PVC Type I, Grade I, or other specified material. Gaskets shall be a minimum of 1/4" thickness and constructed of 40-50 durometer EPDM, 60-70 durometer Viton◆ or other specified material. There shall be a minimum of 4 ea. full thread bolts. The bolts diameter is to meet ASNI standards based upon the flange size. The bolts may have gasketed flanged metal heads or bolt heads encapsulated in Type II polyethylene material. The encapsulated bolt shall be designed to prevent metal exposure to the liquid in the tank and prevent bolt rotation during installation. The polyethylene encapsulation shall fully encapsulate the bolt head. The polyethylene shall be color coded to distinguish bolt material (white - 316 S.S., yellow - Hastelloy C276, red - Monel, green - Titanium). Each encapsulated bolt shall have a gasket to provide a sealing surface against the inner flange.

10.2.3 Standard orientation of bolted double flange fittings shall have bolt holes straddling the principal centerline of the tank in accordance with ANSI/ASME B-16.5 unless otherwise specified.

11.3 Fittings - Bolted Stainless Steel Fittings

11.3.1 Bolted stainless steel fittings are available for below liquid level installation depending on the tank diameter and the placement of the fitting in the tank. Fittings must be placed away from tank knuckle radius' and flange lines. Consult the manufacturer for placement questions. Allowable fittings sizes based on tank diameter for curved surfaces are shown below.

Tank Diameter	Maximum Bolted Fitting Size Allowable
48 in.	3 in.
64 in. - 142 in.	4 in.

The bolted stainless steel fittings shall allow tank wall thickness up to 2 1/2 in.

11.3.2 The bolted stainless steel fittings shall be constructed with a minimum of 4 fully threaded 3/8 in. studs. Each fitting shall have one gasket and two flanges. The gasket shall be compressed between the inside of the tank wall surface and the inside flange of the fitting. The stainless steel fittings come standard with female x female pipe threads. The fittings shall be constructed of Type 316 stainless steel. Gaskets shall be a minimum of 1/4" thickness and constructed of 40-50 durometer EPDM, 60-70 durometer Viton◆ or other specified material.

11.4 Fittings - Siphon Tube Fittings

11.4.1 Siphon tubes may be added to the fittings specified in sections 11.1, 11.2 and 11.3. Siphon tubes will allow these fittings, when used as drainage fittings, to provide better tank drainage.

11.5 Fittings - Snyder Unitized Molded Outlet (SUMO™) - Patent #5,374,026

11.5.1 The SUMO fitting shall be an integral part of the tank and provide complete drainage of liquid through the sidewall of a flat bottom container without the use of a special support structure or concrete pad. The standard outlet provided is a PVC socket which allows solvent weld PVC pipe attachments at the tank pad level. This option is offered in 4 places (0, 90, 180, 270 degree tank locations) at the tank pad level. It provides a metal reinforcement completely isolated from any chemical attack.

11.5.2 The tank attachment shall be constructed from a PVC schedule 80 male adapter and is standard in 2,3,4 or 6 in. sizes on select tank sizes. This provides a schedule 80 pipe socket attachment (Except for the 6 in. size). Other outlet attachments are available in a variety of materials. The fitting orifice shall not be less than schedule 80 interior pipe size per ANSI B36.10-1979. O-rings shall be constructed of 70 +/- 5 durometer Viton◆ or other specified material. The inside diameter of the outlet is to be molded and is not to be drilled out to increase chemical flow.

11.6 Fittings - Self-Aligning Threaded Bulkhead

11.6.1 Self-Aligning fittings are available for installation in vapor phase applications on curved surfaces depending on the spherical dome radius and the placement of the fitting on the tank dome. Fittings must be placed away from tank radiuses. Consult the manufacturer for placement questions. The maximum allowable size for self-aligning fittings placed on a spherical section of the tank is shown below.

Tank Diameter	Maximum Fitting Size Allowable
45 in. - 48 in.	2 in.
64 in. - 142 in.	3 in.

Tank thickness and fitting angle may need to be considered for self-aligning fitting placement. The maximum thickness and installation angle for fitting sizes are shown below.

Fitting Size	Maximum Angle	Maximum Thickness
1 in.	27 degrees	1.000 in.
2 in.	25 degrees	0.750 in.
3 in.	20 degrees	1.000 in.

11.6.2 The self-aligning fittings shall be constructed of PVC or CPVC. Gaskets shall be a minimum of 1/4" thickness and constructed of 40-50 durometer EPDM, 60-70 durometer Viton◆, or other specified material.

11.7 Vents

11.7.1 Each tank must be properly vented for the type of material and flow rates expected. Vents must comply with OSHA 1910.106 (f) (2) (iii) or other accepted standard. All tanks must be vented for atmospheric pressure as well as any pressure created by filling and emptying the tank. Some applications may require a sealed tank with a vent line going to a scrubber system for proper chemical safety. Venting equipment should be sized to limit pressure or vacuum in the tank to a maximum of 1/2" of water column (0.02 psi). U-Vents are offered in sizes from 1 in. to 6 in. with or without mesh insect screening. U-Vents with mesh screening may require additional sizing due to reduced air-flow rates. Consult the manufacturer for necessary venting and placement information.

11.7.2 All u-vents shall be constructed of PVC or other specified materials.

11.7.3. When a tank is being filled from a pressurized tanker truck or rail car steps need to be taken to avoid pressurizing the tank. The tank may require a secondary surge protection lid to avoid any pressure build up. The surge protection lid is to be a 14” or 18” hinged and be design that it is self-closing.

11.8 Flange Adapters

11.8.1 Flange adapters may be purchased as optional equipment to adapt threaded or socket fitting outlets to 150 lb. flange connections for connection to piping system components. Flange adapters are available in PVC, CPVC or other specified materials. Flange adapter construction shall utilize schedule 80 components in sizes ranging from ¾” to 8” depending on material required.

11.9 Flexible Connections

11.9.1 All tank fitting attachments shall be equipped with flexible couplers or other movement provisions provided by the tank customer. The tank will deflect based upon tank loading, chemical temperature and storage time duration. Tank piping flexible couplers shall be designed to allow 4% design movement. Movement shall be considered to occur both outward in tank radius and downward in fitting elevation from the neutral tank fitting placement.

11.9.2 The flexible connection is to be manufactured of the same material as the tank or a compatible material approved by the project engineer. If an elastomer flexible connection is used control bolts are required if recommended by the manufacturer. The flexible connection is to be designed for a minimum of 4% movement. The flexible connection is to be designed with 150# flange connections to allow for attachment to the tank and the piping system. The flexible connection is to be attached as close as possible to the tank to reduce stress.

12. Tank Accessories

12.1 Level Indication

12.1.1 Sight Level Gage

a. The sight level gage shall be constructed of flexible PE or PVC tubing to allow for tank contraction and expansion due to loading and temperature changes. The level gage shall be connected to the tank with 2 Ea. appropriate 3/4" fittings as described in section 11.1 or 11.2.. Each fitting can have valves installed for isolation or drainage purposes.

12.1.2 Float Level Gage

a. The float level gage shall be constructed of a guided float on the inside of the tank connected to a weight indicator on the exterior of the tank with a 1/4" rope. The weighted indicator shall move along inside a clear guide pipe and may be equipped with an optional gallonage indicator board. The gallonage indicator board is made of PVC material and may be attached to the clear guide pipe. If specified the board shall be stenciled with one hundred gallon marks and labeled every five hundred gallons. The level gage shall be connected to the tank at an appropriate tank flat on the tank dome with a 3" threaded bulkhead fittings and held along the tank sidewall with appropriate 1" fittings and stand-off connections.

b. The float level gage rigid components shall be constructed of PVC. The rope shall be constructed of polypropylene or other specified material. Gaskets shall be constructed of EPDM, Viton◆ or other specified material.

12.1.3 Ultrasonic Level Indicator

a. The ultrasonic enclosure is to be an all plastic design with a NEMA 4X rating. The ultrasonic transducer is to have a 12" dead band and beam with a 20 ft range. The supply voltage can be 110, 220 VAC or 24 VDC. The connection to the tank is to be 2" NPT.

The ultrasonic level indicator shall provide a visual display of liquid level in the tank showing gallonage in measurement of hundreds of gallons along with 4-20 mA output for other alarm or control systems as well as four independent contacts capable of handling 10 amps each. Each contact can be programmed to operate in different opening and closing methods (7 modes). Contacts can be used to control pumps, valves, alarms, etc.

12.2 Manway and Fill Cap (Non-sealed)

12.2.1 Fill caps are available in a 10 in. vented-threaded style on various tank sizes with a minimum opening diameter of 7.125 in. Cap attachment shall be provided with all standard 10 in. cap placements with a polyurethane cap tie. Check the manufacturers specification drawing for availability and position.

12.2.2 Manways are available in an 18 in. vented or non-vented threaded design or hinged style (minimum opening diameter of 15 in.) and a 24 in. vented or non-vented threaded or hinged style (minimum opening diameter of 22 in.) on various tank sizes. Check the manufacture's specification drawing for availability and position.

13.1.3 All caps and manways shall be constructed of polyethylene material.

12.3 Bolted Sealed Top Manway

12.3.1 Sealed manways are available in 14, 18, 20 and 24 in. sizes on certain tanks in selected positions. Consult the manufacturer for placement positions.

12.3.2 The sealed manway shall be constructed of polyethylene material. The bolts shall be polypropylene or other specified material. The gaskets shall be closed cell, crosslinked polyethylene foam and Viton◆ o-rings to seal the bolts.

12.4 Surge Protection Lid

12.4.1 The hinged lid is to be manufactured of polyethylene. The lid will be a 14 in. size with 11 in. access opening or 18" with 15" access. The opening of the lid is to be restricted by a tether. The lid is to be designed so that is will close when the pressure has been released. Check SII specification drawing for availability and position.

12.5 Down Pipes and Fill Pipes

12.5.1 Down pipes and fill pipes shall be prepared per the customer approved drawings and specifications. All down pipes and fill pipes shall be supported at 5 ft. maximum intervals with support structures. Standard support structure design shall utilize bulkhead fitting tank attachments or welded attachments on Type II tanks. All designs shall be done according to the specific needs of the customer.

12.5.2 All down pipes and fill pipes shall be constructed of PVC or other specified materials.

12.6 Ladders

12.6.1 Ladders shall be constructed of galvanized mild steel or FRP.

12.6.2 Safety cages shall be provided with ladders as optional equipment unless required by OSHA standards.

12.6.3 All ladders shall be designed to meet applicable OSHA standards. Reference: OSHA 2206; 1910.27; fixed ladders.

12.5.4 Ladders must be mounted to the tank to allow for tank expansion and contraction due to temperature and loading changes. All top ladder mounts shall be connected to integrally molded in attachment lugs that allow for tank movement due to temperature and loading changes.

12.6.5 Mild steel parts shall be deburred and galvanized.

12.7 Tie Down Systems

12.7.1 The tie down system shall be designed to withstand 150 MPH wind loads. Tie down systems must meet seismic requirements per IBC 2006 / CBC 2007 code with seismic loads ≤ .445g (Seismic Design Category "D" - Fa=1.0, Fv=1.5, Ss=1.4, S1=0.5). Anchor bolts shall be provided by the contractor per the calculations and the base plates for the system. A registered engineer's wet stamped calculations and or drawings may be required.
12.7.2 The tie down system shall be offered galvanized, 304 or 316 stainless steel.

12.7.3 Mild steel parts shall be deburred and galvanized.

12.8 Tank Heating Systems

12.8.1 Heating systems for use with polyethylene tanks shall be designed to meet specific requirements such as tank material type, tank size, low ambient temperature, and desired maintenance temperature.

12.8.2 All control components of the heating system shall be mounted in water tight, high impact plastic box(es) with a gasketed cover.

12.8.3 All heating system components shall be Nema 4 rated and factory pre-wired for 110 VAC. All connections shall be labeled to prevent errors in field installation.

12.8.5 Each control box shall contain two temperature controls. One control shall regulate the maintenance temperature setting and the other control shall regulate the high temperature setting. The maintenance temperature setting should be set at the desired maintenance temperature. The high temperature setting shall be adjusted to 10 degrees above the desired maintenance temperature to a maximum of 130 degrees Fahrenheit. All control systems must be designed with a power off failure mode.

12.8.6 The heating panels shall be designed to wrap around and lie flat against the surface of the tanks. The heating panels shall have a maximum heating density of 0.022 watts per square centimeter. All heating panels and sensor bulbs shall be attached to the tank with 2" wide duct tape. Under no circumstances shall cable type heaters be used with polyethylene tanks.

12.8.7 Insulation used shall be polyurethane foam with a density of 2.0 - 3.0 lb./ft ^3 with a nominal "R" value of 8.33/in. The foam shall be applied with a nominal thickness of 2" to all external tank surfaces except the tank bottom shell.

12.8.8 Upon completion of application and curing of the insulation, two 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. The latex mastic can be ordered in gray (standard) or white in color.

13. Warranty

13.1 The tank shall be warranted for three years in regards to defects in materials and workmanship.

14. Marking, Packing and Packaging

14.1 The tanks shall be marked to identify the product, date (month and year) of manufacture, capacity, and serial number. The tank shall be shipped with a 3 of 9, HRI bar code label containing tank description, manufacturing order number, part number, serial number, manufacturer, and date.

14.2 The proper caution or warning signs as prescribed by OSHA standard 29 CFR 1910.106 shall be customer determined and supplied.

14.3 All packing, packaging, and marking provisions of ASTM Practice D3892 shall apply to this standard.

14.4 Customer specified labeling is available.

14.5 Tank shrink wrapping and bagging is available upon customer request.

14.6 All fittings that do not interfere with tank shipment shall be installed unless otherwise specified. Fittings and accessories that interfere with tank shipment or could be broken during shipment are shipped separately.

14.7 Permanent Labels:

a. Engraved stainless steel identification plate (if required).
b. National Fire Protection Association label specifically coded for the tank contents in accordance with NFPA 30. (to be supplied by the contractor).
c. Stencil the chemical label on to the tank wall to be clearly visible from outside the tank enclosure.

15. Shipping

15.1 Since there are variations in methods of shipping, SII's instruction shall be followed in all cases.

15.2 Consult the manufacturer's "Guideline for Use and Installation" booklet included with your tank for unloading instructions on specific tanks. This booklet can be found attached to the cap or manway area on the inside of the tank. Tanks with capacities of 2000 gallons or more have molded-in lifting lugs provided to assist with handling the empty tank.

15.3 Upon receipt of the tank, fittings and accessories the purchaser and/or his agent shall be responsible for inspection for damage and to verify that the system is complete. If damage has occurred, a claim should be filed with the carrier by the purchaser, and the manufacturer should be notified prior to the tank being put into service. All fittings and accessories need to be installed and adjusted in the field according to the manufacturer's Guidelines for Use & Installation.

16. Delivery & Storage

16.1 Installation

16.1.1 Transportation, handling, storage of the tanks, and installation shall be in accordance with the manufacturer's printed instructions.

16.1.2. Repair any damage to tank components or the insulation due to transportation or installation.

16.1.3. All tank fitting attachments shall be equipped with flexible couplers or other movement provisions provided by the tank customer. The tank will deflect based

upon tank loading, chemical temperature and storage time duration. Tank piping flexible couplers shall be designed to allow 4 percent design movement. Movement shall be considered to occur both outward in tank radius and downward in fitting elevation from the neutral tank fitting placement.