Manufacturing Specification for Vertical Storage Tanks

**1. Scope**

1.1 This specification covers polyethylene tanks manufactured in one-piece construction by rotational molding at our facility in Garrett, IN or Marshall, TX. The tanks are molded from FDA conforming linear polyethylene or cross-linked polyethylene for above ground installation and are capable of containing contents at atmospheric pressure. This specification covers flat bottom, closed top tanks 65-gallons to 12,000-gallons, double wall vessels from 20-gallons to 6500-gallons.

1.2 This specification does not cover the design of vessels intended for applications involving pressure above atmospheric, vacuum, burial, or temperatures above the maximum limit of the tank design.

1. **Applicable Documents**

2.1 ASTM Standards

* D648 Heat distortion temperature
* D638 Tensile properties
* D790 Flexural properties of plastic
* D883 Definitions of terms relating to plastics
* D1505 Density by density gradient technique
* D1693 Environmental stress crack resistance
* D1921 Particle size (sieve analysis) of plastic
* D2765 Degree of cross-linking ethylene plastics as determined by solvent extraction
* D2837 Standard 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
* ARM Std. Low temperature impact resistance (Falling dart test)
1. **Terminology**

3.1 General – definitions are in accordance with ASTM D883 and F412, unless otherwise specified.

3.2 Rotational molding – a four stage process consisting of loading resin in the mold; heating/fusion of the material while biaxial rotating; air-cooling, and removal.

1. **Materials**

4.1 The resin used shall be virgin cross-linked polyethylene, (Schulink XL 350) or Exxon Escorene 8460 conventional.

4.2 All tanks used for outdoor installation shall contain a suitable ultraviolet stabilizer, minimum 0.3%  2-hydroxy-4-n-Octoxy-benzophenone or equivalent. The stabilizer shall be compounded into the polyethylene.

4.3 The resins can be pigmented (black, blue, green, yellow, gray). Standard loading is limited to 0.02% to avoid degradation of material.

4.4 Tanks molded in cross-linked polyethylene shall be Schulink XL 350 or equivalent.

4.5 Tanks molded in LDPE polyethylene shall be Exxon Escorene 8460 resins by Exxon or equivalent.

4.6 No fillers shall be added to either resin.

4.7 The resin suppliers’ recommended maximum material use temperature for cross linked resin is 150 degrees F, and for LDPE resins is 120 degrees F. Generally, the less exposure to elevated temperatures, the greater the tank life.

4.8 Laboratory (ideal) material properties are set forth in Materials Properties Table (below) as stated by the resin suppliers.

This chart lists nominal properties as supplied by the resin suppliers

|  |  |
| --- | --- |
|  | Material Properties |
| Density | **.938** | **.942** |
| ASTM D1505ESCR (hrs) 100% solution | >1,000 | >1,000 |
| ASTM D1505ESCR (hrs) 10% solution | 145 | >1,000 |
| ASTM 1693Flexural modulus (psi) | 112,000 | 102,000 |
| ASTM D790Tensile strength (psi) | 2,575 | 2,800 |
| ASTM D638Impact (ft.-lbs.) | 190 | 450 |
| ARM 1⁄4 -in. thicknessUV-stabilized | Yes | Yes |
| FDA-grade resin | Yes | Yes |

1. **Design requirements**

5.1 The minimum required wall thickness of the cylindrical straight shell at any fluid level shall be determined by the following equation, but shall not be less than 3/16-in. thick. The tolerance indicated in section 7.3 applies to these dimensions.



Standard product line includes tanks designed for use with materials having a specific gravity of 1.5, 1.9 and 2.2

5.2 The hydrostatic design shall be determined by multiplying the hydrostatic design basis (determined by ASTM D2837 using rotationally molded samples) by a service (design) factor selected for the application. The standard product line of tanks is engineered using a maximum hydrostatic design stress, 600-psi for Cross linked and 550 psi for Conventional, respectively.

5.3 Note: The hydrostatic design basis for various polyethylenes are typically supplied by the resin manufacturer.

5.4 The vessels are designed and molded with a uniform wall thickness equal to or greater than the minimum thickness requirement per the Barlow Formula shown in this specification. This procedure in the manufacturing process allows the part to cure evenly throughout the entire surface area, thus allowing a more controlled and higher cross-linking percentage with less stress on the part when reaching the cooling process. The end result will give each unit greater structural integrity and a longer life span.

5.5 Each vessel is air-cooled in chambers with high velocity fans giving a controlled temperature drop, insuring a more uniform resin cure, less stress on the part, improved shrinkage parameter and a more consistent product.

5.6 Top head shall be integrally molded (one piece) with the cylinder shell. The minimum thickness of the top head shall be 3/16-in. The tolerance indicated in section 7.3 applies to this dimension.

5.7 Tanks are designed with top mounting flats to enhance fixture assemblies.

5.8 The bottom head of a tank shall be integrally molded (one piece) with the cylinder shell. The minimum thickness for a fully supported flat bottom head shall be 3/16-in. All parting lines shall be located within the top 1/3 of the vertical sidewall.

5.9 Double wall vessels shall be designed so the top head of the primary vessel covers the interstitial space between the two structures providing protection against the elements. The secondary structure shall be the same diameter as the top head of the primary vessel. The secondary vessel shall hold a minimum 120% of the primary vessel.

1. **Nozzles**

6.1 Nozzle material types available are PVC, CPVC, PVDF, virgin polypropylene, black polypropylene, and stainless steel. Bolt material types are Stainless Steel, Hastelloy, and Titanium.

6.2 Gasket materials types are EPDM, Viton, XLPE, and Buna N. Other gaskets are available upon request.

1. All sidewall nozzles shall be a bolted design. All flanged nozzles shall be 150 lb. ANSI-drilled bolt patterns.

6.3 Vents will be provided as agreed, to prevent pressure or vacuum from damaging the tank when filling or draining. Vents shall be sized to maintain atmospheric pressure under normal filling and discharge operations. Some applications or service conditions may require larger vents.

6.4 All piping shall be supported independently of the tank. Flexible expansion joints are required to allow the tank to expand and contract when filling and draining.

1. **Ladder and Restraint Systems**

7.1 Ladder assemblies shall be built to the most recent OSHA guidelines from a material that is chemically resistant to the environment. Suitable materials shall be Isophthalic Polyester or Vinyl ester Fiber Glass Reinforced Plastic, or Mild Steel with two-part epoxy primer and black epoxy finish. The ladder shall have a 24” x 24” platform with a 48” high handrail on both sides and safety chain enclosure. The top of the platform shall be located 48” below the top manway promontory. The ladder shall be fastened to the vessel with 1⁄2” dia Viton or EPDM gasketed bolts at the platform and shall be anchored to the concrete at the base of the ladder. Concrete anchors supplied by others.

7.2 Wind and Seismic Restraint Systems shall be designed to meet UBC1997. Restraints shall be cable design with foot pads anchored to the concrete foundation. The cable assemblies shall extend from an anchor up and over the centerline of the vessel’s top head and down 180 degrees from the point of origin. A turnbuckle shall be supplied on at least one side of each cable assembly to adjust cable tension. The cable assemblies shall be tethered together at the intersection. Design calculations shall be provided with the technical drawings.

1. **Dimensions and Tolerances**

8.1 General - dimensions shall be taken with tank empty.

1. 9.2 Thickness – The tolerance for thickness is specified in section 5 shall be +/- 3%

9.2 Fitting placement – The tolerances for fitting placement shall be +/- 3% in elevation and degree.

1. **Workmanship**

9.1 The finished tank wall, so far as is commercially practical, shall be free of visual defects such as foreign inclusions, air-bubbles, and pinholes that may impair the serviceability of the vessel.

9.2 The inner surface shall be smooth and free of cracks, crazing or pits. Waviness is a characteristic of the molding process for large tanks and is acceptable, provided the surface is smooth and free of cracks.

**10. Quality Assurance**

10.1 Materials (Resins)

* Manufacturer will verify receipt of a supplier certification that each lot of resin conforms to supplier’s specification.
* Manufacturer will verify that each lot of resin complies with its purchase order.
* Manufacturer will visually examine each lot of resin for contamination, color, texture, etc.
* Samples of each lot must be stored a minimum 3 years.
* Each Crosslinked lot sample shall be processed and tested for gel consistency.

10.2 Vessels

* Available testing; impact, gel test, hydrostatic test, ultra sonic thickness test, and HIC specialty procedures shall be provided upon request.

**11. Marking**

11.1 Each tank shall be marked with a quality and routing control number. This number will be used to trace the vessel and shall be common to all required documentation.

11.2 Product identification label with installation and use instructions will be applied to each tank.

**12. Shipping**

12.1 When the tank arrives at the destination, the purchaser shall be responsible for inspecting the tank. If damaged, notify Assmann Corporation of America at (260) 357-3181.

**13. Product Handling**

13.1 The purchaser shall follow recommendations as shown in the installation and use instructions. The purchaser is responsible to insure that all products shipped will be stored, handled and installed in such a manner as not to degrade quality, serviceability or appearance. Vertical tanks should be stored in an upright position on a clean surface with no sharp objects under the tank.

**14. Installation**

14.1 Tanks and accessories shall be installed and handled according to the manufacturer’s recommendations as shown in the installation and use instructions as supplied with the tank. Failure to follow these recommendations will void the warranty. This includes support of all pipes leading to and from the tank and a method to control expansion and vibration of the piping.

14.2 Purchaser should position the tank before assembling to peripheral equipment to ensure proper clearances.

**15. Submittals**

15.1 Approved Drawings

ASTM D-1998

* Certification of testing requested by customer

**16. Warranty**

16.1 Assmann Corporation of America warrants that all tanks manufactured and sold shall be free of defects in material and workmanship for a period of five (5) years limited. Full warranty terms can be supplied upon request.