



General Specification

Industrial Wastewater

Fiberglass Underground Storage Tanks Single Wall or Double Wall

Short Form Specification

The contractor shall provide materials, labor, and expertise to install the underground tank and accessories as represented on the plans and drawings. The tank shall be a single wall (SW) or double wall (DW) fiberglass storage tank as shown on plans and in specifications. The tank shall be installed using the manufacturers engineered anti-flotation system. The tank and anti-flotation system shall be installed in accordance with the engineered plans, the manufacturers' installation guide, details, and drawings.

Submittal documents shall include scaled drawings in both plan, profile, and 3-D to properly illustrate the final product. Finite Element Analysis (FEA) of the underground tank structure & design features, along with buoyancy calculations for the given site conditions shall be provided. The FEA and buoyancy calculations shall be provided with a Professional Engineer's stamp for the State in which the tank is installed.

The contractor shall exhibit an expertise with a reference of three or more similar fiberglass underground tank installations. For contractors with less than three successful documented installations, the tank manufacturer shall provide "Training" to the contractor at additional fees to insure a successful tank installation. Key tank installation steps and backfill materials, as noted in the Manufacturers Installation Guide Checklist, shall be confirmed, and documented by the contractor. Final documents shall be provided with As-Built documentation as part of project closeout procedures.

FRP Underground Tanks shall be supplied by **Fiberglass Tank Solutions, LLC** or approved equals.

Long Form Specification

1 General

2 Sections – Underground Water & Wastewater Tanks

- 2.1 33 16 00 Underground Storage Tank (Industrial Wastewater)
- 2.2 02200 Earthworks
- 2.3 03300 Concrete

3 References

- 3.1 ASTM D4097 Contact-Molded Glass-Fiber-Reinforced-Thermoset Resin/Corrosion – Resistant Tanks
- 3.2 ANSI / AWWA D 120/ Tanks and Materials
- 3.3 ACI 318 / American Concrete Institute
- 3.4 ASTM D3299 /Filament Wound Fiberglass Tanks

4 Summary

- 4.1 The contractor shall provide materials, labor, and expertise to install the underground tank and accessories as represented on the plans and drawings. The tank shall be a single wall (SW) or double wall (DW) fiberglass storage tank as shown on plans. The tank shall be installed using the manufacturers engineered anti-flotation system. The tank and anti-flotation system shall be installed in accordance with the engineered plans, the manufacturers' installation guide, details, and drawings.

5 Submittals

- 5.1 Provide Tank Product Data Sheets with general tank application and lay-out.
- 5.2 Provide Anti-Flotation Product Data Sheets showing material properties.
- 5.3 Provide Tank Resin Conformity Letter, showing material properties, along with resin manufacturers letter of conformity for the tank's storage application.
- 5.4 Provide Finite Element Analysis for the tank structure and design features with P.E Stamp for State tank is installed.
- 5.5 Provide Buoyancy Calculations with P.E. Stamp for State tank is installed.
- 5.6 Provide Manufacturers' Installation Guide including comprehensive shipping, handling, and installation instructions.
- 5.7 Provide Bedding and Backfill Sieve Analysis, along with Supplier Delivery Tickets showing material description matching the sieve analysis.
- 5.8 Provide Scaled Shop Drawings in PDF and DWG Format, including all tank manufacturer accessories.
- 5.9 Provide Contractors Project References of three or more similar successful installations of underground fiberglass tanks.
- 5.10 Provide Manufacturer's Quality Management Plan Outline for manufacturing process and procedures.

6 Approval Process

- 6.1 Throughout this document, the terms “or engineer-approved equal” and “or approved equal” are used. For this project the terms “engineer-approved equal” or “approved equal” shall mean equal in the judgment of the engineer. Bidders seeking approval of products as an “approved equal” shall furnish written evidence that such product conforms in all respects to the specified requirements, and that it has been used successfully elsewhere under similar conditions. Where the specified requirements involve conformance to recognized codes or standards, the bidder shall furnish evidence of such conformance in the form of test or inspection reports. Bidders seeking approval of products as an “approved equal, shall provide submissions, meeting the specified product’s requirements, no fewer than 10 days prior to bid opening for review by the engineer. Failure to provide complete data prior to bid date will be cause for rejection of the product.

7 Quality Assurance

- 7.1 Manufacturing shall comply with the Occupational Safety and Health Administration (OSHA) requirements.
- 7.2 The FRP tank manufacturer shall follow a QMP for materials, process, shipping, with a comprehensive documentation that follow each tank throughout the submittal, manufacturing, shipping, and delivery process.

8 Design Criteria

8.1 Manufacturing Process

- 8.1.1 (FRP) Fiberglass Reinforced Tanks shall be manufactured using a combination hoop winding, chop, and hand layup process. Tanks shall be built using a C-Veil interior resin rich layer, with a combination of chopped strand mat and mechanical winding process to achieve a multi layered laminate. Tanks utilizing a chop only process will not be accepted.
- 8.1.2 The chop / hoop wound tank body shall have a certifiable minimum flexural modulus of 2,000,000 PSI and the chopped reinforced heads no less than 1,000,000 PSI.
- 8.1.3 Both the shell and heads shall be built using a half round or hemispheric rib design utilizing a structural foam core.
- 8.1.4 Resin types shall be compatible for the tank application as referenced on plans and specifications per section 5.3.

8.2 Tank Size

- 8.2.1 The underground single wall or double wall tank shall have a diameter or _____ft. with a length of _____ft.
- 8.2.2 Total storage volume shall be _____gallons.
- 8.2.3 Total storage to invert of outlet or overflow shall be _____gallons.

8.3 Loading Conditions

- 8.3.1 The tank shall be installed with a total backfill over the top of the tank at _____ ft.
- 8.3.2 The tank shall be designed to handle pedestrian or H-20 axle loads (32,000 lbs. / axle) per the plans.
- 8.3.3 Tank risers and lids shall be designed for a maximum of 2500 # wheel load limits in common areas to accommodate mowing and maintenance equipment.
- 8.3.4 Tanks with H-20 load conditions shall be supplied with reinforced concrete or asphalt per the manufacturer's Installation Guide.
- 8.3.5 All risers and lids, manways, or sumps, in H-20 load applications shall be fitted with appropriately sized steel manways and covers as manufactured by Universal Valve Company.
- 8.3.6 All tank penetrations shall be 100% watertight and installed by the manufacturer, no field inlet assembly allowed.

8.4 Product Storage

- 8.4.1 Tanks shall be design for atmospheric pressure only.
- 8.4.2 Tanks shall be designed to store Industrial Wastewater with a specific gravity up to 1.1.
- 8.4.3 Tanks shall be designed to operate at ambient temperatures not to exceed 100 F.

8.5 Testing

- 8.5.1 The tank shall be designed to be watertight and testable per the manufacturer's Installation Guide.

8.6 Accessories

8.6.1 PVC Pipe Stubs

- 8.6.1.1 PVC Pipe Stubs shall be Sch. 40 designed for drain, waste, or vent (DWV)
- 8.6.1.2 PVC Pipe Stubs shall be utilized for inlets up to 10", locations at tank top dead center or inlet hubs < 1/3 of tanks sidewall height.

8.6.2 FRP Pipe Stubs

- 8.6.2.1 FRP Pipe Stubs shall be a minimum of ¼" wall thickness, 4" thru 48".
- 8.6.2.2 FRP Pipe Stubs may be located at any location on the tank shell.

8.6.3 FRP Flanged Nozzles

- 8.6.3.1 Flanged nozzles shall be 2" thru 24" in size.
- 8.6.3.2 Cone or plate gussets shall be utilized on flanges over 4" for structural strength.
- 8.6.3.3 FRP Flanges shall be flat faced utilizing ANSI B 165, 150# bolt patterns.
- 8.6.3.4 Flanges shall be designed for atmospheric pressure only.

8.6.4 FRP Threaded Fittings

- 8.6.4.1 Threaded fittings shall be located on the tanks top dead center or on manway covers only.

8.6.5 Flexible Connectors

- 8.6.5.1 Flexible connectors and load isolation techniques should be utilized for all inlet or outlet connections that penetrate the tank on a horizontal or vertical plane.
- 8.6.5.2 Flexible connectors should be designed to provide movement to accommodate settlement.
- 8.6.5.3 Flexible connectors shall be designed to withstand needed soil burial depths.

8.6.6 FRP Riser Lids

- 8.6.6.1 FRP lids 24", 30", 36", 42", or 48" shall be of an FRP composite material with 316 S.S. bolts and latches.

8.6.6.2 FRP lids shall have a gasket connection that fits either a flat face flange or the riser pipe plain end connection.

8.6.6.3 FRP lids shall utilize a textured finish with UV inhibitors at finish grade.

8.6.6.4 FRP lids shall be rated for 300 # pedestrian rating for use in common foot traffic areas.

8.6.6.5 FRP lids shall be rated for 2500 # occasional wheel load.

8.6.6.6 FRP Risers in H-20 load areas shall utilizing steel or C.I. manhole ring and lids.

8.6.7 Hinged & Lockable Covers

8.6.7.1 Hinged and lockable covers shall be 100% FRP laminate in construction. Covers shall be hinged for easy inspection and sealed with a watertight gasket to keep out dirt, groundwater, or insects.

8.6.8 FRP Risers

8.6.8.1 FRP risers 24", 30", 36", 42" or 48" may be either a flanged connection or plain end to fit tank access openings or FRP riser lids.

8.6.8.2 FRP risers will be a minimum of 1/4" wall thickness with a gelcoat finish when projected above finish grade.

8.6.8.3 FRP risers will utilize a structural adhesive or an FRP bonding kit when bonding to a FRP tank access collar.

8.6.9 PVC Risers

8.6.9.1 PVC risers 24" or 30" shall be made of a PVC profile construction, cut to length, and bonded to tank access opening collars with a structural adhesive.

8.6.9.2 For PVC riser lengths over 3' tall, a grade ring insert (GRI) shall be utilized to ensure a proper seal is obtained at the tank access opening to riser connection.

8.6.10 Tank Access Openings

8.6.10.1 Tank access openings shall be 24", 30", 36", or 48" in size.

8.6.10.2 Tank access openings shall utilize an FRP collar that is 1/2" less than the riser I.D.

8.6.10.3 Tank access collars shall be a minimum of 3" tall.

8.6.11 FRP Manways

8.6.11.1 FRP Manways shall provide a 24" or 30" I.D. opening and come complete with 304 S.S. bolts, nuts, and neoprene flat face gaskets.

8.6.12 Manway Extensions

8.6.12.1 FRP Manways shall provide a 24" or 30" I.D. opening and come complete with 304 S.S. bolts, nuts, and neoprene flat face gaskets. Manways shall provide lengths needed to extend 12" above grade for easy assembly of covers to top manway connection.

8.6.12.2 Manway extensions shall be gel-coated 12" at finish grade.

8.6.13 Ladders

8.6.13.1 Ladders shall be FRP or aluminum in material construction and shall be supplied by the tank manufacturer.

8.6.13.2 Ladders shall be mounted in a way to allow for a flexible connection to accommodate tank movement during filling and empty cycles.

8.6.14 Level Controls and Sensors

8.6.14.1 Interstitial dry double-wall fiberglass tank monitoring shall utilize an Omtec model LWF non-distinguishing sensor.

8.6.14.2 Product level sensors shall utilize an Omtec model L-Series to provide product-level alarms for high, caution, or low product levels.

8.6.14.3 The control panel for a combination DW monitoring and product level shall be an Omtec model LU NEMA 4X rated series.

8.6.14.4 Remote Annunciators shall be an Omtec unit compatible with LU controllers utilizing a NEMA 4X enclosure and non-external power type.

8.7 Anti-Flotation Systems

8.7.1 Precast Concrete Deadmen

8.7.1.1 Precast concrete deadmen shall be provided by the tank manufacturer and shall meet the following design criteria:

8.7.1.2 Manufactured with a reinforced concrete design with a minimum of a 4000-psi concrete.

8.7.1.3 Provide adjustable anchor points for hold down straps.

8.7.1.4 Provide multiple lengths to provide a full-length anchor to any sized tank, 6', 8', 10, or 12' in diameter.

8.7.1.5 Precast concrete deadmen for 4' – 8' diameter tanks shall be 12" wide.

8.7.1.6 Precast concrete deadmen for 10' & 12" diameter tanks shall be 18" wide.

8.7.2 TankAnchor™ Geocomposite Anti-flotation System

8.7.2.1 Geocomposite deadman systems shall be provided by the tank manufacturer. The geocomposite anti-flotation system shall consist of a polyester geogrid with a nonwoven geotextile. TankAnchor™ shall be installed per the manufacturers recommendations and sizing based on buoyancy calculations and site conditions.

8.7.3 Fiberglass Deadmen

8.7.3.1 Fiberglass Deadmen shall be provided by the tank manufacturer and shall meet the following design criteria:

8.7.3.2 FRP Deadmen for 4' – 6' diameter tanks shall be 12" wide.

8.7.3.3 FRP Deadmen for 8' diameter tanks shall be 18" wide.

8.7.3.4 FRP Deadmen for 10' – 12' diameter tanks shall be 24" wide.

8.7.3.5 FRP Deadmen shall be full length of tank.

8.7.4 Deadman Anchor Straps

8.7.4.1 Anchor straps shall be supplied by the tank manufacturer and be composed of a pultruded fiberglass strap with engineered D-Rings for connection to turnbuckles.

8.7.4.2 Each anchor strap shall be rated for a maximum load of 25,000 lbs.

8.7.4.3 The qty. and location of the straps shall be noted by the tank manufacturer on the tank drawing.

8.7.5 Turnbuckles

8.7.5.1 Turnbuckles shall be provided by the tank manufacturer.

8.7.5.2 Turnbuckles shall be a Class 7 forged type, meeting performance requirements of Federal Specification F1145 Type 1, Form1 and ASTM FF-T-791B.

8.7.5.3 Design loads for turnbuckles shall be based on a design factor of 5:1

9 Execution

- 9.1.1 Single wall fiberglass tanks shall be installed and tested in the methods established in the manufacturer's installation guide and checklist.
- 9.1.2 Tanks shall only store the products listed in the appropriate warranty and for which the tank is specified.
- 9.1.3 Failure to follow the installation guide will terminate the manufacturer's warranty.

10 As-Built Documentation

- 10.1.1 Provide Manufacturers Installation Check List, reference documentation including pictures, videos, and handwritten reports, for general points of interest regarding tank installation steps.
- 10.1.2 Provide picture & video documentation of tank installation for each step required per the manufacturer's installation guide.
- 10.1.3 Provide Supplier Delivery Tickets showing supplied bedding and backfill material description matching the sieve analysis.

11 Warranty

- 11.1.1 Warranty shall be the limited warranty in effect at the time of delivery, as provided by Fiberglass Tank Solutions, LLC.