

Specification for Fiberglass Reinforced Plastic Tanks

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Specification for Fiberglass Reinforced Plastic Tanks

1 Scope

1.1 General

This specification covers material, design, fabrication, and testing requirements for fiberglass-reinforced plastic (FRP) tanks. Only shop-fabricated, vertical, cylindrical tanks are covered. Tanks covered by this specification are intended for aboveground and atmospheric pressure service. Unsupported cone bottom tanks are outside the scope of this specification.

This specification is designed to provide the petroleum industry with various standard sizes of FRP tanks. Because of the versatility of FRP tanks, the user shall be responsible for determining the suitability of FRP tanks for the intended service.

NOTE The consequences of exposing FRP tanks to high temperatures created by exposure fires should be considered. This material loses strength as the temperature increases. FRP tanks should be suitably protected against fire exposure or so located that any spills resulting from the failure of these materials could not unduly expose persons, buildings, structures, or other equipment to the possible fire incident.

1.2 Compliance

1.2.1 The manufacturer is responsible for complying with all of the provisions of this specification. The purchaser is responsible defining their specific requirements in the data sheet (see Figure D.1; hereafter referred to as “the data sheet”). The purchaser may make any investigation necessary to be satisfied with compliance by the manufacturer and may reject any material that does not comply with this specification.

NOTE The purchaser is encouraged to arrange for inspection independent of the inspection furnished by the manufacturer, and the purchaser’s inspector should follow closely all the details of shop fabrication and testing herein specified that affect the integrity and safety of the completed structure.

1.2.2 If specified by the purchaser on the data sheet, the tank shall be constructed in accordance with API Q1 and the API Monogram Program (see Annex A).

1.2.3 This specification applies to new tanks. The requirements may be applied to existing tanks at the discretion of the owner/operator.

1.2.4 This specification has requirements given in two alternate systems of units. The manufacturer shall comply with the U.S. customary (USC) units. The SI unit equivalent is provided for convenience.

NOTE Per API document style, SI unit values appear first, followed by their USC equivalents in parentheses

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any addenda) applies.

API Standard 650, *Welded Tanks for Oil Storage*

API Standard 2000, *Venting Atmospheric and Low-pressure Storage Tanks*

API Recommended Practice 2003, *Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents*

AISC.,¹ *Steel Construction Manual*

ASCE 7,² *Minimum Design Loads for Buildings and Other Structures*

ASME B16.5, *Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard*

ASTM A153, *Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware*

ASTM A193/A193M, *Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications*

ASTM A307, *Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength*

ASTM A325, *Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength*

ASTM A325M, *Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric)*

ASTM C581, *Standard Practice for Determining Chemical Resistance of Thermosetting Resins Used in Glass-Fiber-Reinforced Structures Intended for Liquid Service*

ASTM D638, *Standard Test Method for Tensile Properties of Plastics*

ASTM D790, *Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials*

ASTM D2583, *Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor*

ASTM D2584, *Standard Test Method for Ignition Loss of Cured Reinforced Resins*

ASTM D2990, *Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics*

ASTM D3299, *Standard Specification for Filament-Wound Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks*

ASTM D4097, *Standard Specification for Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Corrosion-Resistant Tanks*

IBC., *International Building Code*³

SPI E-1067.,⁴ *Recommended Practice for Acoustic Emission Examination of Fiberglass Tanks/Vessels*

SSPC-SP1,⁵ *Solvent Cleaning*

U.S. Government, 29 CFR Section 1910, General Industry Regulations, OSHA ⁶

¹ American Institute of Steel Construction, One East Wacker Drive Suite 700, Chicago, IL 60601-1802, www.aisc.org.

² American Society of Civil Engineers, 1801 Alexander Bell Drive, Reston, VA 20191, www.asce.org.

³ International Building Code, 500 New Jersey Avenue, NW, 6th Floor, Washington, DC 20001, www.iccsafe.org.

⁴ Society of the Plastics Industry, 1425 K Street NW., Suite 500, Washington, DC 20005, <http://www.plasticsindustry.org>.

⁵ The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, PA 15222, www.sspc.org.

⁶ U.S. Department of Labor, Occupational Safety and Health Administration, 200 Constitution Avenue, NW, Washington, DC 20210, www.osha.gov.

3 Terms and Definitions

For the purposes of this document, the following definitions apply.

3.1

chop-hoop

A unique blend of chop-spray and filament winding. The FRP composite is constructed using the chop-spray and the filament winding processes simultaneously. This process gives the strength from the directional glass from the filament winding process plus the higher resin content from the chop-spray process, which provides improved corrosion protection to the reinforcement.

3.2

chop-spray

Continuous strand glass roving, and catalyzed resin are fed through a chopper gun, which cuts the fiberglass into specific lengths that can be adjusted on site. The chopper gun deposits the resin-saturated “chop” on the mold. The laminate is then rolled to thoroughly saturate the glass strands and compact the chop. Additional layers of chop laminate are added as required for thickness.

3.3

design thickness

The thickness necessary to satisfy tension and compression strength requirements by this Specification or, in the absence of such expressions, by good and acceptable engineering practice for specified design conditions, without regard to construction limitations or corrosion allowances.

3.4

fiberglass-reinforced plastic (FRP)

A fiber-reinforced plastic composite which is a combination of a polymer matrix resin, referred to as plastic, (thermoset resin such as polyester, isopolyester, vinyl ester, epoxy, phenolic) and fiber reinforcement such as glass, carbon, aramid, or other reinforcing material.

3.5

filament wound

Filament winding is an automated open molding process that uses a rotating mandrel as the mold. The male mold configuration produces a finished inner surface and a laminate surface on the outside diameter of the product. Filament winding results in a high degree of fiber loading, which provides high tensile strengths in the manufacture of hollow, generally cylindrical products such as chemical and fuel storage tanks, pipes, stacks, and pressure vessels.

3.6

inspector

The person(s) designated by the purchaser or manufacturer to perform inspections.

3.7

mandatory

Required sections of the specification become mandatory if the specification has been adopted by a legal jurisdiction or if the purchaser and the manufacturer choose to make reference to this specification on the nameplate of in the manufacturer's certification.

3.8

manufacturer

The party having the primary responsibility to construct the tank.

3.9

purchaser

The owner, owner's engineer, or operator who specifies the tank data sheet for the purchase.