Fiberglass Tank & Piping Fundamentals

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Introduction

Fiberglass reinforced thermosetting plastic ("fiberglass") first became a viable alternative to protected steel, stainless steel and exotic materials in 1948. That year centrifugal cast fiberglass piping was first used in the crude oil production industry as a solution to steel piping corrosion problems. It was during the 1960's that manufacturers began to develop nationally recognized standards and test methods for fiberglass storage and fiberglass piping systems.

Nationally Recognized Standards and Specifications

There are a number of nationally recognized standards and specifications for fiberglass tanks and fiberglass piping. While there are standards developed for military applications, e.g., MIL standards for helicopter rotor blades, following is a list of civilian organizations with published standards and specifications:

Fiberglass	**Civilian Organizations**
Tanks & Piping	API American Petroleum Institute ASME American Society of Mechanical Engineers ASTM American Society for Testing and Material AWWA American Water Works Association FM Factory Mutual Research NSF National Sanitation Foundation UL Underwriters Laboratories Inc.

What is Fiberglass?

Fiberglass tanks and fiberglass piping contain glass fiber reinforcement embedded in cured thermosetting resin; hence the term Fiberglass Reinforced Plastic (FRP) describes the fiberglass material system. This composite structure typically contains additives such as pigments and dyes. By selecting the proper combination of resin, glass fibers, additives and design, the fabricator can create a product that meets the equipment designer's performance standard.

***Glass Fibers*:** All fiberglass begins as individual filaments of glass drawn from a furnace of molten glass. Many filaments of glass are formed simultaneously and gathered into a glass "roving" when a surface treatment "sizing" is added to maintain the fiber's properties. Glass fibers are designed for several applications, some of which are for applications in an acid, alkali or other chemical environments. The mechanical strength of a fiberglass product

depends upon the amount, type and arrangement of glass fiber reinforcement within the material system and increases proportionally with the amount of glass fiber reinforcement.

***Thermosetting and Thermoplastic Resins*:** Thermosetting and thermoplastic are two basic groups of resins, however only thermosetting resins are used with glass fiber reinforcing to form a thermosetting resin system. A comparison of the two resin systems is shown below:

Thermosetting plastics are resins that undergo an irreversible reaction when cured in the presence of a catalyst. They cannot be re-melted and are insoluble. Fiberglass products use only thermosetting resin systems of which there are two generic types, polyester and epoxy resins. The resin system is chosen for its chemical, mechanical and thermal properties. Polyester resins come in many variations with different properties to resist acids, caustics and high temperatures. Epoxy resins are used primarily for the manufacture of small diameter piping, whereas polyester resins are commonly used for large diameter piping and storage tanks.

Thermoplastics are resins that are normally solid at room temperature, but are softened by heat and will flow under pressure. Typical applications include household kitchenware, children's toys, bottles and other common items.

Resistance to corrosion in aggressive environments is one of the primary reasons for specifying fiberglass tanks or piping. Typical types of corrosion do not affect fiberglass. This would include galvanic, aerobic, pitting and inter-granular corrosion which harms metals but not fiberglass. Although fiberglass resists a wide range of chemicals and temperatures, it requires the right design, fabrication and installation to match the appropriate application. For example, fiberglass may be subject to chemical attack from hydrolysis, oxidation, or incompatible solutions. However, the proper resin/glass matrix will address this chemical attack.

Today, off-the-shelf or custom fiberglass tanks and fiberglass piping is used in corrosive environments and high pressure (e.g. 4,000 psi.) applications. These fiberglass systems are widely used in retail petroleum, exploration & production, chemical, municipal and industrial applications.

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