

SPECIFICATIONS FOR FIBERGLASS REINFORCED POLYESTER (FRP) PIPES FOR PRESSURE LINES

1.0 General

This specification covers design, material requirements, dimensions, inspection and factory testing of FRP pressure pipe and fittings, in nominal diameters of 16" and larger for use in buried pressure applications.

FRP pipes and fittings shall be filament wound and shall be manufactured from fiberglass reinforcing materials, impregnated with Polyester resin, and pure silica sand. The maximum continuous service temperature allowed for FRP piping shall not exceed 125 Degrees F.

1.1. Specification references

The material, subject of this specification will be fabricated and tested in accordance with the latest edition, revision or addendum of the referenced codes, specifications or standards.

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| C | ASTM D3517 | Standard Specification for Fiberglass Pressure Pipe |
| C | AWWA C950 | AWWA Standard for Fiberglass Pressure Pipe |
| C | AWWA M 45 | AWWA Manual 'Fiberglass Pipe Design' |

2.0 Materials and manufacture

FRP Pipes shall be manufactured using the filament winding process. The pipes shall consist of a corrosion resistant liner, structural walls and a resin rich exterior surface.

The resin rich liner, shall have a nominal thickness of 0.03" consisting of an inner most 0.01" layer reinforced with 'C' glass.. An outer resin rich layer shall provided and shall be reinforced with 'C' glass mat or veil.

3.0 Design Pressure

The design pressure should be the continuous internal operating pressure that the system will be subjected to under all normal modes of operation, throughout the entire life time of the system. The design working pressure for pressure pipe shall be as shown on the drawings or bill of materials, but shall not less than 75 psi.

4.0 Stiffness

Pipe shall have a minimum pipe stiffness (PS) of not be less than 36 psi when tested in accordance with AWWA C950 section 5.1.2.2. The pipe shall also meet the initial ring deflection requirements of table 9 of AWWA C950 and section 5.1.2.2.2 of AWWA C950 for level 'A' and level 'B' deflections as appropriate for the stiffness class specified.

5.0 Diameters

Pipe shall be supplied in standard nominal inside diameters (ND). The tolerance on actual inside diameter shall be +/- 1 % of the nominal pipe ID or 0.25" whichever is greater.

6.0 Length

FRP Pipes shall be supplied in the following nominal lengths, unless otherwise specified:

- C Diameters below 16" 20 ft
- C Diameters 16" and larger 40 ft

The actual length supplied shall not vary from the nominal declared length by more than 1". At least 90 % of the pipe supplied for each diameter and pressure class shall be supplied in the nominal lengths specified by the pipe manufacturer. The remaining 10 % may be supplied in random lengths.

7.0 Joints

7.1 Pipe joints shall be either of the following:

- Integral Bell and spigot with rubber ring gasket
- FRP coupling joints with two rubber seals

For unrestrained underground pressure service, the piping system shall incorporate concrete thrust blocks at changes of direction, changes of x-section and dead ends for system stabilization, unless restrained joints are used. FRP pipes, if supplied with restrained joints shall have high axial strengths to resist the axial tensile forces at thrust locations. Rubber gasketed joints shall allow at least 1 degree of joint deflection while remaining water-tight for sizes above 36" and at least 2 degrees for smaller sizes. The pipe manufacturer shall furnish the maximum allowable deflections for each pipe size.

7.2. Joint performance

Joints shall meet the performance requirements of section 7 of ASTM D4161. Rigid joints (laminated) shall be exempted from angular deflection requirements. A test report showing compliance of the joint design shall be submitted for approval.

8.0 Testing of finished products

8.1 Visual

All pipes and fittings will be inspected for visual defects. Pipes and fittings shall be commercially free from all defects including indentation, delaminations, bubbles, pinholes, foreign inclusions and resin starved areas, which due to their nature degree or extent, detrimentally affect the strength and serviceability of pipes and fittings. Pipes and fittings shall be as uniform as commercially practicable in colour, density and other physical properties.

8.2 Dimensions

All relevant dimensions of all pipes and fittings will be inspected in accordance ASTM D3567 or AWWA C950 for compliance to the requirements of these specifications.

8.3 Hydrostatic testing

FRP pipe up to 96" in diameter shall be hydrostatically tested at 100 % frequency at 2.0 times the rated working pressure classification of the pipes in accordance with AWWA C950 section 5.1.2.1. Testing frequency for pipes larger than 96" shall be by agreement.

8.4 Physical properties

The following physical tests will be performed:

- C The Barcol hardness will be determined in accordance with ASTM D 2583 for every pipe and fitting.
- C The hoop tensile strength of pipe shall be determined in accordance with ASTM D2290 at least once per 100 pipe produced of the same diameter, and class.
- C The axial tensile strength of pipe shall be determined in accordance with ASTM D638 at least once per 100 pipe produced of the same diameter, and class.
- C Stiffness shall be determined in accordance with ASTM D2412, at least once per 100 pipe produced of the same diameter, and class.

9.0 NSF approval

NSF approval shall be a requirement for all pipe installed in the drinking water network.

10.0 Marking

All pipes and fittings shall be marked with:

- Manufacturers name or trade mark & production date.
- The nominal diameter, pressure class, and stiffness class

The marking shall remain legible under normal handling and installation practices.

11.0 Installation

FRP pipes and fittings shall be installed in accordance with the manufacturers written installation instructions and as shown on the contract drawings. As a minimum, underground pipe shall be installed in accordance with chapter 6 of AWWA manual M45. Pipe shall be installed in dry trenches. A 6" thick compacted clean sand bed shall be provided under the pipes and "Bell" holes shall be dug at each joint location, such that the entire length of the pipe is supported by the bedding material. Backfilling up to 6" above the pipe crown shall be with granular sand compacted to a minimum standard proctor density of 90 %. For unrestrained joints, a short pipe section shall be provided outside every chamber or thrust block to protect the pipeline from settlement. The length of the short pipe section shall be as per the manufacturer's recommendations. Pipe deflections measurements shall be taken on all pipes installed as soon as backfilling is completed. The maximum initial vertical deflection allowed for pressure pipe shall not exceed 2 % of the actual pipe inside diameter.
