

SPECIFICATIONS FOR
FIBERGLASS REINFORCED POLYESTER (FRP)
PIPES FOR GRAVITY SEWERS

1.1 General

This specification covers design, material requirements, dimensions, inspection and factory testing of FRP sewer pipe and joints, in nominal diameters of 16" and larger for use in underground gravity sewer applications, either direct buried, or by micro-tunnelling or slip lined into existing sewers.

FRP pipes and joints shall be filament wound and shall be manufactured from fiberglass reinforcing materials, impregnated with Polyester resin, and pure silica sand.

1.2. 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.

- C ASTM D3262-04 Standard Specification for Fiberglass sewer 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 minimum thickness of 0.03" consisting of an inner most 0.01" layer reinforced with 'C' glass impregnated with a high-grade Isophthalic polyester resin. An outer resin rich layer shall provided and shall be reinforced with 'C' glass mat or veil.

3.0 Stiffness

Direct buy gravity pipe shall have a minimum pipe stiffness (PS) of 46 psi when tested in accordance with section 8.3 of ASTM D3262. Direct buried pipe installed at depths of cover greater than 26 feet shall have a minimum pipe stiffness of 72 psi. The minimum pipe stiffness for slip-lining pipe shall be 36 psi.

4.0 Diameters

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

5.0 Length

FRP direct buried pipes shall be supplied in 20 feet lengths for sizes below 16" and in 20 or 40 feet lengths for larger sizes. 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 stiffness class shall be supplied in the nominal lengths specified by the pipe manufacturer. The remaining 10 % may be supplied in random lengths. The length of pipe supplied for micro-tunnelling installations or slip-lining installations may be shorter than 20 feet, and shall be suitable for the type of equipment used and on site access conditions.

6.0 Joints

6.1 Direct buried pipe joints shall be either of the following:

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

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 angular deflections for each pipe size. Joints used for micro-tunnelling/jacking shall utilize the same basic designs above, but shall be flush with the outside surface of the pipe or slightly recessed. Pipe used for slip lining applications shall have a low-profile FRP bell attached to one end of the pipe and shall incorporate one or more confined gaskets in the pipe spigot or the Bell. The slip-lining bell shall form a 'Bell' profile or shall be essentially flush with the pipe depending of the clearance available with the existing sewer pipe, the method of installation specified and the total wall thickness of the proposed pipe.

6.2. Joint performance

Direct bury joints shall meet the performance requirements of section 7 of ASTM D4161 at a test pressure of at least 30 psig. A test report showing compliance of the joint design shall be submitted for approval.

7.0 Chemical requirements (strain corrosion)

Direct bury pipe used in sanitary sewer drainage shall meet the chemical requirements outlined in section 6.3 of ASTM D3262-04.

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 and ASTM D3262 for compliance to the requirements of these specifications.

8.3 Hydrostatic testing

All direct bury FRP sewer pipe up to 100" in diameter shall be hydrostatically tested at 100 % frequency at 30 psig for 3 minutes with no signs of weeping or leaks. Testing frequency for pipes larger than 100" shall be agreed upon.

8.4 Physical properties

The following physical tests will be performed:

- C The Barcol hardness (resin cure) will be determined in accordance with ASTM D 2583 for every pipe and fitting and a minimum Barcol hardness of 30 shall be required.
- 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 stiffness class.
- C Stiffness shall be determined in accordance with ASTM D2412, at least once per 100 pipe produced of the same diameter, and stiffness class.

8.5 Chemical control tests for direct bury pipes.

For direct bury pipes, representative pipe samples when tested in accordance with section 8.2.2 of ASTM D3262, shall meet the 100 hr and 1000 hr control requirements set forth in section 6.3.2 of ASTM D3262. A test report showing compliance to the control requirements shall be submitted prior to supply of pipe to site.

9.0 Marking

All pipes shall be marked with:

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

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

10.0 Design calculations

The pipe manufacturer shall provide detailed design calculations in accordance with AWWA M45 showing the suitability of the pipe stiffness to the installation conditions specified and that the maximum specified pipe deflection is not exceeded.

For micro-tunnelling/jacking installations, the pipe manufacturer shall provide detailed design calculations to demonstrate the suitability of the proposed net pipe thickness and compressive strengths to the expected jacking loads to be applied on the pipe during installation. The compressive strength and net wallthickness of the pipe shall provide a safety factory of at least 2.5 for the design jacking load specified by the contractor.

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. Direct buried 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 direct buried pipe, a short pipe section shall be provided outside every manhole or rigid structure 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 direct buried pipes installed as soon as backfilling is completed. The maximum initial vertical deflection allowed shall not exceed 3 % of the actual pipe inside diameter.
