Designation: D 5686 – 95

AMERICAN SOCIETY FOR TESTING AND MATERIALS
100 Barr Harbor Dr., West Conshohocken, PA 19428
Reprinted from the Annual Book of ASTM Standards. Copyright ASTM

Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Pipe Fittings, Adhesive Bonded Joint Type Epoxy Resin, for Condensate Return Lines[1]

This standard is issued under the fixed designation D 5686; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This specification covers machine-made reinforced thermosetting epoxy resin pipe and fittings nominal pipe size (NPS) 2 in. (50 mm) through 12 in. (304 mm) diameter to be used for continuous service in condensate return lines for the specific maximum temperature and pressure covered by this specification, 250°F (121°C) and 125 psig (862 kPa).

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are provided for information purposes only.

1.3 The dimensionless designator NPS has been substituted in this specification for such traditional terms as "nominal diameter"," size", and "nominal size".

1.4 The following safety hazards caveat pertains only to the test method portion, Section 9, of this specification:

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

NOTE 1—There is no similar or equivalent ISO standard.

2. Referenced Documents

2.1 *ASTM Standards:*

D 883 Terminology Relating to Plastics[2]

D 1600 Terminology for Abbreviated Terms Relating to Plastics[2]

D 2310 Classification for Machine-Made Reinforced Thermosetting Resin Pipe[3]

D 3567 Practice for Determining Dimensions of Reinforced Thermosetting Resin Pipe (RTRP) and Fittings[3]

D 3951 Practice for Commercial Packaging[4]

F 412 Terminology Relating to Plastic Piping Systems[3]

2.2 *ANSI Standard:*

B 16.5 Steel Pipe Flanges and Flanged Fittings[5]

3. Terminology

3.1 *Definitions:*

3.1.1 *General*—Definitions are in accordance with Terminologies D 833 and F 412 and abbreviations are in accordance with Terminology D 1600, unless otherwise indicated. The abbreviation for reinforced thermosetting-resins pipe is RTRP.

4. Classification

4.1 *General*:

4.1.1 Pipe meeting this specification is classified by type, grade, and class similar to Classification D 2310.

4.1.2 Fittings meeting this specification are also classified by types (method of manufacture) and grades (generic type of resin).

4.2 *Types of Pipe*:

4.2.1 *Type I*—Filament-wound pipe.

4.2.2 *Type II*—Centrifugally-cast pipe.

4.3 *Types of Fittings*:

4.3.1 *Type I*—Filament-wound fittings.

4.3.2 *Type II*—Centrifugally-cast fittings.

4.3.3 *Type III*—Molded fittings.

4.4 *Grades of Pipe and Fittings*:

4.4.1 *Grade I*—Glass-fiber-reinforced epoxy resin (pipe and fittings).

4.5 *Classes of Pipe*:

4.5.1 *Class C*—Epoxy resin liner (nonreinforced).

4.5.2 *Class F*—Epoxy resin liner (reinforced).

5. Materials and Manufacture

5.1 *General*—The fiberglass pipe and fittings shall be round, straight, and of uniform density, resin content, and surface finish. All pipe ends shall be cut at right angles to the axis of the pipe and any sharp edges removed. The bore of the pipe shall contain a smooth uniform liner to protect the glass fiber reinforcement. The liner shall be composed of all epoxy

[1] This specification is under the jurisdiction of ASTM Committee D-20 on Plastics and is the direct responsibility of Subcommittee D20.23 on Reinforced Plastic Piping System and Chemical Equipment.

Current edition approved April 15, 1995. Published June 1995.

[2] Annual Book of ASTM Standards, Vol 08.01.

[3] Annual Book of ASTM Standards, Vol 08.04.

[4] Annual Book of ASTM Standards, Vol 15.09.

[5] Available from American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.

resin formulation and may contain a reinforcement. The bore of the fittings shall have a smooth, uniform surface with no exposed fibers.

5.2 *Materials*—Materials used shall be free from defects which would adversely affect the performance or maintainability of individual components or of the overall assembly.

5.2.1 *Pipe and Fittings*—The pipe and fittings shall be made from epoxy resins and glass-fiber reinforcement. Fillers, colorants, and other materials may be added, provided that the pipe and fittings produced meet all the requirements of this specification.

5.2.2 *Adhesive*—Adhesive for joint assembly shall be a material suitable for providing a permanent seal between the pipe and fittings in continuous service up to 125 psig (862 kPa) at 250°F (121°C). The adhesive shall be supplied as a kit which includes containers of all components in the amounts needed for each adhesive mixture. Instructions for use shall be marked on each container or listed on an instruction sheet included in each adhesive kit. As specified on the purchase order, adhesive kits shall be furnished in a sufficient quantity for the particular procurement of pipe and fittings.

6. Dimensions

6.1 *Pipe*—The pipe shall be 2, 3, 4, 6, 8, 10, or 12-in. nominal size as specified on the purchase order and shall have the dimensions and tolerances shown in Table 1.

6.1.1 *Length*—Unless other lengths are specified on the purchase order, the length of the pipe shall be 20 ft (6.1 m) or 30 ft (9.1 m) with a plus tolerance of 2 ft (0.61 m) and a minus tolerance of 5 ft (1.5 m), when measured in accordance with 8.2.3.

6.1.2 *Wall Thickness*—The minimum wall thickness of the pipe shall be not less than 87.5 % of the average wall thickness of the pipe as tested in Section 9, when measured in accordance with 8.2.3.

6.2 *Fittings*—Fittings shall be 2, 3, 4, 6, 8, 10 or 12-in. nominal size, as specified on the purchase order and shall have dimensions suitable for joining to the pipe and enabling the pipe and fitting joint to meet the requirements of this specification. For purposes of this specification, fittings shall include couplings and flanges.

TABLE 1 Dimensions of Pipe

Nominal Pipe Size, in.	Outside Diameter,		Tolerance			
			Type I		Type II	
	in.	(mm)	in.	(mm)	in.	(mm)
2	2.375	(60.32)	+0.060 −0.018	(+1.52 −0.46)	+0.012	(±0.305)
3	3.500	(88.90)	+0.060 −0.018	(+1.52 −0.46)	+0.012	(±0.305)
4	4.500	(114.30)	+0.060 −0.018	(+1.52 −0.46)	+0.015	(±0.381)
6	6.625	(168.28)	+0.066 −0.028	(+1.68 −0.64)	+0.025	(±0.635)
8	8.625	(219.08)	+0.086 −0.040	(+2.18 −1.02)	+0.025	(±0.635)
10	10.750	(273.05)	+0.108 −0.048	(+2.74 −1.22)	+0.025	(±0.635)
12	12.750	(323.85)	+0.128 −0.056	(+3.25 −1.42)	+0.025	(±0.635)

6.3 *Flanges*—Flanges shall conform to the bolt-hole sizes and pattern for 150-lb steel flanges in ANSI B 16.5.

7. Performance Requirements

7.1 *Joint Strength*—Pipe, fittings, and joints shall show no porosity or other evidence of failure when tested in accordance with 9.4.

7.2 *Impact Resistance*—Pipe and fittings shall show no porosity or visual evidence of damage that would affect serviceability when tested in accordance with 9.5.

7.3 *Boil Resistance*—Pipe and fittings shall show no evidence of delamination or other impairment and shall have a weight gain no greater than 1.0 % when tested in accordance with 9.6.

7.4 *Beam Strength*—The elastic modulus of the pipe shall be a minimum of 1 000 000 psi (6895 MPa) in accordance with 9.7.

7.5 *Cycling Resistance*—The pipe and fittings assembly shall not show evidence of leakage or other visible signs of damage after being subjected to the following series:

7.5.1 Initial deflection cycles,

7.5.2 Pressure cycles,

7.5.3 Temperature cycles,

7.5.4 Water-hammer cycles, and

7.5.5 Final deflection cycles when tested in accordance with 9.8.

7.6 *Hydrostatic Proof Pressure*—The pipe and fittings shall withstand 200 psig (1380 kPa) without any indication of porosity when tested in accordance with 9.9.

8. Workmanship

8.1 *Pipe*—The pipe shall be free from all defects including delaminations, cracks, indentations, bubbles, pinholes, porosity, resin-rich areas, and resin-starved areas which due to their nature, degree or extent, may detrimentally affect the strength and serviceability of the pipe and fittings. The pipe liner shall be free of cracks, chips, or other damage.

8.2 *Examination*:

8.2.1 *Sampling*—Select a sufficient quantity of pipe, fittings, and adhesive kits, in accordance with accepted statistical practice and as agreed upon between the purchaser and the seller, from each lot or shipment. Examine to determine conformance with this specification. In the case of no prior agreement, random samples selected by the testing laboratory shall be deemed adequate.

8.2.2 *Pipe and Fittings*—Examine the sample pipe and fittings selected for the following defects: incorrect dimensions; ends of pipe not cut at right angles to the axis; exposed fibers or nonuniform surface on bore of pipe or fittings; cracked or chipped liner (if used); bubbles, pinholes, delaminations, cracks, indentations, resin-rich or resin-starved areas in the outer wall that will affect the strength and performance of the product; and incorrect or missing identification marking. Any sample pipe or fitting having one or more of the defects listed shall be considered a defective unit.

8.2.3 *Dimensions*—Determine the pipe and fitting dimensions in accordance with the applicable sections of Practice D 3567.

8.2.4 *Adhesive*—Examine the sample adhesive kits selected