



Standard Specification for Reinforced Epoxy Resin Gas Pressure Pipe and Fittings¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope*

1.1 This specification covers requirements and methods of test for materials, dimensions and tolerances, hydrostatic-burst strength, chemical resistance, and longitudinal tensile properties, for reinforced epoxy resin pipe and fittings for use in gas mains and services for direct burial and insertion applications. The pipe and fittings covered by this specification are intended for use in the distribution of natural gas, petroleum fuels (propane–air and propane–butane vapor mixtures), manufactured and mixed gases where resistance to gas permeation, toughness, resistance to corrosion, aging, and deterioration from water, gas, and gas additives are required. Methods of marking are also given. Design considerations are discussed in Appendix X1.

1.2 The values in SI units are to be regarded as the standard.

1.3 The following safety hazards caveat pertains only to the test method portion, Section 8, of this specification: *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.

1.4 A recommended inplant quality control program is given in Appendix X2.

2. Referenced Documents

2.1 ASTM Standards:

- D 396 Specification for Fuel Oils²
- D 543 Test Method for Resistance of Plastics to Chemical Reagents³
- D 618 Practice for Conditioning Plastics and Electrical Insulating Materials for Testing³
- D 883 Terminology Relating to Plastics⁴

- D 1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure⁴
- D 1599 Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings⁴
- D 1898 Practice for Sampling of Plastics⁵
- D 2105 Test Method for Longitudinal Tensile Properties of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Tube⁴
- D 2143 Test Method for Cyclic Pressure Strength of Reinforced, Thermosetting Plastic Pipe⁴
- D 2290 Test Method for Apparent Tensile Strength of Ring or Tubular Plastics and Reinforced Plastics by Split Disk Method⁴
- D 2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Pipe Loading⁴
- D 2924 Test Method for External Pressure Resistance of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Pipe⁴
- D 2992 Practice for Obtaining Hydrostatic or Pressure Design Basis for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings⁴
- D 2996 Specification for Filament Wound “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe⁴
- D 3567 Practice for Determining Dimensions of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings⁴
- D 3839 Practice for Underground Installation of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Pipe⁴
- D 3892 Practice for Packaging/Packing of Plastics
- D 5685 Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe Fittings

3. Terminology

3.1 Definitions:

3.1.1 General—Definitions are in accordance with Terminology D 883 or F 412. Abbreviations are in accordance with Terminology D 1600, unless otherwise indicated. The abbreviation for fiberglass pipe is RTRP and the abbreviation for fiberglass fittings is RTRF.

¹ This specification is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.23 on Reinforced Plastic Piping Systems.

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² Annual Book of ASTM Standards, Vol 05.01.

³ Annual Book of ASTM Standards, Vol 08.01. Subcommittee D 20.23 has completed work to develop methods which are adapted for RTRP.

⁴ Annual Book of ASTM Standards, Vol 08.04.

⁵ Annual Book of ASTM Standards, Vol 08.02.

*A Summary of Changes section appears at the end of this standard.

3.1.2 The gas industry technology used in this specification is in accordance with definitions given in The Department of Transportation of Natural and Other Gas by Pipeline Minimum Safety Standards.

3.1.3 *Standards Reinforced Thermosetting Resin Pipe Materials Designation Code*—The pipe material designation code shall consist of the abbreviation RTRP followed by type and grade in arabic numerals, class by a capital letter and the long term steady pressure strength by a second capital letter. The fittings material designation shall consist of the abbreviation RTRF followed by type (method of manufacture), grade (general type of resin), class (configuration of joining system), and pressure rating.

4. Classification

4.1 *Pipe*—The pipe covered in this specification is made by the filament winding process and is described in Specification D 2996. Requirements of this pipe are based on short-term tests defined in this specification.

4.2 *Fittings*—This specification covers reinforced epoxy resin fittings described in specification D 5685 and made of the type of materials covered in Section 5, which are capable of being joined to the pipe and will provide a suitable gas distribution system.

5. Materials

5.1 The resins and reinforcements used to make pipe shall be as specified in 5.1.1.

5.1.1 This specification covers glass fiber reinforced epoxy resin pipe and fittings as defined in Specification D 2996—RTRP 11 AU and RTRP 11 CU and fittings as defined in specification D 5685—RTRF 11A1D, RTRF 21A1D, RTRF 11F2D and RTRF 21A2D.

NOTE 2—The particular reinforced thermosetting resin included initially in this specification for gas pressure piping was selected on the basis of engineering test studies made by Battelle Memorial Institute, experimental use in field installations, and technical data supplied by the manufacturers of the plastics materials used to make the pipe and fittings. It is the intent of ASTM Committee D-20 on Plastics to consider for inclusion other resins and reinforcements in this specification when evidence is presented to show that they are suitable for gas service. Minimum requirements are an ASTM pipe specification and long-term strength determined in accordance with Test Method D 2992, Procedure B, in addition to the requirements of this specification.

6. Requirements

6.1 *Workmanship*—The pipe and fittings shall be free of visible cracks, holes, foreign inclusions, blisters, and other

injurious defects. The pipe and fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

6.2 Pipe Dimensions and Tolerances:

6.2.1 *Diameters*—The outside diameter of the pipe shall be in accordance with Table 1 when measured in accordance with 8.4.1.

6.2.2 *Wall Thickness*—The wall thickness of the pipe shall meet the requirements given in Table 1 when measured in accordance with 8.4.1.

6.2.3 *Lengths*—The pipe shall be in lengths as specified on the purchase order when measured in accordance with 8.4.1.

NOTE 3—Either threaded adaptors or bonded joints are acceptable. Joints of up to 5 % of the shipment are acceptable to meet the length requirements. No section less than 1.5 m (5 ft) long can be used to make a joint and only one jointer can be used in a length.

6.3 *Fittings Dimensions and Tolerances*— The fittings dimensions shall enable the pipe and fittings to be joined and shall be measured in accordance with 8.4.2.

NOTE 4—Subcommittee D 20.23 is working towards development of dimensional requirements for fittings; however, it will be some time before the requirements are available. Therefore, the method of measuring is provided only to have a standard method of measuring fittings dimensions for inspection purposes.

6.4 *Short-Term Rupture Strength (Burst Pressure)*—The minimum hoop stress at burst for pipe covered by this specification shall be as listed in Table 2 when tested in accordance with 8.5. The minimum burst requirements for fittings covered by this specification shall be 4.82 MPa (700 psi) internal pressure or 27.5 MPa (4000 psi) hoop tensile stress, whichever is greater, when tested in accordance with 8.5 at temperatures of 23°C (73.4°F) and 65.6°C (150°F), and calculated using the equation listed in Test Method D 1599 for hoop stress. The calculations shall use the fittings wall thickness and diameter at a point where the wall thickness is at a minimum and which is also in the section of the fittings which is not reinforced by the pipe.

6.5 *Crush Strength*—The minimum stiffness factor at 5 % deflection of the pipe shall be as shown in Table 2 when tested in accordance with Test Method D 2412.

6.6 *Chemical Resistance*—The pipe shall not change more than ±12 % in apparent tensile strength when measured in accordance with 8.7.

NOTE 5—A suitable chemical resistance test for fittings is not available at the present time and will be added when available.

TABLE 1 Pipe Dimensions, mm (in.)

Nominal	Outside Diameter	Tolerance	Minimum Wall Thickness
2	60.325 (2.375)	+1.524, -0.457 (+0.060, -0.018)	1.524 (0.060)
3	88.900 (3.500)	+1.524, -0.457 (+0.060, -0.018)	1.524 (0.060)
4	114.300 (4.500)	+1.524, -0.457 (+0.060, -0.018)	1.780 (0.070)
6	168.275 (6.625)	+1.678, -0.711 (+0.066, -0.028)	2.540 (0.100)
8	219.075 (8.625)	+2.184, -1.016 (+0.086, -0.040)	3.227 (0.125)
10	273.050 (10.750)	+2.743, -1.219 (+0.108, -0.048)	3.830 (0.150)
12	323.850 (12.750)	+3.251, -1.422 (+0.128, -0.056)	4.215 (0.175)