



Standard Classification for Machine-Made “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe¹

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

1. Scope

1.1 This classification covers machine-made “fiberglass” (glass-fiber-reinforced thermosetting-resin) pressure pipe. Methods of classification, requirements, test methods and the method of marking are included. Both glass-fiber-reinforced thermosetting-resin pipe (RTRP) and glass-fiber-reinforced polymer mortar pipe (RPMP) are fiberglass pipes.

NOTE 1—For the purposes of this standard, polymer does not include natural polymers.

1.2 This classification is based on the method of manufacture, the type of materials used in construction, and the test performance of the product type. It is not based on dimensions or raw material specifications.

1.3 Two methods of classifying long-term strength are included: (1) based on cyclic loads for use in those liquid-handling applications where the effects of pumping by duplex or triplex pumps or other cyclic pressure loads dictate the performance requirements of the piping, and (2) based on the steady (static) loads such as would be required for gas service applications.

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

1.5 The following precautionary caveat pertains only to the test method portion, Section 7, of this classification. *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 2—There is no known ISO equivalent to this standard.

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

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2. Referenced Documents

2.1 ASTM Standards:²

D883 Terminology Relating to Plastics

D1600 Terminology for Abbreviated Terms Relating to Plastics

D2992 Practice for Obtaining Hydrostatic or Pressure Design Basis for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings

D3567 Practice for Determining Dimensions of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fittings

F412 Terminology Relating to Plastic Piping Systems

3. Terminology

3.1 *General*—Definitions are in accordance with Terminology D883 or F412 and abbreviations are in accordance with Terminology D1600, unless otherwise indicated.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 *fiberglass pipe, n*—a tubular product containing glass fiber reinforcements embedded in or surrounded by cured thermosetting resin; the composite structure may contain aggregate, granular, or platelet fillers, thixotropic agents, pigments, or dyes; thermoplastic or thermosetting liners or coatings may be included.

3.2.2 *reinforced thermosetting resin pipe (RTRP), n*—a fiberglass pipe without aggregate.

3.2.3 *reinforced polymer mortar pipe (RPMP), n*—a fiberglass pipe with aggregate.

3.2.4 *centrifugal casting, n*—a manufacturing process used to produce tubular goods by applying resin and reinforcement to the inside of a mold that is rotated and heated, subsequently polymerizing the resin system. The outside diameter of the finished pipe is fixed by the inside diameter of the mold tube. The inside diameter of the pipe is determined by the amount of material introduced into the mold.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

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

3.2.5 *filament winding, n*—a process used to manufacture tubular goods by winding continuous fibrous glass strand roving or roving tape onto the outside of a mandrel in a predetermined pattern under controlled tension; the roving may be saturated with liquid resin or preimpregnated with partially cured resin; subsequent polymerization of the resin system may require application of heat; the inside diameter of the finished pipe is fixed by the mandrel outside diameter; the outside diameter of the finished pipe is determined by the amount of material that is wound onto the mandrel.

3.2.6 *liner, n*—the inner portion of the wall, at least 0.005 in. (0.13 mm) in thickness when determined in accordance with Practice **D3567**, that does not contribute to the strength in the determination of the hydrostatic design basis.

3.2.7 *pressure laminating, n*—a process to manufacture tubular goods in which reinforcement is impregnated with a thermosetting resin, and the resin partially cured to form a prepreg; it is subsequently laminated around a mandrel and cured under heat and pressure to form the pipe; the pipe is then removed from the mandrel and postcured. The inside diameter of the finished pipe is fixed by the mandrel outside diameter; the outside diameter of the finished pipe is determined by the amount of material that is wound onto the mandrel.

3.2.8 *aggregate, n*—a siliceous sand conforming to the requirements of Specification C33, except that the requirements for gradation shall not apply.

NOTE 3—For the purpose of this classification, polyester resin includes vinyl ester resins.

4. Basis of Classification

4.1 *General*—This classification covers machine-made fiberglass pipe defined by method of manufacturing (type), raw materials in body (grade), liner material (class), and long-term cyclic pressure strength or long-term static pressure strength, whichever is applicable. It covers the following types, grades, and classes of machine-made fiberglass pipe:

NOTE 4—All possible pressure strength combinations of types, grades, and classes may not be commercially available.

4.1.1 *Types*:—Type I

Filament-wound pipe

Type II—Centrifugally cast pipe

Type III—Pressure-laminated pipe

4.1.2 *Grades*:—Grade 1

Glass-fiber-reinforced epoxy resin pipe (RTRP epoxy)

Grade 2—Glass-fiber-reinforced polyester resin pipe (RTRP polyester)

Grade 3—Glass-fiber-reinforced phenolic resin pipe (RTRP phenolic)

Grade 7—Glass-fiber-reinforced furan resin pipe (RTRP furan)

Grade 8—Glass-fiber-reinforced epoxy resin mortar pipe (RPMP epoxy)

Grade 9—Glass-fiber-reinforced polyester resin mortar pipe (RPMP polyester)

4.1.3 *Classes*:—Class A

No liner

Class B—Polyester resin liner (nonreinforced)

Class C—Epoxy resin liner (nonreinforced)

Class D—Phenolic resin liner (nonreinforced)

Class E—Polyester resin liner (reinforced)

Class F—Epoxy resin liner (reinforced)

Class G—Phenolic resin liner (reinforced)

Class H—Thermoplastic resin liner (specify)

Class I—Furan resin liner (reinforced)

4.1.4 *Pressure Strength*—Two methods of classifying the pressure strength of the pipe are incorporated in this document; one or both may be used. Pipe meeting this classification shall be identified by one or both of the hydrostatic design bases shown in **Table 1**.

4.1.5 *Designation Requirements*—The pipe materials designation code shall consist of the abbreviation RTRP or RPMP, followed by type and grade in arabic numerals, class by a capital letter, and the long-term strength by a second capital letter. **Table 1** presents a summary of the designation requirements. Thus a complete material code shall consist of RTRP or RPMP . . . two numerals, and two letters.

4.1.5.1 *Examples*: (1) RTRP-11AE for filament-wound glass-fiber-reinforced epoxy resin pipe, unlined, with a 6300 psi (43.4 MPa) (cyclic) hydrostatic design basis, or

(2) RTRP-11AT for filament-wound glass-fiber-reinforced epoxy resin pipe, unlined, with a 10 000 psi (68.9 MPa) (static) hydrostatic design basis, or

(3) both, if the pipe is to be dual rated.

NOTE 5—Although *Form and Style for ASTM Standards* requires that the type classification be roman numerals, it is recognized that few companies have stencil-cutting equipment for this style of type, and it is, therefore, acceptable to mark the product type in arabic numerals. Precedence for this change has been made in other ASTM standards.

5. Materials

5.1 *General*—The resins, reinforcements, and other materials, when combined as a composite structure, shall produce a pipe that shall meet the performance requirements of this classification.

6. Requirements

6.1 *Properties*:

6.1.1 *Hydrostatic Design Basis*—The hydrostatic design basis for products meeting this classification is derived from the long-term pressure strength, as determined at ambient temperature in accordance with **7.1** or **7.2**. Standard categories for the hydrostatic design basis are shown in **Table 1**. A hydrostatic design basis as shown in **Table 1** shall be determined for each type, grade, and class of product manufactured. Changes in materials or manufacturing processes will necessitate a screening evaluation as described in Practice **D2992**.

6.1.2 *Pressure Rating*—The hydrostatic design stress for products meeting this classification is obtained by multiplying the applicable hydrostatic design basis (from **Table 1**) by a service (design) factor equal to or less than 1.0.

NOTE 6—Information regarding selection of service (design) factors and pressure rating is provided in Practice **D2992** and the individual product standards.

TABLE 1 General Designation Requirements^A for Machine-Made Fiberglass Pipe

Designation Order	Property	Cell Limits								
		1	2	3	7	8	9			
1	Type	1 filament-wound	2 centrifugally cast	3 pressure-laminated						
2	Grade	1 glass-fiber-reinforced epoxy resin (RTRP)	2 glass-fiber-reinforced polyester resin (RTRP)	3 glass-fiber-reinforced phenolic resin (RTRP)			7 glass-fiber-reinforced furan resin (RTRP)	8 glass-fiber-reinforced epoxy resin (RPMP)	9 glass-fiber-reinforced polyester resin mortar (RPMP)	
3	Class	A no liner	B polyester resin liner (nonreinforced)	C epoxy resin liner (nonreinforced)	D phenolic resin liner (nonreinforced)	E polyester resin liner (reinforced)	F epoxy resin liner (reinforced)	G phenolic resin liner (reinforced)	H thermoplastic resin liner (specify)	I furan resin liner (reinforced)
Hoop Stress—Hydrostatic Design Basis ^B										
4	Cyclic psi (MPa)	A 2500 (17.2)	B 3150 (21.7)	C 4000 (27.5)	D 5000 (34.4)	E 6300 (43.4)	F 8000 (55.1)	G 10 000 (68.9)	H 12 500 (86.1)	
or										
4	Static psi (MPa)	Q 5000 (34.4)	R 6300 (43.4)	S 8000 (51.5)	T 10 000 (68.9)	U 12 500 (86.1)	W 16 000 (110.0)	X 20 000 (137.0)	Y 25 000 (172.0)	Z 31 500 (217.0)

^A The cell-type format provides the means of identification and specification of piping materials. This cell-type format, however, is subject to misapplication since unobtainable property combinations can be selected if the user is not familiar with commercially available products. The manufacturer should be consulted.

^B Refer to Practice **D2992** to obtain classification of the values.

7. Test Methods

7.1 *Cyclic Pressure Strength*—Determine the cyclic pressure strength in accordance with Procedure A of Practice **D2992**.

7.2 *Static Pressure Strength*—Determine the static pressure strength in accordance with Procedure B of Practice **D2992**.

8. Marking

8.1 Marking on the pipe shall include the following items, spaced at intervals of not more than 15 ft (4.5 m):

8.1.1 Nominal pipe size (example: 2 in.),

8.1.2 Type of fiberglass pipe, in accordance with the designation code given in **4.1.5**,

8.1.3 ASTM pipe product specification with which the pipe complies, and

8.1.4 Manufacturer's name (or trademark).

8.2 All markings shall be such that they will remain legible under normal handling and installation practices.

9. Keywords

9.1 centrifugal casting; fiberglass pipe; filament winding; hydrostatic design basis; machine-made fiberglass pressure pipe; pipe; pressure laminating; pressure strength; reinforced polymer mortar pipe (RPMP); reinforced thermosetting-resin pipe (RTRP)

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