



# Standard Specification for Thermosetting Resin Fiberglass Pipe Systems to Be Used for Marine Applications<sup>1</sup>

This standard is issued under the fixed designation F1173; 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.

## 1. Scope

1.1 This specification covers reinforced thermosetting resin pipe systems with nominal pipe sizes (NPS) 1 in. through 48 in. (25 mm through 1200 mm) which are to be used for all fluids approved by the authority having jurisdiction in marine piping systems.

1.2 The dimensionless designator NPS has been substituted for traditional terms as “nominal diameter,” “size,” and “nominal size.”

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 The following safety hazards caveat pertains to the test methods which are included in 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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

D883 Terminology Relating to Plastics

D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

D1599 Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings

D2105 Test Method for Longitudinal Tensile Properties of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Tube

D2310 Classification for Machine-Made “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe (Withdrawn 2017)<sup>3</sup>

D2584 Test Method for Ignition Loss of Cured Reinforced Resins

D2924 Test Method for External Pressure Resistance of “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe

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

D5028 Test Method for Curing Properties of Pultrusion Resins by Thermal Analysis

D5686 Specification for “Fiberglass”(Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Pipe Fittings, Adhesive Bonded Joint Type Epoxy Resin, for Condensate Return Lines (Withdrawn 2002)<sup>3</sup>

E1529 Test Methods for Determining Effects of Large Hydrocarbon Pool Fires on Structural Members and Assemblies

F412 Terminology Relating to Plastic Piping Systems

### 2.2 Other Documents:

ANSI B16.1 Cast Iron Pipe Flanges and Flanged Fittings<sup>4</sup>

ANSI B16.5 Pipe Flanges and Flanged Fittings<sup>4</sup>

IMO Resolution A.753(18) Guidelines for the Application of Plastic Pipes on Ships<sup>5</sup>

NSF-61<sup>6</sup>

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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

<sup>3</sup> The last approved version of this historical standard is referenced on [www.astm.org](http://www.astm.org).

<sup>4</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, <http://www.ansi.org>.

<sup>5</sup> Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, <http://quicksearch.dla.mil>.

<sup>6</sup> Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48105, <http://www.nsf.org>.

Code of Federal Regulations 21CFR175.105, 21CFR177.2280, 21CFR177.2410, and 21CFR177.2420<sup>5</sup>  
 Code of Federal Regulations Title 46, Part 56, for Piping Systems, and Subpart 56.60-25 for Nonmetallic Materials<sup>5</sup>  
 IMO Resolution A.653(16) Recommendation on Improved Fire Test Procedures for Surface Flammability of Bulkhead, Ceiling, and Deck Finish Materials<sup>5</sup>  
 IMO Resolution MSC.61(67) International Code for Application of Fire Test Procedures<sup>5</sup>  
 OTI 95 634 Jet-Fire Resistance Test of Passive Fire Protection Materials<sup>7</sup>

### 2.3 ISO Documents:

ISO 9001 Quality Management Systems—Requirements<sup>4</sup>  
 ISO 75 Plastics—Determination of Temperature of Deflection Under Load<sup>4</sup>

## 3. Terminology

3.1 Definitions are in accordance with Terminologies D883 and F412.

### 3.2 Definitions of Terms Specific to This Standard:

3.2.1 *continuously electrically conductive, adv*—pipe and fittings made conductive using discretely conductive materials or layers.

3.2.2 *homogeneously electrically conductive, adv*—pipe and fittings made conductive using a resin additive so that conductivity is maintained between any two points on the pipe or fitting.

3.2.2.1 *Discussion*—For conveying nonconducting fluids (those having conductance less than 1000 pico-Siemens per metre), pipe systems which are continuously or homogeneously conductive or have conductivity from the inside surface to the outside surface are recommended. In accordance with IMO Resolution A.753(18), all pipe located in a hazardous area, regardless of the fluid being conveyed, must be electrically conductive.

3.2.3 *maximum operating pressure, n*—the highest pressure that can exist in a system or subsystem under normal operating conditions.

3.2.4 *representative piping system, n*—a system composed of a single manufacturer's pipes, fittings, joints, and adhesives that would normally be used by a customer or installer.

## 4. Classification

4.1 *General*—Pipe and fittings are to be classified using the following system which is similar to that of Classification D2310 for pipe.

### 4.1.1 Types:

- 4.1.1.1 *Type I*—Filament wound.
- 4.1.1.2 *Type II*—Centrifugally cast.
- 4.1.1.3 *Type III*—Molded (fittings only).

### 4.1.2 Resin:

- 4.1.2.1 *Resin 1*—Epoxy resin.
- 4.1.2.2 *Resin 2*—Vinylester resin.
- 4.1.2.3 *Resin 3*—Polyester resin.

- 4.1.2.4 *Resin 4*—Phenolic resin.
- 4.1.2.5 *Resin 5*—Customer-specified resin.
- 4.1.3 *Class*:
- 4.1.3.1 *Class A*—No liner.
- 4.1.3.2 *Class B*—Reinforced liner.
- 4.1.3.3 *Class C*—Nonreinforced liner.

4.2 *Pressure Rating*—Pipe and fittings shall be classified as to the method used to obtain their pressure rating (refer to Appendix X1).

- 4.2.1 *Rating Method 1*—Short-term test.
- 4.2.2 *Rating Method 2*—Medium-term (1000 h) test.
- 4.2.3 *Rating Method 3*—Long-term (10 000 h) test.
- 4.2.4 *Rating Method 4*—Long-term (10 000 h) regression test.

4.3 *Fire Endurance*—Piping systems are to be classified in accordance with the following cells if fire performance is to be specified (refer to Appendix X2).

### 4.3.1 Fluid:

- 4.3.1.1 *Fluid E*—Empty.
- 4.3.1.2 *Fluid EF*—Initially empty for 5 min, followed by flowing water. Fluid velocity of 3 ft/s maximum during qualification test.)
- 4.3.1.3 *Fluid S*—Stagnant water.

### 4.3.2 Fire Type:

- 4.3.2.1 *Fire Type JF*—Jet fire with heat flux between 95 100 Btu/(h·ft<sup>2</sup>) and 126 800 Btu/(h·ft<sup>2</sup>) (300 kW/m<sup>2</sup> and 400 kW/m<sup>2</sup>).
- 4.3.2.2 *Fire Type IF*—Impinging flame with heat flux of 36 011 Btu/(h·ft<sup>2</sup>) (113.6 kW/m<sup>2</sup>).
- 4.3.2.3 *Fire Type HF*—Hydrocarbon furnace test at 2012 °F (1100 °C).

### 4.3.3 Integrity/Duration:

- 4.3.3.1 *Integrity A*—No leakage during or after fire test.
- 4.3.3.2 *Integrity B*—No leakage during fire test, except a slight weeping is acceptable. Capable of maintaining rated pressure for a minimum of 15 min with a leakage rate of 0.05 gal/min (0.2 L/min) after cooling.
- 4.3.3.3 *Integrity C*—Minimal or no leakage (0.13 gal/min (0.5 L/min)) during fire test. Capable of maintaining rated pressure with a customer-specified leakage rate after cooling.
- 4.3.3.4 *Duration*—The duration of the test shall be specified in minutes and shall be specified or approved by the authority having jurisdiction.

## 5. Ordering Information

5.1 When ordering pipe and fittings under this specification, the following should be specified (where applicable):

### 5.1.1 Service Conditions:

- 5.1.1.1 Fluid being transported.
- 5.1.1.2 Design temperature (reference 6.6).
- 5.1.1.3 Internal design pressure.
- 5.1.1.4 External design pressure.

### 5.1.2 General Information:

- 5.1.2.1 Type (reference 4.1.1).
- 5.1.2.2 Resin (reference 4.1.2).
- 5.1.2.3 Class (reference 4.1.3).

5.1.3 *Pressure Rating Method (Internal Only)* (reference 4.2).

<sup>7</sup> Offshore Technology Information (OTI) Report is available from Health and Safety Executive, HSE Information Centre, Broad Ln., Sheffield, S3 7HQ, U.K.