



Designation: F2896 – 23

Standard Specification for Reinforced Polyethylene Composite Pipe For The Transport Of Oil And Gas And Hazardous Liquids¹

This standard is issued under the fixed designation F2896; 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 requirements and test methods for materials, dimensions, workmanship, and markings for on-site manufactured multilayer reinforced polyethylene composite pipe. It covers nominal sizes 6 in. through 36 in. (150 mm through 915 mm). These multilayered reinforced polyethylene composite pipe products² are assembled and installed in various lengths, including long continuous lengths. These products are intended for the transport of crude oil, natural gas and hazardous liquids in the rehabilitation of existing pipelines and for new pipelines.

NOTE 1—Hazardous liquids are those liquids defined by the U.S. Department of Transportation in 49 CFR 195.2.

1.2 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.

1.3 *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.*

1.4 *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.*

¹ This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.68 on Energy Piping Systems.

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² The reinforced polyethylene composite pipe product described in this standard is covered by patents. Interested parties are invited to submit information regarding the identification of an alternative(s) to this patented item to the ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

2. Referenced Documents

2.1 ASTM Standards:³

- A312/A312M Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes
- A333/A333M Specification for Seamless and Welded Steel Pipe for Low-Temperature Service and Other Applications with Required Notch Toughness
- A519 Specification for Seamless Carbon and Alloy Steel Mechanical Tubing
- D624 Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
- D638 Test Method for Tensile Properties of Plastics
- D792 Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement
- D1000 Test Methods for Pressure-Sensitive Adhesive-Coated Tapes Used for Electrical and Electronic Applications
- 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
- D1600 Terminology for Abbreviated Terms Relating to Plastics
- D1693 Test Method for Environmental Stress-Cracking of Ethylene Plastics
- D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
- D2256/D2256M Test Method for Tensile Properties of Yarns by the Single-Strand Method
- D2513 Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing, and Fittings
- D2774 Practice for Underground Installation of Thermoplastic Pressure Piping
- D2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis

³ 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

for Thermoplastic Pipe Products

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

D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials

D3850 Test Method for Rapid Thermal Degradation of Solid Electrical Insulating Materials By Thermogravimetric Method (TGA)

D5035 Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)

F412 Terminology Relating to Plastic Piping Systems

F585 Guide for Insertion of Flexible Polyethylene Pipe Into Existing Sewers

F1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

F1606 Practice for Rehabilitation of Existing Sewers and Conduits with Deformed Polyethylene (PE) Liner

F1668 Guide for Construction Procedures for Buried Plastic Pipe

F2619/F2619M Specification for High-Density Polyethylene (PE) Line Pipe

F2620 Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

G14 Test Method for Impact Resistance of Pipeline Coatings (Falling Weight Test)

2.2 *ANSI Standards*.⁴

B 16.5 Pipe, Flanges, and Flanged Fittings

2.3 *API Standards*.⁵

15S Spoolable Reinforced Plastic Line Pipe

17 J Unbonded Flexible Pipe – Unbonded Flexible Pipe

2.4 *PPI Standards*.⁶

TR-3 HDB/HDS/PDB/SDB/MRS Policies – Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Hydrostatic Design Stresses (HDS), Pressure Design Basis (PDB), Strength Design Basis (SDB), Minimum Required Ballot (MRS) Ratings and Categorized Required Strength (CRS) for Thermoplastic Piping Materials or Pipe

2.5 *Other Documents*.⁷

49 CFR 195 Code of Federal Regulations - Transportation of Hazardous Liquids by Pipeline

3. Terminology

3.1 Definitions are in accordance with Terminology **F412** and abbreviations are in accordance with Terminology **D1600**, unless otherwise specified.

3.2 *Definitions of Terms Specific to This Standard:*

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

⁵ Available from American Petroleum Institute (API), 1220 L. St., NW, Washington, DC 20005-4070, <http://www.api.org>.

⁶ Available from Plastics Pipe Institute (PPI), 105 Decker Court, Suite 825, Irving, TX 75062, <http://www.plasticpipe.org>.

⁷ Available online from the Department of Transportation at http://setonresourcecenter.com/transportation/49CFR/172_101tb.pdf

3.2.1 *Reinforced Polyethylene Composite Pipe (RPCP)*, *n*—Polyethylene piping helically wrapped with non-metallic reinforcing materials and then overwrapped with an outer protective layer (**Fig. 1**).

3.2.2 *core pipe*, *n*—the inner liner or polyethylene pipe

3.2.2.1 *Discussion*—The typical reinforced polyethylene composite pipe to be described in this standard is a multilayer pipe construction consisting of a polyethylene liner or core pipe, co-helically wrapped with multiple layers (counter wound in pairs) (of non-metallic reinforcing material, and then wrapped with an outer polyethylene or other thermoplastic protective layer. The polyethylene core pipe is heat fusion joined to make long continuous lengths of pipe. Longitudinal direction reinforcing materials may be applied to reinforce the pipe linearly to increase the strength in sliplining installations. The polyethylene liner pipe may either be manufactured on-site or shipped to the site and fusion joined on-site prior to being wrapped with the reinforcing materials. These products are constructed from individual pipe lengths of the polyethylene core pipe and not from coiled polyethylene pipe. See **Fig. 1**.

3.2.3 *on-site*, *adj*—accomplished or located at the site of a particular activity or concern.

3.2.4 *pressure class*, *n*—The maximum allowable operating pressure.

4. Ordering Information

4.1 *General*—The reinforced polyethylene multilayer composite pipe meeting the requirements of this specification are classified by pressure design basis.

NOTE 2—**Fig. 1** is meant to be representative of the reinforced polyethylene PE composite pipes described in this standard.

5. Materials

5.1 *Polyethylene Pipe Materials* :

5.1.1 *Polyethylene*—Polyethylene shall be PE4710 pipe in accordance with Specification **F2619/F2619M** or Specification **D2513**.

5.2 *Reinforcement Materials*:

5.2.1 *Polyamide reinforcing fibers*—Polyamide reinforcing fibers used in the assembly of the Reinforced Polyethylene Composite Pipe shall have the minimum properties as shown in **Table 1**. Polyamide reinforcing fabrics shall have the minimum properties as shown in **Table 2**.

5.2.2 *Ultra high molecular weight polyethylene (UHMW) reinforcing fibers*—Polyethylene reinforcing fibers used in the assembly of the Reinforced Polyethylene Composite Pipe shall have the minimum properties as shown in **Table 3**. UHMW Polyethylene reinforcing fabrics shall have the minimum properties as shown in **Table 4**.

5.2.3 *Polyester fibers*—Polyester reinforcing fibers used in the assembly of the Reinforced Polyethylene Composite Pipe shall have the minimum properties as shown in **Table 5**. Polyester reinforcing fabrics shall have the minimum properties as shown in **Table 6**.

5.3 *Non-Structural Materials*:

5.3.1 *Polyester fibers*—Polyester non-structural fibers used in the assembly of the Reinforced Polyethylene Composite