



Standard Specification for Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges¹

This standard is issued under the fixed designation F 1545; 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 factory-made plastic-lined ferrous metal pipe, fittings, and flanges intended primarily for conveying corrosive fluids. Requirements for materials, workmanship, dimensions, design, fabrication, working pressure and temperatures, test methods, qualification requirements, and markings are included.

1.1.1 This specification does not define the suitability of different liner materials to various chemical and operating environments. Refer to the manufacturer's chemical resistance data for suitability recommendations.

1.1.2 This specification does not include products coated with plastics.

1.2 This specification covers plastic-lined pipe, flanges, and fittings as listed in Table 1. Pressure limitations shall be in accordance with ANSI/ASME B16 Standards, except reduced pressure limitations may be established by the manufacturer, considering both pressure and temperature limitations of the ferrous metal housing and the sealing ability of the liner.

NOTE 1—In this specification, propylene plastics cover those materials defined as both polypropylene plastics and propylene plastics in Terminology F 412. Both materials are identified as “PP” on the product. Note that this is at variance with Terminology D 1600, where “PP” is the abbreviation for polypropylene.

1.3 The plastic-lined flanged pipe and fitting assemblies are limited to temperatures shown in Table 2. End users should consult with manufacturers as to the likely result of using a particular lined piping component at temperatures below the rated minimum.

NOTE 2—The temperature limitations are based on noncorrosive test conditions. Use in specific aggressive environments may alter temperature limitations. In such instances, specific temperature limits shall be established by mutual agreement between the purchaser and the manufacturer.

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

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the*

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TABLE 1 Specification Coverage

Material	ANSI Class	Nominal Pipe Size, in. (mm)
Ethylene Tetrafluoroethylene Copolymer (ETFE)	150/300	1 to 10 (25 to 254)
Perfluoro (Alkoxyalkane) Copolymer (PFA)	150/300	½ to 12 (13 to 305)
Perfluoro (Ethylene-Propylene) Copolymer (FEP)	150/300	1 to 12 (25 to 305)
Poly(Vinylidene Chloride) (PVDC)	125/150/300	1 to 8 (25 to 203)
Poly(Vinylidene Fluoride) (PVDF)	150/300	1 to 10 (25 to 254)
Poly(Vinylidene Fluoride) Copolymer (PVDF)	150/300	1 to 10 (25 to 254)
Polytetrafluoroethylene (PTFE)	150/300	½ to 24 (13 to 610)
Propylene and Polypropylene (PP)	125/150/300	½ to 16 (13 to 406)

TABLE 2 Temperature Specifications

Material	Temperature Range, °F (°C)
Ethylene Tetrafluoroethylene Copolymer (ETFE)	–20 to 300 (–29 to 149)
Perfluoro (Alkoxyalkane) Copolymer (PFA)	–20 to 500 (–29 to 260)
Perfluoro (Ethylene-Propylene) Copolymer (FEP)	–20 to 300 (–29 to 149)
Poly(Vinylidene Chloride) (PVDC) ^A	0 to 175 (–18 to 79)
Poly(Vinylidene Fluoride) (PVDF)	0 to 275 (–18 to 135)
Poly(Vinylidene Fluoride) Copolymer (PVDF)	–20 to 275 (–29 to 135)
Polytetrafluoroethylene (PTFE)	–20 to 500 (–29 to 260)
Propylene and Polypropylene (PP)	0 to 225 (–18 to 107)

^A Storage or handling below 20°F (–7°C) of uninstalled 4, 6, and 8-in. components should be avoided.

responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2. Referenced Documents

2.1 ASTM Standards:

- A 48 Specification for Gray Iron Castings²
- A 53 Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless³
- A 105 Specification for Forgings, Carbon Steel, for Piping Components³
- A 106 Specification for Seamless Carbon Steel Pipe for High-Temperature Service³
- A 126 Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings²
- A 135 Specification for Electric-Resistance-Welded Steel Pipe³

² Annual Book of ASTM Standards, Vol 01.02.

³ Annual Book of ASTM Standards, Vol 01.01.

TABLE 3 Polymer Standard Specifications^A

Lining Material—Resin Type	Standard Resin Specification	Allowable Resin Classification	Standard Liner Color	Maximum Filler Material (by weight)
Polypropylene (PP)	ASTM D 4101	Type I and II	orange	<30 % glass fiber
Poly(Vinylidene Chloride) (PVDC)	ASTM D 729		gray	<20 % glass fiber
Poly(Vinylidene Fluoride) (PVDF)	ASTM D 3222		black	
Poly(Vinylidene Fluoride) Copolymer (PVDF)	ASTM D 5575		black	
Polytetrafluoroethylene (PTFE)	ASTM D 1457		white	
	ASTM D 4894	Type III		
	ASTM D 4895			
Perfluoro (Ethylene-Propylene) Copolymer (FEP)	ASTM D 2116		green	
Perfluoro (Alkoxyalkane) Copolymer (PFA)	ASTM D 3307	Type II	natural	
Ethylene Tetrafluoroethylene Copolymer (ETFE)	ASTM D 3159	Type I	natural	

^A A maximum of 1 % by weight of additives or colorants, or both, is permissible. Colorants, if used, shall be identified in the manufacturer's specification. Clean, reworked resins may be used provided all mechanical property requirements are maintained. Only virgin PTFE resin may be used.

A 182/A 182M Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service³

A 216/A 216M Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service³

A 234/A 234M Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures³

A 278 Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F²

A 312/A 312M Specification for Seamless and Welded Austenitic Stainless Steel Pipes³

A 351/A 351M Specification for Castings, Austenitic, Austenitic-Ferritic (Duplex), for Pressure-Containing Parts³

A 395 Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures²

A 403/A 403M Specification for Wrought Austenitic Stainless Steel Piping Fittings³

A 513 Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing³

A 536 Specification for Ductile Iron Castings²

A 587 Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry³

D 729 Specification for Vinylidene Chloride Molding Compounds⁴

D 792 Test Method for Specific Gravity (Relative Density) and Density of Plastics by Displacement⁴

D 1457 Specification for PTFE Molding and Extrusion Materials⁴

D 1505 Test Method for Density of Plastics by the Density-Gradient Technique⁴

D 1600 Terminology for Abbreviated Terms Relating to Plastics⁴

D 2116 Specification for FEP-Fluorocarbon Molding and Extrusion Materials⁴

D 3159 Specification for Modified ETFE-Fluoropolymer Molding and Extrusion Materials⁵

D 3222 Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding, Extrusion, and Coating Materials⁵

D 3307 Specification for PFA-Fluorocarbon Molding and Extrusion Materials⁵

D 4101 Specification for Propylene Plastic Injection and Extrusion Materials⁵

D 4894 Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials⁶

D 4895 Specification for Polytetrafluoroethylene (PTFE) Resins Produced from Dispersion⁶

D 5575 Specification for Copolymers of Vinylidene Fluoride (VDF) with Other Fluorinated Monomers⁶

F 412 Terminology Relating to Plastic Piping Systems⁷

2.2 ANSI/ASME Standards:

B 16.1 Cast Iron Pipe Flanges Flanged Fittings⁸

B 16.5 Steel Pipe Flanges and Flanged Fittings⁸

B 16.9 Factory-Made Wrought Steel Butt Welding Fittings⁸

B 16.28 Wrought Steel Butt Welding Short Radius Elbows and Returns

B 16.42 Ductile Iron Pipe Flanges and Flanged Fittings—Section IX of the ASME Boiler and Pressure Vessel Code⁸

2.3 Manufacturers Standardization Society (MSS) Standard:

MSS SP-43 Wrought Stainless Steel Butt-Welding Fittings⁹

3. Terminology

3.1 *General*—The definitions used are in accordance with Terminologies F 412 and D 1600, unless otherwise indicated.

4. Materials

4.1 Lining:

4.1.1 *Material*—The lining shall be made from a resin conforming to one of the requirements in Table 3.

4.1.2 *Mechanical Properties*—The minimum tensile strength and minimum elongation at break when tested in accordance with the specifications outlined in 4.1.1 shall conform to Table 4, except the test specimens shall be obtained from extruded or molded liners. Sample orientation is not critical except for PTFE liners made using the paste extrusion process. For paste-extruded PTFE liners, test specimens with

⁶ *Annual Book of ASTM Standards*, Vol 08.03.

⁷ *Annual Book of ASTM Standards*, Vol 08.04.

⁸ Available from American Society of Mechanical Engineers, 345 East 47th St., New York, NY 10017.

⁹ Available from Manufacturers Standardization Society of the Valve and Fittings Industry, Inc., 127 Park St. N.E., Vienna, VA 22180.

⁴ *Annual Book of ASTM Standards*, Vol 08.01.

⁵ *Annual Book of ASTM Standards*, Vol 08.02.