



Standard Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings¹

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1. Scope

1.1 This specification covers factory-made propylene and polypropylene (PP) plastic-lined ferrous metal pipe and fittings, primarily intended for conveying corrosive liquids and gases. Requirements for materials, workmanship, dimensions, design, construction, working pressures and temperatures, test methods, and markings are included.

NOTE 1—In this specification, propylene plastics cover those materials defined as both polypropylene plastics and propylene plastics in Definitions D 883. Both materials are identified as “PP” on the product. Note that this is at variance with Abbreviations D 1600, where PP is the abbreviation for polypropylene.

NOTE 2—This specification does not include products *coated* with PP nor does it define the suitability of PP-lined components in chemical environments.

1.2 The ferrous piping products shall meet the requirements of the relevant specifications listed in 1.2.1. Nominal sizes from ½ through 12 in. in Class 125, 150, and 300-psi are covered.

NOTE 3—The PP sealing faces may prevent achievement of the full pressure rating of the ferrous housings. For pressure limitations, the manufacturer should be consulted.

NOTE 4—Flanged fittings are not available in sizes ½ and ¾.

1.2.1 For Ferrous Pipe:

Title of Specification	ASTM Designation
Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless (Types E and S)	A 53
Seamless Carbon Steel Pipe for High-Temperature Service	A 106
Electric-Resistance Welded Steel Pipe	A 135
Electric-Welded Low-Carbon Steel Pipe for the Chemical Industry	A 587
Seamless and Welded Austenitic Stainless Steel Pipe	A 312
Electric-Resistance Welded Carbon and Alloy Steel Mechanical Tubing	A 513

1.2.2 For Ferrous Flanges:

Title of Specification	ASTM Designation
Gray Iron Castings	A 48

Title of Specification	ASTM Designation
Forgings, Carbon Steel, for Piping Components	A 105
Gray Iron Castings for Valves, Flanges, and Pipe Fittings	A 126
Forgings, Carbon Steel, for General-Purpose Piping	A 181
Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service	A 182
Carbon-Steel Castings Suitable for Fusion Welding for High-Temperature Service (Grade WCB)	A 216
Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650°F (345°C)	A 278
Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures (60-40-18)	A 395
Ductile Iron Castings (60-40-18, 65-45-12, 80-55-06)	A 536

1.2.3 For Ferrous Fittings:

Title of Specification	ASTM Designation
Gray Iron Castings	A 48
Forgings, Carbon Steel, for Piping Components	A 105
Gray Iron Castings for Valves, Flanges, and Pipe Fittings	A 126
Forgings, Carbon Steel, for General-Purpose Piping	A 181
Carbon Steel Castings Suitable for Fusion Welding for High-Temperature Service (Grade WCB)	A 216
Piping Fittings of Wrought Carbon Steel and Alloy for Moderate and Elevated Temperatures Steel Welding Fittings	A 234
Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650°F (345°C)	A 278
Austenitic Steel Castings for High-Temperature Service	A 351
Alloy Steel Castings Specially Heat-Treated for Pressure-Containing Parts Suitable for High-Temperature Service	A 389
Ductile Iron Castings (60-40-18, 64-45-12, 80-55-06)	A 536
Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures (60-40-18)	A 395
Wrought Austenitic Stainless Steel Piping Fittings	A 403

1.3 The PP-lined flanged pipe and fitting assemblies are limited to use from –18 to 107°C (0 to 225°F). For use below –18°C (0°F) consult the manufacturer. Use in specific aggressive environments may alter the above temperature range. The operating temperature limits shall be established by mutual agreement between the purchaser and the seller.

1.4 The values stated in inch-pound units are to be regarded as the standard.

2. Referenced Documents

2.1 ASTM Standards:

D 1238 Test Method for Flow Rates of Thermoplastics by Extrusion Plastometer²

¹ This specification is under the jurisdiction of ASTM Committee F-17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.11 on Composite.

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² Annual Book of ASTM Standards, Vol 08.01.

D 1600 Terminology for Abbreviated Terms Relating to Plastics²

D 2146 Specification for Propylene Plastic Molding and Extrusion Materials³

F 412 Terminology Relating to Plastic Piping Systems⁴

2.2 ANSI Standards:

B 16.1 Cast Iron Pipe Flanges and Flanged Fittings⁵

B 16.5 Steel Pipe Flanges and Flanged Fittings⁵

B 16.42 Fittings, Flanges and Valves⁵

2.3 Federal Standard:

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)⁶

2.4 Military Standard:

MIL-STD-129 Marking for Shipment and Storage⁶

3. Terminology

3.1 Definitions—Definitions are in accordance with Terminology F 412, and abbreviations are in accordance with Terminology D 1600, unless otherwise indicated.

4. Materials

4.1 Lining:

4.1.1 *Material*—The lining shall be made from PP resins conforming to the requirements of Specification D 2146, except that (1) a maximum of 1 % by weight of colorants is permissible for identification, and (2) up to 30 % by weight glass fiber filler is permissible to modify physical properties. Organic colorants, if used, shall be identified in the manufacturer's specification.

4.1.2 The PP lining shall be made from virgin resin or clean reworked resin which is not thermally degraded.

4.1.3 Two types of PP resins are covered in this specification. Type I materials are polypropylene homopolymer resins; Type II are propylene copolymer resins.

4.1.4 *Mechanical Properties*—The following table lists minimum tensile strength and minimum elongation at yield for each PP type when tested in accordance with the requirements of Specification D 2146, except that the test specimens shall be obtained from extruded or molded PP liner. The minimum values for tensile strength and elongation shall apply to both the longitudinal and circumferential directions.

Mechanical Properties of PP		
PP Type	Minimum Tensile Properties at Yield	
	Strength, psi (MPa)	Elongation, %
Type I (Homopolymer)	4000 (28)	10
Type II (Copolymer)	3000 (21)	10
30 % Glass Fiber Filled	2500 (17)	2

4.1.5 *Flow Rate*—PP resins used to manufacture the PP liner and molded fittings shall have the following flow rate when tested in accordance with Condition L of Test Method D 1238.

Type I—0.2 to 0.6 g/10 min

Type II—0.3 to 0.8 g/10 min

30 % Glass Fiber Filled—3.0 to 6.0 g/10 min

The flow rate of PP linings made from Type I and Type II resins shall not exceed 1.7 g/10 min, or 1.7 times the flow rate of the original resin, whichever is smaller. The melt flow rate of PP linings made from 30 % glass filled materials shall not exceed 7.5 g/10 min, or 1.25 times the melt flow rate of the original resin, whichever is smaller.

4.2 Ferrous Pipe and Fittings:

4.2.1 The mechanical properties of the pipes and fittings shall conform to the requirements of the appropriate specification of 1.2 except as they are influenced by accepted methods of processing in the industry, for example, Van Stone flaring, bending, swagging, and welding. The carbon steel pipe and wrought fittings shall be welded or seamless steel, Schedule 40 or Schedule 80, except that Schedule 30 pipe may be used in 8, 10, and 12-in. nominal size. Schedule 20 may also be used for 12-in. nominal size with the agreement of the purchaser.

4.2.2 *Finish*—The interior surfaces of all housings shall be clean and free of mold burrs, rust, scale, or other protrusions that may adversely affect the integrity or performance of the lining.

4.3 Back-Up Gaskets:

4.3.1 *General*—Back-up gaskets shall be used to cover the pipe end and gasket face of threaded or slip-on flanges unless a full radius or chamfer is provided at the end of the pipe and flange. Gaskets may also be required on fittings to provide accommodation or elimination, or both, of sharp corners that could damage the lining.

4.3.2 *Material*—Plain gaskets meeting the temperature requirements, or perforated metallic gaskets, may be used.

5. Requirements

5.1 Dimensions:

5.1.1 *Housings*—Housing installation dimensions are as required in the applicable material specification listed in 1.2.

5.1.2 *Wall Thickness*—Fitting linings shall have a minimum wall thickness of $\frac{3}{32}$ in. (24 mm), and shall have a uniform face thickness of not less than $\frac{3}{32}$ in. (24 mm). Pipe linings shall have a minimum wall thickness of 0.050 in. (13 mm), and the flared radius and gasket faces shall have a uniform thickness not less than 80 % of the wall thickness. Molded faces shall not be less than $\frac{3}{32}$ in. thick.

5.1.3 *PP Face Diameter*—The outside diameter of the PP covering the gasket face of the flange or the full face of the lap-joint stub end shall not be less than the diameter specified in the following table. They shall be concentric within $\frac{1}{16}$ in.

Nominal pipe size, in.	Face Diameter	
	Minimum PP face diameter,	
	in. (mm)	
1	1 $\frac{7}{8}$ (48)	
1 $\frac{1}{2}$	2 $\frac{1}{16}$ (68)	
2	3 $\frac{7}{16}$ (87)	
2 $\frac{1}{2}$	3 $\frac{15}{16}$ (100)	
3	4 $\frac{5}{8}$ (119)	
4	5 $\frac{15}{16}$ (151)	
6	8 (203)	
8	10 $\frac{1}{16}$ (256)	
10	12 $\frac{1}{4}$ (311)	
12	14 $\frac{3}{8}$ (365)	

³ Discontinued—See 1984 Annual Book of ASTM Standards, Vol 08.02.

⁴ Annual Book of ASTM Standards, Vol 08.04.

⁵ Available from American National Standards Institute, 11 West 42nd Street, 13th Floor, New York, NY 10036.

⁶ Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.