



Designation: F 599 – 95

An American National Standard

# Standard Specification for Poly(Vinylidene Chloride) (PVDC) Plastic-Lined Ferrous Metal Pipe and Fittings<sup>1</sup>

This standard is issued under the fixed designation F 599; 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 poly(vinylidene chloride) (PVDC) plastic-lined ferrous metal pipe and fittings primarily intended for conveying corrosive liquids and gases. Requirements for materials, workmanship, dimensions, construction, working pressure and temperatures, test methods, and markings are included.

NOTE 1—This specification does not include products coated with PVDC nor does it define the suitability of PVDC-lined components in chemical environments.

1.2 The values given in parentheses are provided for information purposes only.

1.3 The ferrous piping products shall meet the requirements of the relevant specifications listed in 1.3.1, 1.3.2, and 1.3.3. Nominal sizes from 1 through 8 in. in 125, 150, and 300 psi ratings are covered.

NOTE 2—The PVDC sealing faces may prevent achievement of the full pressure rating of the ferrous housing. For pressure limitations, the manufacturer should be consulted.

### 1.3.1 For Ferrous Pipe:

| Title of Specification                                               | ASTM Designation |
|----------------------------------------------------------------------|------------------|
| Pipe, Steel, Black, and Hot-Dipped, Zinc-Coated, Welded and Seamless | A 53             |
| Seamless Carbon Steel Pipe for High-Temperature Service              | A 106            |
| Electric-Resistance-Welded-Carbon and Alloy Steel Mechanical Tubing. | A 513            |
| Electric-Resistance-Welded Steel Pipe                                | A 135            |
| Electric-Welded Low-Carbon Steel Pipe for the Chemical Industry      | A 587            |

### 1.3.2 For Ferrous Flanges:

| 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            |

|                                                                                                               |       |
|---------------------------------------------------------------------------------------------------------------|-------|
| 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                                | 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                            | A 395 |
| Ductile Iron Castings                                                                                         | A 536 |

### 1.3.3 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            |
| 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                                  | A 216            |
| Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures                  | A 234            |
| Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650°F (345°C)                           | A 278            |
| Alloy Steel Castings Specially Heat-Treated for Pressure-Containing Parts Suitable for High-Temperature Service | A 389            |
| Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures                              | A 395            |
| Wrought Austenitic Stainless Steel Piping Fittings                                                              | A 403            |

1.4 The PVDC-lined pipe and fitting assemblies are limited to use from −18 to 79°C (0 to 175°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 range shall be established by mutual agreement between consumer and producer.

NOTE 3—Storage or handling below −7°C (20°F) of uninstalled 4, 6, and 8-in. lined pipe should be avoided.

## 2. Referenced Documents

### 2.1 ASTM Standards:

- D 729 Specification for Vinylidene Chloride Molding Compounds<sup>2</sup>
- D 792 Test Methods for Specific Gravity (Relative Density)

<sup>1</sup> 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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<sup>2</sup> Annual Book of ASTM Standards, Vol 08.01.

and Density of Plastics by Displacement<sup>2</sup>

D 1505 Test Method for Density of Plastics by the Density-Gradient Technique<sup>2</sup>

D 1600 Terminology for Abbreviated Terms Relating to Plastics<sup>2</sup>

F 412 Terminology Relating to Plastic Piping Systems<sup>3</sup>

## 2.2 ANSI Standards:

B 16.1 Cast Iron Pipe Flanges and Flanged Fittings<sup>4</sup>

B 16.5 Steel Pipe Flanges and Flanged Fittings<sup>4</sup>

## 3. Terminology

3.1 The terminology used is in accordance with Terminology F 412, and abbreviations are in accordance with Terminology D 1600, unless otherwise specified.

3.2 The abbreviation for poly(vinylidene chloride) is PVDC.

## 4. Materials

### 4.1 Lining:

4.1.1 *Material*—The lining shall be made from PVDC compounds conforming to the requirements of Specification D 729, except that up to a 20 weight % glass fiber filler is used to modify physical properties, and a maximum of 1 weight % of colorant is permissible for identification. Organic colorants, if used, shall be identified in the manufacturer's specification.

4.1.2 The PVDC shall be virgin compound or clean re-worked compound.

4.1.3 *Mechanical Properties*—The minimum tensile strength and minimum elongation at yield when tested in accordance with Specification D 729 shall be 1500 psi (10.34 MPa) and 2 % respectively. The minimum values for tensile strength and elongation shall apply to both the longitudinal and circumferential directions.

4.1.4 *Specific Gravity*—The linings manufactured from PVDC resins with 20 % glass fibers shall have a relative density of 1.8 to 1.9 when tested in accordance with the requirements of Test Methods D 792 and D 1505.

### 4.2 Ferrous Pipe and Fittings:

4.2.1 *Mechanical Properties*—The mechanical properties of the pipe and fittings shall conform to the requirements of the appropriate specification of 1.3 except as they are influenced by accepted methods of processing in the industry, for example, Van Stone flaring, bending, swaging, 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-in. nominal size.

4.2.2 *Finish*—The interior surfaces of all housings shall be clean and free of mold burrs, rust, scale, or other protrusions which may adversely affect 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 which 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 1.3.

5.1.2 *Wall Thickness*—Fitting linings shall have a minimum wall thickness of  $\frac{3}{32}$  in. (2.4 mm), and shall have a uniform face thickness of not less than  $\frac{3}{32}$  in. Pipe linings shall have a minimum wall thickness of  $\frac{3}{32}$  in., and the flared radius and gasket faces shall have a uniform thickness of not less than 80 % of the wall thickness. Molded faces shall not be less than  $\frac{3}{32}$  in. thick.

5.1.3 *PVDC Face Diameter*—The outside diameter of the PVDC 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 Table 1. They shall be concentric within  $\frac{1}{16}$  in. (1.6 mm).

5.1.4 *Tolerances*—Tolerance for pipe, flanges, and fittings shall be as specified in Table 2. Bolt holes in both flanges on a fixed spool shall straddle the same center line to facilitate alignment. Finish lined (plastic face to plastic face) fabricated fittings shall conform to the nominal face-to-face, etc., as specified in ANSI B 16.1 or B 16.5 with the applicable tolerances.

### 5.2 Flange Construction:

5.2.1 Screw-type flanges shall be secured in position to prevent inadvertent turning of the flange.

5.2.2 Socket-type flange shall be fully back-welded to the pipe housing and the inside surfaces of the socket flanges shall be welded and ground smooth.

5.2.3 Slip-on flanges shall be fully back-welded.

NOTE 4—No welding shall be done on lined components.

5.2.4 Lap-joint (or Van Stone) flanged ends may be manufactured by standard forming techniques or by using fully welded stub ends or collars. Lap-joints shall not contain any cracks or buckles.

NOTE 5—The use of lap-joint flanges in a piping system may simplify alignment.

### 5.3 Workmanship:

5.3.1 Pipe and fitting linings shall show no evidence of pinholes, porosity, or cracks when inspected in accordance with 5.4.2. The lining shall fit snugly inside the pipe and fitting

TABLE 1 PVDC Face Diameter

| Nominal Pipe Size, in. | Minimum PVDC Face Diameter, in. (mm) |          |
|------------------------|--------------------------------------|----------|
| 1                      | 1 $\frac{7}{8}$                      | (47.62)  |
| 1.5                    | 2 $\frac{1}{16}$                     | (68.26)  |
| 2                      | 3 $\frac{7}{16}$                     | (87.31)  |
| 2.5                    | 3 $\frac{15}{16}$                    | (104.01) |
| 3                      | 4 $\frac{9}{8}$                      | (117.48) |
| 4                      | 5 $\frac{15}{16}$                    | (150.81) |
| 6                      | 8                                    | (203.20) |
| 8                      | 10 $\frac{1}{16}$                    | (255.59) |

<sup>3</sup> Annual Book of ASTM Standards, Vol 08.04.

<sup>4</sup> Available from the American National Standards Institute, 11 West 42nd St., 13th Floor, New York, NY 10036.