Designation: D2680 – 20

Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping[1]

This standard is issued under the fixed designation D2680; 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 thermoplastic composite pipe, fittings and a joining system for use in gravity flow, nonpressure sanitary sewer, and storm drain installations. The pipe and fittings are made of ABS or PVC plastic material. Recommended installation practices are referenced in Appendix X1.

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 The following safety hazards caveat pertains only to the test method portion, Section 10, of 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.*

1.4 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D618 Practice for Conditioning Plastics for Testing
D1084 Test Methods for Viscosity of Adhesives
D1600 Terminology for Abbreviated Terms Relating to Plastics
D1784 Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings
D2152 Test Method for Adequacy of Fusion of Extruded Poly(Vinyl Chloride) (PVC) Pipe and Molded Fittings by Acetone Immersion
D2235 Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
D2321 Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
D2564 Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
D3138 Specification for Solvent Cements for Transition Joints Between Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Non-Pressure Piping Components
D3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
D3965 Classification System and Basis for Specifications for Rigid Acrylonitrile-Butadiene-Styrene (ABS) Materials for Pipe and Fittings
D4396 Specification for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds for Plastic Pipe and Fittings Used in Nonpressure Applications
F402 Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings
F412 Terminology Relating to Plastic Piping Systems
F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F913 Specification for Thermoplastic Elastomeric Seals (Gaskets) for Joining Plastic Pipe

2.2 *Federal Standard:*

Fed. Std. No. 123 Marking for Shipment (Civil Agencies)[3]

2.3 *Military Standard:*

MIL-STD-129 Marking for Shipment and Storage[3]

[1] This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.62 on Sewer.

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[2] 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.

[3] Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

***A Summary of Changes section appears at the end of this standard**

3. Terminology

3.1 *Definitions:*

3.1.1 *General*—Definitions are in accordance with Terminology F412 and abbreviations are in accordance with Terminology D1600, unless otherwise specified. The abbreviation for acrylonitrile-butadiene-styrene is ABS and the abbreviation for poly(vinyl chloride) is PVC.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *acrylonitrile-butadiene-styrene (ABS)*—plastics containing polymers or blends of polymers, or both, in which the minimum butadiene content is 6 %; the minimum acrylonitrile content is 15 %; the minimum styrene or substituted styrene content, or both, is 15 %; and the maximum content of all other monomers is not more than 5 %, plus lubricants, stabilizers, and colorants.

3.2.2 *poly (vinyl chloride) (PVC)*—plastic compounds containing poly(vinyl chloride) homopolymer, and such additives as stabilizers, lubricants, processing aids, impact improvers, and colorants as needed to provide the required processing and toughness characteristics.

4. Classification

4.1 Pipe produced in accordance with this specification shall be classified as ABS composite pipe or PVC composite pipe based on plastic materials used in manufacture.

5. Materials and Manufacture

5.1 ABS composite pipe or PVC composite pipe shall consist of two concentric thermoplastic tubes integrally braced across the annulus. The resultant annular space is filled to provide continuous support between the inner and outer tubes.

5.2 *Compounds*—The ABS and PVC composite pipe and fittings shall be produced from the following compounds:

5.2.1 *ABS*—The pipe shall be made from a rigid ABS plastic and shall meet or exceed the requirements of Specification D3965 for a minimum cell classification of 1-0-2-2-3. The fittings shall be made from ABS plastic and shall meet or exceed the requirements of Specification D3965 for cell classifications of 1-0-2-2-3 or 4-2-2-2-2. Clean rework ABS, generated from the manufacturer's own pipe extrusion and fittings produced before filling the annulus as described in 5.3 may be used by the same manufacturer, provided that the pipe and fittings produced meet all the requirements of this specification.

5.2.2 *PVC*—The thermoplastic material shall be a rigid PVC plastic and shall meet or exceed the requirements of Specification D1784, for a minimum cell classification of 12454 or of Specification D4396, for a minimum cell classification of 11432. Homopolymer PVC compounds that have higher cell classifications, because one or more properties are superior to those of the specified compounds, are also acceptable. Clean rework PVC, generated from the manufacturer's own pipe and fittings production produced before filling the annulus as described in 5.3 may be used by the same manufacturer provided that the pipe and fittings produced meet all the requirements of this specification.

5.3 The other component shall be portland cement-perlite concrete or other inert filler material exhibiting the same degree of performance, that essentially fills the truss annulus to form a composite pipe that meets the requirements of this specification.

5.4 *Gaskets*—Elastomeric seals (gaskets) shall comply with requirements described in Specifications F477 and F913.

NOTE 1—Gasket joints manufactured for PVC composite pipe only.

5.5 *Lubricants*—The lubricant used for the assembly of gasket joints shall have no detrimental effect on the gasket or on the pipe.

6. Performance Requirements

6.1 *Pipe Stiffness*—Pipe tested in accordance with 10.2 shall have a minimum pipe stiffness of 200 lb/in./in. (1380 kPa) at 5 % deflection.

6.2 *Pipe Deflection*—Pipe tested in accordance with 10.2 shall deflect a minimum of 7.5 % without rupture of inner or outer wall.

NOTE 2—The purpose of the quality control tests in 6.1 and 6.2 is to furnish test results for a consumer only upon his request at the time of order and prior to shipment from the point of manufacture.

6.3 *Acid Conditioning*—Pipe tested in accordance with 10.3 shall meet the requirements of 6.1 and 6.2.

NOTE 3—This test is intended only for use as a qualification test, not for use as a simulated service test nor a quality control test.

6.4 *Joint Tightness:*

6.4.1 *Solvent Cement Joints*—Pipe and fittings attached to the pipe shall show no signs of leakage when tested in accordance with 10.4.1 (See Note 3).

6.4.2 *Gasket Joints for PVC Composite Pipe*—Joints shall show no signs of leakage when tested in accordance with 10.4.2 (See Note 3).

6.5 *Extrusion Quality*—When tested in accordance with 10.5, PVC extruded pipe tubes shall not flake or disintegrate.

NOTE 4—This test is intended for use as a quality control test, not for use as a simulated service test.

7. Other Requirements

7.1 *Joints and Fittings* as shown in Fig. 1 and Fig. 2, shall be molded or fabricated from materials described in Section 5. Joints and fittings may be factory-attached to the pipe or furnished loose, at the option of the purchaser.

7.2 *Solvent Cement Joints:*

7.2.1 *Solvent Cement Joint*—In the solvent cement joint, the pipe spigot wedges into the tapered socket and the surfaces fuse together.

7.2.2 *ABS Solvent Cement Joints*—Primer for priming solvent cemented joints shall be MEK (methyl ethyl ketone) and the cement shall be MEK containing a minimum of 20 % by weight of dissolved ABS as described in 5.2.1. The cement viscosity when measured in accordance with Method D of Test Method D1084 at 70 to 75° F (21 to 23°C) with a No. 5 Zahn

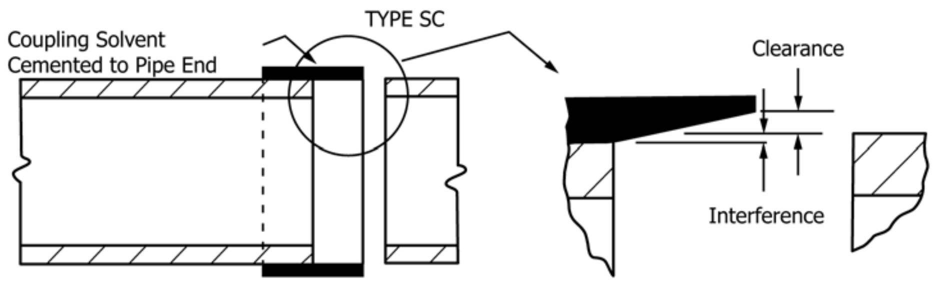

FIG. 1 Assembly of Joints

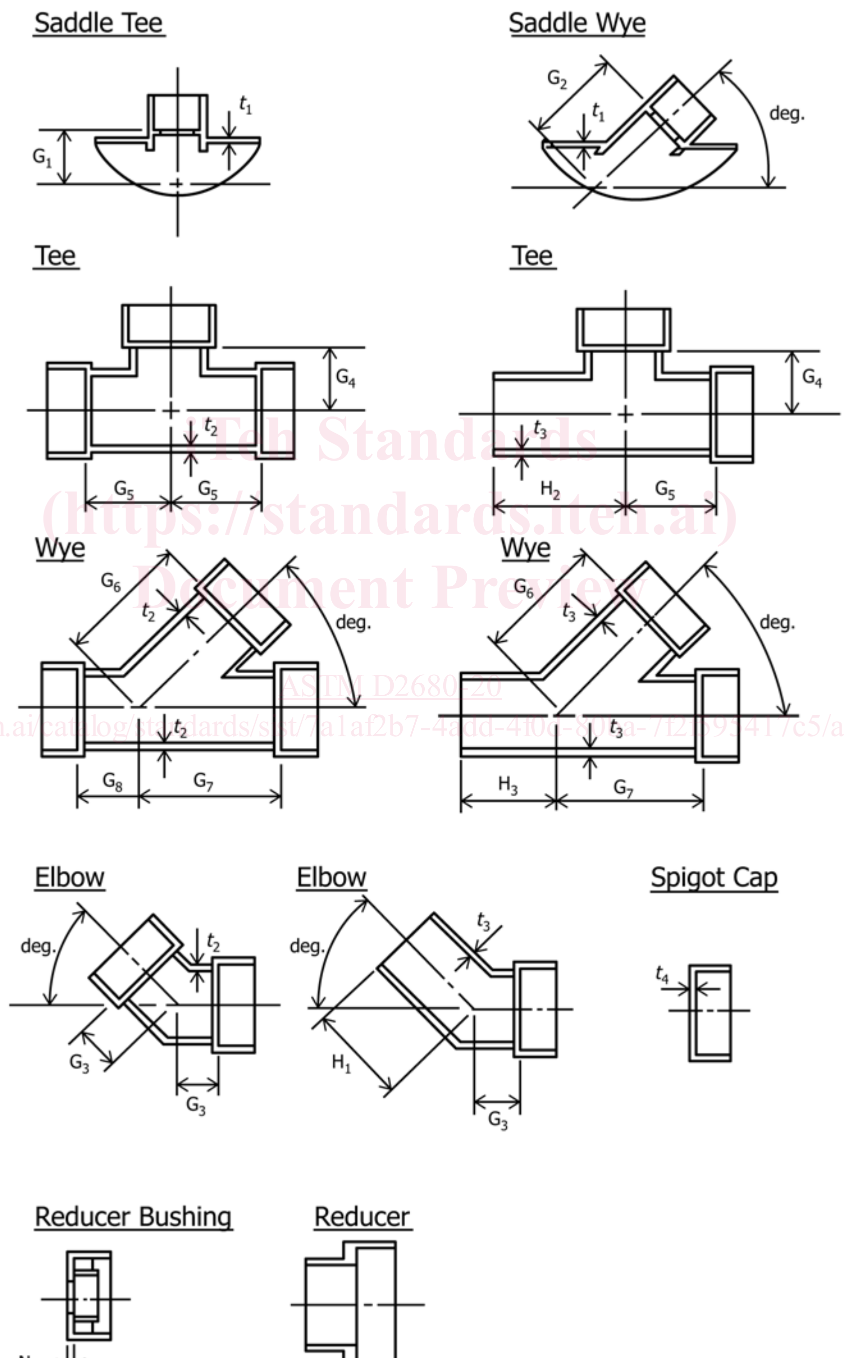

FIG. 2 Fittings (see Tables 5 and 6 for dimensions)

Cup, shall fall within a range of 60 to 80 s. The solids content of the cement shall be measured in accordance with Specification D2235.

7.2.3 *PVC Solvent Cement Joints*—The cement shall comply with Specification D2564, with the exception that the minimum resin content shall be 16 % and minimum viscosity shall be 3500 cP (3500 mPa·s).

7.2.4 *Transition Joints (ABS to PVC)*— Whenever a transition joint is to be assembled, the cement shall comply with Specification D3138. (**Warning—**Solvent cements for plastic pipe are made from flammable liquids and should be kept away from all sources of ignition. Good ventilation should be maintained to reduce fire hazard and to minimize breathing of solvent vapors. Avoid contact of cement with skin and eyes. Refer to Practice F402 for additional information.)

NOTE 5—Unless otherwise specified, it is permissible to use transition joints in accordance with this specification and Specification D3138.

7.3 *Elastomeric (Gasket) Joints for PVC Composite Pipe:*

7.3.1 Elastomeric joints shall be designed so that when assembled, the gasket will be compressed in the joint to form a positive seal.

7.3.2 The joint shall be designed to avoid displacement of the gasket when assembled in accordance with the manufacturers' recommendation.

7.3.3 The assembly of joints shall be in accordance with the manufacturers' recommendation.

8. Dimensions

8.1 *Diameters and Thickness*—The pipe shall conform to the dimensions and tolerances shown in Table 1 for ABS composite pipe, and Table 2 for PVC composite pipe, when measured in accordance with 10.6.1 and 10.6.2.

8.2 *Laying Length*—Pipe shall be furnished in standard 12½ ft (3.82 m) lengths with a tolerance of −1 in. (−25 mm) when measured in accordance 10.6.1. There is no limit for plus variation. Other lengths may be provided, if agreed upon by the purchaser and the seller.

8.3 *Straightness*—Pipe intended to be straight shall have a maximum deviation from straightness of 1⁄16 in./ft (4.85 mm/m) of length, when measured in accordance with 10.6.1.

8.4 *End Squareness*—Pipe ends shall be cut square to the longitudinal axis as provided in Table 3, when measured in accordance with 10.6.3.

8.5 *Joint Couplings,* shall conform to the dimensions shown in Table 4, when measured in accordance with 10.6.1.

8.6 *Fittings:*

8.6.1 *Molded Fittings*—The wall thickness of the water way shall be no less than the respective minimum thickness listed in Table 5. The socket dimensions and respective wall thickness shall conform to Table 4. The dimensions and wall thicknesses shall be determined in accordance with 10.6.1.

8.6.2 *Fabricated Fittings*—Fabricated fittings shall be considered satisfactory if made from pipe and molded fittings meeting the requirements of this specification.

8.6.3 The spur (lateral) socket shall be suitable for attaching the respective ABS or PVC solid wall pipe or adapters shall be furnished for attaching other types of pipes.

9. Workmanship

9.1 The inner and outer surfaces of the pipe, joints, and fittings shall be homogeneous throughout and free from visible cracks, holes, foreign inclusions, and other injurious defects. The pipe, joints, and fittings shall be as uniform as commercially practicable in other physical properties.

10. Test Methods

10.1 *Conditioning:*

10.1.1 *Referee Testing*—When conditioning is required for referee tests, condition the specimens in accordance with

TABLE 1 Pipe Dimensions for ABS Composite Pipe

Nominal Size, in.	Outside Diameter			Average Inside Diameter		Average Concentric Tube Thickness	
	Average	Tolerance	max	min	max	Inner, min	Outer, min
			Inches				
8	9.41	+0.04 −0.03	9.51	7.75	7.90	0.060	0.035
10	11.75	+0.04 −0.04	11.87	9.75	9.88	0.068	0.038
12	14.07	+0.06 −0.05	14.22	11.75	11.83	0.079	0.048
15	17.62	+0.07 −0.07	17.80	14.75	14.80	0.096	0.059
			Millimetres				
8	239	+1.0 −0.8	242	197	201	1.52	0.90
10	298	+1.2 −1.0	302	248	251	1.73	0.96
12	357	+1.5 −1.2	361	298	301	2.01	1.22
15	447	+1.8 −1.5	452	375	376	2.44	1.50

TABLE 2 Pipe Dimensions for PVC Composite Pipe

Nominal Size, in.	Outside Diameter			Average Inside Diameter		Average Concentric Tube Thickness	
	Average	Tolerance	max	min	max	Inner, min	Outer, min
				Inches			
8	9.41	+0.04 −0.03	9.51	7.75	7.90	0.050	0.030
10	11.75	+0.04 −0.04	11.87	9.75	9.88	0.058	0.035
12	14.07	+0.06 −0.05	14.22	11.75	11.83	0.067	0.041
15	17.62	+0.07 −0.07	17.80	14.75	14.80	0.080	0.050
				Millimetres			
8	239	+1.0 −0.8	242	197	201	1.27	0.76
10	298	+1.2 −1.0	302	248	251	1.47	0.89
12	357	+1.5 −1.2	361	298	301	1.70	1.04
15	447	+1.8 −1.5	452	375	376	2.03	1.27

TABLE 3 End Squareness

Nominal Size, in.	Max Allowable Gap	
	in.	mm
8	0.25	6.4
10	0.33	8.4
12	0.41	10.4
15	0.50	12.8

Procedure A of Methods D618 at 73 ± 4 °F (23 ± 2 °C) and 50 ± 5 % relative humidity for not less than 40 h prior to test. Conduct tests under the same conditions of temperature and humidity, unless otherwise specified.

10.1.2 *Quality Control Testing*—Condition specimens for a minimum of 4 h in air or 1 h in water at 73 ± 4 °F (23 ± 2 °C). Test the specimens at 73 ± 4 °F without regard to relative humidity.

10.1.3 *Test Conditions*—Conduct tests in the Standard Laboratory Atmosphere of 73 ± 4 °F (23 ± 2°C) and 50 ± 5 % relative humidity, unless otherwise specified in the test methods or in this specification. In cases of disagreement, the tolerances shall be ±2 °F (±1 °C) and ±2 % relative humidity.

10.2 *Stiffness and Deflection:*

10.2.1 After filling the annulus as described in 5.3 test three specimens in accordance with Test Method D2412. Determine the pipe stiffness at 5 % deflection and verify that pipe will deflect to 7.5 % without wall rupture.

10.2.2 Calculate the percent vertical deflection as follows:

$$Vertical\ deflection, \% = (\Delta\ y/Nominal\ ID) \times 100 \quad (1)$$

where:

$\Delta\ y$ = vertical deflection of the inside diameter as measured by the plate travel of the apparatus. Both ID and Δy must be in the same units.

10.2.3 Calculate the pipe stiffness at 5 % deflection as follows:

$$Pipe\ stiffness\ (PS) = F/\Delta\ y \quad (2)$$

where:

F = load recorded at 5 % deflection.

NOTE 6—If F is expressed in newton metres, and Δy is in metres, then PS is given in N/m^2, if F is expressed in pounds-force/inch, and Δy is in inches, then PS is given in lb/in./in.

10.3 *Acid Conditioning*—Completely immerse three 6 in. (150 mm) long specimens cut from each sample in a suitable vat containing a 5 % solution by weight of sulfuric acid. Allow the specimen to remain submerged for 24 h. After removal from the acid, wash the specimen with running water, wipe with a clean, dry cloth, condition for 2 h, and then test in accordance with 10.2 within 30 min.

10.4 *Joint Tightness:*

10.4.1 *Solvent Cement Joints*—Assemble joints by first applying a coat of primer to the inside of the socket and to the outside of the spigot end of pipe. Without delay, apply a coating of cement to the same surfaces in sufficient quantity that when the spigot is fully inserted into the socket, a bead of excess cement will form around the complete circumference of the outside juncture of the spigot and socket. Remove the excess cement and allow the assembly to cure for 24 h. Seal all open ends by any convenient method and apply an internal hydrostatic head of 10 psi (70 kPa) to the assembly for 1 h. Observe evidence of any leakage. Leakage through the inert filler shall not be considered reason for rejection.

10.4.2 *Elastomeric Seal (Gasketed) Joints*— Conduct joint tightness test in accordance with Specification D3212, except use the shear loading saddle shown in Fig. 3.

10.5 *Extrusion Quality*—Test shall be run in accordance with Test Method D2152. This procedure is used for determining the extrusion quality of extruded PVC plastic pipe as indicated by reaction to immersion in anhydrous acetone. It is applicable only for distinguishing between unfused and properly fused PVC.