



# Standard Specification for Smooth-Wall Poly(Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage<sup>1</sup>

This standard is issued under the fixed designation F758; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the Department of Defense.*

<sup>ε1</sup> NOTE—Section 7.2.8.1 was editorially corrected in February 2007.

## 1. Scope

1.1 This specification covers the requirements for smooth-wall perforated and nonperforated poly(vinyl chloride) (PVC) plastic pipe and couplings for use in subsurface drainage systems of highways, airports, and similar applications in nominal sizes of 4, 6, and 8 in. and in pipe stiffnesses (PS) that are designated as Type PS 28 and Type PS 46 in accordance with its minimum pipe stiffness.

1.2 Molded fittings for use with highway underdrain pipe are in accordance with Specification D3034. For convenience, some of these fittings are reproduced in Annex A1.

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

NOTE 1—Type PS 28 and Type PS 46 indicate “pipe stiffness” of 28 and 46, respectively, as outlined in 11.1.

NOTE 2—Pipe and fittings should be installed in accordance with Practice D2321, or applicable state or local specifications.

1.4 The following safety hazards caveat pertains only to the test methods portion, Section 11, 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 and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

### 2.1 ASTM Standards:<sup>2</sup>

D618 Practice for Conditioning Plastics for Testing

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.65 on Land Drainage.

Current edition approved Feb. 1, 2007. Published February 2007. Originally approved in 1982. Last previous edition approved in 2000 as F758 – 95(2000). DOI: 10.1520/F0758-95R07E01.

<sup>2</sup> 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.

D1600 Terminology for Abbreviated Terms Relating to Plastics

D1784 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

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

D2444 Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

D2564 Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems

D2855 Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings

D3034 Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

D3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals

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

### 2.2 Federal Standard:

Fed. Std. No. 123 Marking for Shipments (Civil Agencies)<sup>3</sup>

### 2.3 Military Standard:

MIL-STD-129 Marking for Shipment and Storage<sup>3</sup>

<sup>3</sup> Available from Standardization Documents Order Desk, Bldg. 4 Section D, 700 Robbins Ave., Philadelphia, PA 19111-5094, Attn: NPODS.

3. Terminology

3.1 *Definitions*—Definitions are in accordance with Terminology F412, and abbreviations are in accordance with Terminology D1600, unless otherwise specified. The abbreviation for poly(vinyl chloride) plastic is PVC.

4. Classification

4.1 Two classes (or pipe stiffness) are included and designated as PS 28 and PS 46 as determined in accordance with 11.1.

5. Materials

5.1 The pipe shall be made of PVC plastic having a minimum cell classification of 12454 or 12364 as defined in Specification D1784 or a minimum cell classification of 11432 or 11332 as defined in specification D4396. Homopolymer PVC compounds must equal or exceed the requirements of the listed cell classification numbers.

5.2 *Rework Material*—Rework material from the manufacturer’s own pipe or fittings production may be used by the same manufacturer, provided that the pipe or fabricated fittings produced meet all the requirements of this specification.

6. Joint Systems

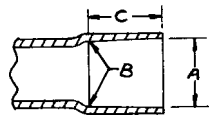
6.1 *Gasket-Type Joints*, meeting the applicable requirements of Specification D3212, may be utilized.

6.2 *Solvent-Cement-Type Joints*, made with bell ends meeting the requirements of Table 1; stop-type couplings in conformance with Table 2; or sleeve-type couplings in conformance with Table 3, may be utilized.

6.2.1 Belled ends shall be formed so as to provide a uniform shoulder around the entire circumference of the pipe.

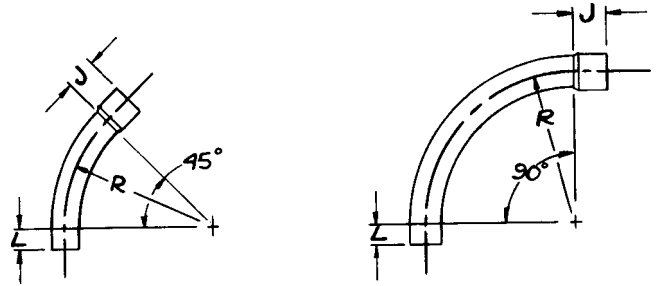
TABLE 1 Socket-Type Bell Dimensions

(Belled Ends for Solvent-Cement-Type Pipe and Bends)



in.			
Nominal Size, in.	A Entrance	B Socket Bottom	C Bell Depth, min
4	4.235 ± 0.009	4.210 ± 0.009	1.750
6	6.305 ± 0.011	6.270 ± 0.011	3.000
8	8.424 ± 0.012	8.388 ± 0.012	4.000
mm			
Nominal Size, in.	A Entrance	B Socket Bottom	C Bell Depth, min
4	107.57 ± 0.22	106.93 ± 0.22	44.44
6	160.15 ± 0.28	159.26 ± 0.28	76.20
8	213.97 ± 0.30	213.06 ± 0.30	101.60

TABLE 2 Dimensions of Bends



Nominal Size, in.	Angle	in.		Socket Depth <sup>A</sup> Dimension J, min	Length of Tangent Dimension L, min
		Radius	Radius		
4	45°	16, 24, 36	16, 24, 36	1.750	2.00
	90°	16, 24, 36	16, 24, 36		
6	45°	24, 36	24, 36	3.000	3.50
	90°	24, 36	24, 36		
8	45°	24, 36	24, 36	4.000	5.00
	90°	24, 36	24, 36		

Nominal Size, in.	Angle	mm		Socket Depth <sup>A</sup> Dimension J, min	Length of Tangent Dimension L, min
		Radius	Radius		
4	45°	406.4 609.6 914.4	406.4 609.6 914.4	44.44	50.80
	90°	406.4 609.6 914.4	406.4 609.6 914.4		
6	45°	609.6 914.4	609.6 914.4	76.20	88.90
	90°	609.6 914.4	609.6 914.4		
8	45°	609.6 914.4	609.6 914.4	101.60	127.00
	90°	609.6 914.4	609.6 914.4		

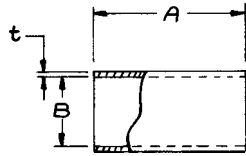
<sup>A</sup>Socket dimensions shall be as shown in Table 1.

6.2.2 Solvent-cemented joints shall be made using PVC cement meeting the requirements of Specification D2564, and shall be made in accordance with Practice D2855 and Practice F402.

7. Requirements

7.1 *Workmanship*—The pipe shall be homogeneous throughout and essentially uniform in color, opacity, density, and other properties. The inside and outside surfaces shall be semimatte or glossy in appearance (depending on the type of plastic) and free of chalking, sticky, or tacky material. The surfaces shall be free of excessive bloom, that is, slight bloom is acceptable. The pipe walls shall be free of cracks, holes, blisters, voids, foreign inclusion, or other defects that are visible to the naked eye and that may affect the wall integrity. Holes deliberately placed in perforated pipe are acceptable. Bloom or chalking may develop in pipe exposed to direct rays of the sun (ultraviolet radiant energy) for extended periods and consequently these requirements do not apply to pipe after extended exposure to direct rays of the sun.

TABLE 3 Sleeve Coupling Dimensions



in.			
Nominal Pipe Size, in.	Dimension A	Dimension B	Dimension t, min
4	3.5 ± 0.250	4.230 ± 0.005	0.120
6	6.0 ± 0.250	6.291 ± 0.005	0.180
8	8.0 ± 0.250	8.418 ± 0.006	0.240
mm			
Nominal Pipe Size, in.	Dimension A	Dimension B	Dimension t, min
4	88.8 ± 6.34	107.44 ± 0.13	3.05
6	152.4 ± 6.34	159.77 ± 0.13	4.57
8	203.2 ± 6.34	213.74 ± 0.15	6.10

7.2 Dimensions and Tolerance:

7.2.1 Outside Diameter—The outside diameter and tolerances shall meet the requirements of Table 4 when measured in accordance with Test Method D2122. The tolerances for out-of-roundness shall apply to pipe prior to shipment.

7.2.2 Wall Thickness—The actual wall thickness of pipe shall be the wall required to meet the physical requirements of this specification but not less than that shown in Table 4 when measured in accordance with Test Method D2122.

7.2.3 Length—Laying length shall be 20 ft (6.1 m) (or as mutually agreed upon between the purchaser and the manufacturer). A tolerance of ±1 in. (±25 mm) shall be permitted.

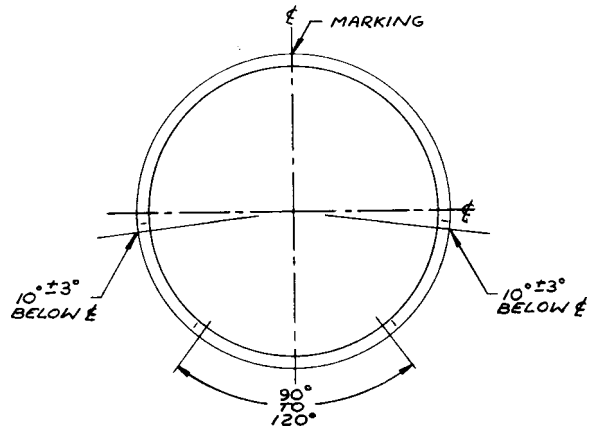
7.2.4 Perforations—Perforated pipe shall be perforated in accordance with Table 5. The perforations shall be approximately circular and cleanly cut. The spigot end, and bell, of

TABLE 4 Pipe Dimensions

in.					
Nominal Size, in.	Outside Diameter			Minimum Wall Thickness	
	Average Tolerance	Out-of-Roundness <sup>A</sup>		Type PS 28	Type PS 46
		min	max		
4	4.215 ± 0.009	4.165	4.265	0.103	0.120
6	6.275 ± 0.011	6.225	6.325	0.153	0.180
8	8.400 ± 0.012	8.325	8.475	0.205	0.240
mm					
Nominal Size, in.	Outside Diameter			Minimum Wall Thickness	
	Average Tolerance	Out-of-Roundness <sup>A</sup>		Type PS 28	Type PS 46
		min	max		
4	107.06 ± 0.22	105.80	108.34	2.62	3.05
6	159.38 ± 0.28	158.12	160.66	3.88	4.57
8	213.36 ± 0.30	212.08	214.62	5.20	6.10

<sup>A</sup>The tolerance for out-of-roundness applies only at the time of production.

TABLE 5 Perforations<sup>A</sup>



Nominal Diameter, in.	Minimum Rows of Perforations	Hole Size <sup>A</sup>		Hole Spacing <sup>A</sup>	
		mm	in.	mm	in.
4	2	4.8 to 9.7	3/16 to 3/8	82.55 ± 6.35	3 1/4 ± 1/4
6	4	4.8 to 9.7	3/16 to 3/8	82.55 ± 6.35	3 1/4 ± 1/4
8	4	4.8 to 9.7	3/16 to 3/8	82.55 ± 6.35	3 1/4 ± 1/4

<sup>A</sup>Combination of hole size and spacing of holes shall provide a minimum inlet area greater than 0.2200 in.<sup>2</sup>/ft of pipe (that is, 3/16-in. holes at 3-in. center would permit a 0.2206-in.<sup>2</sup> area).

belled-end pipe may be unperforated for a length equal to the depth of the socket or shoulder, or both.

7.2.5 Integral Bell Dimensions—Integral bell dimensions of pipe, bends, and sweeps shall comply with Table 1. Elastic seal joints shall meet dimensions recommended by the manufacturer. The thickness of the wall shall be considered satisfactory if the bell was formed from pipe meeting the requirements of this specification.

7.2.6 Sleeve-Type Coupling Dimensions—Dimensions shall be in accordance with Table 3. Sleeve-type couplings shall have a wall thickness not less than that required for pipe and shall meet the requirements of Section 8.

7.2.7 Fitting Dimensions:

7.2.7.1 Molded Fittings—See Annex A1.

7.2.7.2 Fabricated fittings are acceptable provided they are made from pipe that meets or exceeds all of the applicable requirements of this specification.

7.2.8 Bend Dimensions:

7.2.8.1 The dimensions for bends shall be as shown in Table 2.

7.2.8.2 The thickness of the wall shall be considered satisfactory if the bend was formed from Type PS 46 pipe that meets the requirements of this specification.

8. Performance Requirements

8.1 General:

8.1.1 Pipe Stiffness—The pipe stiffness (F/ΔY) values shall be in conformance with Table 6, when tested in accordance with 11.1.

8.2 Quality Control: