



Designation: **D2683—14** **D2683 – 20**

An American National Standard

Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter- Controlled Polyethylene Pipe and Tubing¹

This standard is issued under the fixed designation D2683; 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.

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

1. Scope*

1.1 This specification covers polyethylene socket-type fittings for use with outside diameter-controlled polyethylene pipe as specified by Specifications **D3035** and **D2513**. Requirements for materials, workmanship, dimensions, and pressure performance are included. Where applicable in this specification, “pipe” shall mean “pipe and tubing.”

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 8.8.2, 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.

<https://standards.iteh.ai/catalog/standards/sist/243e16e4-4a89-4e38-bbdc-33bdc43e5db2/astm-d2683-20>

2. Referenced Documents

2.1 ASTM Standards:²

- [D618 Practice for Conditioning Plastics for Testing](#)
- [D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure](#)
- [D1599 Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings](#)
- [D1600 Terminology for Abbreviated Terms Relating to Plastics](#)
- [D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings](#)
- [D2513 Specification for Polyethylene \(PE\) Gas Pressure Pipe, Tubing, and Fittings](#)
- ~~[D2657 Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings](#)~~
- [D3035 Specification for Polyethylene \(PE\) Plastic Pipe \(DR-PR\) Based on Controlled Outside Diameter](#)
- [D3350 Specification for Polyethylene Plastics Pipe and Fittings Materials](#)
- [F412 Terminology Relating to Plastic Piping Systems](#)
- [F2620 Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings](#)

¹ This specification is under the jurisdiction of ASTM Committee **F17** on Plastic Piping Systems and is the direct responsibility of Subcommittee **F17.10** on Fittings. Current edition approved Nov. 1, 2014; Nov. 1, 2020. Published December 2014; November 2020. Originally approved in 1968. Last previous edition approved in 2010 as **D2683 – 10**; **D2683 – 14**.^ε DOI: [10.1520/D2683-14](https://doi.org/10.1520/D2683-14); [10.1520/D2683-20](https://doi.org/10.1520/D2683-20).

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.

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

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 Storage³

2.4 *Plastic Pipe Institute*⁴

PPI TR-3 Policies and Procedures for Developing Hydrostatic Design Basis (HDB), Pressure Design Basis (PDB), Strength Design Basis (SDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe⁷

PPI TR-4 HDB/SDB/PDB/MRS Listed Materials, PPI Listing of Hydrostatic Design Basis (HDB), Strength Design Basis (SDB), Pressure Design Basis (PDB), and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe

3. Terminology

3.1 Definitions are in accordance with Terminology F412 and abbreviations are in accordance with Terminology D1600, unless otherwise specified. The abbreviation of polyethylene plastic is PE.

3.2 *standard thermoplastic pipe dimension ratio (SDR)*—the ratio of pipe outside diameter to wall thickness. It is calculated by dividing the average outside diameter of the pipe by the minimum wall thickness.

4. Classification

4.1 This specification covers polyethylene fittings of the socket type made as specified in 5.1 and 5.2

4.1.1 Fittings covered by this specification are normally molded. In-line fittings such as couplings, unions, bushings, caps, nipples, etc., may be extruded or machined from extruded stock. Special fittings such as transition fittings and tapping teets shall be assembled and fabricated in accordance with procedures agreed upon between the manufacturer and the purchaser.

4.1.2 Fittings covered by this specification are intended to be joined by heat fusion to PE pipe.

4.1.3 Fittings intended for use in the distribution of natural gas or petroleum fuels shall also meet the requirements of Specification D2513.

5. Materials

5.1 *Polyethylene Compound*—Polyethylene material compounds suitable for use in the manufacture of fittings under this specification shall meet Specification D3350 and shall meet the Specification D3350 classification and property requirements in Table 1, and shall have PPI TR-4 HDB and HDS listings at 73°F (23°C) and HDB listings 140°F (60°C) in accordance with Table 1.

TABLE 1 Specification D3350 Classification of Polyethylene Fittings Materials

Physical Properties	Cell Classification and Properties for Polyethylene Pipe Materials								
	PE2606	PE2706	PE2708	PE3608	PE3708	PE3710	PE4708	PE4710	
Density	2	2	2	3	3	3	4	4	
Melt Index	3 or 4	3 or 4	3 or 4	4	4	4	4	4	
Flexural modulus	≥4	≥4	≥4	≥4	≥4	≥4	≥4	≥5	
Tensile Strength	≥3	≥3	≥3	≥4	≥4	≥4	≥4	≥4	
Slow crack growth resistance (F1473)	6	7	7	6	7	7	7	7	
Hydrostatic strength classification	3	3	3	4	4	4	4	4	
Color and UV Stabilizer ^A	C or E B	C or E B	C or E B	C or E B	C or E B	C or E B	C or E B	C or E B	
HDB at 140°F (60°C), PPI TR-4, psi (MPa)	630 (4.34)	630 (4.34)	800 (5.52)	800 (5.52)	800 (5.52)	1000 (6.90)	800 (5.52)	1000 (6.90)	

^ASee 5.2.

^BListing required; consult manufacturer for listed value.

³ DLA Document Services Building 4/D 700 Robbins Avenue Philadelphia, PA 19111-5094 <http://quicksearch.dla.mil/>

⁴ Available from Plastics Pipe Institute (PPI), 105 Decker Court, Suite 825, Irving, TX 75062, <http://www.plasticpipe.org>.

5.2 *Color and Ultraviolet (UV) Stabilization*—Polyethylene material compounds shall meet Specification D3350 code C or E. Code C material compounds shall have 2 to 3 percent carbon black. Code E material compounds shall be colored with UV stabilizer.

5.3 *Rework Material*—Clean polyethylene compound from the manufacturer’s own production that met 5.1 and 5.2 as virgin material is suitable for remolding into fittings, either alone or blended with new compound of the same cell classification or material designation. Fittings containing the rework material shall meet the material and product requirements of this specification.

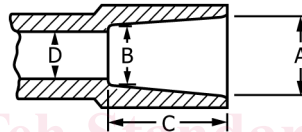
6. Requirements

6.1 Dimensions and Tolerances:

6.1.1 Fittings, sockets, dimensions, and tolerances shall be as shown in Table 2 and Table 3 when measured in accordance with 8.4. For reducing fittings, socket and inside diameter minimums for the appropriate size shall apply.

6.1.1.1 *Laying Lengths*—Laying lengths shall be in accordance with manufacturer’s specifications.

TABLE 2 Fittings for Outside Diameter-Controlled Polyethylene Pipe^A



Nominal Pipe Size, in.,	A Socket Entrance Diameter ^B			B Socket Bottom Diameter ^{C,D}			C Socket Depth, min	D Inside Diameter	
	Average Diameter	Tolerance on Diameter	Maximum Out-of-Round	Average Diameter	Tolerance on Diameter	Maximum Out-of-Round		min	max
1/2	0.810 (20.57)	+0.005 (+0.127) -0.010 (-0.254)	±0.008 (±0.203)	0.804 (20.42)	+0.005 (+0.127) -0.026 (-0.660)	±0.008 (±0.203)	0.625 (15.88)	0.648 (16.46)	0.804 (20.42)
3/4	1.020 (25.91)	±0.008 (±0.203)	±0.010 (±0.254)	1.012 (25.70)	+0.008 (+0.203) -0.012 (-0.305)	±0.010 (±0.254)	0.625 (15.88)	0.814 (20.68)	1.020 (25.91)
1	1.275 (32.38)	±0.008 (±0.203)	±0.010 (±0.254)	1.267 (32.18)	+0.008 (+0.203) -0.012 (-0.305)	±0.010 (±0.254)	0.687 (17.4)	1.020 (25.91)	1.275 (32.38)
1 1/4	1.620 (41.15)	±0.008 (±0.203)	±0.012 (±0.305)	1.612 (40.94)	+0.008 (+0.203) -0.016 (-0.406)	±0.012 (±0.305)	0.875 (22.22)	1.301 (33.04)	1.620 (41.15)
1 1/2	1.860 (47.24)	±0.010 (±0.254)	±0.012 (±0.305)	1.849 (46.96)	+0.010 (+0.254) -0.020 (-0.508)	±0.012 (±0.305)	0.875 (22.22)	1.496 (38.0)	1.859 (47.22)
2	2.335 (59.31)	±0.010 (±0.254)	±0.012 (±0.305)	2.324 (59.03)	+0.010 (+0.254) -0.020 (-0.508)	±0.012 (±0.305)	0.875 (22.22)	1.885 (47.88)	2.334 (59.28)
3	3.455 (87.76)	±0.015 (±0.381)	±0.015 (±0.381)	3.439 (87.35)	+0.015 (+0.381) -0.025 (-0.635)	±0.015 (±0.381)	1.000 (25.4)	2.780 (70.61)	3.454 (87.73)
4	4.450 (113.03)	±0.015 (±0.381)	±0.015 (±0.381)	4.434 (112.62)	+0.015 (+0.381) -0.035 (-0.889)	±0.015 (±0.381)	1.125 (28.58)	3.575 (90.80)	4.449 (113.00)

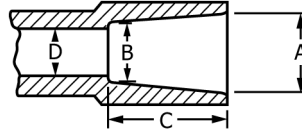
^A Minimum dimensions have zero negative tolerance. The sketches and designs of fittings are illustrative only. Entrance chamfer or radius is optional.

^B Measured at top of socket wall taper, just below entrance radius.

^C Dimensions of tools should be checked for consistency with fittings used. Socket bottom diameter must be equal to or smaller than entrance diameter.

^D Measured at bottom of socket wall taper, just above bottom radius.

TABLE 3 Fittings for Outside Diameter-Controlled Polyethylene Tubing^A



Nominal Tubing Size, in.	A Socket Entrance Diameter ^B			B Socket Bottom Diameter ^{C,D}			C	D	
	Average Diameter	Tolerance on Diameter	Maximum Out-of-Round	Average Diameter	Tolerance on Diameter	Maximum Out-of-Round	Socket Depth, min	Inside Diameter	
								min	max
	in. (mm)								
1/2	0.585 (14.86)	+0.010 (+0.25) -0.007 (-0.18)	±0.010 (±0.25)	0.575 (14.61)	+0.010 (+0.25) -0.007 (-0.18)	±0.010 (±0.25)	0.625 (15.88)	0.500 (12.70)	0.585 (14.86)
3/4	0.835 (21.21)	±0.010 (±0.25)	±0.010 (±0.25)	0.825 (20.96)	±0.010 (±0.25)	±0.010 (±0.25)	0.625 (15.88)	0.750 (19.05)	0.835 (21.21)
1	1.075 (27.30)	±0.008 (±0.20)	±0.008 (±0.20)	1.070 (27.18)	+0.008 (+0.20) -0.012 (-0.30)	±0.008 (±0.20)	0.625 (15.88)	0.850 (21.59)	1.078 (27.38)
1 1/4	1.330 (33.78)	±0.008 (±0.20)	±0.010 (±0.25)	1.322 (33.58)	±0.008 (±0.20)	±0.010 (±0.25)	0.687 (17.45)	1.250 (31.75)	1.330 (33.78)

^A Minimum dimensions have zero negative tolerance. The sketches and designs of fittings are illustrative only. Entrance chamfer or radius is optional.

^B Measured at top of socket wall taper, just below entrance radius.

^C Dimensions of tools should be checked for consistency with fittings used. Socket bottom diameter must be equal to or smaller than entrance diameter.

^D Measured at bottom of socket wall taper, just above bottom radius.

iTeh Standards

(<https://standards.iteh.ai>)
Document Preview

6.1.2 The maximum angular variation of any opening shall not be more than 2° off the true centerline axis.

6.1.3 The minimum wall thickness of fittings shall be 125 % of the minimum wall thickness of the pipe with which they are designed to be joined. For reducing fittings, the smallest size wall thickness shall be 125 % of the smallest pipe wall.

ASTM D2683-20

6.2 System Pressure Test Requirements:

<https://standards.iteh.ai/catalog/standards/sist/243e16e4-4a89-4e38-bbdc-33bdc43e5db2/astm-d2683-20>

6.2.1 Short-Term Rupture Strength—The minimum short-term rupture strength of the fitting and fused pipe shall not be less than the minimum short-term rupture strength of the pipe or tubing in the system when tested in accordance with 8.5.2. The test pressures shall be as shown in Table 4. Test specimens shall be prepared for testing as described in 8.5.1.

6.2.2 Sustained Pressure—The fitting(s) and fused pipe or tubing shall not fail (as defined in the Descriptions of Terms Section

TABLE 4 Quick Burst Minimum Hoop Stress Requirements for Water At 73°F (23°C) for SDR-PR PE Plastic Pipe Fittings^{A, B}

Material	psi	(MPa)
Density Class 2 materials	2500	(17.24)
Density Class 3 and 4 materials	2900	(20.00)

^A For outside diameter controlled pipe, calculate internal test pressure in accordance with the following formula:

$$P = \frac{2S}{\left(\frac{D_o}{t} - 1\right)}$$

Where:

- P = test pressure, psig (kPa)
- S = test pressure hoop stress, psi. (kPa)
- D_o = measured outside diameter, in. (mm), and
- t = measured minimum wall thickness, in (mm)

^BFiber Stress listed are to be calculated on the pipe being used in the test, not the fitting.

TABLE 5 Elevated Temperature Sustained Pressure Test Requirements^{A,B}

Condition	Test Temperature, °F (°C) ^B	PE2606, PE2706, PE2708 PE3608 PE3708, PE4708			PE3710, PE4710	
		Test Pressure Hoop Stress ^A , psi (kPa) ^B	Minimum Average Time Before Failure, Hours ^B	Test Pressure Hoop Stress ^A , psi (kPa) ^B	Minimum Average Time Before Failure, Hours ^B	
1	176 (80)	670 (4620)	170	750 (5170)	200	
2	176 (80)	650 (4480)	340	730 (5020)	400	
3	176 (80)	630 (4345)	510	705 (4870)	600	
4	176 (80)	610 (4210)	680	685 (4715)	800	
5	176 (80)	590 (4070)	850	660 (4565)	1000	
6	176 (80)	580 (4000)	1000	640 (4415)	1200	

^A Calculate internal test pressure in accordance with

$$P = \frac{2S}{\left(\frac{D_o}{t} - 1\right)}$$

Where:

- P = test pressure, psig (kPa)
- S = test pressure hoop stress, psi. (kPa)
- D_o = measured outside diameter, in. (mm), and
- t = measured minimum wall thickness, in (mm)

^B Test temperature tolerance $\pm 3.6^\circ\text{F}$ ($\pm 2^\circ\text{C}$). Test pressure tolerance ± 5 psi (± 35 kPa); test pressure hoop stress values are rounded to the nearest 5 psi or 5 kPa. Note: **Table 5** conditions are based on PE validation requirements per PPI TR-3 with Condition 6 being 85% of Condition 1 test pressure hoop stress and six times greater minimum average time before failure. Conditions 2 through 5 are linear stress and time interpolations between Conditions 1 and 6. The intent of multiple conditions is to maintain equivalent performance criteria, but provide for retest in the event of ductile failure. The test pressure hoop stress levels for Conditions 2-5 are linear interpolations for arbitrarily chosen time increments. An equivalent performance requirement, however, may be determined by arbitrarily choosing a test pressure hoop stress between Conditions 1 and 6 and linearly interpolating the minimum average time before failure. For example for PE3710 and PE4710 material, at 670 psi test pressure hoop stress, the minimum average time before failure would be 927 hours ($200 + (750 - 670) \times ((1200 - 200) / (750 - 640)) = 927$).

of Test Method **D1598**) at the test pressures given in **Table 5** when tested in accordance with **8.5.3**. To ensure uniformity in preparation of assemblies for sustained pressure evaluation, all test joints shall be made in accordance with heat fusion practices found in **Practice D2657F2620**.

7. Workmanship, Finish, and Appearance

7.1 The manufacture of these fittings shall be in accordance with good commercial practice so as to produce fittings meeting the requirements of this specification. Fittings shall be homogeneous throughout and free of cracks, holes, foreign inclusions, or injurious defects. The fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

8. Test Methods

8.1 **Conditioning**—Condition the test specimens at $73.473 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) for 40 h minimum prior to test in accordance with Procedure A of Methods **D618**, for those tests where conditioning is required and in all cases of disagreement.

8.2 **Test Conditions**—Conduct tests at the standard laboratory temperature of $73.473 \pm 3.6^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$).

8.3 **Sampling**—Select at random sufficient quantity of fittings from each lot of shipment and test to determine that the basic properties and dimensions are in conformance with this specification.

NOTE 1—For individual orders or specifications, only those tests and numbers of tests specifically agreed upon between the purchaser and the manufacturer need be conducted.

8.4 **Dimensions**—Measure in accordance with Test Method **D2122**.

8.4.1 Maximum out-of-round tolerance on sockets applies to the actual measured average inside diameter.

NOTE 2—*Example*—In the 1-in. IPS size, if the actual measured average inside socket entrance diameter was 1.281 in. (32.54 mm) then the extreme