Designation: F1733 – 13

Standard Specification for Butt Heat Fusion Polyamide(PA) Plastic Fitting for Polyamide(PA) Plastic Pipe and Tubing[1]

This standard is issued under the fixed designation F1733; 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 polyamide (PA) butt fusion fittings for use with polyamide pipe (IPS and ISO) and tubing (CTS). Included are requirements for materials, workmanship, dimensions, marking, sustained pressure, and burst pressure.

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 *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:*[2]

NOTE 1—For over 40 years D2513 was the singular US CFR Title 49 Part 192 referenced Standard Specification codifying the installation and use of thermoplastic gas piping in jurisdictional installations. Initially all materials (PE, PVC, ABS, CAB) were contained within the body of the standard D2513. In later years D2513 was completely reformatted to make it more user friendly by moving material-specific requirements from the standard's body to mandatory annexes. The next major change occurred late in 2009 at which time all thermoplastic materials, except polyethylene, were removed from D2513 changing its Title and Scope from a thermoplastic gas piping standard to a polyethylene-only gas piping standard. This recent change required that new standards be developed for those materials that were removed from D2513 including PA11. This causes problems for PA11 piping because it has been referenced and permitted for jurisdictional use and installation under US CFR Title 49 Part 192 as complying with D2513 and D2513 no longer has the A5 polyamide annex and Part 192 still references D2513-99 which makes for potential confusion. This puts PA11 gas piping standards into somewhat of a limbo since D2513 is now a PE-only specification is referenced in all of these standards. Therefore until Part 192 is revised to reference the new PA11 specification, F2945, PA11 has to fall back to citing the US Code referenced 1999 edition of D2513 in related standard such as this one. Until CFR Title 49 Part 192 references the newly developed thermoplastic gas piping standards for those materials removed from D2513, there will be dual references, both D2513–99 and F2945 for PA11, as seen in this standard. At which time Part 192 references F2945, the PA11 gas piping standard, all references to D2513 and this note will be removed from these standards.

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 Thermoplastic Gas Pressure Pipe, Tubing, and Fittings

D4066 Classification System for Nylon Injection and Extrusion Materials (PA)

D6779 Classification System for and Basis of Specification for Polyamide Molding and Extrusion Materials (PA)

F412 Terminology Relating to Plastic Piping Systems

F2785 Specification for Polyamide 12 Gas Pressure Pipe, Tubing, and Fittings

F2945 Specification for Polyamide 11 Gas Pressure Pipe, Tubing, and Fittings

2.2 *Federal Standard:*[3]

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

CFR Title 49 Part 192 Transportation of Natural and Other Gas By Pipeline: Minimum Federal Safety Standards

2.3 *Military Standard:*

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

2.4 *National Sanitation Foundation Standard:*

Standard No. 14 for Plastic Piping Components and Related Materials[4]

[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.

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

[4] Available from NSF International, P.O. Box 130140, 789 N. Dixboro Rd., Ann Arbor, MI 48113-0140, http://www.nsf.org.

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

3. Terminology

3.1 Definitions are in accordance with Terminology F412 and abbreviations are in accordance with Terminology D1600, unless otherwise specified.

3.2 *dimension ratio (DR) for thermoplastic pipe*—the ratio of diameter to wall thickness. For this specification it is calculated by dividing the specified outside diameter by the specified wall thickness of the fitting at its area of fusion. DRs are rounded and do not calculate exactly.

4. Classification

4.1 *General*—This specification covers butt fusion fittings intended for use with polyamide pipe and tubing.

4.1.1 Fittings covered by this specification are normally molded. Fittings may be machined from extruded or molded stock.

4.1.2 Fittings fabricated by thermal welding are not included in this specification.

4.1.3 Fittings intended for use in the distribution of natural gas or petroleum fuels shall also meet the requirements of Specification D2513–99 and Specification F2945 for PA11 materials or Specification F2785 for PA12 materials.

5. Ordering Information

5.1 When ordering fittings under this specification, the following should be specified:

5.1.1 Polyamide compound (material designation or trade name)

5.1.2 Style of fitting (tee, 90° ell, and the like)

5.1.3 Size:

5.1.3.1 Nominal diameter.

5.1.3.2 CTS, IPS, or schedule.

5.1.3.3 Dimension ratio number or schedule number.

6. Materials

6.1 *Basic Materials*—This specification covers fittings made from polyamide plastics as defined in Specifications D4066 or D6779.

NOTE 2—The PA plastic fittings intended for use in the transport of potable water should be evaluated and certified as safe for this purpose by a testing agency acceptable to the local health authority. The evaluation should be in accordance with requirements for chemical extraction, taste, and odor, that are no less restrictive than those included in National Sanitation Foundation (NSF) Standard No. 14. The seal or mark of the laboratory making the evaluation should be included on the pipe and tubing.

6.2 *Compounds*—The polyamide fittings compounds shall meet the requirements for Group 3, Class 2, and Grade 3, or Group 4, Class 2 and Grade 3 as prescribed in Specifications D4066 or D6779.

NOTE 3—Fittings produced from compounds meeting the requirements of Group 3, Class 2, and Grade 3 (PA 323) are intended for use with pipe manufactured from compounds meeting the requirements of Group 3, Class 2, and Grade 3. Fittings produced from compounds meeting the requirements of Group 4, Class 2, and Grade 3 (PA 423) are intended for use with pipe manufactured from compounds meeting the requirements of Group 4, Class 2, and Grade 3. As per the recommendations of respective resin manufacturers, no cross fusion between PA 323 pipe and fittings and PA 423 pipe and fittings is permitted.

6.3 *Rework Material*—Clean rework material generated from the manufacturer's own production may be used by the same manufacturer as long as the fittings produced conform to the requirements of this specification.

7. Requirements

7.1 *Dimensions and Tolerances:*

7.1.1 *Outside Diameter*—Nominal outside diameters of butt fusion fittings shall conform to the nominal iron pipe size (IPS) or copper tubing size (CTS) dimensions at area of fusion. These dimensions and tolerances shall be as shown in Table 1, Table 2, and Table 3 of this specification.

7.1.2 *Inside Diameter (CTS Fittings Only)*—Inside diameters of butt fusion fittings for tubing at area of fusion shall conform to the dimensions of the tubing being joined. The dimensions and tolerances for the fittings are shown in Table 3.

7.1.3 *Wall Thickness*—The wall thicknesses of butt fusion fittings shall not be less than the minimum specified for the pipe or tubing. The wall thicknesses and tolerances at the area of fusion shall be as shown in Table 3, Table 4, and Table 5 of this specification.

7.1.4 *Measurements*—These shall be made in accordance with Test Method D2122 for roundable pipe.

7.1.5 *Design Dimensions*—Overall fitting dimensions may be as preferred from a design standpoint by the manufacturer and accepted by the purchaser consistent with 7.1.3.

7.2 *Pressure Test Requirements :*

7.2.1 *Short-Term Rupture Strength for Fittings ½ to 12 in. and 90 to 315 mm, Nominal Diameter*—The minimum short-term rupture strength of the fitting and fused pipe or tubing shall not be less than the minimum short-term rupture strength of the pipe or tubing in the system when tested in accordance

TABLE 1 IPS Sizing System Outside Diameters and Tolerances for Fittings for Use with Polyamide Pipe, in.

Nominal Pipe Size	Average Outside Diameter at Area of Fusion[A]	Tolerance
½	0.840	±0.008
¾	1.050	±0.008
1	1.315	±0.010
1¼	1.660	±0.010
1½	1.900	±0.010
2	2.375	±0.010
3	3.500	±0.012
4	4.500	±0.015
6	6.625	±0.018
8	8.625	±0.025
10	10.750	±0.027
12	12.750	±0.036
14	14.000	±0.063
16	16.000	±0.072
18	18.000	±0.081
20	20.000	±0.090
21.5	21.500	±0.097
22	22.000	±0.099
24	24.000	±0.108
28	28.000	±0.126
32	32.000	±0.144
36	36.000	±0.162
42	42.000	±0.189
48	48.000	±0.216

[A] Defined as measured ¼ in. (6.4 mm) from fitting outlet extremity.

TABLE 2 ISO Sizing System (ISO 161/1) Outside Diameters and Tolerances for Fit for Use with Polyamide Pipe, (mm)

Nominal Pipe Size	Average Outside Diameter at Area of Fusion	
	Min	Max[A]
90	90.0	90.8
110	110.0	111.0
160	160.0	161.4
200	200.0	201.8
250	250.0	252.3
280	280.0	282.5
315	315.0	317.8
355	355.0	358.2
400	400.0	403.6
450	450.0	454.1
500	500.0	504.5
560	560.0	565.0
630	630.0	635.7
710	710.0	716.4
800	800.0	807.2
900	900.0	908.1
1000	1000.0	1009.0
1200	1200.0	1210.8
1400	1400.0	1412.6
1600	1600.0	1614.4

[A] Specified in ISO 3607.

with 10.5.3. These minimum pressures shall be as shown in Table 6 of this specification. Test specimens shall be prepared for testing in the manner described in 10.5.1 of this specification. The test equipment, procedures, and failures definitions shall be as specified in Test Method D1599.

7.2.2 *Short-Term Strength for Fittings 14 to 48 in. and 355 to 1600 mm, Nominal Diameter*—Fittings shall not fail when tested in accordance with 10.5.3. The minimum pressure shall be as shown in Table 6 of this specification. Test specimens shall be prepared for testing in the manner described in 10.2 of this specification. The test equipment and procedures shall be as specified in Test Method D1599.

7.2.3 *Sustained Pressure*—The fitting and fused pipe or tubing shall not fail, as defined in Test Method D1598, when tested at the time, pressures, and test temperatures selected from test options offered in Table 7. The test specimens shall be prepared for testing in the manner prescribed in 10.5.1.

8. Workmanship, Finish, and Appearance

8.1 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 other injurious defects. The fittings shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

9. Sampling

9.1 Parts made for sale under this specification should be sampled at a frequency appropriate for the end use intended. When the fittings are to be installed under a system specification the minimum requirements of that specification must be satisfied.

10. Test Methods

10.1 *General*—The test methods in this specification cover fittings to be used with pipe and tubing for gas, water, and other engineered piping systems. Test methods that are applicable from other specifications will be referenced in the paragraph pertaining to the particular test. Certain special test methods applicable to this specification only are explained in the appropriate paragraph.

10.2 *Conditioning*—Unless otherwise specified, condition the specimens prior to test at 73.4 ± 3.6°F (23 ± 2°C) for not less than 6 h in air, or 1 h in water, for those tests where conditioning is required and in all cases of disagreement. Newly molded fittings shall be conditioned 40 h prior to test.

10.3 *Test Conditions*—Conduct the tests at the standard laboratory temperature of 73.4 ± 3.6°F (23 ± 2°C) unless otherwise specified.

10.4 *Dimensions and Tolerances:*

10.4.1 *Outside Diameter*—Measure the outside diameter of the fittings at the area of fusion in accordance with the Wall Thickness section of Test Method D2122 by use of a circumferential tape readable to the nearest 0.001 in. (0.02 mm).

10.4.2 *Inside Diameter (CTS Fittings Only)*—Use a stepped plug gage to determine the inside diameter of the CTS end of the fitting. The plug gage shall be of the go/no go type and shall have ½-in. (12.7-mm) land lengths cut to the minimum inside diameter and maximum inside diameter. A fitting is unacceptable (no go) if it fits snugly on the minimum inside diameter land of the gage or if it fits loosely on the maximum diameter land of the gage.

10.4.3 *Wall Thickness*—Make a series of measurements using a cylindrical anvil tubular micrometer or other accurate device at closely spaced intervals to ensure that minimum and maximum wall thicknesses to the nearest 0.001 in. (0.02 mm) have been determined. Make a minimum of six measurements at each cross section.

10.5 *Pressure Testing:*

10.5.1 *Preparation of Specimens for Pressure Testing*—Prepare test specimens in such a manner that each, whether individual fittings or groups of fittings, is a system incorporating at least one length of pipe or tubing. Fuse all fitting outlets with the appropriate size pipe or tubing. At least one piece of pipe or tubing in the system shall have a minimum length equal to five pipe diameters.

10.5.2 *Sustained Pressure Test:*

10.5.2.1 Select the test temperature and pressures from one of the options offered in Table 7.

10.5.2.2 Select the test specimens at random and condition at the selected option test temperature. Test the fitting specimens with water, in accordance with Test Method D1598 at the selected option, stress, and hours of testing.

NOTE 4—Other test mediums and test conditions than offered in Table 7 may be used as agreed upon between the manufacturer and the purchaser.

10.5.2.3 Test six specimens at the selected option conditions and time.

TABLE 3 Diameter, Wall Thickness, and Tolerances for Fittings for Use with Polyamide Tubing

Tubing Type, in. (mm)	Nominal Tubing Size, in.	Diameter at Area of Fusion[A]				Minimum Wall Thickness, in. (mm)
		Outside, in. (mm)		Inside, in. (mm)		
		Average	Tolerance	Average	Tolerance	
0.062 (1.57)	½ CTS	0.625 (15.88)	±0.010 (±0.26)	0.495 (12.58)	±0.004 (±0.10)	0.062 (1.58)
	¾ CTS	0.875 (22.22)	±0.010 (±0.26)	0.745 (18.92)	. . .	. . .
0.090 (2.29)	½ CTS	0.625 (15.88)	±0.010 (±0.26)	0.437 (11.10)	±0.004 (±0.10)	0.090 (2.28)
	¾ CTS	0.875 (22.22)	±0.010 (±0.26)	0.687 (17.44)	±0.004 (±0.10)	0.090 (2.28)
	1 CTS	1.125 (28.58)	±0.013 (±0.34)	0.937 (23.80)	±0.005 (±0.12)	0.090 (2.28)
	1¼ CTS	1.375 (34.92)	±0.013 (±0.34)	1.187 (30.14)	±0.005 (±0.12)	0.090 (2.28)
DR 11	¾ CTS	0.875 (22.22)	±0.010 (±0.26)	0.715 (18.16)	±0.004 (±0.10)	0.077 (1.96)
	1 CTS	1.125 (28.58)	±0.013 (±0.34)	0.915 (23.24)	±0.005 (±0.12)	0.101 (2.56)
	1¼ CTS	1.375 (34.92)	±0.013 (±0.34)	1.125 (28.58)	±0.005 (±0.12)	0.121 (3.08)
DR 9.3	½ CTS	0.625 (15.88)	±0.010 (±0.26)	0.483 (12.26)	±0.004 (±0.10)	0.067 (1.70)
	¾ CTS	0.875 (22.22)	±0.010 (±0.26)	0.679 (17.24)	±0.004 (±0.10)	0.094 (2.38)
	1 CTS	1.125 (28.58)	±0.013 (±0.34)	0.873 (22.18)	±0.005 (±0.12)	0.121 (3.08)
	1¼ CTS	1.375 (34.92)	±0.013 (±0.34)	1.069 (27.16)	±0.005 (±0.12)	0.148 (3.76)

[A] Defined as measured ¼ in. (6.4 mm) from fitting outlet extremity.

TABLE 4 IPS Sizing System Wall Thickness and Tolerance at the Area of Fusion for Fittings for Use with Polyamide Pipe, in.[A,B,C]

Nominal Pipe Size	Minimum Wall Thickness									
	SCH 40	SCH 80	SDR 21	SDR 17	SDR 13.5	DR 10	DR 11.5	SDR 11	DR 9.3	SDR 9
½	0.109	0.147	. . .	. . .	. . .	. . .	. . .	0.076	0.090	. . .
¾	0.113	0.154	. . .	. . .	. . .	. . .	. . .	0.095	0.113	0.117
1	0.133	0.179	. . .	. . .	. . .	. . .	. . .	0.119	0.142	0.146
1¼	0.140	0.191	. . .	. . .	. . .	0.166	. . .	0.151	0.179	0.184
1½	0.145	0.200	. . .	. . .	. . .	. . .	. . .	0.173	0.204	0.211
2	0.154	0.218	. . .	. . .	. . .	. . .	. . .	0.216	0.256	0.264
3	0.216	0.300	. . .	. . .	0.259	. . .	0.305	0.318	0.377	0.389
4	0.237	0.337	. . .	0.264	0.333	. . .	0.392	0.409	0.484	0.500
6	0.280	0.432	0.316	0.390	0.491	. . .	0.576	0.603	0.713	0.736
8	0.322	. . .	0.410	0.508	0.639	. . .	0.750	0.785	0.928	0.958
10	0.365	. . .	0.511	0.633	0.797	. . .	0.935	0.978	1.156	1.194
12	0.406	. . .	0.608	0.750	0.945	. . .	1.109	1.160	1.371	1.417
14	. . .	. . .	0.667	0.824	. . .	. . .	. . .	1.273	1.505	1.556
16	. . .	. . .	0.762	0.941	. . .	. . .	. . .	1.455	1.720	1.778
18	. . .	. . .	0.857	1.059	. . .	. . .	. . .	1.636	1.935	2.000
20	. . .	. . .	0.952	1.176	. . .	. . .	. . .	1.818	2.151	2.222
21.5	. . .	. . .	1.024	1.265	. . .	. . .	. . .	. . .	. . .	. . .
22	. . .	. . .	1.048	1.294	. . .	. . .	. . .	2.000	2.366	2.444
24	. . .	. . .	1.143	1.412	. . .	. . .	. . .	2.182	2.581	. . .
28	. . .	. . .	1.333	1.647	. . .	. . .	. . .	2.545	. . .	. . .
32	. . .	. . .	1.524	1.882	. . .	. . .	. . .	2.909	. . .	. . .
36	. . .	. . .	1.714	2.118	. . .	. . .	. . .	. . .	. . .	. . .
42	. . .	. . .	2.000	2.471	. . .	. . .	. . .	. . .	. . .	. . .
48	. . .	. . .	2.286	. . .	. . .	. . .	. . .	. . .	. . .	. . .

[A] Tolerance +20 %, −0 %.
[B] For those SDR groups having overlapping thickness requirements, a manufacturer may represent their product as applying to the combination (for example, 11.0/11.5) so long as their product falls within the dimensional requirements of both DR's.
[C] For wall thicknesses not listed the minimum wall thickness may be calculated by the average outside diameter/SDR rounded up to the nearest 0.001 in.

10.5.2.4 Failure of two of the six specimens tested shall constitute failure of the test. Failure of one of the six specimens tested is cause for retest of six additional specimens. Failure of one of the six specimens in retest shall constitute failure of the test.

10.5.3 *Minimum Hydrostatic Burst Pressure for Fittings ½ to 12 in. and 90 to 315 mm, Nominal Diameter*—The test equipment, procedures, and failure definitions shall be as specified in Test Method D1599. The hydrostatic pressure shall be increased at a uniform rate such that the specimen fails between 60 and 70 s from start of the test. Minimum failure pressures are shown in Table 6.

10.5.4 *Minimum Hydrostatic Pressure for Fittings 14 to 48 in. and 355 to 1600 mm, Nominal Diameter*—The test equipment and procedures shall be as specified in Test Method D1599. The hydrostatic pressure shall be increased at a uniform rate such that the test pressure is reached within 60 to 70 s from the start of the test. No failure should occur in the sample during the test period.

11. Product Marking

11.1 Fittings shall be marked with the following:
11.1.1 This designation: "ASTM F1733,''
11.1.2 Manufacturer's name or trademark,
11.1.3 Material designations (such as PA32312)
11.1.4 Date of manufacture or manufacturing code,
11.1.5 Size, and

TABLE 5 ISO Sizing System Wall Thickness and Tolerance at the Area of Fusion for Fittings for Use with Polyamide Pipe, (mm)[A,B,C]

Nominal Pipe Size	Minimal Wall Thickness					
	DR 41	DR 32.5	DR 26	DR 21	DR 17	DR 11
90	. . .	. . .	3.5	4.3	5.3	8.2
110	. . .	3.4	4.2	5.2	6.5	10.0
160	. . .	4.9	6.2	7.6	9.4	14.5
200	. . .	6.2	7.7	9.5	11.8	18.2
250	. . .	7.7	9.6	11.9	14.7	22.7
280	. . .	8.6	10.8	13.3	16.5	25.5
315	. . .	9.7	12.1	15.0	18.5	28.6
355	. . .	10.9	13.7	16.9	20.9	32.3
400	. . .	12.3	15.4	19.0	23.5	36.4
450	. . .	13.8	17.3	21.4	26.5	. . .
500	. . .	15.4	19.2	23.8	29.4	. . .
560	. . .	17.2	21.5	26.7	32.9	. . .
630	. . .	19.4	24.2	30.0	37.1	. . .
710	. . .	21.8	27.3	33.8	41.8	. . .
800	. . .	24.6	30.8	38.1	47.1	. . .
900	. . .	27.7	34.6	42.9	. . .	. . .
1000	24.4	30.8	38.5	47.6	. . .	. . .
1200	29.3	36.9	46.2	. . .	. . .	. . .
1400	34.1	43.1	. . .	. . .	. . .	. . .
1600	39.0	49.2	. . .	. . .	. . .	. . .

[A] Tolerance +20 %, –0 %.
[B] For those SDR groups having overlapped thickness requirements, a manufacturer may represent their product as applying to the combination (for example, 11.0/11.5) so long as their product falls within the dimensional requirements of both DR's.
[C] For wall thicknesses not listed the minimum wall thickness may be calculated by the average outside diameter/SDR rounded up to the nearest 0.001.

11.1.6 For PA 32312 fittings:
"for fusion to PA 32312 (PA11) pipe only"
For PA 42316 fittings:
"for fusion to PA 42316 (PA12) pipe only."

11.2 Where the physical size of the fitting does not allow complete marking, marking may be omitted in the following sequence: size, date of manufacture, material designation, manufacturer's name or trademark.

11.3 Where recessed marking is used, take care not to reduce the wall thickness below the minimum specified.

12. Quality Assurance

12.1 When the product is marked with this ASTM designation, F1733, the manufacturer affirms that the product was manufactured, inspected, sampled, and tested in accordance with this specification and has been found to meet the requirements of this specification.

TABLE 6 Minimum Burst Pressure Requirements at 73.4°F for Common Fitting Sizes[A]

Wall Thickness, DR, or Schedule	Nominal Diameter	Minimum Pressure, psi
DR 7	ALL[B]	1300
SDR 9	ALL[B]	975
DR 9.3	ALL[B]	945
SDR 11	ALL[B]	775
DR 11.5	ALL[B]	745
DR 15.5	ALL[B]	540
SDR 17	ALL[B]	495
SDR 21	ALL[B]	385
DR 32.5	ALL[B]	250
0.062 in. (1.575 mm)	½ CTS	860
0.062 in. (1.575 mm)	¾ CTS	590
0.062 in. (1.575 mm)	1 CTS	450
0.090 in. (2.286 mm)	½ CTS	1315
0.090 in. (2.286 mm)	¾ CTS	700
0.090 in. (2.286 mm)	1 CTS	650
0.090 in. (2.286 mm)	1¼ CTS	540
SCH 40	½ IPS	1160
SCH 40	¾ IPS	930
SCH 40	1 IPS	880
SCH 40	1¼ IPS	710
SCH 40	1½ IPS	650
SCH 40	2 IPS	590
SCH 40	3 IPS	510
SCH 40	4 IPS	435
SCH 40	6 IPS	340
SCH 40	8 IPS	310
SCH 40	10 IPS	280
SCH 40	12 IPS	265
SCH 40	16 IPS	255
SCH 40	20 IPS	240

[A] Fiber stress of 3900 psi (27 MPa) for PA32312 and PA42316.
[B] Refers to IPS and ISO diameters shown in Table 1 and Table 2.

TABLE 7 Sustained Pressure Test Options, psig (MPa)

SDR/DR	Option 1[A, B] 73°F (23°C)/1000 h	Option 2[C, B] 176°F (80°C)/170 h
DR 7	935 (6.5)	485 (3.3)
SDR 9	700 (4.8)	360 (2.5)
SDR 11	560 (3.9)	290 (2.0)
DR 15.5	385 (2.7)	200 (1.4)
SDR 17	350 (2.4)	180 (1.2)
SDR 21	280 (1.9)	145 (1.0)
DR 32.5	180 (1.2)	90 (0.6)

[A] Sustained pressure is based on stress of 2800 psi (19 MPa).
[B] All psig values were rounded to nearest 5 psig.
[C] Sustained pressure is based on stress of 1450 psi (10 MPa).

SUPPLEMENTARY REQUIREMENTS

GOVERNMENT/MILITARY PROCUREMENT

These requirements apply *only* to federal/military procurement, not domestic sales or transfers.

S1. *Responsibility for Inspection*—Unless otherwise specified in the contract or purchase order, the producer is responsible for the performance of all inspection and test requirements specified herein. The producer may use his own or any other suitable facilities for the performance of the inspection and test requirements specified herein, unless the purchaser disapproves. The purchaser shall have the right to perform any of the inspections and tests set forth in this specification where such inspections are deemed necessary to ensure that material conforms to prescribed requirements.

NOTE S1.1—In U.S. federal contracts, the contractor is responsible for inspection.

S2. *Packaging and Marking for U.S. Government Procurement:*

S2.1 *Packaging*—Unless otherwise specified in the contract, the materials shall be packaged in accordance with the supplier's standard practice in a manner ensuring arrival at destination in satisfactory condition and which will be acceptable to the carrier at lowest rates. Containers and packing shall comply with Uniform Freight Classification rules or National Motor Freight Classification rules.

S2.2 *Marking*—Marking for shipment shall be in accordance with Fed. Std. No. 123 for civil agencies and MIL-STD-129 for military agencies.

NOTE S2.1—The inclusion of U.S. Government procurement requirements should not be construed as an indication that the U.S. Government uses or endorses the products described in this specification.

POTABLE WATER REQUIREMENT

This requirement applies whenever a Regulatory Authority or user calls for the product to be used to convey or to be in contact with potable water.

S3. Products intended for contact with potable water shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard 61 or the health effects portion of NSF Standard 14 by an acceptable certifying organization when required by the regulatory authority having jurisdiction.

SUMMARY OF CHANGES

Committee F17 has identified the location of selected changes to this standard since the last issue (F1733–07) that may impact the use of this standard.

(1) Added Classification D6779 and Specifications F2945 and F2785 to 2.1.
(2) Added Specifications F2945 and F2785 to 4.1.3.
(3) Deleted parenthetical reference to D2513 in 9.1.
(4) Added -99 to D2513 reference in 9.1.
(5) Added historical Note 1 explaining rationale for changes
(6) Added D6779 to 6.1 and 6.2.