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An American National Standard

Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems[1]

This standard is issued under the fixed designation D 2846/D 2846M; 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 Department of Defense.

1. Scope

1.1 This specification covers requirements, test methods, and methods of marking for chlorinated poly(vinyl chloride) plastic hot- and cold-water distribution system components made in one standard dimension ratio and intended for water service up to and including 180°F (82°C). These components comprise pipe and tubing, socket-type fittings, street fittings, plastic-to-metal transition fittings, solvent cements, and adhesives. Requirements and methods of test are included for materials, workmanship, dimensions and tolerances, hydrostatic sustained pressure strength, and thermocycling resistance. The components covered by this specification are intended for use in residential and commercial, hot and cold, potable water distribution systems.

1.2 The products covered by this specification are intended for use with the distribution of pressurized liquids only, which are chemically compatible with the piping materials. Due to inherent hazards associated with testing components and systems with compressed air or other compressed gases some manufacturers do not allow pneumatic testing of their products. Consult with specific product/component manufacturers for their specific testing procedures prior to pneumatic testing.

NOTE 1—Pressurized (compressed) air or other compressed gases contain large amounts of stored energy which present serious saftey hazards should a system fail for any reason.

1.3 The text of this specification references notes, footnotes, and appendixes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the specification.

1.4 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

NOTE 2—Suggested hydrostatic design stresses and hydrostatic pressure ratings for pipe, tubing, and fittings are listed in Appendix X1. Design, assembly, and installation considerations are discussed in Appendix X2. An optional performance qualification and an in-plant quality control program are recommended in Appendix X3.

1.5 The following safety hazards caveat pertains only to the test method portion, Sections 9 and 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 and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D 1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure

D 1599 Test Method for Resistance to Short-Time Hydraulic Pressure of Plastic Pipe, Tubing, and Fittings

D 1784 Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

D 1898 Practice for Sampling of Plastics[3]

D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D 2444 Test Method for Determination of the Impact Resistance of Thermoplastic Pipe and Fittings by Means of a Tup (Falling Weight)

D 2837 Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products

F 402 Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

F 412 Terminology Relating to Plastic Piping Systems

F 493 Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic 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 F17.61 on Water.

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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] Withdrawn.

F 1498 Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings
F 1960 Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing
F 1961 Specification for Metal Mechanical Cold Flare Compression Fittings with Disc Spring for Crosslinked Polyethylene (PEX) Tubing
F 1807 Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing
F 2080 Specification for Cold-Expansion Fittings With Metal Compression-Sleeves for Cross-Linked Polyethylene (PEX) Pipe
F 2098 Specification for Stainless Steel Clamps for Securing SDR9 Cross-linked Polyethylene (PEX) Tubing to Metal Insert and Plastic Insert Fittings
F 2159 Specification for Plastic Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing
F 2434 Specification for Metal Insert Fittings Utilizing a Copper Crimp Ring for SDR9 Cross-linked Polyethylene (PEX) Tubing and SDR9 Cross-linked Polyethylene/Aluminum/Cross-linked Polyethylene (PEX-AL-PEX) Tubing

2.2 *ANSI Standards:*
ANSI Z17.1-1958 Preferred Numbers[4]

2.3 *Federal Standard:*
Fed. Std. No. 123 Marking for Shipments (Civil Agencies)[5]

2.4 *Military Standard:*
MIL-STD-129 Marking for Shipment and Storage[5]

2.5 *NSF Standards:*
Standard No. 14 for Plastic Piping Components and Related Materials[6]
Standard No. 61 for Drinking Water Systems Components—Health Effects[6]

3. Terminology

3.1 *Definitions:*

3.1.1 *General*—Definitions used in this specification are in accordance with Terminology F 412, unless otherwise specified. The abbreviation for chlorinated poly(vinyl chlo-ride) is CPVC. Plastic tubing denotes a particular diameter schedule of plastic pipe in which the outside diameter of the tubing is equal to the nominal size plus ⅛ in. (3.18 mm).

3.1.2 *relation between standard dimension ratio, stress, and internal pressure*—the following expression is used to relate standard dimension ratio, stress, and internal pressure for pipe and tubing:

$$2S/P = R - 1 \quad (1)$$

or

$$2\,S/P = (D_0/t) - 1 \quad (2)$$

where:

S = stress in circumferential or hoop direction, psi (MPa),
P = internal pressure, psi (MPa),
D_0 = average outside diameter, in. (mm),
t = minimum wall thickness, in. (mm), and
R = standard dimension ratio, SDR

3.1.3 *standard dimension ratio (SDR)*—a selected series of numbers in which the average outside diameter to minimum wall thickness dimension ratios are constant for all sizes of pipe and tubing in each standard dimension ratio, and which are the ANSI Z17.1 Preferred Number Series 10 modified by +1. SDR fittings shall by definition be equivalent in minimum socket wall thickness to the minimum wall thickness of the corresponding SDR and size of pipe or tubing, and the minimum body wall thickness shall be 125 % of that value.

3.1.4 *standard material designation code*—the chlorinated poly(vinyl chloride) material designation code shall consist of the abbreviation CPVC followed by two digits indicating the ASTM type and grade in Arabic numerals. Where necessary, a third and fourth digit shall be added to indicate the hydrostatic design stress for water at 73°F [23°C] in units of 100 psi [0.69 MPa].

4. Classification

4.1 *Pipe, Tubing, and Fittings*—This specification classifies CPVC 4120 pipe, tubing, and fittings by a single standard dimension ratio which shall be SDR 11, by a maximum continuous use temperature which shall be 180°F [82°C] and by nominal pipe or tubing diameters from ¼ in. [9.5 mm] through 2 in. [50 mm].

4.2 *Transition Fittings*—This specification classifies transition fittings intended for use up to and including 180°F [82°C] as CPVC-180°F on the basis of resistance to failure by thermocycling.

4.3 *Solvent Cements and Adhesives*— This specification classifies solvent cements and adhesives meeting the requirements contained herein as CPVC Solvent Cement or CPVC Adhesive.

5. Materials

5.1 *Basic Materials Description*—Chlorinated poly(vinyl chloride) plastics used to make pipe, tubing, and fittings meeting the requirements of this specification are categorized by two criteria; namely, basic short-term properties, and long-term hydrostatic strength. Sections 5.1.1 and 5.1.2 respectively define these categories.

5.1.1 *Basic Short-Term Properties*—This specification covers CPVC 41 pipe, tubing, and fittings made from plastic materials meeting the mechanical strength, heat resistance, flammability, and chemical resistance requirements for CPVC 23447 in Specification D 1784.

NOTE 3—CPVC 23447 was formerly designated as CPVC Type IV Grade 1, and is herein designated as CPVC 41. This is also used in marking pipe, tubing, or fittings.

5.1.2 *Long-Term Hydrostatic Strength*— This specification covers CPVC 41 pipe, tubing, and fittings which are further

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

[5] Available from Standardization Documents Order Desk, DODSSP, Bldg. 4, Section D, 700 Robbins Ave., Philadelphia, PA 19111-5098, http://www.dodssp.daps.mil.

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

TABLE 1 Outside Diameters, Wall Thicknesses, and Tolerances for CPVC 41, SDR 11, Plastic Pipe and Tubing[A]

Nominal Tube or Pipe Size		Outside Diameter, in. [mm] Average	Tolerance on Average	Max Out-of-Round[C]	Wall Thickness, in. [mm][B] SDR 11 Min	Tolerance
¼ Tubing		0.375 [9.5]	±0.003 [±0.08]	±0.003 [±0.08]	0.055 [1.40][D]	+0.020 [+0.51]
⅜ Tube	[10]	0.500 [12.7]	±0.003 [±0.08]	±0.003 [±0.08]	0.060 [1.52][D]	+0.020 [+0.51]
½ Tube	[15]	0.625 [15.9]	±0.003 [±0.08]	±0.004 [±0.10]	0.060 [1.52][D]	+0.020 [+0.51]
¾ Tube	[20]	0.875 [22.2]	±0.003 [±0.08]	±0.005 [±0.13]	0.080 [2.03]	+0.020 [+0.51]
1 Tube	[25]	1.125 [28.6]	±0.003 [±0.08]	±0.006 [±0.15]	0.102 [2.59]	+0.020 [+0.51]
1¼ Tube	[32]	1.375 [34.9]	±0.003 [±0.08]	±0.007 [±0.18]	0.125 [3.18]	+0.020 [+0.51]
1½ Tube	[40]	1.625 [41.3]	±0.004 [±0.10]	±0.008 [±0.20]	0.148 [3.76]	+0.020 [+0.51]
2 Tube	[50]	2.125 [54.0]	±0.004 [±0.10]	±0.010 [±0.25]	0.193 [4.90]	+0.023 [+0.58]
1½ Pipe	[40]	1.900 [48.6]	+0.006, −0.002 [+0.15, −0.05]	±0.008 [±0.20]	0.173 [4.39]	+0.021 [+0.53]
2 Pipe	[50]	2.375 [60.7]	+0.006, −0.002 [+0.15, −0.05]	±0.010 [±0.25]	0.216 [5.49]	+0.026 [+0.66]

[A] All dimensions are in inches and millimetres. (1 in. = 25.4 mm.)
[B] The minimum is the lowest wall thickness at any cross section. The maximum permitted wall thickness, at any cross section, is the minimum wall thickness plus the stated tolerance. All wall tolerances are on the plus side of the minimum requirement.
[C] The maximum out-of-roundness applies to the average measured outside diameter.
[D] For tubing sizes of ½ in. and below, wall thickness minimums are not a function of SDR.

defined by hydrostatic design stress as CPVC 4120. Pipe and tubing are so defined on the basis of long-term hydrostatic strength tests and are made from compounds having an established 180°F [82°C] hydrostatic design stress of 500 psi [3.45 MPa] or greater in accordance with Test Method D 2837. Fittings are so defined by hydrostatic sustained pressure tests on fitting assemblies, required by this specification (see 6.2), based on the hydrostatic strength of the corresponding pipe or tubing.

NOTE 4—No hydrostatic design stress, as such, exists for fittings until such time as long-term hydrostatic strength test methods for fittings are developed.

5.2 The PEX fitting ends of CPVC to PEX transition fittings shall meet the material and dimensional requirements of the corresponding PEX fitting standard.

5.3 *Rework Material*—Clean rework plastic material generated from the manufacturer's own plastic tube or fitting production may be used by the same manufacturer provided the pipe, tubing, or fittings meet all the requirements of this specification.

6. Requirements for Pipe, Tubing and Fittings

6.1 *Dimensions and Tolerances*:

6.1.1 *General*:

6.1.1.1 *Wall Minimums*—Table 1 and Table 2 show wall thickness minimums. Calculated SDR 11 fitting wall thicknesses that fall below 0.102 in. [2.59 mm] for the fitting socket bottom, or 0.128 in. [3.25 mm] for the fitting body, shall be arbitrarily increased to these values.

6.1.1.2 *Interference Fit*—The diameters and tolerances in Table 1 and Table 2 provide for socket-type joints having an interference fit based on the major diameter of pipe and tubing having a degree of out-of-roundness.

6.1.1.3 *Out-of-Roundness*—The maximum out-of-roundness requirements shown in Table 1 and Table 2 for pipe, tubing, and fittings apply to the average measured diameter.

NOTE 5—*Example*: In the 1-in. [25 mm] tubing size, if the measured average tubing diameter was 1.123 in. [28.52 mm], then the extreme measured diameters due to ovality could be 1.129 in. [28.68 mm] maximum and 1.117 in. [28.37 mm] minimum.

6.1.2 *Pipe and Tubing*:

6.1.2.1 *Outside Diameter and Wall Thickness*—The outside diameters and wall thicknesses for pipe and tubing shall meet the requirements for dimension and tolerance given in Table 1 when measured in accordance with Test Method D 2122.

6.1.2.2 *Wall Thickness Range*—The wall thickness range for pipe and tubing shall be within 12 % when measured in accordance with Test Method D 2122.

6.1.2.3 *Flattening*—There shall be no evidence of splitting, cracking, or breaking when the pipe is tested in accordance with 9.2.

6.1.2.4 *Length*—Pipe and tubing supplied in straight lengths shall have a tolerance on any specified length of +½ , −0 in. [+12.5, −0 mm].

6.1.3 *Socket-Type Fittings*:

6.1.3.1 *Dimensions*—Fitting sockets, inside diameters (waterways), wall thicknesses, laying lengths, and reducing bushing minimums shall meet the requirements for dimension and tolerance given in Table 2, Table 3, and Table 4 when measured in accordance with Test Method D 2122. The spigot ends of street fittings shall meet the outside diameter and minimum wall requirements of Table 1.

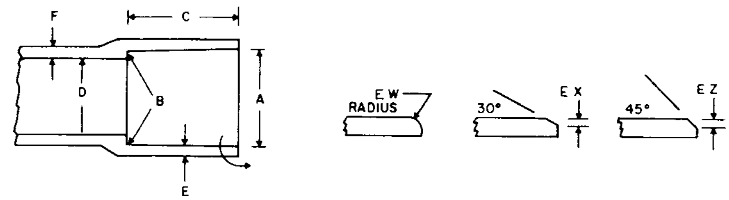
6.1.3.2 *Alignment*—The maximum angular variation of any socket opening shall not exceed ½ ° off the true centerline axis.

6.1.4 *Plastic-to-Metal Transition Fittings*:

6.1.4.1 *Basic Dimensions*—Plastic parts of plastic-to-metal transition fittings shall meet the dimensional requirements of Table 1 and Table 2, where applicable, with the following exceptions. Such parts shall be exempted from the requirements for inside diameter (waterway) and wall thickness tolerance.

6.1.4.2 *Threads*—For all fittings having taper pipe threads, threads shall conform to Specification F 1498 and be gaged in accordance with 9.5.

TABLE 2 Tapered Socket Dimensions for CPVC 41, SDR 11, Plastic Pipe and Tubing Fittings[A,B]

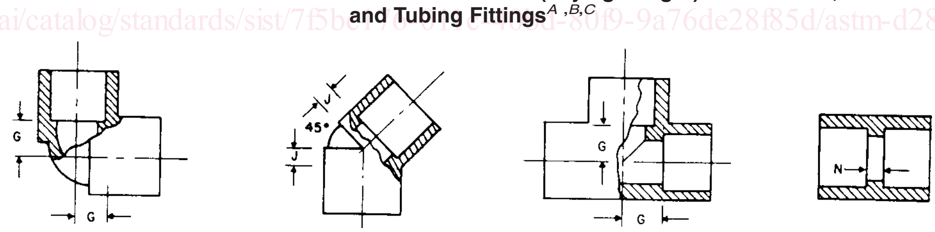


Nominal Tube or Pipe Size		*A* Socket Entrance Diameter, in. [mm]			*B* Socket Bottom Diameter, in. [mm]		
		Average	Tolerance on Average	Max Out-of-Round[C]	Average	Tolerance on Average	Max Out-of-Round[C]
⅜ Tube	[10]	0.508 [12.90]	±0.003 [±0.08]	±0.003 [±0.08]	0.494 [12.55]	±0.003 [±0.08]	±0.003 [±0.08]
½ Tube	[15]	0.633 [16.08]	±0.003 [±0.08]	±0.004 [±0.10]	0.619 [15.72]	±0.003 [±0.08]	±0.004 [±0.10]
¾ Tube	[20]	0.884 [22.45]	±0.003 [±0.08]	±0.005 [±0.13]	0.870 [22.10]	±0.003 [±0.08]	±0.005 [±0.13]
1 Tube	[25]	1.135 [28.83]	±0.003 [±0.08]	±0.006 [±0.15]	1.121 [28.47]	±0.003 [±0.08]	±0.006 [±0.15]
1¼ Tube	[32]	1.386 [35.20]	±0.003 [±0.08]	±0.007 [±0.18]	1.372 [34.85]	±0.003 [±0.08]	±0.007 [±0.18]
1½ Tube	[40]	1.640 [41.66]	±0.004 [±0.10]	±0.008 [±0.20]	1.622 [41.20]	±0.004 [±0.10]	±0.008 [±0.20]
2 Tube	[50]	2.141 [54.38]	±0.004 [±0.10]	±0.010 [±0.25]	2.123 [53.92]	±0.004 [±0.10]	±0.010 [±0.25]
1½ Pipe	[40]	1.918 [48.72]	±0.004 [±0.10]	±0.008 [±0.20]	1.900 [48.26]	±0.004 [±0.10]	±0.008 [±0.20]
2 Pipe	[50]	2.393 [60.78]	±0.004 [±0.10]	±0.010 [±0.25]	2.375 [60.33]	±0.004 [±0.10]	±0.010 [±0.25]

C Socket Length, min, in. [mm]	*D* Inside Diameter, min, in. [mm]	Wall Thickness, min,[D] in. [mm]			Entrance; min *EW EX EZ*, in. [mm]
		(E_a) Socket Entrance	(E_b) Socket Bottom	*F*	
0.500 [12.70]	0.364 [9.25]	0.068 [1.73]	0.102 [2.59]	0.128 [3.25]	0.034 [0.86]
0.500 [12.70]	0.489 [12.42]	0.068 [1.73]	0.102 [2.59]	0.128 [3.25]	0.034 [0.86]
0.700 [17.78]	0.715 [18.16]	0.080 [2.03]	0.102 [2.59]	0.128 [3.25]	0.034 [0.86]
0.900 [22.86]	0.921 [23.39]	0.102 [2.59]	0.102 [2.59]	0.128 [3.25]	0.034 [0.86]
1.100 [27.94]	1.125 [28.58]	0.125 [3.18]	0.125 [3.18]	0.156 [3.96]	0.042 [1.07]
1.300 [33.02]	1.329 [33.76]	0.148 [3.76]	0.148 [3.76]	0.185 [4.70]	0.049 [1.24]
1.700 [43.18]	1.739 [44.17]	0.193 [4.90]	0.193 [4.90]	0.241 [6.12]	0.064 [1.63]
1.375 [34.92]	1.494 [37.95]	0.173 [4.39]	0.173 [4.39]	0.216 [5.49]	0.058 [1.47]
1.500 [38.10]	1.933 [49.10]	0.216 [5.49]	0.216 [5.49]	0.270 [6.86]	0.072 [1.83]

[A] All dimensions are in inches and millimetres. (1 in. = 25.4 mm.)
[B] All sketches and designs of fittings are illustrative only.
[C] Maximum out-of-roundness applies to the average measured inside diameter.
[D] The minimum is the lowest wall thickness at any cross section.

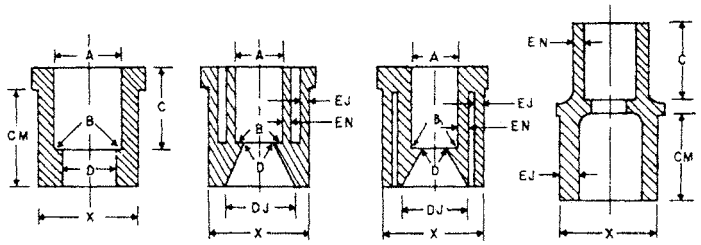
TABLE 3 Minimum Dimensions from Center to End of Socket (Laying Length) for CPVC 41, SDR 11 Plastic Pipe and Tubing Fittings[A,B,C]



Nominal Tube or Pipe Size		*G* Min[D], in. [mm]	*J* Min[D], in. [mm]	*N* Min[D], in. [mm]
⅜ Tube	[10]	0.359 [9.12]	0.174 [4.42]	0.102 [2.59]
½ Tube	[15]	0.382 [9.70]	0.183 [4.65]	0.102 [2.59]
¾ Tube	[20]	0.507 [12.88]	0.235 [5.97]	0.102 [2.59]
1 Tube	[25]	0.633 [16.08]	0.287 [7.29]	0.102 [2.59]
1¼ Tube	[32]	0.758 [19.25]	0.339 [8.61]	0.102 [2.59]
1½ Tube	[40]	0.884 [22.45]	0.391 [9.93]	0.102 [2.59]
2 Tube	[50]	1.134 [28.83]	0.495 [12.57]	0.102 [2.59]
1½ Pipe	[40]	1.022 [25.96]	0.448 [11.38]	0.102 [2.59]
2 Pipe	[50]	1.260 [32.00]	0.547 [13.89]	0.102 [2.59]

[A] All dimensions are in inches and millimetres. (1 in. = 25.4 mm.)
[B] All dimensions not shown shall be in accordance with those in Table 2.
[C] The sketches and designs of fittings are illustrative only.
[D] Minimum dimensions have zero negative tolerance.

TABLE 4 Dimensions of Reducer Bushings for CPVC 41, SDR 11, Socket-Type, Plastic Pipe and Tubing Fittings[A,B,C,D]



[A] Tubing socket dimensions, *A*, *B*, and *C*, and tolerances on these dimensions shall be the same as in Table 2. The minimum length of the male end of the bushing or coupling, *CM*, shall be the same as *C* in Table 2, but in any case the male end shall bottom in the mating fitting. Minimum waterway dimensions, *D* and *DJ*, shall be the same as *D* in Table 2. Minimum wall dimensions, *EJ* and *EN*, apply to the larger and smaller sizes joined respectively, and shall be the same as the corresponding values for E_a in Table 2.

[B] The minimum socket wall thickness for reducing bushings shall be 102 in. [2.59 mm]. If the socket wall thickness exceeds the total of *EJ* and *EN* calculated from the appropriate E_b values in Table 2 and the reducer bushing is cored, the inner socket shall be reinforced from the outer wall by a minimum of three ribs extending the full depth of the coring.

[C] The transition from *D* to *DM* shall be straight, tapered as shown, or radiused, at the discretion of the manufacturer.

[D] A taper on the male end of a bushing is optional. If a taper is used, it shall be a positive taper in the same direction as the taper in the socket. Whether a taper is used or not, all diameters *X* shall conform to the diameter and tolerance for the corresponding size of tubing shown in Table 1.

6.1.5 *CPVC to PEX Transition Fittings:*

6.1.5.1 Basic Dimensions:

(1) CPVC spigot-ends of CPVC to PEX fittings shall meet the dimensional requirements of Table 1, where applicable, with the following exceptions. Such parts shall be exempted from the requirements for inside diameter (waterway) and wall thickness tolerance and,

(2) CPVC tapered socket-ends of CPVC to PEX transition fittings shall meet the dimensional requirements of Table 2 where applicable.

(3) The PEX fitting end of CPVC to PEX transition fittings shall meet the applicable requirements of the corresponding ASTM fitting standard. See the following specifications for these requirements: F 1960, F 1961, F 1807, F 2080, F 2098, F 2159 and F 2434.

6.2 *Hydrostatic Sustained Pressure*:

6.2.1 *General*—Pipe, tubing, and fittings (tested as assemblies) shall meet the minimum hydrostatic sustained pressure requirements of both test conditions shown in Table 5 when tested in accordance with 9.2.

6.2.2 *Pipe and Tubing Quality*—Test Condition B shall be termed the primary sustained pressure test for pipe and tubing and shall be used for quality control (see Appendix X3). Test Condition A shall be termed the secondary sustained pressure test for pipe and tubing and shall be used for periodic performance qualification. Failure to pass either test is cause for rejection.

6.2.3 *Fitting Quality*—Test Condition A shall be termed the primary sustained pressure test for fittings and shall be used for quality control (see Appendix X3). Test Condition B shall be termed the secondary sustained pressure test for fittings and shall be used for periodic performance qualification. Failure to pass either test is cause for rejection.

NOTE 6—Drop weight impact resistance is correlatable with hydrostatic sustained pressure resistance for CPVC 41 components, and may be useful for predicting compliance with the sustained pressure requirements of Table 5. Such correlations will necessarily differ with the size, wall thickness, and geometry of individual components. Test Method D 2444 using Tup A and Holder A is suggested for nominal diameters of 1 in. [25 mm] and above. For smaller components, a guided mandrel type of impacter such as the Gardner Impacter[7] equipped with a ½ in. [12.7 mm] radius mandrel is suggested. Drop impact is not included in this specification directly as a quality requirement because of the wide test scatter normally associated with this test, and also because of the wide differences in value over the range of sizes and components covered in this specification.

TABLE 5 Minimum Hydrostatic Sustained Pressure Requirements for CPVC 4120, SDR 11, Pipe, Tubing, and Fitting Assemblies Tested in Either Water or Air Bath External Environment at 180°F [82°C][A]

Test Condition	Test Duration	Hydrostatic Test Pressure	
		Water Bath	Air Bath
A	6 min	521 psi [3 590 kPa]	551 psi [3 800 kPa]
B	4 h	364 psi (2 510 kPa)	403 psi [2 780 kPa]

[A] Test conditions were calculated from the following experimentally derived, 95 % confidence, rupture pressure versus time relationships for CPVC 41, SDR 11, pipe and tubing at 180°F [82°C]. Pressure, *P*, and time, *t*, are in psi and h respectively. The 50 % confidence relationships are given for information only.

log P = –0.085155 log t + 2.726805 (50 % confidence in air)
log P = –0.085155 log t + 2.656225 (95 % confidence in air)
log P = –0.097269 log t + 2.690464 (50 % confidence in water)
log P = –0.097269 log t + 2.619884 (95 % confidence in water)

6.3 *Thermocycling*—Transition fittings (other than metal socket-type transitions for use with adhesives), assembled according to the manufacturer's instructions, shall not separate or leak when thermocycled 1000 times between the temperatures of 60°F and 180°F [16°C and 82°C] in accordance with 9.3.[8]

7. Requirements for Solvent Cement and Adhesive Joints

7.1 *CPVC Solvent Cements*:

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

[8] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR: F17–1039.

TABLE 6 Minimum Hydrostatic Burst Strength Requirements for Nominal 2-in. [50-mm] CPVC Solvent Cemented Joints after 2 h Drying at Test Temperature

Temperature	Burst Pressure
73.4°F [23°C]	400 psi [2 760 kPa]
180°F [82°C]	200 psi [1 380 kPa]

NOTE 7—CPVC solvent cements may exist which meet the requirements of the specification when used in accordance with the manufacturer's recommendations, without a primer or cleaner. It is recommended that those CPVC solvent cements which may be used without a primer or cleaner be clear or yellow in color. Otherwise, it is recommended that CPVC solvent cement requiring the use of a primer or cleaner be orange in color. Color identification is recommended to facilitate cement recognition, to prevent the misuse of the cement and to minimize the unintentional use of other cements that may fail at elevated service temperatures.

7.1.1 *General*—CPVC solvent cements, for use in CPVC 41, plastic-to-plastic, socket-type joints shall meet the requirements set forth in Specification F 493.

7.1.2 *Hydrostatic Burst Strength*—2-in. [50-mm] CPVC solvent cement joints shall exceed the minimum hydrostatic burst strength requirements given in Table 6 after a maximum drying interval of 2 h when tested in accordance with 10.1.1. Failure to pass the burst requirement at either temperature is cause for rejection.

7.1.3 *Hydrostatic Sustained Pressure Strength*—½-in. [15-mm] CPVC solvent cement joints shall meet the requirements of 6.2 when tested in accordance with 9.3.

7.1.4 *Safe Handling of Solvent Cement*— Refer to Practice F 402.

7.2 *CPVC Adhesives*:

7.2.1 *General*—CPVC adhesives (other than CPVC solvent cement), shall qualify for use in CPVC socket-type joints by a rigorous simulated use testing program as further defined in 7.2.2 and 7.2.3. CPVC adhesives shall be tested in the largest size joint and in the exact type of joint for which they are intended; that is, 2-in. [50-mm] plastic-to-metal or 2-in. [50-mm] plastic-to-plastic.

7.2.2 *Hydrostatic Sustained Pressure Strength*—Socket-type CPVC adhesive joints, made and cured according to the adhesive manufacturer's instructions, shall not separate or leak when tested in accordance with 10.2 at the hydrostatic sustained pressure condition given in Table 7.

7.2.3 *Thermocycling*—Socket-type CPVC adhesive joints, made and cured according to the adhesive manufacturer's instructions, shall not separate or leak when thermocycled 10 000 times between the temperatures of 60°F and 180°F [16°C and 82°C] in accordance with 10.2.

8. Workmanship, Finish, and Appearance

8.1 *Workmanship*—The pipe and fittings shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, or other defects. The pipe shall be as uniform as commercially practicable in color, opacity, density, and other physical properties.

9. Test Methods for Pipe, Tubing, and Fittings

9.1 *Sampling*—A sufficient quantity of pipe, tubing, or fittings, as agreed upon between the purchaser and the seller, shall be selected from each lot or shipment and tested to determine conformance with this specification (see Practice D 1898). In the case of no prior agreement, random samples selected by the testing laboratory shall be deemed adequate.

TABLE 7 Minimum Hydrostatic Sustained Pressure Requirements for CPVC Socket-Type Adhesive Joint Assemblies Tested Either in Water Bath or Air Bath External Environment at 180°F [82°C][A]

Test Duration, h	Test Pressure	
	Water Bath	Air Bath
10 000	170 psi [1 170 kPa)	207 psi (1 430 kPa)

[A] Test conditions were calculated from the experimentally derived, 95 % confidence limit, rupture pressure versus time relationships for CPVC 41, SDR 11, pipe and tubing noted in Table 5. It is implied that CPVC adhesive joints meeting the sustained pressure requirements of 7.2.2 would necessarily pass the less rigorous requirements of 6.2.1.

9.1.1 *Test Specimens*—Not less than 50 % of the test specimens required for any pressure test shall have at least a part of the marking in their central sections. The central section is that portion of pipe which is at least one pipe diameter away from an end closure.

9.2 *Flattening*—Flatten three specimens of the pipe, 2 in. [50-mm] long, between parallel plates in a suitable press until the distance between the plates is 40 % of the outside diameter of the pipe or the walls of the pipe touch, whichever occurs first. The rate of loading shall be uniform and such that the compression is completed within 5 min. Upon removal of the load, examine the specimens for evidence of splitting, cracking, or breaking.

9.3 *Hydrostatic Sustained Pressure*:

9.3.1 *Summary of Test Method*—This test method describes a pass-fail test for CPVC 41 pipe, tubing, or fittings (tested as assemblies) subjected to a constant internal hydrostatic pressure for a predetermined period of time. Test conditions are based on known rupture pressure versus time relationships for standard CPVC 41 components (see footnote to Table 5). The external test environment shall be either water or air; however, test pressures differ depending on the environment selected (see Table 5).

9.3.2 *Apparatus*:

9.3.2.1 *Constant-Temperature Environment*—Either a water bath or an air bath capable of maintaining a constant and uniform temperature of 180 ± 1.8°F [82 ± 1°C] throughout.

9.3.2.2 *Pressurizing System*—A pressure source capable of rapidly and continuously applying a constant hydrostatic pressure, controlled to ±10 psi [±69 kPa] or better, to the test specimens.

9.3.2.3 *Timing Device*—Any clock capable of accuracy to within 1 % of the total test time.

9.3.2.4 *Closure Fittings*—Any suitable specimen closure that allows "free-end" mounting, is free of leaks, and will not contribute to end failures.

NOTE 8—Various types of compression and flared, metal fittings have been found to be acceptable. Socket-type CPVC 41 caps are also acceptable provided that the necessary solvent cemented or adhesive joints are suitably dried or cured (refer to 9.3.3.2).

9.3.3 *Sampling and Specimen Preparation*: