



## Standard Specification for Socket-Type Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40<sup>1</sup>

This standard is issued under the fixed designation F 438; 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—Table 3 was editorially updated in April 2003.

### 1. Scope

1.1 This specification covers chlorinated poly(vinyl chloride) (CPVC) Schedule 40 socket-type pipe fittings. Included are requirements for materials, workmanship, dimensions, and burst pressure.

NOTE 1—The CPVC fittings covered by this standard were covered previously in Specification D 2466.

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 2—Pressurized (compressed) air or other compressed gases contain large amounts of stored energy which present serious safety 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 inch-pound units are to be regarded as the standard. The values in parentheses are given for information only.

1.5 The following safety hazards caveat pertains only to the test method portion, Section 8, 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:

- D 618 Practice for Conditioning Plastics for Testing<sup>2</sup>
- D 1599 Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings<sup>3</sup>
- D 1600 Terminology for Abbreviated Terms Relating to Plastics<sup>2</sup>
- D 1784 Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds<sup>2</sup>
- D 2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings<sup>3</sup>
- D 2749 Symbols for Dimensions of Plastic Pipe Fittings<sup>3</sup>
- F 412 Terminology Relating to Plastic Piping Systems<sup>3</sup>
- F 1498 Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings<sup>3</sup>

#### 2.2 Federal Standard:

- Fed. Std. No. 123 Marking for Shipment (Civil Agencies)<sup>4</sup>

#### 2.3 Military Standard:

- MIL-STD-129 Marking for Shipment and Storage<sup>5</sup>

#### 2.4 NSF Standard:

- Standard No. 14 for Plastic Piping Components and Related Materials<sup>5</sup>

### 3. Terminology

#### 3.1 Definitions:

3.1.1 Definitions are in accordance with Terminology F 412 and abbreviations are in accordance with Terminology D 1600, unless otherwise indicated. The abbreviation for chlorinated poly(vinyl chloride) is CPVC.

<sup>2</sup> Annual Book of ASTM Standards, Vol 08.01.

<sup>3</sup> Annual Book of ASTM Standards, Vol 08.04.

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

<sup>5</sup> Available from the National Sanitation Foundation, P.O. Box 1468, Ann Arbor, MI 48106.

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.10 on Fittings.

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## 4. Classification

4.1 *General*—This specification covers Schedule 40 CPVC pipe fittings, socket-type, intended for use with Iron Pipe Size (IPS) outside-diameter plastic pipe.

4.1.1 Fittings covered by this specification are normally molded. In-line fittings, such as couplings, unions, bushings, caps, nipples, etc., shall be molded or machined from extruded stock.

4.1.2 Fittings fabricated by backwelding are not included in this specification.

## 5. Materials and Manufacture

5.1 This specification covers CPVC pipe fittings made from compounds meeting the requirements of Class 23447 as defined in Specification D 1784.

NOTE 3—Mechanical strength, heat resistance, flammability, and chemical resistance requirements are covered in Specification D 1784.

5.2 *Rework Material*—The manufacturers shall use only their own clean rework fitting material and the fittings produced shall meet all the requirements of this specification.

## 6. Requirements

### 6.1 *Dimensions and Tolerances:*

6.1.1 Fitting sockets, inside diameters (waterways), minimum wall thicknesses, and dimensions shall be as shown in Table 1, Table 2, and Table 3 when measured in accordance with Test Method D 2122.

6.1.2 When multistep reducer bushings are cored out, the inner socket shall be reinforced from the outer wall by a minimum of three ribs extending from the top of the inner socket in the deepest extremity of the coring. The transition from D to DJ (Table 3) shall be straight, tapered as shown, or radiused. A positive taper in the same direction of the taper in the socket on the outside diameter of the bushing is optional.

6.1.3 The maximum angular variation of any opening shall be not more than  $\frac{1}{2}^\circ$  off the true centerline axis.

6.1.4 The minimum wall thickness of fittings shall be 125 % of the minimum wall thickness of the corresponding size of Schedule 40 pipe for which they are designed to be used, except that for the socket, the wall thickness shall be at least equal to the minimum wall thickness of the corresponding size of Schedule 40 pipe. For any threaded transition fitting the minimum wall thickness of the threaded portion shall be at least equal to the thickness of material under the thread root of threaded Schedule 80 pipe of the same size.

6.1.5 The minimum inside diameter of the fittings shall be not less than the minimum specified inside diameter of the corresponding size of Schedule 40 pipe. Any fitting having a male thread shall have an internal diameter not larger than Schedule 80 pipe of the same size.

6.1.6 Minimum dimensions have zero negative tolerance. Tolerances on other dimensions are shown in Table 1 and Table 3.

6.2 *Threads*—For all fittings having taper pipe threads, threads shall conform to Specification F 1498 and be gaged in accordance with 8.4.

### 6.3 *Burst Pressure:*

6.3.1 The minimum burst strength of the fittings shall be not less than that calculated for the size and wall thickness of the pipe with which it is to be used, when calculated from the following equation:

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

where:

$S$  = hoop stress, psi (or MPa),

$P$  = internal pressure, psi (or MPa),

$D_o$  = average outside diameter, in. (or mm), and

$t$  = minimum wall thickness, in. (or mm).

Fittings tested in accordance with 8.5 shall withstand the minimum burst pressure shown in Table 4.

6.3.2 Pressures shown are minimum burst pressures and do not imply rated working pressures. The burst pressure shall be used only as an indication of quality.

## 7. Workmanship, Finish, and Appearance

7.1 The fittings shall be homogeneous throughout and free of cracks, holes, foreign inclusions, or other 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  $73.4 \pm 3.6^\circ\text{F}$  ( $23 \pm 2^\circ\text{C}$ ) and  $50 \pm 5\%$  relative humidity for not less than 40 h prior to test in accordance with Procedure A of Practice D 618, for those tests where conditioning is required.

8.2 *Test Conditions*—Conduct tests in the Standard Laboratory Atmosphere of  $73.4 \pm 3.6^\circ\text{F}$  ( $23 \pm 2^\circ\text{C}$ ) and  $50 \pm 5\%$  relative humidity, unless otherwise specified in the test methods or in this specification.

8.3 *Sampling*—A sufficient quantity of fittings as agreed upon between the seller and the purchaser shall be selected at random from each lot or shipment and tested to determine that the basic design is in conformance with this specification.

NOTE 4—For individual orders or specifications where supplemental tests are required, only those tests and numbers of tests specifically agreed upon between the purchaser and the seller need be conducted.

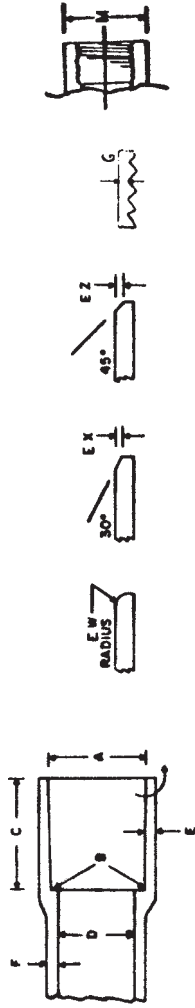
8.4 *Threads*—All taper pipe threads shall be gaged in accordance with Specification F 1498.

8.5 *Burst Pressure*—Determine the minimum burst pressure in accordance with Test Method D 1599. The time of testing each specimen shall be between 60 and 70 s.

8.5.1 *Apparatus*—Fittings shall be tested while held in a test jig constructed in such a manner as to seal the socket by means of O-rings, or gaskets but not to reinforce or support the fittings, except where contact is necessary because of the shape of the fitting to keep the fitting in the test jig. Such contact shall be held to the minimum. The socket plug portion of the test fixture must extend one third to two thirds of the socket depth. Failure of any part of the test apparatus does not constitute failure of the fittings.

## 9. Retest and Rejection

9.1 If the results of any test(s) do not meet the requirements of this specification, the tests(s) shall be conducted again only

**TABLE 1 Tapered Sockets for CPVC Pipe Fittings, Schedule 40, in. (mm)<sup>A</sup>**


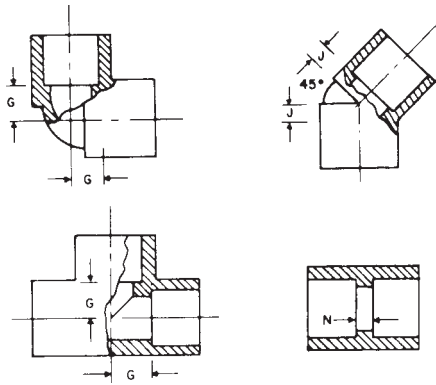
Nominal Pipe Size	A Socket Entrance Diameter		B Socket Bottom Diameter		C <sup>B</sup> Socket min in. (mm)	D <sup>C</sup> Inside Diameter, min in. (mm)	Wall Thickness, min		Entrance, min	
	Diameter in. (mm)	Tolerance on Diameter in. (mm)	Diameter in. (mm)	Tolerance on Diameter in. (mm)			E in. (mm)	F in. (mm)	EW in. (mm)	EX, EZ in. (mm)
1/4	0.552 (14.02)	±0.004 (0.10)	0.536 (13.6)	±0.004 (0.10)	0.500 (12.70)	0.320 (8.13)	0.088 (2.23)	0.110 (2.79)	1/64 (0.40)	1/32 (0.79)
3/8	0.687 (17.45)	±0.004 (0.10)	0.671 (17.04)	±0.004 (0.10)	0.594 (15.08)	0.449 (11.40)	0.091 (2.31)	0.114 (2.90)	1/32 (0.79)	1/16 (1.59)
1/2	0.848 (21.54)	±0.004 (0.10)	0.836 (21.23)	±0.004 (0.10)	0.688 (17.48)	0.578 (14.68)	0.109 (2.76)	0.136 (3.45)	1/32 (0.79)	1/16 (1.59)
3/4	1.058 (26.87)	±0.004 (0.10)	1.046 (26.57)	±0.004 (0.10)	0.719 (18.26)	0.740 (18.80)	0.113 (2.87)	0.141 (3.58)	1/32 (0.79)	1/16 (1.59)
1	1.325 (33.66)	±0.005 (0.13)	1.310 (33.27)	±0.005 (0.13)	0.875 (22.23)	0.990 (25.15)	0.133 (3.38)	0.166 (4.22)	1/16 (1.59)	1/8 (3.18)
1 1/4	1.670 (42.42)	±0.005 (0.13)	1.655 (42.04)	±0.005 (0.13)	0.938 (23.83)	1.335 (33.91)	0.140 (3.56)	0.175 (4.45)	1/16 (1.59)	1/8 (3.18)
1 1/2	1.912 (48.56)	±0.006 (0.15)	1.894 (48.10)	±0.006 (0.15)	1.094 (27.79)	1.564 (39.73)	0.145 (3.68)	0.181 (4.60)	1/16 (1.59)	1/8 (3.18)
2	2.387 (60.63)	±0.006 (0.15)	2.369 (60.17)	±0.006 (0.15)	1.156 (29.36)	2.021 (51.33)	0.154 (3.91)	0.193 (4.90)	1/16 (1.59)	1/8 (3.18)
2 1/2	2.889 (73.38)	±0.007 (0.18)	2.868 (72.85)	±0.007 (0.18)	1.750 (44.45)	2.414 (61.32)	0.203 (5.16)	0.254 (6.45)	3/32 (2.38)	1/4 (3.18)
3	3.516 (89.31)	±0.008 (0.20)	3.492 (88.70)	±0.008 (0.20)	1.875 (47.63)	3.008 (76.40)	0.216 (5.49)	0.270 (6.86)	3/32 (2.38)	1/4 (3.18)
3 1/2	4.016 (102.01)	±0.008 (0.20)	3.992 (101.40)	±0.008 (0.20)	2.000 (50.80)	3.486 (88.54)	0.226 (5.74)	0.283 (7.19)	3/32 (2.38)	1/4 (3.18)
4	4.518 (114.76)	±0.009 (0.23)	4.491 (114.07)	±0.009 (0.23)	2.000 (50.80)	3.961 (100.61)	0.237 (6.02)	0.296 (7.52)	3/32 (2.38)	1/4 (3.18)
5	5.583 (141.81)	±0.010 (0.25)	5.553 (141.05)	±0.010 (0.25)	3.000 (76.20)	4.975 (126.37)	0.258 (6.55)	0.323 (8.20)	3/32 (2.38)	1/4 (3.18)
6	6.647 (168.83)	±0.011 (0.28)	6.614 (168.00)	±0.011 (0.28)	3.000 (76.20)	5.986 (152.04)	0.280 (7.11)	0.350 (8.89)	1/8 (3.18)	3/16 (4.76)

<sup>A</sup> The sketches and designs of fittings are illustrative only.

<sup>B</sup> Socket depth, measured from socket entrance face to socket bottom face.

<sup>C</sup> See 6.1.5.

**TABLE 2 Minimum Dimension from Center to End of Sockets (Laying Length) for Couplings, Tees, 90° and 45° Elbows, CPVC Socket-Type Pipe Fittings, Schedule 40, in. (mm)<sup>A</sup>**



Nominal Pipe Size	G, min in. (mm)	J, min in. (mm)	N, min in. (mm)
1/4	5/16 (7.94)	5/32 (3.97)	1/16 (1.59)
3/8	3/8 (9.53)	3/16 (4.76)	3/32 (2.38)
1/2	1/2 (12.70)	1/4 (6.35)	3/32 (2.38)
3/4	9/16 (14.29)	5/16 (7.94)	3/32 (2.38)
1	11/16 (17.46)	5/16 (7.94)	3/32 (2.38)
1 1/4	7/8 (22.22)	3/8 (9.53)	3/32 (2.38)
1 1/2	1 (25.40)	7/16 (11.11)	3/32 (2.38)
2	1 1/4 (31.75)	5/8 (15.88)	3/32 (2.38)
2 1/2	1 1/2 (38.10)	11/16 (17.46)	3/16 (4.76)
3	1 3/4 (46.04)	3/4 (19.05)	3/16 (4.76)
3 1/2	2 1/8 (53.98)	1 (25.40)	3/16 (4.76)
4	2 5/16 (58.74)	1 (25.40)	3/16 (4.76)
5	3 (76.20)	1 3/8 (34.92)	3/16 (4.76)
6	3 1/2 (88.90)	1 3/4 (44.45)	1/4 (6.35)

<sup>A</sup> The sketches and designs of fittings are illustrative only.

by agreement between the purchaser and seller. Under such agreement, minimum requirements shall not be lowered, changed, or modified, nor shall specification limits be changed. If upon retest, failure occurs, the quantity of product represented by the test(s) does not meet the requirements of this specification.

## 10. Product Marking

10.1 *Quality of Marking*—The markings shall be applied to the fittings in such a manner that they remain legible under normal handling and installation practices.

10.2 *Content of Marking*:

10.2.1 Fittings shall be marked with the following:

10.2.1.1 Manufacturer's name or trademark,

10.2.1.2 Material designation CPVC for CPVC 23447,

10.2.1.3 The seal or mark of the laboratory making the evaluation for potable water contact,

10.2.1.4 Size, and

10.2.1.5 This designation F 438, with which the fitting complies.

10.3 Where the size of the fitting does not allow complete marking, omit identification marking in the following sequence: size, material designation, F 438, manufacturer's name or trademark.

10.4 Markings or symbols shall be molded, hot-stamped, or applied to fittings by any other suitable method, such as printing.

10.5 Where recessed marking is used, care shall be taken to see that in no case marking causes cracks or reduces the wall thickness below the minimum specified.

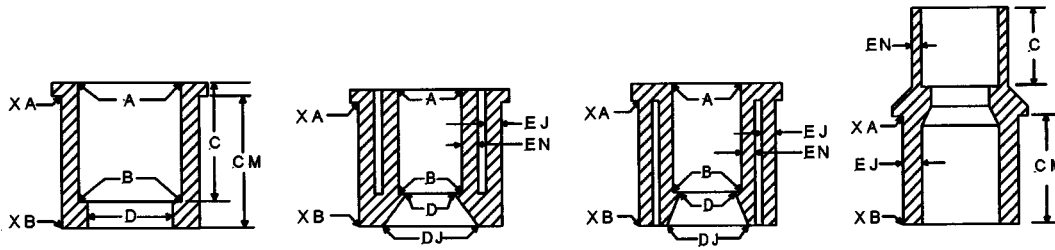
## 11. Quality Assurance

11.1 When the product is marked with this designation, F 438, 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.

## 12. Keywords

12.1 CPVC; fittings; pressure; Sch 40; sockets; threads

TABLE 3 Dimensions of Reducer Bushings, CPVC Socket-Type Pipe Fittings, Schedule 40,<sup>A</sup> in.



Nominal Size	Outside Diameter XA	Tolerance on Outside Diameter	Outside Diameter XB	Tolerance on Outside Diameter	Maximum Out of Roundness (max. minus min.)
1/4 by 1/8	0.540 (13.72)	+ 0.007 - 0.004 (0.18 - 0.10)	0.540 (13.72)	±0.004 (0.10)	0.016 (0.41)
3/8 by 1/4, 1/8	0.675 (17.41)	+ 0.007 - 0.004 (0.18 - 0.10)	0.675 (17.41)	±0.004 (0.10)	0.016 (0.41)
1/2 by 3/8, 1/4	0.840 (21.34)	+ 0.007 - 0.004 (0.18 - 0.10)	0.840 (21.34)	±0.004 (0.10)	0.016 (0.41)
3/4 by 1/2, 3/8, 1/4	1.050 (26.67)	+ 0.007 - 0.004 (0.18 - 0.10)	1.050 (26.67)	±0.004 (0.10)	0.020 (0.51)
1 by 1/2, 3/4	1.315 (33.40)	+ 0.008 - 0.005 (0.20 - 0.13)	1.315 (33.40)	±0.005 (0.13)	0.020 (0.51)
1 1/4 by 1/2, 3/4, 1	1.660 (42.16)	+ 0.008 - 0.005 (0.20 - 0.13)	1.660 (42.16)	±0.005 (0.13)	0.024 (0.61)
1 1/2 by 1/2, 3/4, 1, 1 1/4	1.900 (48.26)	+ 0.010 - 0.006 (0.25 - 0.15)	1.900 (48.26)	±0.006 (0.15)	0.024 (0.61)
2 by 1/2, 3/4, 1, 1 1/4, 1 1/2	2.375 (60.33)	+ 0.010 - 0.006 (0.25 - 0.15)	2.375 (60.33)	±0.006 (0.15)	0.024 (0.61)
2 1/2 by 2	2.875 (73.03)	+ 0.012 - 0.007 (0.30 - 0.18)	2.875 (73.03)	±0.007 (0.18)	0.030 (0.76)
3 by 2 1/2, 2	3.500 (88.90)	+ 0.013 - 0.008 (0.33 - 0.20)	3.500 (88.90)	±0.008 (0.20)	0.030 (0.76)
3 1/2 by 2 1/2, 2	4.000 (101.60)	+ 0.013 - 0.008 (0.33 - 0.20)	4.000 (101.60)	±0.008 (0.20)	0.030 (0.76)
4 by 3 1/2, 3, 2 1/2, 2	4.500 (114.30)	+ 0.015 - 0.009 (0.38 - 0.23)	4.500 (114.30)	±0.009 (0.23)	0.030 (0.76)
5 by 4	5.563 (141.30)	+ 0.017 - 0.010 (0.43 - 0.25)	5.563 (141.30)	±0.010 (0.25)	0.060 (1.52)
6 by 5	6.625 (168.28)	+ 0.018 - 0.011 (0.46 - 0.28)	6.625 (168.28)	±0.011 (0.28)	0.070 (1.78)

<sup>A</sup> The sketches and designs of fittings are illustrative only—per Symbols D 2749.

**TABLE 4 Burst Pressure Requirements for Water at 73°F (23°C)  
for CPVC Socket-Type Pipe Fittings, Schedule 40**

Nominal Size, in.	Min Burst Strength, <sup>A</sup>	
	Class 23447	
	psi	(MPa)
¼	2490	(17.17)
⅜	1990	(13.72)
½	1910	(13.17)
¾	1540	(10.62)
1	1440	(9.93)
1¼	1180	(8.14)
1½	1060	(7.31)
2	890	(6.14)
2½	970	(6.69)
3	840	(5.79)
3½	770	(5.31)
4	710	(4.90)
5	620	(4.27)
6	560	(3.86)

<sup>A</sup> This table was calculated for Schedule 40 pipe using the ISO formula and a stress level as follows:

	psi	(MPa)
Class 23447 (Type IV, Grade 1 (CPVC))	6400	(44.1)

## 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 document.

**POTABLE WATER REQUIREMENT**

This requirement applies whenever a Regulatory Authority or user calls for 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 No. 61 or the health effects portion of NSF Standard No. 14 by an acceptable certifying organization when required by the regulatory authority having jurisdiction.

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