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An American National Standard

Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Fittings for Chemical Waste Drainage Systems[1]

This standard is issued under the fixed designation F2618; 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 the performance requirements of CPVC pipe, fittings and solvent cements used in chemical waste drainage systems.

1.2 A system is made up of pipe, fittings and solvent cement that meet the requirements of this standard.

NOTE 1—Consult the manufacturer's chemical resistance recommendations for chemical waste drainage applications prior to use.

1.3 The text of this specification references notes, footnotes and appendices that 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 pressure tests described in this standard are laboratory hydrostatic tests that are intended to verify joint/system integrity. They are not intended for use as field tests of installed systems.

1.5 Due to inherent hazards associated with testing components and systems with compressed air or other compressed gases, no such testing shall be done unless the component manufacturer gives approval in writing.

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.

1.6 Mechanical joints used for joining pipe and fittings of different materials are provided for in this specification. They include common flanges, couplings, and unions.

1.7 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.

NOTE 3—This specification specifies dimensional, performance, and test requirements for fluid handling applications but does not address venting of combustion gases.

1.8 *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.*

1.9 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D543 Practices for Evaluating the Resistance of Plastics to Chemical Reagents

D618 Practice for Conditioning Plastics for Testing

D1600 Terminology for Abbreviated Terms Relating to Plastics

D1784 Classification System and Basis for Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds

D2122 Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings

D2321 Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2412 Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading

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

D3311 Specification for Drain, Waste, and Vent (DWV) Plastic Fittings Patterns

F402 Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings

F412 Terminology Relating to Plastic Piping Systems

F493 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 F17.63 on DWV.

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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.

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

F1498 Specification for Taper Pipe Threads 60° for Thermoplastic Pipe and Fittings
F2135 Specification for Molded Drain, Waste, and Vent (DWV) Short-Pattern Plastic Fittings

2.2 *Other Documents:*
International Plumbing Code [3]
Uniform Plumbing Code [4]
Federal Standard 123 Marking for Shipment (Civilian Agencies)[5]
Federal Standard 129 Military Marking for Shipment and Storage[5]

3. Terminology

3.1 *Definitions:*

3.1.1 Definitions used in this specification are in accordance with the definitions given in Terminology F412, and abbreviations are in accordance with Terminology D1600, unless otherwise indicated.

3.1.2 The plumbing terminology used in this specification is in accordance with the definitions given in the International Plumbing Code and the Uniform Plumbing Code, unless otherwise indicated.

4. Requirements

4.1 The requirements in this section are intended only for use as quality control tests, not as simulated service tests.

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

4.1.2 Pipe and fittings shall be joined by the use of solvent cement, threading, or mechanical joints meeting the requirements of this standard and as recommended by the manufacturer.

4.1.3 All dimensions shall be determined in accordance with Test Method D2122.

4.1.4 All components within a system shall meet the specifications of this standard.

4.1.5 *CPVC Solvent Cement*—The CPVC solvent cement used to join the pipe and fittings covered under this specification shall comply with Section 5 and 9.4. Consult the pipe and fitting manufacturer to determine whether or not a primer is required.

NOTE 4—At lower temperatures (< 40 °F, or < 4 °C) and for larger diameters of pipe and fittings (>6 in. in diameter), a primer may be recommended by the manufacturer.

4.1.6 Mechanical fittings shall meet the requirements of 7.4.

4.2 *Materials:*

4.2.1 *CPVC Material*—All pipe and fittings shall be made CPVC compounds meeting or exceeding the requirements of cell classification 23447 as defined in Specification D1784.

4.2.2 CPVC materials shall be permitted to contain stabilizers, lubricants, and pigments not detrimental to pipe and fittings provided that the final compound, and the pipe and fittings produced, meet the requirements of this specification.

4.2.3 *Rework Material*—Clean rework material generated from the manufacturer's own pipe or fittings may be used provided the pipe or fittings produced meet the requirements of this specification.

4.2.4 All thread sealants, gaskets, and seal rings shall be of a material that meets the chemical resistance for the end use application.

5. General Requirements for Solvent Cement

5.1 The solvent cement shall meet the general requirements of standard F493 and be classified as heavy-bodied, having a minimum viscosity of 1600 cP (1600 MPa-s).

5.2 The cement shall not contain any inorganic fillers.

5.3 CPVC solvent cement meeting the requirements of this standard shall be mustard in color to facilitate identification and minimize unintentional use of other cements that may fail at elevated service temperatures.

NOTE 5—Safe handling of solvent cements: Solvent cements for plastic pipe are made from flammable liquids. Keep them away from all sources of ignition. Maintain proper ventilation to reduce fire hazard and to minimize breathing of solvent vapors. Avoid contact of cement with skin and eyes. Refer to Practice F402 for information on safe handling of solvent cements.

6. Dimensions and Tolerances

6.1 The patterns, dimensions, and laying lengths of molded fittings, including adaptors, shall meet the requirements of Specifications D3311 or F2135 or shall be of a proven design and shall allow a smooth transition of flow from one direction to another. Specialty fittings or fittings with laying lengths not meeting the requirements of Specification D3311 or Specification F2135 shall not be excluded. For these fittings, laying lengths shall be provided by the manufacturer.[6]

NOTE 6—ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

6.1.1 The outside diameter and wall thickness of pipe shall meet the requirements of Table 1 and Table 2.

6.1.2 Fitting sockets shall conform to the dimensional requirements as specified in Table 3.

6.1.3 The spigot dimensions of fittings shall meet the requirements of Table 1 and Table 2.

[3] Available from International Code Council (ICC), 500 New Jersey Ave., NW, 6th Floor, Washington, DC 20001-2070, http://www.iccsafe.org.

[4] Available from International Association of Plumbing and Mechanical Officials, 5001 E. Philadelphia St., Ontario, CA 91761, http://www.iapmo.org.

[5] Available from DLA Document Services, Building 4/D, 700 Robbins Ave., Philadelphia, PA 19111-5094, http://quicksearch.dla.mil.

[6] Molded fittings meeting the requirements of Specification D3311 made from CPVC and used for piping that handles corrosive waste are covered by a patent. Interested parties are invited to submit information regarding the identification of an alternative(s) to this patented item to the ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend.

TABLE 1 Outside Diameters and Tolerances for Pipe and Spigot Ends, in. (mm)

Nominal Pipe Size	Average Outside Diameter	Tolerance	Out-of-Roundness [maximum minus minimum]
1¼	1.660	± 0.005	0.024
	(42.2)	(±0.13)	(0.61)
1½	1.900	± 0.006	0.024
	(48.3)	(±0.15)	(0.61)
2	2.375	± 0.006	0.024
	(60.3)	(±0.15)	(0.61)
3	3.500	± 0.008	0.030
	(88.9)	(±0.20)	(0.76)
4	4.500	± 0.009	0.100
	(114.3)	(±0.23)	(2.54)
6	6.625	± 0.011	0.100
	(168.3)	(±0.28)	(2.54)
8	8.625	± 0.015	0.150
	(219.1)	(±0.38)	(3.81)
10	10.750	± 0.015	0.150
	(273.1)	(±0.38)	(3.81)
12	12.750	± 0.015	0.150
	(323.9)	(±0.38)	(3.81)

TABLE 2 Wall Thickness and Tolerances for Pipe and Fitting Spigot Ends, in. (mm)

Nominal Pipe Size	Minimum	Tolerance
1¼	0.140 (3.56)	+0.020 (+0.51) – 0.000
1½	0.145 (3.68)	+0.020 (+0.51) –0.000
2	0.154 (3.91)	+0.020 (+0.51) –0.000
3	0.216 (5.49)	+0.026 (+0.66) –0.000
4	0.237 (6.02)	+0.028 (+0.71) –0.000
6	0.280 (7.11)	+0.034 (+0.86) – 0.000
8	0.322 (8.18)	+0.039 (+0.99) – 0.000
10	0.365 (9.27)	+0.044 (+1.12) –0.000
12	0.406 (10.31)	+0.049 (+1.24) –0.000

6.2 *Cleanouts*—Cleanout plugs, and caps, as commonly used in the manufacturer's laboratory drainage system, shall have a thread size and depth sufficient to ensure that the minimum waterway dimensions are maintained. All CPVC cleanouts having female threads shall be supplied with CPVC plugs.

6.3 *Traps*—All traps shall have a minimum water seal of 2 in. (50 mm).

6.4 *Threaded fittings*—for all fittings having taper pipe threads, threads shall conform to standard F1498.

7. System Integrity

7.1 *Solvent Cemented Joint Hydrostatic Pressure Test*—Solvent cement joints shall not leak when tested in accordance with 8.4.

7.2 Solvent Cement Joint Chemical Resistance Integrity Test: Solvent cemented joints shall not leak when tested in accordance with 8.3.

7.3 CPVC Pipe Flattening Test: There shall be no evidence of splitting, cracking, or breaking when the pipe is tested in accordance with 8.8.

7.4 *Impact Resistance*—The impact resistance testing shall be in accordance with 8.9.

7.5 *Mechanical Joints:*

7.5.1 *Hydrostatic Pressure Test*—Mechanical joints shall not leak when tested in accordance with 8.5.

7.5.2 *Mechanical Joint Separation Test*—Mechanical joints shall neither separate nor leak when tested in accordance with 8.6.

7.6 *CPVC Compound Chemical Resistance*—CPVC compounds used to produce pipe or fittings to this standard shall meet the requirements of 8.2.

NOTE 7—Before installing a CPVC chemical waste piping system, chemical resistance data for the piping in question should be evaluated. Caution should be taken when mixing chemicals as properties can change. If there is a chemical resistance question, consult the manufacturer(s).

8. Test Methods

8.1 *Conditioning:*

8.1.1 For routine quality control testing, condition the specimens at the room temperature and humidity of the manufacturers testing facilities for not less than one hour or until the specimens reach room temperature.

8.1.2 For referee purposes, condition and test the specimens before testing, in a standard laboratory atmosphere of 73 °F ± 4 °F (23 °C ± 2 °C) and 50 ± 5% relative humidity for not less than 40 h prior to testing in accordance with Procedure A of Practice D618.

8.2 *CPVC Compound Chemical Resistance*—Pipe and fitting materials shall be evaluated in accordance with Test Method D543 practice A, procedures I and II, using the chemicals listed in Table 4. Weight change shall not exceed 2% nor shall apparent tensile strength change by more than 10 %. In cases where there is a change in the apparent tensile strength greater than 10%, a further evaluation shall be made after the test specimen is removed from the chemical and conditioned for 72 h. If after 72 h, there is a minimum of 50% recovery of tensile strength as compared to the unexposed specimen, and that figure is within ±10% of the original tensile strength of the unexposed specimen, the test shall be considered acceptable.

8.3 *Solvent Cement Joint Chemical Resistance Integrity Test*—Prepare ten pipe test specimens, each having two sections of pipe connected by a coupling using the manufacturer's specified solvent cement that is used to join the CPVC chemical waste drainage systems. The ten pipe test specimens shall be fitted with test caps on both ends with drain and vent connections to enable the specimens to be filled with chemicals and to subsequently be internally pressurized. Allow the materials to be conditioned at 73 °F ± 4 °F (23 °C ± 2 °C) for 24 h after the joints are completed. After the 24 h conditioning period, completely fill each of the ten specimens with the chemicals listed in Table 4. One chemical at the specified concentrations within Table 4 shall be used per test specimen, making sure that the chemical media completely fills the specimen prior to being capped off. The specimens shall be pre-labeled to identify with which of the chemicals it is filled. Expose each of the ten specimens to the chemicals for one week at 73 °F ± 4 °F (23 °C ± 2 °C) under an internal test pressure of 5 psig (34.5 kPa). After the holding period, remove the specimens and drain the chemical reagents. The specimens shall be rinsed and dried to remove any traces of the chemicals from the inside of the pipe. Each specimen shall then be

TABLE 3 Dimensions and Tolerances for Fitting Sockets, in. (mm)

Nominal Pipe	A			B			C	E	Internal Threads	
	Socket Entrance Diameter			Socket Bottom Diameter			Socket Depth min	Wall thickness min[A]	Outside Diameter of Hub, M min	Thread length min
	Average	Tolerance on Avg in. (mm)	Out -of- Roundness	Average	Tolerance on Avg in. (mm)	Out -of - Roundness				
1 ¼	1.675 (42.54)	+0.010/-0.005 (+0.25/-0.13)	0.024 (0.61)	1.655 (42.04)	± 0.005 (± 0.13)	0.024 (0.61)	0.687 (17.44)	0.156 (3.96)	1.871 (47.52)	0.687 (17.44)
1 ½	1.915 (48.64)	+0.010/-0.005 (+0.25/-0.13)	0.024 (0.61)	1.894 (48.11)	± 0.006 (± 0.15)	0.024 (0.61)	0.687 (17.44)	0.156 (3.96)	2.127 (54.03)	0.687 (17.44)
2	2.390 (60.71)	+0.010/-0.005 (+0.25/-0.13)	0.024 (0.61)	2.369 (60.17)	± 0.006 (± 0.15)	0.024 (0.61)	0.750 (19.05)	0.156 (3.96)	2.634 (66.90)	0.750 (19.05)
3	3.520 (89.41)	+0.010/-0.005 (+0.25/-0.13)	0.030 (0.76)	3.492 (88.70)	± 0.008 (± 0.20)	0.030 (0.76)	1.500 (38.10)	0.219 (5.56)	3.841 (97.56)	1.187 (30.15)
4	4.520 (114.8)	+0.010/-0.005 (+0.25/-0.13)	0.030 (0.76)	4.491 (114.1)	± 0.009 (± 0.23)	0.030 (0.76)	1.750 (44.45)	0.250 (6.35)	4.907 (124.6)	1.281 (32.54)
6	6.647 (168.8)	+0.015/-0.010 (+0.38/-0.25)	0.060 (1.52)	6.614 (168.0)	± 0.011 (± 0.28)	0.060 (1.52)	3.000 (76.20)	0.281 (7.14)	7.203 (183.0)	1.500 (38.10)
8	8.655 (219.8)	+0.030/-0.000 (+0.76/-0.00)	0.090 (2.29)	8.610 (218.7)	+0.015/-0.015 (+0.38/-0.38)	0.090 (2.29)	4.000 (101.6)	0.328 (8.33)	[B] [B]	[B] [B]
10	10.780 (273.8)	+0.025/-0.020 (+0.64/-0.51)	0.120 (3.05)	10.737 (272.7)	± 0.015 (± 0.38)	0.120 (3.04)	5.000 (127.0)	0.365 (9.28)	[B] [B]	[B] [B]
12	12.780 (324.6)	+0.030/-0.025 (+0.76/-0.64)	0.150 (3.81)	12.736 (323.5)	± 0.015 (± 0.38)	0.150 (3.81)	6.000 (152.4)	0.406 (10.30)	[B] [B]	[B] [B]

[A] The thickness is a minimum value except that a ±10% variation resulting from core shift is allowable. In such case, the average of the two opposite wall thickness shall equal or exceed the value shown in the table.
[B] Not applicable for these nominal sizes.

TABLE 4 Chemical List

Chemical Environment	72 °F (23 °C)
Acetic Acid	100 % by volume
Acetone	30 % by volume
Methyl Alcohol	100 % by volume
Ammonium Hydroxide	15 % NH_3 by weight
Nitric Acid	70 % by weight
Sodium Hydroxide	60 % by weight
Sulfuric Acid	98 % by weight
Hydrochloric Acid	36 % by weight
Hydrogen Peroxide	50 % by weight
Sodium Hypochlorite	15 % by weight

subjected to a hydrostatic test pressure of a minimum of 50 psig (345 kPa) at 73 °F ± 4 °F (23 °C ± 2 °C) for a minimum duration of 5 min. The pressure test must be completed within 24 h after the specimens have been drained and cleaned.

8.4 *Solvent Cemented Joint Hydrostatic Pressure Test*—Select at random six specimens of pipe, each five times the nominal diameter or a maximum of 18 in. (450 mm) in length, for each size of piping and each type of system being considered. Also select three suitable couplings at random. Prepare three joined specimens by joining two pipe specimens with one coupling, using the solvent cement, instructions and cure time supplied by the manufacturer of the system. Fill each specimen with water at 73 °F ± 4 °F (23 °C ± 2 °C) and cap, taking care to exclude all air from the system. Fix one end of the specimen to a pressurizing apparatus, and support the free end if necessary. Pressurize each specimen to 50 psi (345 kPa) for a minimum of 5 min and inspect for leaks (laboratory performance test only, not for field use).

8.5 *Mechanical Joint Hydrostatic Pressure Test*—. Perform the pressure test on specimens of mechanical joints in a similar manner to that described in 8.4 using appropriate pipe specimens that are intended to join pipes of similar or dissimilar materials and sizes. Pressurize the assembly to 14.5 psi (100 kPa) for a period of 24 h and inspect for signs of leakage. None of the test specimens shall leak. Apply this test to each size and type of joint being considered (laboratory performance test only, not for field use).

8.6 *Mechanical Joint Separation Test*— Using a suitable set-up, apply a minimum of 50 lbf (220 N) of force to a complete mechanical joint assembled in accordance with the manufactures procedures. Apply the force within 5 s to 30 s for a period of 60 s. Remove the force from the test sample and perform a hydrostatic pressure test at 14.5 psi (100 kPa) for a period of 1 h. and inspect for leaks.

8.7 *Threads*—All taper pipe threads shall be gauged in accordance with Specification F1498.

8.8 *Flattening*—Using Test Method D2412, flatten three specimens of pipe 6 in. (152 mm) long, between parallel plates in a suitable press until the distance between the plates is 40 % of the original outside diameter of the pipe. The rate of vertical displacement shall be uniform and such that the flattening is completed within 2 to 5 min. On removal of the load, examine the specimens for evidence of splitting, cracking, or breaking.

8.9 *Impact Resistance for CPVC pipe and fittings*—Determine and test CPVC pipe and fitting impact values in