Designation: ~~F493 – 10~~ F493 – 14

~~An American National Standard~~

Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings[1]

This standard is issued under the fixed designation F493; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

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

1. Scope*

1.1 This specification provides requirements for chlorinated poly(vinyl chloride) (CPVC) solvent cements to be used in joining chlorinated poly(vinyl chloride) pipe, tubing, and socket-type fittings.

1.2 CPVC solvent cements are used with CPVC 41 chlorinated poly(vinyl chloride) pipe, tubing, and fittings, which meet Class 23447 as defined in Specification D1784.

1.3 A recommended procedure for joining CPVC pipe and fittings is given in Appendix X1.

1.4 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.

1.5 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.

1.6 The following safety hazards caveat pertains only to the test methods portion, Section 6, 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]

D1084 Test Methods for Viscosity of Adhesives

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

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

D2846/D2846M Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems

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

F439 Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80

2.2 *NSF Standards:*

Standard No. 14 for Plastic Piping Components and Related Materials[3]

Standard No. 61 for Drinking Water Systems Components—Health Effects[3]

3. Terminology

3.1 *Definitions*—The definitions in this specification are in accordance with Terminology F412.

4. General Requirements

4.1 The solvent cement shall be a solution of the base CPVC resin used to make Class 23447, chlorinated poly(vinyl chloride) molding or extrusion compound as defined in Specification D1784.

[1] This specification is under the jurisdiction of ASTM Committee F17 on Plastic Piping Systems and is the direct responsibility of Subcommittee F17.20 on Joining.

Current edition approved ~~Aug. 1, 2010~~Nov. 1, 2014. Published ~~September 2010~~December 2014. Originally approved in 1977. Last previous edition approved in ~~2004~~2010 as ~~F493 – 04.~~F493 – 10. DOI: ~~10.1520/F0493-10.~~10.1520/F0493-14.

[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 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**

4.2 When rework material is used, the manufacturer shall use only his own clean rework material that is compatible with virgin material and produces a cement that meets the requirements of this specification.

4.3 The cement shall be free-flowing and shall not contain lumps, undissolved resin, or any foreign matter that will adversely affect the ultimate joint strength or chemical resistance of the cement.

4.4 The cement shall show no gelation or stratification that cannot be removed by stirring.

4.5 When inert fillers and colorants are added, the resulting cement shall meet all requirements of this specification.

NOTE 1—It is recommended that CPVC solvent cement be orange in color to facilitate identification and minimize unintentional use of other cements that may fail at elevated service temperatures.

4.6 The particular solvent system to be used in the formulation of this solvent cement is not specified, since it is recognized that a number of adequate solvent systems for CPVC exist. Solvent systems consisting of blends of tetrahydrofuran and cyclohexanone have been found to make cements that meet the requirements of this specification.

5. Detail Requirements

5.1 *Resin Content*—The CPVC resin content shall be 10 % minimum when tested in accordance with 6.1.

5.2 *Dissolution*—The cement shall be capable of dissolving an additional 3 % by weight of CPVC 41 compound (either powder or granular) or equivalent CPVC resin at 73 ± 3.6°F (23 ± 2°C) without evidence of gelation.

5.3 *Viscosity*—Cements are classified as regular-, medium-, or heavy-bodied types, based on their minimum viscosity when tested in accordance with 6.2.

5.3.1 Regular-bodied cements shall have a minimum viscosity of 90 cP (90 MPa·s).

5.3.2 Medium-bodied cements shall have a minimum viscosity of 500 cP (500 MPa·s).

5.3.3 Heavy-bodied cements shall have a minimum viscosity of 1600 cP (1600 MPa·s).

NOTE 2—Refer to Appendix X2 for guidelines in selecting CPVC solvent cements for joining different pipe sizes.

5.4 *Shelf Stability*—The cement, in the container in which it is supplied, shall show no gelation or stratification that cannot be removed by stirring after aging 30 days at 120°F (49°C).

5.5 *Hydrostatic Burst Strength*—Joints made using 2-in. (63 mm) CPVC piping and this cement shall meet the requirements of Table 1 when tested in accordance with 6.3.

5.6 *Hydrostatic Sustained Pressure Strength*—Joints made using ½-in. CPVC tubing and this cement shall meet the requirements of Table 2 when tested in accordance with 6.4.

6. Test Methods

6.1 *Solid Contents:*

6.1.1 *Apparatus:*

6.1.1.1 *Ointment Tins,* Style No. 12, 1-oz (30-mL), all metal,

6.1.1.2 *Analytical Balance,*

6.1.1.3 *Vacuum Oven,*

6.1.1.4 *Desiccator,* and

6.1.1.5 *Centrifuge.*

6.1.2 *Procedure*—Stir the sample thoroughly with a spatula before weighing (Note 3). Weigh 0.106 ± 0.123 oz (3.0 ± 0.5 g) of the sample to the nearest 3.53×10^{-5} oz (1 mg) into a tared ointment tin with cover. Place the tin into the vacuum oven (Note 4), and heat at 248°F (120°C) for 45 to 60 min. Discard specimens left in for more than 60 min. The vacuum must be continually

TABLE 1 Minimum Hydrostatic Burst Strength Requirements for Nominal 2 in. CPVC Solvent-Cemented Joints After 2 h Drying at Test Temperature

Temperature, °F (°C)	Burst Pressure, psi (MPa)
~~73 (23)~~	~~2.76 (400)~~
~~180 (82)~~	~~1.38 (200)~~

TABLE 1 Minimum Hydrostatic Burst Strength Requirements for Nominal 2 in. CPVC Solvent-Cemented Joints After 2 h Drying at Test Temperature

Temperature, °F (°C)	Burst Pressure, psi (MPa)
73 (23)	400 (2.76)
180 (82)	200 (1.38)

TABLE 2 Minimum Hydrostatic Sustained Pressure Requirements for Nominal ½ in. CPVC Solvent-Cemented Joints Tested in Water or Air External Environment at 180 ± 3.6°F (82 ± 2°C)

Test Condition	Test Duration	Hydrostatic Test Pressure, psi (MPa)	
		Water Bath	Air Bath
A	6 min	521 (3.59)	551 (3.80)
B	4 h	364 (2.51)	403 (2.78)

in operation to draw off flammable solvents and shall be maintained below 0.29 psi (15 mm Hg) pressure. Remove the tin from the oven and cap immediately. Place in a desiccator until cooled to room temperature. Weigh the tin and dried sample to the nearest 3.53×10^{-5} oz (1 mg).

NOTE 3—This material is usually nonhomogeneous and shall be thoroughly stirred before weighing. The weighing shall also be accomplished quickly to avoid loss of solvent by evaporation.

NOTE 4—The use of a vacuum oven is mandatory for drying the specimen, because this oven has neither an exposed heating surface nor an open flame, thus avoiding the danger of flashing. The oven also provides an open vacuum to exhaust solvent fumes.

6.1.3 *Inert Filler Determination*—Dissolve most of the dried sample by adding 0.507 oz (15 mL) of tetrahydrofuran (THF) to the sample in the ointment tin and stirring with a glass rod for 15 min. Collect the liquid decanted from this step, plus the liquid from the next two steps. Dissolve the remainder with a second addition of 0.507 oz (15 mL) of THF, followed by a third addition of 0.17 oz (5 mL) of THF to rinse the ointment tin. Centrifuge the entire volume at 20 000 rpm for 15 min. Discard the supernatant liquid. Add 0.507 oz (15 mL) of THF to the tube, mix thoroughly, and transfer the tube contents to the ointment tin. Use 6.76×10^{-2} (2 mL) more of THF to wash down the tube, and pour into the ointment tin. Evaporate off the THF in the vacuum oven at 248°F (120°C) for 45 min. Cool in desiccator, weigh the tin to the nearest 3.53×10^{-5} oz (1 mg), and determine the weight of inert filler present in the cement.

6.1.4 *Calculation*—Calculate the percentage of CPVC resin as follows:

$$Resin, \% = (B - A - D)/(C - A) \times 100$$

where:

A = weight of ointment tin,
B = weight of tin and specimen after drying,
C = weight of tin and specimen before drying, and
D = weight of inert filler, if present.

NOTE 5—Other methods for determination of resin and inert filler content may be used provided that the results of the alternative method are as accurate and consistent as the above method.

6.2 *Viscosity:*

6.2.1 Measure the viscosity in accordance with Method B of Test Methods D1084, except that conditioning to temperature equilibrium only is required. For qualification purposes, use a Model RVF viscometer, a speed of 10 r/min, and the spindle that, by trial, gives the closest reading to center range of scale for the cement being tested. Other speeds may be used for quality control purposes.

6.3 *Hydrostatic Burst Strength:*

6.3.1 Test in accordance with Test Method D1599, except as herein specified.

6.3.2 Prepare a test assembly containing at least six nominal 2-in. (63 mm) solvent-cemented joints using CPVC 41 SDR 11 pipe and fittings meeting the requirements of Specification D2846/D2846M. Cut the pipe into suitable lengths. The socket depth of the fittings shall be 1½ to 1 9⁄16 in. (38.1 to 38.50 mm) (Schedule 80 in accordance with Specification F439).

6.3.3 The dimensions of the pipe and fitting socket shall be such that the pipe will enter the socket from one third to two thirds of the full socket depth dry when assembled by hand.

6.3.4 Cement the joints in accordance with the recommended solvent cementing procedure given in Appendix X1 except for X1.7.

6.3.5 Attach suitable end closures and fill the test assembly with water, purging all air, and condition in water or air at the test temperature for 120 ± 5 min, then test immediately.

6.3.6 Increase the internal pressure at a constant rate so as to reach the minimum burst requirement in 60 to 70 s.

6.3.7 Leakage or separation at any of the joints tested at less than the minimum hydrostatic burst strength requirements specified in Table 1 shall constitute failure in this test.

6.4 *Hydrostatic Sustained Pressure Strength:*

6.4.1 Test in accordance with Test Method D1598, except as herein specified.

6.4.2 Prepare a test assembly containing six nominal ½-in.(15.24 cm) solvent-cemented joints using CPVC 41 SDR 11 tubing and fittings meeting the requirements of Specification D2846/D2846M. Cut the tubing into 6-in. lengths and use two couplings and two male adapters.